Neuroradiology
**TEACHING POINTS**

1. The aim of this presentation is to review the multiple neuroradiological findings that take place in patients with infective endocarditis. 2. To follow the radiological evolution of the patients in order to illustrate the underlying pathogenic mechanisms which generate the lesion spectrum 3. To show the strengths and limitations of the wide array of neuroimaging techniques available for the diagnosis and treatment of the disease complications.

**TABLE OF CONTENTS/OUTLINE**

1. Pathophysiology of central nervous system involvement in IE. 2. Review of neuroimaging findings and their pathologic correlates: CT, CT angio, CT perfusion, MR, MR angio, MR perfusion, SWI, Catheter angiography diagnostic and therapeutic 3. To review the transformation and the appearance of new neurological events in patients with IE. 4. Sample cases
NR003-EB-X

**Posterior Circulation: What Every Radiologist Should Keep at the Back of Their Mind**

All Day Location: NR Community, Learning Center

**Participants**
Rami Eldaya, MD, Galveston, TX (*Presenter*) Nothing to Disclose
Omar S. Eissa, MD, Galveston, TX (*Abstract Co-Author*) Nothing to Disclose
Stephen Herrmann, MD, Galveston, TX (*Abstract Co-Author*) Nothing to Disclose
Howard Gill, Galveston, TX (*Abstract Co-Author*) Nothing to Disclose
Jax H. Pham, DO, Galveston, TX (*Abstract Co-Author*) Nothing to Disclose
Tomas E. Uribe, MD, Galveston, TX (*Abstract Co-Author*) Nothing to Disclose
Jorge A. Lee Diaz, MD, Galveston, TX (*Abstract Co-Author*) Nothing to Disclose

**TEACHING POINTS**

Posterior Circulation pathology is relatively common and devastating. Prompt diagnosis is crucial and potentially lifesaving. Multiple pathologies can affect the posterior circulation. Understanding the pathophysiology and imaging findings of these pathologies is essential for making the right diagnosis. This review aims to detail the anatomy, pathology, and pathophysiology of the posterior circulation with emphasis on multimodality imaging findings. Review Anatomy and embryology of the posterior circulation including normal variants. Review the common pathologies affecting the posterior circulation through a summary table and pictorial guide including: aneurysm, verteobasilar dolicoectasia, vascular loop, thrombus occlusion, congenital anomalies, dissection, and vascular malformations.

**TABLE OF CONTENTS/OUTLINE**

Introduction to posterior circulation anatomy and embryology. Provide a table with the common etiologies providing pathophysiology, potential causes, and classical appearance on CT/CTA, MR/MRA, and angiogram. Pictorial guide of CT/CTA, MR/MRA, and angiography of posterior circulation pathology with classical complication and short discussion highlighting the imaging findings. Summary of posterior circulation pathology with suggested practical approach to diagnosis posterior circulation pathology.
NR004-EB-X

Neuroimaging of Mitochondrial Diseases and Related Disorders

All Day Location: NR Community, Learning Center

Participants
Daniel T. Ginat, MD, Chicago, IL (Presenter) Nothing to Disclose
Gul Moonis, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Review of the mechanisms responsible for mitochondrial disorders. Depict the spectrum of neuroimaging findings related to mitochondrial disorders.

TABLE OF CONTENTS/OUTLINE
* Overview of mitochondrial molecular biology and genetics.* Imaging findings of mitochondrial diseases, including Leigh's syndrome, Leber optic neuropathy, mitochondrial encephalomyopathy with lactic acidosis and stroke-like episodes, myoclonic epilepsy with ragged-red fibers, Menke's kinky hair, Alpers syndrome, Kearns-Sayre syndrome, chronic progressive external ophthalmoplegia, Glutaric aciduria type 1, Huntington disease, and Friedreich's ataxia.* Clinical implications.
"The Unusual Suspects", Uncommon CNS Side Effects of Chemotherapy and Biological Treatments
All Day Location: NR Community, Learning Center

Participants
Ruth Eliahou, MD, Philadelphia, PA (Presenter) Nothing to Disclose
Asaf Honig, MD, Jerusalem, Israel (Abstract Co-Author) Nothing to Disclose
Alexander Losus, Jerusalem, Israel (Abstract Co-Author) Nothing to Disclose
John M. Gomori, MD, Jerusalem, Israel (Abstract Co-Author) Consultant, Medymatch Technology Ltd
Eliel Ben-David, MD, Jerusalem, Israel (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Pemetrexed (Alimta) related periorbital edema may be severe and mimic leptomeningeal spread or an inflammatory condition. Gemcitabine (Gemzar) -associated thrombotic microangiopathy is a severe side effect with infarcts and hemorrhagic manifestations, associated with high mortality. Hypophysitis, a reported side affect of Ipilimumab (Yervoy), is detectable on MRI.

TABLE OF CONTENTS/OUTLINE
The purpose of this exhibit is: To describe uncommon chemotherapy and biological treatment related side effects in the CNS that may be overwhelming and acute and may mimic other clinical entities and can be diagnosed with CT or MRI. To increase awareness of these unusual entities in order to ensure the correct management. To achieve these purposes we will present: Unusual clinical and imaging CNS manifestations of various chemotherapy medications and biological treatments for cancer that may be mistaken for tumor progression or non related conditions. Sample cases including clinical story, management and imaging findings in CT and MRI, including: Pemetrexed (Alimta) related periorbital edema, Gemcitabine (Gemzar) -associated thrombotic microangiopathy, Mitomycin C related hemolytic uremic syndrome, Posterior reversible encephalopathic syndrome (PRES) following a combination of chemotherapy drugs and Ipilimumab (Yervoy) related hypophysitis. Summary.
A Review Of Endovascular Treatment Of Vein Of Galen Aneurysmal Malformations (VGAM)

All Day Location: NR Community, Learning Center

Participants
Carolina Parada, MD, Buenos Aires, Argentina (Presenter) Nothing to Disclose
Pablo A. Diluca, MD, Capital Federal, Argentina (Abstract Co-Author) Nothing to Disclose
Hector E. Lambre, MD, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
Rosana Salvatico, MD, Capital Federal, Argentina (Abstract Co-Author) Nothing to Disclose
Pedro Lylyk, MD, Buenos Aires, Argentina (Abstract Co-Author) Consultant, Surpass Medical Ltd; Consultant, Cardiatis SA; Consultant, Stryker Corporation

TEACHING POINTS

Review the pathophysiology of VGAM
Review the classifications of this pathology
To explain the different endovascular techniques in the management of this condition
VGAM are congenital vascular abnormalities characterized by enlarged venous structures of the Galenic system due to a high flow shunt into the median prosencephalic vein or an excessive venous drainage into the already formed vein.

Yasargil classification
Cisternal fistula between the VOG and the pericallosal arteries or PCA
Multiple fistulas between the VOG and thalamoperforating vessels
High flow type 1 and 2
Parenchymal arteriovenous malformation with drainage into the VOG

Lasjaunias classification
Choroidal Mural
Transarterial embolization with coils or acrylic agents is preferred when there are limited arterial pedicles.
With numerous arterial feeders, transvenous embolization should be performed, followed by transarterial embolization.
If endovascular treatment is insufficient, surgical clipping may be indicated.
A child with normal development without neurological deficit is the primary therapeutic goal.
Patient selection, timing, and a trained multidisciplinary team are key for optimal management.

TABLE OF CONTENTS/OUTLINE

Introduction Teaching points Tables and Images Conclusion References
Horner's Syndrome - An Eye-Opening Radiological Review

All Day Location: NR Community, Learning Center

Participants
Joseph Barnett, MA, MBBS, Stevenage, United Kingdom (Presenter) Nothing to Disclose
Claire Elliot, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Jane M. Young, MD, London, United Kingdom (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Horner's syndrome (HS) is caused by a range of pathologies, from benign to life threatening. This poster aims to provide the Radiologist with the:
- Anatomy of the occulosympathetic pathway and the pathological processes which disrupt it
- Optimal imaging of these pathological processes, including limitations of chest radiography and carotid Doppler in assessing HS
- Limitations in clinical and pharmacological assessment of acute HS
- Combining knowledge of the above, we present a systematic Radiological Management scheme which can aid the Radiologist to protocol the appropriate acuity and optimal modality to image acute cases of HS.

TABLE OF CONTENTS/OUTLINE

Anatomy of the Occulosympathetic 'three neuron' pathway. Disease Processes affecting each of these neurons, with radiological examples. Limitations of chest radiography and doppler ultrasound, with examples. A brief review of the clinical and pharmacological limitations in diagnosis of HS. Radiological Management pathway, outlining the required acuity and suggested modalities for imaging acute HS.
Pterygopalatine Fossa: Anatomical Review Through Pathological Cases of a Commonly Seen, Anatomically Remote, and Complex Route for Disease Spread

All Day Location: NR Community, Learning Center

Participants
Rami Eldaya, MD, Galveston, TX (Presenter) Nothing to Disclose
Omar S. Eissa, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose
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Jax H. Pham, DO, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Tomás E. Uribe, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Susana Calle, MD, Bogota, Colombia (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The pterygopalatine fossa is a major pathway between the nasal cavity, oral cavity, masticator space, orbit, and middle cranial fossa serving as a potential crossroad for disease spread between all of these spaces. Thus, understanding its anatomy, anatomical relationship, and role in disease spread is crucial for appropriate appreciation of the extent of pathological processes. Simplify the anatomy of the pterygopalatine fossa utilizing CT/MR images while summarize the routes of communication between the pterygopalatine fossa and surrounding structures. Review common diseases that spread through the pterygopalatine fossa via a summary table containing pathophysiology and their imaging appearances on CT/MR with case correlates.

TABLE OF CONTENTS/OUTLINE

Introduction to pterygopalatine fossa anatomy with review of multi-imaging modalities depicting normal pterygopalatine fossa anatomy. Chart summarizing the skull base foramina and fissures and reviews their contents with imaging correlates, placing an emphasis on their relationship with the pterygopalatine fossa. Chart summarizing common pathological process involving the pterygopalatine fossa with review of their pathophysiology and imaging appearance on CT/MR. Present multiple complex cases demonstrating pterygopalatine fossa disease spread into multiple head, neck, and brain compartments.
Cauda Equina: Understanding the Tail End of Neuroradiology through a Pictorial Guide of Pathology

All Day Location: NR Community, Learning Center

Participants
Rami Eldaya, MD, Galveston, TX (Presenter) Nothing to Disclose
Omar S. Eissa, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Jax H. Pham, DO, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Gabriel E. Calles, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose
William T. Chandler, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Jorge A. Lee Diaz, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Tomás E. Uribe, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The Cauda Equina constitutes a small portion of the neuroaxis yet it is rich with pathology some of which is very subtle yet carries significant clinical importance. It acts as a reservoir and potential spread for multiple disease processes including: malignancies, inflammatory, infectious, neurological, and congenital diseases. The purpose of this review is to provide a detailed summary of these entities with pathological and radiological correlation. Review Cauda Equina anatomyReview pathologies affecting the Cauda EquinaReview Cases of pathologies involving the Cauda Equina

TABLE OF CONTENTS/OUTLINE
Introduction Anatomy A Chart summarizing common pathologies with detailed pathophysiological and imaging findings of each pathology Imaging case review of multiple Cauda Equina pathologies
Awards
Certificate of Merit

Participants
Suraj J. Kabadi, MD, Charlottesville, VA (Presenter) Nothing to Disclose
Sugoto Mukherjee, MD, Charlottesville, VA (Abstract Co-Author) Nothing to Disclose
Bradley Kesser, MD, Charlottesville, VA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Review normal temporal bone anatomy relevant to Congenital Aural Atresia Understand the Jahrsdoerfer scoring system for congenital aural atresia and its usefulness in determining a patient’s surgical candidacy for atresia repair Be able to recognize abnormalities of each of the Jahrsdoerfer scoring system components on high resolution CT

TABLE OF CONTENTS/OUTLINE
Normal temporal bone anatomy, with an emphasis on middle ear structures Review of the Jahrsdoerfer scoring system for congenital aural atresia, and how it is used to determine the appropriateness of performing atresiaplasty Patients with score 6/10 or lower are poor surgical candidates Evaluation of the more critical components which include middle ear space, course of the facial nerve, and the appearance of the stapes A pictorial review of each component of the Jahrsdoerfer scoring system as seen on high resolution CT correlated with intraoperative images The most commonly seen middle ear abnormality is incus-malleus fusion and deformity Examples of abnormalities of the stapes, course of the facial nerve, middle ear space, and oval and round windows A brief overview of surgical approaches for congenital aural atresia, including atresiaplasty, Partial Ossicular Replacement Prostheses (PORP), and bone anchored hearing aid (BAHA)
White Matter Matters! A Radiologist’s Guide to the Clinico-radiological Spectrum of Demyelinating Disease

Participants
Faraz T. Sheikh, FRCR, Southampton, United Kingdom (Abstract Co-Author) Nothing to Disclose
Sina Kafiabadi, Southampton, United Kingdom (Presenter) Nothing to Disclose
Janine M. Domjan, MRCP, FRCR, Portsmouth, United Kingdom (Abstract Co-Author) Nothing to Disclose
Jason Macdonald, MBBS, FRCR, Southampton, United Kingdom (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Discovery of specific auto-antibodies have allowed better classification between multiple sclerosis (MS), acute demyelinating encephalomyelitis (ADEM), neuromyelitis optica (NMO) and its spectrum disorder (NMOSD) which have characteristic imaging features also. The purpose of this exhibit is to: 1. Discuss the clinical features and course of MS, ADEM, NMO / NMOSD. 2. Summarize their imaging features with imaging clues on how to differentiate between these. 3. Provide an overview of the tests utilised in diagnosis and management of these entities. By the end of this exhibit, the learner should gain an understanding of the spectrum of imaging appearances allowing differentiation between these entities when possible, whilst also gaining an awareness of their clinical courses when stratified by anti-body status which should enable more confident image interpretation of follow up imaging.

TABLE OF CONTENTS/OUTLINE
1. Nomenclature
2. Imaging features of MS with diagnostic criteria
3. Imaging features of ADEM
4. Imaging features of NMO and NMOSD with diagnostic criteria
5. Tips - Discussion of clinical course of the diseases with clues to differentiation of entities. (Sections 2-5 to be accompanied by cases)
6. Summary table of tests utilised in diagnosis
7. Discussion of mainline treatments and prognoses of the three entities.
Brain Ischemic White Matter Lesions; New Insights in Radiologic Investigation of Myelin Physiology

All Day Location: NR Community, Learning Center

Participants
Mohammad Salehi Sadaghiani, MD, MPH, Philadelphia, PA (Presenter) Nothing to Disclose
Meng-Kang Hsieh, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Ilya M. Nasrallah, MD, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Guray Erus, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Lisa M. Desiderio, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
R. Nick Bryan, MD, PhD, Philadelphia, PA (Abstract Co-Author) Officer, RadDx Owner, RadDx

TEACHING POINTS

1- To review the risk factors of brain ischemic white matter lesions (WML)
2- To discuss the radiologic, pathologic and clinical features of WML
3- To elaborate on research trends in understanding the consequences of myelin defects

TABLE OF CONTENTS/OUTLINE

1- Introduction to (White matter lesions) WML
a- Risk factors
b- Differential diagnosis
2- WML manifestations
a- Radiologic features
b- Pathologic correlates
c- Clinical effects
3- Radiologic approaches to quantify how WML may contribute to myelin physiology and impairments in axonal function
a- Resting state fMRI
b- Magnetoencephalography

Outline:
Cerebral WML or leukoaraiosis is a common finding which is associated with risk for incident dementia and stroke. Pathologically it is characterized by rarefaction, a reduction in axonal and myelin density. This educational exhibit reviews the cerebral WMLs and their risk factors. Moreover, we will elaborate on the radiologic and pathologic findings of WMLs along with their diverse clinical manifestations. Finally we will discuss the diagnostic modalities including radiologic approaches to investigate myelin physiology and the relation of possible conduction velocity compromise with brain functional changes, which may give us a better understanding of the effects of WML on myelin and brain network function.
CNS lymphoma is a rare malignant brain neoplasm. MRI appearance of the CNS lymphoma can be various and nonspecific and in some patients can mimic other CNS pathologies, which can cause the delay of the proper diagnosis and treatment. We consider demonstrating: The common MRI appearance of CNS lymphoma, natural dynamic with regression after corticotherapy. The atypical features of CNS lymphoma: atypical pathologic hyper-vascularization on DSA; non-enhancing lesions; solitary cranial nerve infiltration, etc. The impact of corticosteroids to CNS lymphoma’s imaging, which can lead to misinterpretation of MRI findings. The major teaching points of this exhibit are: MRI appearance of CNS lymphoma can be various; some cases the CNS lymphomas are underdiagnosed or misdiagnosed and only clinical and imaging follow-ups might suggest proper diagnosis.

**TABLE OF CONTENTS/OUTLINE**

Pathology, pathophysiology and epidemiology of CNS lymphoma
Usual MRI appearance and natural dynamic of CNS lymphoma
Atypical features of CNS lymphoma
Impact of corticosteroids on lymphoma appearance
Be Easy on the Eye! Review of the Basic Orbital Anatomy and Schematic Approach to Evaluating Common Ocular Lesions

All Day Location: NR Community, Learning Center

Participants
Jax H. Pham, DO, Galveston, TX (Presenter) Nothing to Disclose
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Rami Eldaya, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Gabriel E. Calles, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose
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Tomas E. Uribe, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
- Evaluation of ocular pathologies on imaging can be complex due to the relatively small size of the orbits and the intricate structures of the eye. Understanding the basic anatomy of the orbital contents is key to providing accurate diagnosis of ocular pathologies. This educational exhibit will present a quick and simplified approach to evaluating the orbital compartments with unique and interesting pathologies.
- The basic anatomy of the orbits can be divided into the eye globe, intraconal structures (i.e. the optic nerve sheath complex) and extraconal structures (i.e periorbital fat).

TABLE OF CONTENTS/OUTLINE
- Pictorial review of the orbits detailing the basic compartments of the eye.
- Schematic layout of unique pathologies involving the different components of the eyes.
- Table discussing the differential diagnosis, pathophysiology, and epidemiology of the common diseases within each orbital compartments.
- Radiographic examples of common/unique lesions involving the orbital compartment like Rupture Globe and Scleritis.
- Examples of lesions involving the intraconal compartment like optic neuritis/glioma, cavernous hemangioma, lymphatic malformation, and superior ophthalmic vein thrombosis.
- Examples of lesions involving the extraconal compartment like Dacryocystocele, Capillary Hemangioma, Venous Varix, and Carotid Cavernous Fistula.
Parathyroid Adenoma or Parathyroid Carcinoma - What Can Ultrasound Tell Us?

All Day Location: NR Community, Learning Center

Participants
Cheng Fang, MBBS, BSC, London, United Kingdom (Presenter) Nothing to Disclose
Eleni Konstantatou, MD, MSc, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Serena Baromcini, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Mohammad A. Husainy, MD, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Klaus-Martin Schulte, MD, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Paul S. Sidhu, MRCP, FRCR, London, United Kingdom (Abstract Co-Author) Speaker, Bracco Group; Speaker, General Electric Company

TEACHING POINTS

The teaching points of this pictorial education exhibit is to:

Understand the diagnostic challenges in distinguishing parathyroid carcinoma from parathyroid adenoma
Review typical and variant greyscale and colour Doppler features of a parathyroid adenoma such as cystic change, heterogeneity and shape
Highlight other sonographic appearances such as presence of calcification, capsular thickening and local infiltration which may raise the suspicion of parathyroid carcinoma

TABLE OF CONTENTS/OUTLINE

B: Factors contributing to the diagnostic difficulty of parathyroid carcinoma and parathyroid adenoma.
C: Pictorial review of typical features of parathyroid adenoma.
D: Pictorial review of variant features of parathyroid adenoma.
E: Pictorial review of parathyroid carcinoma.

In summary, we will illustrate that ultrasound, free of ionising radiation, is a valuable and unique tool during the investigation of primary hyperparathyroidism by providing not only anatomical but also morphological information. Certain sonographic features will increase the confidence of pre-operative diagnosis of a benign lesion or raise the suspicion of a rare malignant parathyroid carcinoma so that a more extensive neck surgery can be planned.
NR016-EB-X

Pearls and Pitfalls in MR Imaging Following Gamma Knife Radiosurgery in Five Commonly Treated Brain Tumors

All Day Location: NR Community, Learning Center

Participants
Alysha K. Vartevan, DO, Miami, FL (Presenter) Nothing to Disclose
Steven Deprima, MD, South Miami, FL (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is to review the MR imaging findings following gamma knife radiosurgery in commonly encountered brain tumors including intracranial metastasis, glial tumors, meningiomas, acoustic schwannomas, and pituitary neoplasm with an emphasis on findings seen in early treatment response.

TABLE OF CONTENTS/OUTLINE

Gamma knife is a radiosurgical tool that utilizes a cobalt-60 source to produce ionizing gamma ray radiation to treat brain tumors, vascular malformations, and multiple functional disorders. There are multiple imaging findings seen after gamma knife radiosurgery of brain tumors, which may reflect early response to treatment as opposed to tumor progression. MR imaging is the preferred imaging modality for tumor surveillance to evaluate mass effect, edema, hemorrhage, enhancement, necrosis and response to treatment. Changes seen in brain tumors after gamma knife radiosurgery include: 1) Transient increase in tumor size; 2) Transient increase in the surrounding vasogenic edema; 3) Temporary hemorrhage; 4) Interval development of central necrosis/ cystic changes; 5) Variable enhancement patterns. The major teaching points of this exhibit include recognizing imaging changes seen with brain tumor treatment response to gamma knife radiosurgery as this is a common treatment option for many brain tumors.
NR017-EB-X

Revisiting the Imaging Characteristics of Subependymomas: Pictorial Review of Computed Tomography and Magnetic Resonance Imaging Appearance

All Day Location: NR Community, Learning Center

Participants
Marie-Helene Gagnon, BA, MA, Atlanta, GA (Presenter) Nothing to Disclose
Mark E. Mullins, MD, PhD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Stewart Neill, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Daniel J. Brat, MD, PhD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Constantinos G. Hadjipanayis, MD, PhD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Jason W. Allen, MD, PhD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Review common imaging characteristics of subependymomas on CT and MRI
Provide a radiological approach to the evaluation of possible subependymomas
Create a pictorial review of subependymomas

TABLE OF CONTENTS/OUTLINE

Subependymomas are rare, low grade (WHO grade 1) glial tumors that usually present in males in their fifth and sixth decades and comprise only 0.5% of all brain tumors in Western countries. Therefore, data concerning their appearance on imaging is limited and radiologists may never encounter a subependymoma during their training. However, subependymomas have imaging characteristics that can help distinguish them from other tumors. It is important that radiologists in all settings be familiar with the appearance of these tumors on both CT and MRI as their benign nature may spare a patient a biopsy or intervention. The purpose of this exhibit is to review the common imaging characteristics of pathologically proven subependymomas - including appearance on CT and T1 and T2 weighted MRI sequences, pattern of enhancement, and presence of cystic components and calcification - as well as to evaluate features on MRI sequences less frequently discussed in the literature, including diffusion weighted imaging and gradient-recalled echo sequences. We will also provide an approach to the radiological evaluation of these tumors.
TEACHING POINTS

STAGING. 1/ MRI diagnoses the loco-regional spread: direct extension, lymphatic dissemination, and neurovascular spread. 2/ MRI and FDG-PET diagnose the lymphatic dissemination which is the most important prognosis factor. A N0 tumor does not preclude a neck dissection due to the high rate of micrometastases. 3/ PET is the reference for the M-staging, synchronous tumors are frequent. 4/ PET and MRI are useful for cancer of unknown primitive. 5/ There are several prognostic biomarkers in imaging. 6/ The imaging findings of HPV+ patients differ from HPV-. POST TREATMENT. 1/ MRI and CT-scan should be performed initially. First PET: 10-12 weeks after the end of CRT. 2/ There are several pitfalls after treatment: imaging to early leads to false-positive (inflammation, edema, fibrosis, infection, and loss of symmetry) but more problematically to false negative (micro-metastases, stunning). 3/ At 12 weeks, the overall diagnostic accuracy of imaging is good. The main interest of PET is to establish a complete metabolic response: the negative predictive value is excellent. 4/ PET and MRI are useful for the follow-up: 2/3 of the recurrences occur in the first 2 years after the end of CRT, the follow-up must be longer in HPV+ carcinoma.

TABLE OF CONTENTS/OUTLINE

I. ANATOMY. II. EPIDEMIOLOGY. III. PATHOLOGY. IV. ROLE OF F18-FDG-PET/CT AND MRI. V. TAKE HOME MESSAGES.
TEACHING POINTS

The British thyroid association (BTA) issued an ultrasound classification for thyroid nodules in 2014 based on recognised nodule morphology, rather than nodule size. This was used to give a U1-5 score, U1 normal; U2 benign; U3 indeterminate/equivocal; U4 suspicious; U5 malignant. A graphic reference of this is also available. The operator can with greater ease, then identify and categorise nodules that would need a fine needle aspiration. All needle test results are discussed at the multidisciplinary meeting. 1. To familiarise the radiologist with the ultrasound appearance of thyroid nodules, using the British Thyroid Association classification. 2. To be able to identify with ease and confidence nodules that would warrant a needle test, U3-5. 3. Radio-pathological correlation of nodules classified U3-5.

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The detection of thyroid nodules has increased in the last few years particularly from other imaging modalities like CT and PET CT. These nodules, in many instances, are subsequently investigated by ultrasound leading to a fine needle aspiration. This pictorial essay depicts ultrasound images with various examples outlining their pertinent features according to the BTA classification, the graphic description of which is also shown. Radio-pathological correlation in the cytology proven cases (U3-5) with relevant outcomes.
Is That for Real? Unusual Manifestation of CNS Lymphoma and Review of "Lookalike" Lesions

All Day Location: NR Community, Learning Center

Participants
Jax H. Pham, DO, Galveston, TX (Presenter) Nothing to Disclose
Gabriel E. Calles, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Samuel Gatzert, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Rami Eldaya, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Howard Gill, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Tomás E. Uribe, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Lymphoma within the brain and spinal cord is a great mimicker of numerous disease states ranging from other brain tumors to infectious abscess to demyelinating disorders. The clinical history, advancing imaging like PET and magnetic resonance spectroscopy (MRS) are indispensable in narrowing the differential diagnosis. However, even with these tools, the histopathological diagnosis of lymphoma can sometimes be quite surprising. The purpose of this educational exhibit is to expose the learner to some of the more uncommon and rare manifestation of CNS lymphoma and review "lookalike" lesions to improve radiographic recognition and detection of CNS lymphoma.

TABLE OF CONTENTS/OUTLINE
The cases will be presented in a quiz format with significant differential diagnostic points highlighted in each case discussion. The list of histopathologically proven cases of CNS lymphoma includes (but not limited to): Lymphoma vs Multiple Sclerosis (or other demyelinating conditions), Lymphoma vs Glioblastoma Multiforme, Lymphoma vs Nasopharyngeal Carcinoma, Lymphoma vs Mengenigoma, Lymphoma vs Filum Terminale Fibrolipoma (Now that you have lymphoma on your mind...a case of suspected lymphoma that was histopathologically sarcoidosis)
Role of Nuclear Medicine in Neuroradiology

All Day Location: NR Community, Learning Center

Participants
Mamta Gupta, MD, Chicago, IL (Presenter) Nothing to Disclose
Charanjeet Singh, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Sumeet Virmani, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Rashmi Virmani, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Amjad Ali, MD, Burr Ridge, IL (Abstract Co-Author) Nothing to Disclose
Sharon E. Byrd, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To list and to discuss different Nuclear Medicine scan useful in various neurological disorders.
2. To recognize diagnostic appearance of different radionuclide scan useful in various neurological disorders.
3. To discuss role of newer radiopharmaceuticals in various neurological disorders, particularly in dementia and movement disorders.

TABLE OF CONTENTS/OUTLINE
Nuclear Medicine and Neuroradiology: Introduction
1. Tc99m HMPAO/ECD Scan: For cerebral blood flow in TIA, stroke, Carotid stenosis. Seizure focus localization. Cerebral reserve flow study (Diamox Scan). Dementia - Alzheimer's, Fronto-temporal, Lewy body and, multi-infarct dementia. Brain Tumor, Early Herpes Encephalitis.
2. 1123 Ifupane (Dat scan): dopaminergic nerve terminal imaging.
3. F-18 FDG - glucose metabolism and cerebral blood flow.
4. F-18 FDG PET-CT for tumor recurrence vs radiation necrosis.
5. F-18 Florbetapir PET-CT for amyloid plaques in Alzheimer's disease.
7. Shunt patency.
8. CSF leak study.
9. Non-communicating hydrocephalus. Discussion on Nuclear medicine baseline and ictal SPECT study for SISCOM protocol prior to definite surgery.
Imaging Demonstration of Intra- and Extracranial Arterial Anastomoses: Implication for Safe Endovascular Treatment

All Day Location: NR Community, Learning Center

Participants
Shuichi Tanoue, MD, Yufu-Shi, Japan (Presenter) Nothing to Disclose
Hiro Kiyosue, MD, Yufu, Japan (Abstract Co-Author) Nothing to Disclose
Hiromu Mori, MD, Yufu-Shi, Japan (Abstract Co-Author) Nothing to Disclose
Yuzo Hori, MD, Oita, Japan (Abstract Co-Author) Nothing to Disclose
Mika Okahara, MD, Beppu, Japan (Abstract Co-Author) Nothing to Disclose
Yoshiko Sagara, MD, Oita, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The teaching points of this exhibit are: The functional anatomy of intra- and extracranial arteries in relation to their anastomoses
The imaging findings of the intra- and extracranial arteries demonstrated on conventional angiography and reconstructed images of rotational angiography
The endovascular treatments for cranial lesions

TABLE OF CONTENTS/OUTLINE
A. Functional anatomy of intra- and extracranial arteries with focusing on Orbit and frontal base Cavernous and paracavernous region Petrosal region Posterior fossa
B. Imaging appearance of intra- and extracranial arterial anastomoses Normal angioarchitectures on conventional and rotational angiography Imaging findings of pathological conditions
C. Endovascular treatment for Dural arteriovenous fistula Other vascular and neoplastic lesions supplied by arteries potentially having dangerous arterial anastomoses

OUTLINE
There is a variety of neoplastic and vascular lesions fed by extracranial arteries having potential anastomoses with intracranial and intraorbital arteries. The knowledge and assessment of anatomy is important for safe endovascular treatment. This exhibit demonstrates functional and imaging anatomy in reference to intra- and extracranial arterial anastomoses, and endovascular treatments.
Mandibular Lesions: A Thorough but Practical Approach for Diagnosis Based on Multimodality Imaging Findings

All Day Location: NR Community, Learning Center

Participants
Rami Eldaya, MD, Galveston, TX (Presenter) Nothing to Disclose
Omar S. Eissa, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Stephen Herrmann, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Howard Gill, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Gabriel E. Calles, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Tomas E. Unbe, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Susana Calle, MD, Bogota, Colombia (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To review and provide a reasonable differential diagnosis for a cystic mandibular lesion based on age, location, and imaging characteristics. To review and provide a reasonable differential diagnosis for a solid mandibular lesion based on age, location, and imaging characteristics. To recognize classical imaging appearance of some of the common and rare but important mandibular lesions.

TABLE OF CONTENTS/OUTLINE
Review the mandibular bone anatomy and embryology. Provide a summary table that encompasses the cystic disorders, pathophysiology of these disorders, CT imaging findings, MR imaging findings, extra modalities imaging findings if available, and differential diagnosis. Provide a summary table that encompasses the Solid disorders, pathophysiology of these disorders, CT imaging findings, MR imaging findings, extra modalities imaging findings if available, and differential diagnosis. Provide a summary table that encompasses the bone marrow/osseous disorders, pathophysiology of these disorders, CT imaging findings, MR imaging findings, extra modalities imaging findings if available, and differential diagnosis. Summarize and highlight the prior points through multiple complex cases demonstrating mandibular lesions from all 3 classes.
Central Nervous System Myeloma: Imaging Findings

All Day Location: NR Community, Learning Center

Participants
Mohammad T. Shujaat, MD, Columbus, OH (Presenter) Nothing to Disclose
Herbert B. Newton, MD, Columbus, OH (Abstract Co-Author) Nothing to Disclose
Hasel W. Slone, MD, Powell, OH (Abstract Co-Author) Nothing to Disclose
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Daniel J. Boulter, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Grace Mang Yuet Ma, MD, Dublin, OH (Abstract Co-Author) Nothing to Disclose
Eric C. Bourekas, MD, Columbus, OH (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
We detail MRI manifestations of CNS multiple myeloma (MM) with a brief overview of systemic findings. CNS involvement is a grave prognostic indicator observed in 1% of cases in advanced disease states with survival rates of less than 6 months.

TABLE OF CONTENTS/OUTLINE
Intracranial osteodural invasion is common with calvarial, skull base, and sinus lesions. Less common are separate areas of dural thickening and enhancement, which may appear as thick extra-axial collections mimicking subdural or epidural hematomas. The disease is usually multifocal with cranial and spinal nerve involvement. Leptomeningeal disease may represent myelomatous meningitis or carcinomatosis. Parenchymal and intramedullary lesions are rare, but are more common within the brain than in the spine, in contradistinction to extra axial lesions, which are more common in the spine. On MRI, the lesions are T1 isointense and T2 iso-hyperintense with homogenous enhancement. MRI is sensitive in the diagnosis of the disease, often confirmed by the presence of atypical B-cells in the cerebrospinal fluid (CSF). However, CSF cytology can be negative despite CNS involvement found upon biopsy. In these cases MRI findings are extremely useful, and when combined with clinical data, can guide intrathecal therapeutic options. Therapeutic options remain promising with rare cases of regression reported.
Approach to Interpretation and Pictorial Review of the Radiographic Appearance of Calvarial Lesions and Instrumentation

All Day Location: NR Community, Learning Center

Participants
Drew A. Streicher, MD, MBA, Atlanta, GA (Presenter) Nothing to Disclose
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Jason W. Allen, MD, PhD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Mark E. Mullins, MD, PhD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Review pertinent anatomy on skull radiographs. Provide an approach to the interpretation of the calvarium on skull radiographs. Create a pictorial review of commonly encountered pathology on skull radiography focusing on calvarial lesions, post-operative changes, and instrumentation.

TABLE OF CONTENTS/OUTLINE
The use of skull radiography has significantly declined due to its inferior sensitivity and specificity in detecting pathology. In concert with decreased use, there has been less emphasis on educating radiologists how to interpret skull radiographs with the focus shifting toward cross-sectional imaging. However, skull radiography remains relevant in current radiology practice, especially in the setting of multiple myeloma and in patients with instrumentation such as ventricular shunts and cochlear implants. While interpreting these studies, radiologists still encounter calvarial lesions and post-operative changes on skull radiographs and would benefit from a refresher on this topic. The purpose of this exhibit is to provide radiologists with an approach to interpretation and a pictorial review of pathology. We will outline radiologic findings commonly encountered in the calvarium on skull radiographs including inflammatory, neoplastic, and congenital calvarial lesions as well as post-operative changes and instrumentation.
The Added Value of Susceptibility-Weighted Imaging (SWI) in Diagnosis of Intracranial Vascular Lesions

All Day Location: NR Community, Learning Center

FDA Discussions may include off-label uses.

Participants
Sung Won Kim, MD, Goyang, Korea, Republic Of (Presenter) Nothing to Disclose
Eun Kyoung Lee, MD, Goyang-Si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Eun Ja Lee, Goyang, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: To review the imaging acquisition and processing of SWI To show the imaging findings of various intracranial vascular lesions and emphasize the utility of SWI in the diagnosis

TABLE OF CONTENTS/OUTLINE
MR imaging technique of SWI Review of SWI findings in various vascular lesions Cavernous malformation Developmental venous anomaly Capillary telangiectasia Arteriovenous malformation Dural arteriovenous fistula (dAVF) Acute ischemic stroke Moyamoya disease Venous thrombosis Brain death Sturge-Weber syndrome Summary and conclusion
Imaging of Peritumoral Nonenhancing Region

All Day Location: NR Community, Learning Center

Participants
Rajiv Mangla, MD, Syracuse, NY (Presenter) Nothing to Disclose
Xiang Liu, MD, Rochester, NY (Abstract Co-Author) Nothing to Disclose
Jeevak Almast, MD, Rochester, NY (Abstract Co-Author) Nothing to Disclose
Edward P. Lin, MD, Santa Barbara, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The peritumoral region is commonly understood as the nonenhancing area of hyperintense signal intensity on T2 or T2/FLAIR-weighted images surrounding the enhancing tumor. The term could be a misnomer. Actually there is evidence of tumor cells in this region surrounding the enhancing portion, which can have important radiological and clinical implications. In this educational exhibit, we outline the pitfalls and benefits of different imaging findings seen in Peritumoral Nonenhancing Region on various brain studies that can be helpful in diagnosis or follow-up of mass lesions of the brain.

TABLE OF CONTENTS/OUTLINE
Multiparametric Evaluation of Head and Neck Cancer Using Dual-energy CT

All Day Location: NR Community, Learning Center

FDA Discussions may include off-label uses.

Participants
Reza Forghani, MD, PhD, Montreal, QC (Presenter) Shareholder, Real-Time Medical, Inc; Committee member, Real Time Medical, Inc
Eugene Yu, MD, FRCP, Toronto, ON (Abstract Co-Author) Nothing to Disclose
Mark Levental, MD, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Rajiv Gupta, PhD, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Hugh D. Curtin, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of the exhibit is: To review current applications and advantages of dual-energy CT for imaging head and neck squamous cell carcinoma. To provide the reader with a practical outline of dual-energy CT reconstructions that have been shown to be useful for head and neck cancer evaluation and approach to interpretation. To provide an overview of more advanced and quantitative analytic approaches that can be used for head and neck cancer evaluation on images obtained using a single-source DECT scan with rapid kVp switching.

TABLE OF CONTENTS/OUTLINE
Introduction to DECT Overview of current clinical approaches for DECT scanning: single-source with rapid kVp switching, dual-source, single-source with a layered detector DECT neck acquisitions using a single-source DECT scan with rapid kVp switching: basic technique, radiation dose, standard (single energy CT equivalent) reconstructions Improving lesion conspicuity and contour delineation using low energy reconstructions Evaluation of thyroid cartilage invasion in laryngeal and hypopharyngeal cancer Reduction of dental artifact Practical, multiparametric approach with targeted use of additional reconstructions for cancer evaluation Advanced and quantitative spectral analysis
Multiparametric Ultrasound Evaluation in the Differential Diagnosis of Benign and Malignant Parotid Gland Lesions as Compared with CEUS and MRI

All Day Location: NR Community, Learning Center

Participants
Nicola Di Leo, MD, Rome, Italy (Presenter) Nothing to Disclose
Vito Cantisani, MD, Roma, Italy (Abstract Co-Author) Speaker, Toshiba Corporation; Speaker, Bracco Group; Speaker, Samsung Electronics Co, Ltd;
Emanuele David, Roma, Italy (Abstract Co-Author) Nothing to Disclose
Marco De Vincentis, Roma, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Ferdinando D'Ambrosio, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Luigi Lo Mele, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Giuseppe Schillizzi, Roma, Italy (Abstract Co-Author) Nothing to Disclose
Daniela Elia, Roma, Italy (Abstract Co-Author) Nothing to Disclose
Beatrice Sacconi, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1- Review of epidemiology, clinical presentation, state of the art work up, differential diagnosis and treatment options of the Parotid gland lesions
2- To describe strain and shear wave elastographic features compared with CEUS, US-color-Doppler and MRI findings in the diagnosis such lesions.
3- To explain technical issues of various US multiparametric methods and their application for such lesions.

TABLE OF CONTENTS/OUTLINE
1 Diagnostic features of parotid lesions. 2 State of the art US techniques available for lesion evaluation and their use in the differential diagnosis and their limitations: qualitative elastography with Ueno score, semi-quantitative strain measurements and shear wave elasticity measurements. 3 Tips and tricks for better results. 4 Lesions features at US strain and shear wave elastography, with image review of representative cases from our cohort of 68 patients with parotid masses. 5 Discussion on differential diagnosis and the role of the US imaging modalities compared with MRI and histology. 6 Conclusion. Elastography and CEUS seem to be useful adjuncts to differentiate parotid lesions where CDUS reaches its limits. CEUS facilitates the visualization of micro-macrovascular pattern and elastography allows to evaluate the stiffness, providing additional information in the appropriate classification of focal lesions.
DWI-Thermometry: Its Potential and Applications

All Day Location: NR Community, Learning Center

Participants
Koji Sakai, Kyoto, Japan (Presenter) Nothing to Disclose
Jun Tazoe, MD, Kyoto, Japan (Abstract Co-Author) Nothing to Disclose
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Kei Yamada, MD, Kyoto, Japan (Abstract Co-Author) Research funded, DAIICHI SANKYO Group Research funded, Eisai Co, Ltd
Research funded, FUJIFILM Holdings Corporation Research funded, Nihon Medi-Physics Co, Ltd Research funded, Koninklijke Philips
NV Consultant, H. Lundbeck A/S Consultant, Olea Medical Speaker, Bayer AG Speaker, DAIICHI SANKYO Group Speaker, Eisai Co,
Ltd Speaker, Mitsubishi Corporation Speaker, Nihon Medi-Physics Co, Ltd Speaker, Otsuka Holdings Co, Ltd Speaker, Koninklijke
Philips NV Speaker, Siemens AG Speaker, sanofi-aventis Group Speaker, Takeda Pharmaceutical Company Limited Speaker, Terumo
Corporation

TEACHING POINTS
To demonstrate the potential of diffusion weighted image based thermometry (DWI-thermometry) for the non-invasive measurement of deep brain temperature and to show several clinical applications.

TABLE OF CONTENTS/OUTLINE
Content Organization: How to obtain the DWI-thermometry from conventional DTI images. Computation method How to avoid noises Affections (viscosity and flow) 2. The potential of DWI-thermometry: just converting from conventional DWI 3. Normal aging 3-2. Moya moya disease 3-3. Traumatic brain injury 3-4. Multiple sclerosis 3-5. Comparisons of Schizophrenia and bipolar disorder Summary: This poster exhibit displays the potential of DWI-thermometry and its simplicity for clinical applications. This exhibit also shows temperature observations for both normal and abnormal brains. The knowledge of simple conversion of diffusion coefficient to temperature may help improve the observation view of points for neuroradiology.
Evolution of an Ischemic Infarct: Radiologic-Pathologic Correlation

All Day Location: NR Community, Learning Center

Participants
Rashi I. Mehta, MD, Syracuse, NY (Presenter) Nothing to Disclose
Rupal Mehta, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Provide an overview of the pathophysiology of an ischemic cerebral infarct.
2. Review key cellular and molecular changes that occur during initial onset of focal cerebral ischemia.
3. Review neuroradiologic and neuropathologic changes that occur during the acute, subacute and chronic stages of ischemic infarction.
4. Review mechanisms of cytotoxic edema formation and associated radiologic changes.
5. Review the role of oncotic cell death in blood-brain-barrier disruption and formation of vasogenic edema, and associated radiologic changes.
6. Review causes and consequences of associated reperfusion injuries with imaging correlates.
7. Review the utility of CT, MRI, CTA and perfusion imaging in diagnosis of the above processes.

TABLE OF CONTENTS/OUTLINE
1. Pathophysiology of stroke.
2. Areas susceptible to ischemia and infarct.
3. Cerebral ischemia.
4. Acute Infarct.
5. Subacute Infarct.
6. Chronic Infarct.
7. Petechial hemorrhage and hemorrhagic conversion.
8. Complications of cerebral infarct.
9. Conclusion:
   Knowledge of cellular and molecular changes that occur during the evolution of a cerebral infarct will allow the radiologist to be more adept in radiologic diagnosis of cerebral ischemia and infarct, assess time course and associated complications, and contribute to optimal management of patients who suffer this disease.
NR033-EB-X

Pearls and Pitfalls of Multivoxel Magnetic Resonance Spectroscopy in the Evaluation of True Progression versus Pseudoprogression of High Grade Gial Neoplasm

All Day Location: NR Community, Learning Center

Participants
Jason M. Johnson, MD, Houston, TX (Presenter) Nothing to Disclose
Rutvij J. Shah, MBBS, Houston, TX (Abstract Co-Author) Nothing to Disclose
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Christopher G. Filippi, MD, Grand Isle, VT (Abstract Co-Author) Research Consultant, Regeneron Pharmaceuticals, Inc; Research Consultant, Snyactx

TEACHING POINTS
1. To review the physics and technical aspects of clinical magnetic resonance spectroscopy (MRS) including multi-voxel spectroscopy.
2. To illustrate major neuronal metabolites and their significance.
3. To demonstrate typical patterns of MRS in normal tissue and pathologic states.
4. To reveal common artifacts and interpretation pitfalls.

TABLE OF CONTENTS/OUTLINE
1. Physics and technical aspects of clinical magnetic resonance spectroscopy (MRS) including multi-voxel spectroscopy.
2. Review of the major neuronal metabolites and their significance.
3. Typical patterns of MRS in normal tissue, neoplasm (metastasis and the spectrum of glial based neoplasms), infarct, abscess and radiation necrosis.
4. Common artifacts and interpretation pitfalls including: poor shimming, lipid contamination, water contamination, factitious Cho/NAA ratio in setting of treatment metabolite suppression, mixed tumor and necrosis, intermediate choline elevation with necrosis, lipid/lactate peaks, pilocytic astrocytoma mimicking high-grade tumor.
5. Suggestions for managing a clinical MRS program.
A broad range of entities may present with cervical adenopathy, including infectious, inflammatory, neoplastic, and congenital etiologies. In an adult, cervical adenopathy is concerning for metastasis from squamous cell carcinoma until proven otherwise. Certain imaging features combined with clinical history may help narrow the differential diagnosis and assist in guiding clinical management. The aim of this exhibit is to: • Review the imaging features on CT, MR, and US that may help distinguish between malignant versus benign etiologies for cervical adenopathy. • Enable the learner to review the radiologic features, clinical signs and symptoms, and pathologic correlates of a spectrum of entities that often present with cervical adenopathy through illustrative cases.

**TABLE OF CONTENTS/OUTLINE**

The following case examples are included (but not limited to): Lymphoma/Leukemia Metastasis Mycobacterium tuberculosis Epstein-Barr virus Castleman's Disease Kikuchi-Fujimoto Disease Kimura Disease Sarcoidosis Granulomatosis with polyangiitis (Wegner's Granulomatosis) IgG-4 Sclerosing Disease Histiocytic Disorders
TEACHING POINTS

Tongue cancer has high incidence of uncontrollable cervical lymph node metastasis, which is the most important prognostic factor for survival. Imaging diagnosis plays an important role in the prognostic assessment and planning strategies for cervical lymph node metastasis, particularly for the decision to perform elective neck dissection. For an assessment of cervical lymph node metastasis, traditional criteria, such as nodal size and the presence of a focal defect, or an irregular margin are considered. Additionally, a clear understanding of the lymphatic drainage system facilitates a more accurate evaluation of cervical lymph node metastasis. This educational exhibit provides a survey of the current knowledge for diagnosing cervical lymph node metastasis of tongue cancer with a focus on the lymphatic drainage system, and introduces useful diagnostic predictors.

TABLE OF CONTENTS/OUTLINE

1. Introduction to tongue cancer and the clinical implications of lymph node metastasis  
2. Evaluation of cervical lymph node metastasis of tongue cancer, lymphatic drainage system, and lymph network  
   - Primary tumor status as a diagnostic predictor of cervical lymph node metastasis  
   - Lymph node anatomy and a review of the traditional nodal status criteria  
3. Lymph node metastasis in the patient with an overview of posttreatment status
Visual Assessment of Arterial Spin-Labeling MR Imaging (ASL-MRI) for Central Nervous System Infections

All Day Location: NR Community, Learning Center

Participants
Tomoyuki Noguchi, Shinjuku-Ku, Japan (Presenter) Nothing to Disclose
Masashi Nishihara, MD, Saga, Japan (Abstract Co-Author) Nothing to Disclose
Yoshiaki Egashira, Saga, Japan (Abstract Co-Author) Nothing to Disclose
Shinya Azama, Saga, Japan (Abstract Co-Author) Nothing to Disclose
Hiroyuki Irie, MD, PhD, Saga, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To introduce the concept of ASL-MRI.
2. To present the category-based findings of ASL-MRI in CNS infections.
3. To demonstrate the pathogen-specific findings of ASL-MRI in CNS infections.
4. To summarize their ASL-MRI appearances based on relative CBF values.

TABLE OF CONTENTS/OUTLINE
1. Explanation of the scheme of the perfusion imaging acquisition by ASL-MRI.
2. Presentation of the category-based findings of ASL-MRI in CNS infections.
   (1) non-purulent parenchymal involvement
   (2) meningeal involvement
   (3) abscess formation
   (4) ventricular involvement.
3. Demonstration of ASL-MRI appearances of the following pathogens:
   (1) HSV infection
   (2) Rotavirus infection
   (3) Combined infection of JCV and HIV
   (4) Unspecified viral infection
   (5) Bacterial or mycotic infection
4. Summation of their ASL-MRI appearances based on relative CBF values.
Oncologic Emergency in Patients with Head and Neck Cancer: The Role of the Radiologist in Multidisciplinary Management

All Day Location: NR Community, Learning Center

Participants
Hirofumi Kuno, MD, PhD, Boston, MA (Presenter) Nothing to Disclose
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Margaret N. Chapman, MD, West Roxbury, MA (Abstract Co-Author) Nothing to Disclose
Kotaro Sekiya, DDS, Kashiwa-Shi, Japan (Abstract Co-Author) Nothing to Disclose
Tatsushi Kobayashi, MD, Kashiwa, Japan (Abstract Co-Author) Nothing to Disclose
Masahiko Kusumoto, MD, Chuo, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Head and neck cancers are a complex, heterogeneous group of malignancies that require multifaceted treatment strategies consisting of surgery, radiation therapy, and chemotherapy. These tumors and their treatment could lead to urgent conditions requiring rapid intervention to avoid death or severe permanent disability. In this background, clinical management in emergent situations is complicated and requires prompt diagnosis often with the assistance of imaging. This exhibit discusses the imaging findings that reflect life-threatening emergent conditions in patients with head and neck cancer who are being treated using a multidisciplinary approach.

TABLE OF CONTENTS/OUTLINE


Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Osamu Sakai, MD, PhD - 2013 Honored Educator
Osamu Sakai, MD, PhD - 2014 Honored Educator
Osamu Sakai, MD, PhD - 2015 Honored Educator
Imaging Review of the Spinal Epidural Space: Anatomy and Pathology

All Day Location: NR Community, Learning Center

Awards
Certificate of Merit

Participants
Sumeet G. Dua, MD, Chicago, IL (Presenter) Nothing to Disclose
Miral D. Jhaveri, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Sharon E. Byrd, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. Revisit the anatomy of the spinal epidural space.
2. Depict degenerative spinal epidural pathologies ranging from the commonly seen disc hemiations and sequestration, posterior longitudinal ligament calcification and synovial cysts to the infrequent discal and paradiscal cysts and ligamentum flavum cysts.
3. Familiarize with the imaging appearance of infective spondylodiskitis and associated phlegmon or abscess with emphasis on the difference between the two entities, both on imaging and in terms of management.
4. Discuss the diagnostic features of epidural pathologies like metastases, lymphoma, lipomatosis and hematomas (spontaneous and traumatic) with a brief note on pointers to the diagnosis.
5. Depict the occasional epidural granulomas, venous engorgement, epidural arachnoid cysts and extramedullary hematopoiesis and ways to indentify each based on the history and ancillary imaging findings.

TABLE OF CONTENTS/OUTLINE

1. Anatomy of the spinal epidural space
2. Degenerative pathologies of the spinal epidural space ranging from disc to ligament to facet disease. Infective spondylodiskitis and facetitis with associated epidural phlegmon and abscess. Malignancy and abnormalities of the normal components of the epidural space, namely excessive fat and venous engorgement.
3. Miscellaneous pathologies invading the epidural space.
Participants
Ahmed Abdel Razek, MD, Mansoura, Egypt (Presenter) Nothing to Disclose
Suresh K. Mukherji, MD, Northville, MI (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1- To review basic background and techniques of perfusion MR imaging in head and neck. 2- To discuss analysis of time intensity curve and value of parameters of perfusion MR imaging. 3- To illustrate the potential applications of perfusion MR imaging in head and neck cancer. 4- Merits and limitations of different methods of perfusion MR imaging in head and neck.

TABLE OF CONTENTS/OUTLINE
1- Basic background about neoangiogenesis
2- Basic background and technique of dynamic contrast enhanced MR imaging (DCE), dynamic susceptibility contrast perfusion MR imaging (DSC) and arterial spin (ASL) labeling of head and neck
3- Discuss analysis of time intensity curve of DCE and DSC study
4- Discuss different perfusion MR parameters and maps
5- Role of perfusion MR imaging in differentiation head and neck cancer from benign tumors
6- Discuss correlation perfusion MR parameters with degree of differentiation of malignancy
7- Characterization of cervical lymphadenopathy with perfusion MR imaging
8- Role of perfusion MR imaging in differentiation of recurrent tumors from post-treatment changes and monitoring patient after treatment
9- Merits and limitations of different methods for perfusion weighted MR imaging
10- Future directions and summary.
Magnetic Resonance Imaging of Thyroid-eye Disease: Current Status and Future Prospects

All Day Location: NR Community, Learning Center

Participants
Ahmed Abdel Razek, MD, Mansoura, Egypt (Presenter) Nothing to Disclose
Shefeek A. Ahamed, MD, FRCR, Hawally, Kuwait (Abstract Co-Author) Nothing to Disclose
Hesham Elemam, Ahmadi, Kuwait (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1- To review basic background about thyroid-eye disease (TED).
2- To review routine and diffusion MR imaging of extra-ocular muscle, retro-ocular fat, dysthyroid optic neuropathy and lacrimal gland involvement in patients of TED.
3- To discuss role of MR imaging in evaluation state of activity of TED.

TABLE OF CONTENTS/OUTLINE
1- Pathophysiology, pathology and clinical scores of TED
2- Routine and diffusion tensor MR imaging in patient with TED
3- MR imaging of extra-ocular muscle involvement of TED
4- MR imaging of retro-ocular fat infiltration at TED
5- Imaging findings used to predict dysthyroid optic neuropathy
6- Imaging appearance of lacrimal gland involvement in TED
7- Imaging Biomarkers denoting disease activity
8- Imaging of atypical forms of TED such as unilateral disease, subclinical disease and TED in children
9- Imaging findings used to differentiate TED from simulating lesions such as pseudo tumor
Wallerian Degeneration Beyond the Corticospinal Tract: Conventional and Advanced MR Imaging Findings

All Day Location: NR Community, Learning Center

Participants
S. Ali Nabavizadeh, MD, Philadelphia, PA (Presenter) Nothing to Disclose
Arastoo Vossough, MD, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Yin J. Chen, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
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Laurie A. Loevner, MD, Gladwyne, PA (Abstract Co-Author) Stockholder, General Electric Company; Stockholder, Pfizer Inc; Stockholder, Merck & Co, Inc; Stockholder, Johnson & Johnson; Stockholder, Argen Inc; Stockholder, GlaxoSmithKline plc
Suyash Mohan, MD, Philadelphia, PA (Abstract Co-Author) Consultant, ACR Image Metrix; Investigator, Rad Dx

TEACHING POINTS
1. To review anatomical tracts which are involved in different types of Wallerian degeneration.
2. To become familiar with pathophysiology of different types of Wallerian degeneration in the brain including corticospinal tract, hypertrophic olivary degeneration, pontocerebellar fibers, optic radiations, and posterior column of the spinal cord.
3. To review the conventional and advanced MRI imaging findings of different types of Wallerian degeneration particularly diffusion weighted imaging (DWI), diffusion tensor imaging (DTI) and susceptibility weighted imaging (SWI).

TABLE OF CONTENTS/OUTLINE
B- Review of imaging findings with sample cases and mimics using the following imaging modalities: 1. Conventional MRI. 2. Diffusion weighted and diffusion tensor imaging. 3. Susceptibility weighted imaging.
C- Future directions and summary.
The Many Faces of Developmental Venous Anomaly and Its Mimickers in the Brain: Spectrum of Findings and Diagnostic Pitfalls

All Day Location: NR Community, Learning Center

Participants

S. Ali Nabavizadeh, MD, Philadelphia, PA (Presenter) Nothing to Disclose
Alexander C. Mamourian, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Arastoo Vossough, MD, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
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Robert W. Hurst, MD, Bryn Mawr, PA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. To become familiar with various imaging findings of DVAs in different imaging modalities including brain CT scan, CTA, MRI and cerebral angiogram with or without associated cavernoma.
2. To review the imaging findings of symptomatic DVAs such as thrombosed DVA, and mechanical and functional causes of abnormal flow in DVAs including AVM draining into DVA and obstruction of draining system.

TABLE OF CONTENTS/OUTLINE

1. Imaging findings of DVAs with and without associated cavernoma in different imaging modalities including brain CT scan, CTA, MRI and cerebral angiogram.
2. Symptomatic DVAs: A. Thrombosed DVA with parenchymal T2 prolongation. B. Thrombosed DVA with intraparenchymal hemorrhage. C. Symptomatic DVA due to mechanical obstruction-stenosis. D. Symptomatic DVA due to abnormal flow in DVAs secondary to AVM draining into DVA.
The Forgotten Elements: A Pictorial Review of Lesions in the Posterior Elements

Awards
Certificate of Merit

Participants
Joseph Gampa, DO, Morristown, NJ (Abstract Co-Author) Nothing to Disclose
Jay Patel, MD, Morristown, NJ (Presenter) Nothing to Disclose
Nishith Patel, MD, Morristown, NJ (Abstract Co-Author) Nothing to Disclose
Deborah L. Reede, MD, Brooklyn, NY (Abstract Co-Author) Nothing to Disclose
Wendy R. Smoker, MD, Iowa City, IA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Review the normal anatomy and radiographic appearance of the posterior elements
2. Learn imaging features of common and uncommon diseases affecting the posterior elements
3. Demonstrate an image based algorithm to aid in diagnosis

TABLE OF CONTENTS/OUTLINE
After a review of the normal appearance and anatomy of the posterior elements (pedicles, laminae, articular, spinous and transverse processes) on radiographs, CT and MRI, imaging characteristics and clinical findings of various diseases that alter the appearance of these structures are discussed. Use of the image based algorithm provided at the end of this module will enable the user to formulate an appropriate differential diagnosis. Abnormalities presented include:
- Normal size and configuration
- Sclerotic: Melorheostosis, Hemangioma, Osteoblastic metastasis
- Lytic: Purely lytic: Multiple myeloma, Osteolytic metastasis
- Lytic with associated sclerosis: Osteoid Osteoma
- Normal density: Septic facet arthritis
- Expansile
- Cystic with fluid-fluid levels: Aneurysmal bone cyst, Giant cell tumor
- Ground glass: Fibrous dysplasia
- Sclerotic: Paget disease
- Mineralized: Osteoblastoma, Osteochondroma
- Destructive with soft tissue mass: Langerhans cell histiocytosis, Pott's disease, Ewing sarcoma, Lymphoma
TEACHING POINTS

SESA syndrome is a newly described disease entity, characterized by typical clinical and electroencephalographic (EEG) features in the setting of chronic alcoholism. The purpose of this Education Exhibit Presentation is to describe the imaging findings from a series of 10 patients with SESA syndrome diagnosed. To analyze the main differential diagnosis of SESA syndrome with other imaging findings in alcohol-related encephalopathies.

TABLE OF CONTENTS/OUTLINE

A) SESA definition - Clinical presentation - EEG characteristics
B) Neuroimaging features - Regional cortical-subcortical T2/FLAIR hyperintensities and restricted diffusion • The temporal lobe/hippocampus is especially affected. • Atrophy. • Leukoaraiosis. • Follow-up MRI: • Resolution of the hyperintense lesions. • Focal atrophic changes in some cases.
C) SESA syndrome should be included in the alcohol-related encephalopathies differential.
A Stroke of Bad Luck: An Imaging Approach to Cerebrovascular Accidents in Children and Young Adults

All Day Location: NR Community, Learning Center

Participants
Thomas P. Madaelil, MD, Saint Louis, MO (Presenter) Nothing to Disclose
Amar P. Petel, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Matthew S. Parsons, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Understand relevant vascular anatomy, clinical presentation, and management of stroke in children and young adults
Recognize the essential imaging findings of ischemic and hemorrhagic stroke
Use clinical findings, laboratory tests, and imaging pearls to accurately identify the cause of stroke in children and young adults

TABLE OF CONTENTS/OUTLINE
1. Review relevant vascular anatomy, distribution, and vessel properties
2. Highlight special CT and MRI techniques used in stroke evaluation for children and young adults
3. Case-based presentation of the following etiologies of stroke commonly seen in children and young adults:
   - Ischemic: Arterial, Cardioembolic, Arterial dissection
   - Infection: meningitis
   - Hematologic: sickle cell disease
   - Vasculitis: collagen vascular disease (Lupus), Other: drugs, Moya-Moya disease
   - Venous: sinus thrombosis
4. Review useful clinical findings, laboratory tests, and imaging pearls to keep in mind when trying to differentiate causes of stroke in children and young adults
5. Briefly discuss stroke management for children and young adults
Imaging Review of Emergent Non-Traumatic Spinal Pathologies

All Day Location: NR Community, Learning Center

Participants
Moe Tun, DO, Kansas City, MO (Presenter) Nothing to Disclose
Natasha R. Acosta, MD, Kansas City, MO (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) List emergent non-traumatic spinal abnormalities commonly encountered in the urgent clinical setting
2) Describe the imaging findings of common and uncommon acute, nontraumatic spinal pathologies
3) Discuss appropriate follow up imaging and management of described pathologies

TABLE OF CONTENTS/OUTLINE
Radiological Image Features of Glioblastoma with Oligodendroglioma Component: Comparison With Conventional Glioblastoma

TEACHING POINTS

Exhibit purposes: 1. To clarify the clinical features in glioblastoma with oligodendroglioma component (GBMO), 2. To clarify the radiological image features of GBMO compared with those of conventional glioblastoma (cGBM). Subjects were 15 consecutive cases of GBMO and 32 cases of cGBM. A neuroradiologist reviewed the CT and MRI image findings in terms of density, signal intensity, contrast enhancement (CE), cortical swelling, and cortical swelling without CE. Statistical analysis was performed by the chi-squared test. Teaching points: 1. GBMO dominantly occurs in men and the MIB-1 index of GBMO is higher. 2. on image analysis, there is a significant difference in signal intensity on diffusion weighted image (p =.039) and CE (p =.008) between the two kinds of tumors. It is of note that cortical swelling without CE is a specific finding in GBMO (p =.003).

TABLE OF CONTENTS/OUTLINE

Table 1. Clinical features of each group Age Gender Site MIB-1 index Table 2. Image findings of GBMOS compared with cGBM CT Density Calcification Hemorrhage MRI T1 weighted image T2 weighted image Diffusion weighted image Apparent diffusion coefficient Cortical swelling Cortical swelling without contrast enhancement Contrast enhancement Case presentation 1: cGBM Case presentation 2: GBMO Case presentation 3: GBMO
MR-EYE: The Role of High-resolution Microscopy Coil MRI (MCMRI) for the Assessment of the Orbit and Peri-orbital Structures

All Day Location: NR Community, Learning Center

Awards
Magna Cum Laude

Participants
Nicholas W. Dobbs, MBBS, Nottingham, United Kingdom (Presenter) Nothing to Disclose
Ian A. Zealley, MD, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose
Phy M. Yeap, MBChB, FRCR, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose
Matthew J. Budak, MD, FRCR, Edmonton, AB (Abstract Co-Author) Nothing to Disclose
Jonathan Weir-McCall, MBChB, FRCR, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose
Richard D. White, MBChB, FRCR, Cardiff, United Kingdom (Abstract Co-Author) Nothing to Disclose
Thiru A. Sudarshan, DMRD, FRCR, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose
Ai Wain Yong, MBChB, FRCR, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Introduce the technique of MCMRI of the orbit and peri-orbital structures Illustrate normal anatomy using high-resolution MCMRI images Demonstrate a range of orbital and peri-orbital pathologies as depicted on high-resolution MCMRI images Emphasise added value of high-resolution MCMRI images over routine MRI images to ophthalmic and dermatological surgeons for pre-operative surgical planning

TABLE OF CONTENTS/OUTLINE

MCMRI technique: indications and contraindications microscopy coil positioning acquisition parameters tips and tricks Normal anatomy: orbital structures orbital septum peri-orbital structures Pathology: orbital and peri-orbital neoplasms vascular malformations dysthyroid eye disease cutaneous neoplasms involving peri-orbital structures Review key features which influence surgical planning emphasising added value of MCMRI and highlighting pearls and pitfalls Reporting checklists for orbital and peri-orbital pathologies
The Spectrum of Imaging Findings in Melioidosis (Burkholderia Pseudomallei Infection) of the Central Nervous System

All Day Location: NR Community, Learning Center

Participants
Aruna S. Pallewatte, MD, FRCR, Colombo 10, Sri Lanka (Presenter) Nothing to Disclose

TEACHING POINTS
1. Know the etiology, epidemiology, transmission and clinical presentation of Melioidosis (Burkholderia pseudomallei infection).
2. Review of imaging abnormalities seen in systemic Melioidosis.
3. Learn the spectrum of common imaging findings in Melioidosis affecting Brain and Spine. Learn rare imaging features. Pathophysiology of CNS involvement and complications.
4. Post treatment Imaging appearances.
5. To discuss the radiological differential diagnosis of Melioidosis and imaging clues to differentiate from other similar infections.

TABLE OF CONTENTS/OUTLINE
1. Introduction- epidemiology, microbiology and transmission of Melioidosis (Burkholderia pseudomallei infection).
2. Clinical presentation, organs affected, confirmatory laboratory diagnosis of Melioidosis.
3. Review of Imaging features specially patterns of lung, liver and spleen involvement which help suspect Melioidosis.
4. Spectrum of imaging findings in Brain and Spine on MRI and CT illustrated with our example cases. MR/CT images of encephalitis, epidural and brain abscesses, brain stem involvement, myelitis, paraspinal abscesses, osteomyelitis, corticospinal tract involvement, Dural sinus thrombosis. Advantages of MRI over CT to detect lesions. Brief review of literature.
5. Imaging in post treatment follow-up.
6. Summary of key findings and points useful in radiological differential diagnosis.
Applications of Spectral CT in Neuroimaging

All Day Location: NR Community, Learning Center

Awards
Certificate of Merit

Participants
Mojgan Hojjati, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Elieh Ben-David, MD, Jerusalem, Israel (Abstract Co-Author) Nothing to Disclose
Jacob Sosna, MD, Jerusalem, Israel (Abstract Co-Author) Consultant, ActiViews Ltd Research Grant, Koninklijke Philips NV
Prabhakar Rajiah, MD, FRCR, Cleveland, OH (Presenter) Institutional Research Grant, Koninklijke Philips NV

TEACHING POINTS
Dual energy/spectral CT scanners can provide material characterization capabilities of different tissues. There are several implementations of dual energy CT, including a recently introduced dual-layer technology. There are several areas of application in neuroradiology.

TABLE OF CONTENTS/OUTLINE
- Dual energy CT - Physics and principles
- Implementations of dual energy CT - Dual source, rapid kv switching, dual spin dual layer, photon counting
- Advantages and disadvantages - Types of spectral images
- Phantom studies
- Neuroradiological applications of spectral CT with illustrations
- Bone removal in CT angiography
- Lower radiation dose, misregistration and post processing times
- Iodine versus Hemorrhage in post contrast CT
- Analysis of underlying pathology of hematoma, risk of hemorrhagic transformation
- Hemorrhage versus calcium in non-contrast CT
- Virtual non contrast images from contrast images
- Saves radiation dose, enhancement versus calcification
- Iodine overlay/effective atomic number overlay
- Improved detection of lesions, identification of contrast enhancement/perfusion
- Iodine map - Perfusion
- Plaque characterization
- Beam hardening artifact reduction from subclavian vessels

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Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at:
https://www.rsna.org/Honored-Educator-Award/

Prabhakar Rajiah, MD, FRCR - 2014 Honored Educator
Jacob Sosna, MD - 2012 Honored Educator
**Imaging Findings in Patients with Pulsatile Tinnitus**

All Day Location: NR Community, Learning Center

**Participants**
Daniel T. Ginat, MD, Chicago, IL *(Presenter)* Nothing to Disclose
Gul Moonis, MD, Boston, MA *(Abstract Co-Author)* Nothing to Disclose

**TEACHING POINTS**
* The goal of this exhibit is to provide a comprehensive overview of the variety of potential etiologies and corresponding imaging findings related to pulsatile tinnitus. * Appropriate selection of diagnostic imaging modalities for evaluating patients with pulsative tinnitus will also be reviewed.

**TABLE OF CONTENTS/OUTLINE**
* Definition of pulsatile tinnitus and its subtypes.* Clinical features and work up for patients with pulsatile tinnitus.* Indications for diagnostic imaging.* Overview of appropriate imaging modalities.* Depiction of imaging findings encountered with the different etiologies of pulsatile tinnitus (pseudotumor cerebri, dural venous thrombosis, arteriovenous fistulas, stenotic occlusive lesions, temporal bone tumors, jugular bulb and sigmoid sinus dehiscence and diverticula, aberrant internal carotid artery, among other conditions).* Discussion of implications for management.
Brainstem Pathology: A Case-Based Overview of Pathology and Approach to Diagnosis

Participants
Michael Maldonado, MD, Richmond, VA (Presenter) Nothing to Disclose
Yang Tang, MD, PhD, Glen Allen, VA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
There is a broad spectrum of diverse pathology that affects the brain stem. Given the eloquent structure and vital functions encompassed within the brain stem, these entities have a substantial morbidity and mortality associated with them. Our goal is to highlight these disease entities through an image-based case series of representative examples while providing an outline and systematic approach to the differential diagnosis. Finally, an overview of current treatment options and prognosis for each entity will be discussed.

TABLE OF CONTENTS/OUTLINE
Table of Contents: 1) Disease categories a) Infarction b) Hemorrhage c) Tumor d) Infection e) Inflammatory f) Metabolic g) Degenerative 2) Pathophysiology 3) Clinical features 4) Review of imaging characteristics/approach to differential diagnosis 5) Treatment and Prognosis
Pediatric Parotid Pearls

All Day Location: NR Community, Learning Center

Participants
Peter Lee, MD, Manhasset, NY (Presenter) Nothing to Disclose
Vinh T. Nguyen, MD, New Hyde Park, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To develop an approach to the radiologic evaluation of pediatric parotid gland lesions based on clinical presentation utilizing CT, MRI, and ultrasound. 2. To discuss the types of lesions and imaging characteristics of benign and malignant pediatric parotid lesions.

TABLE OF CONTENTS/OUTLINE
Anatomy of the Parotid Region Approach to the radiologic evaluation of pediatric parotid lesions based on clinical presentation. Clinical presentations of pediatric parotid lesions. Utility of different imaging modalities: MRI, CT, ultrasound. Imaging findings of pediatric parotid lesions. Congenital, e.g. first branchial cleft cyst. Infectious, e.g. parotitis, parotid abscess. Inflammatory, e.g. Sjogren's disease. Neoplastic Benign, e.g. hemangioma, pleomorphic adenoma, plexiform neurofibroma. Malignant, e.g. mucoepidermoid carcinoma. Imaging features that help differentiate benign from malignant neoplasms.
MR Spectroscopy Findings of Common Cerebral Masses and Lesions: Key Points, Artifacts, Pearls

All Day Location: NR Community, Learning Center

Participants
Recep Sade, MD, Erzurum, Turkey (Abstract Co-Author) Nothing to Disclose
Hayri Ogul, Erzurum, Turkey (Abstract Co-Author) Nothing to Disclose
Leyla Karaca, Erzurum, Turkey (Abstract Co-Author) Nothing to Disclose
Ummugulsan Bayraktutan, Erzurum, Turkey (Abstract Co-Author) Nothing to Disclose
Ihsan Yuce, Erzurum, Turkey (Abstract Co-Author) Nothing to Disclose
Mecit Kantarcı, Erzurum, Turkey (Presenter) Nothing to Disclose
Suat Eren, MD, Erzurum, Turkey (Abstract Co-Author) Nothing to Disclose
Akin Levent, Erzurum, Turkey (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Review MRS metabolites and normal MRS findings of brain
2. Learn the most common cerebral mass MRS finding
3. Differentiate benign lesions from malignancies
4. Differentiate recurrence and radiation necrosis after surgery and radiotherapy

TABLE OF CONTENTS/OUTLINE
MRS physics and normal MRS findings. After discussion of the normal MRS findings, cases are presented in a quiz format. MR and MRS findings of relevant case are discussed after all case presentation. Cases are consisted of low grade glial tm, GBM, meningioma, malignant meningioma, radiation necrosis, recurrence GBM, Tumefactive multiple sclerosis, embryonic carcinoma, metastasis, subacute ischemia and infection. Case are organized based on differentiate benign lesions from malignancies and common MRS findings.
Often Avoided Details in Temporal Bone Imaging- Elaborate Anatomy and Implications that Radiologists Must Know

All Day Location: NR Community, Learning Center

Participants
Aruna R. Patil, MD, FRCR, Bangalore, India (Presenter) Nothing to Disclose
Shrivali Nandikoor, MBBS, Bangalore, India (Abstract Co-Author) Nothing to Disclose
Anuradha Rao, Bangalore, India (Abstract Co-Author) Nothing to Disclose
Govindarajan J. Mallarajapatna, MBBS, MD, Bangalore, India (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To acquaint the radiologist with the anatomy of the smaller structures and often overlooked structures of temporal bone such as canals, muscles, labyrinthine apparatus and tympanic recesses.
2. Expand the scope of temporal bone reporting, providing precise details for better management.
3. These structures can be easily mistaken for fracture lines in case of trauma, abnormal soft tissue in case of infection/inflammation. Some of these minute canals serve as a route of spread of disease. Recesses act as source for recurrence of otitis.

TABLE OF CONTENTS/OUTLINE
Petrous bone is a Pandora’s box lodging many structures including nerves, labyrinthine structures, muscles and ossicles. The anatomical landmarks, appearance on HRCT and implications of the following structures will be discussed along with relevant pathological cases.
1. Canal for nerves: - canal of cochlear nerve- canal of superior vestibular nerve- canal of saccular nerve- canal of singular nerve- chorda tympani - inferior tympanic canaliculus- mastoid canaliculus- subarcuate canaliculus- groove for greater superficial petrosal nerve
2. Labyrinthine apparatus: vestibular aqueduct, cochlear aqueduct
3. Muscles: Stapedius, Tensor tympani
4. Retro tympanic recess and other hidden spaces: Sinus tympani, facial recess, lateral and posterior tympanic sinus, Prusaac’s space
Vertebral Artery Ultrasound: A Window to the Great Vessels

Awards
Certificate of Merit

Participants
Sherif Saad, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Mindy M. Horrow, MD, Philadelphia, PA (Presenter) Spouse, Director, Merck & Co, Inc

TEACHING POINTS

1. Discuss intrinsic disease of vertebral/basilar and subclavian/innominate arteries that may be inferred from limited images of vertebral artery obtained during routine carotid Doppler imaging. Review how subclavian disease occurring proximal to vertebral origin results in ipsilateral vertebral flow reversal, "stealing" from contralateral subclavian artery via vertebral artery. Recognize that subclavian steal phenomena occur because vertebral arteries join forming a single circuit via the basilar artery and flow from one vertebral may supply the contralateral side. Identify that pre and partial steal phenomena occur with varying degrees of stenosis of the subclavian artery. Discuss how innominate disease is inferred by combination of flow reversal in right vertebral and abnormal right carotid waveforms. Recognize other unusual vertebral artery waveforms that may imply intrinsic proximal or distal disease.

TABLE OF CONTENTS/OUTLINE

I. Vertebral Artery
A. Normal anatomy and variations
B. Waveforms and velocities
   1. High resistance
   a. Normal
   b. Distal Occlusion
   c. Hypoplastic
   d. Basilar artery disease
   e. Fibromuscular dysplasia
   2. Parvus tardus: proximal disease
II. Subclavian Steal: anatomy and US examples
A. Complete
B. Partial/Pre
III. Brachiocephalic Disease
A. Occlusion
B. Stenosis

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/
Review of False Ischemic Penumbra in Perfusion-CT

All Day Location: NR Community, Learning Center

Participants
Karla H. Vivancos Costaleite, MD, Madrid, Spain (Presenter) Nothing to Disclose
Esther Sanchez Sanz, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Eduardo Barcena Ruiz, Toledo, Spain (Abstract Co-Author) Nothing to Disclose
Antonio Barbosa, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Rafael M. Soler, MD, Rivas-Vaciamadrid, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Familiarize radiologists and residents begin with image patterns and causes of false ischemic penumbra in emergency CT perfusion.

TABLE OF CONTENTS/OUTLINE
The multimodal brain CT plays an essential role in the diagnosis of acute ischemia and treatment decision. The evaluation of suspected ischemic stroke includes images of cerebral perfusion CT performed to allow differentiation of ischemic areas that are at risk of stroke (ischemic penumbra) of areas of infarction established. However, not all anomalies in the CTP are specifically related to ischemic stroke, there are many neurological diseases that cause symptoms that mimic ischemic stroke; also, the presence of cerebrovascular anatomical variations, changes and chronic ischemia physiological conditions (cerebral blood flow limitation) can cause altered cerebral perfusion and therefore may lead to alterations in the CTP. Since 2011, our center has been set in place Stroke Code protocol with involvement of Emergency Radiology, Neuroradiology Interventional Radiology and Neurology. We present through the review of 260 studies Urgency of our hospital from October 2012 to March 2015, patterns of normal and pathological perfusion and false ischemic penumbra.
Participants
Santiago Resano Pardo SR, Madrid, Spain (Presenter) Nothing to Disclose
Inmaculada Mota Goitia, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Esther Garcia Casado, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Daniel Lourido Garcia, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Sara Escoda, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Ines Pecharroman de las Heras, MD, Alcala de Henares, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The main purposes of this presentation are: 1) To review the CT perfusion studies performed in the ED through clinical suspicion of severe brain stroke, susceptible to fibrinolytic treatment. Such CT perfusion studies are always accompanied by a basal cranium CT and an Angio-CT of the supra-aortic trunks and circle of Willis. Occasionally, Magnetic Resonance is also used as a second step. 2) Our dataset would allow us to obtain alternative diagnosis in about 8.4% of the clinical cases, with a different therapeutic and prognostic approach. Our diagnoses have been sustained based on Angio-CT and/or MR images. 3) CT perfusion images bring relevant information in many occasions for the non-ictal pathologic and atypical vascular clinical profile diagnoses.

TABLE OF CONTENTS/OUTLINE
214 CT perfusion Studies are reviewed in the emergency department during 9 consecutive months, with a clinical suspect of severe brain stroke and susceptible of fibrinolytic treatment. The results suggest that about 8.4% of patients show a non-ictal and atypical vascular pathology. 1) Demyelinating disease 2) Sinus thrombosis 3) Encephalitis 4) Seizure 5) Vasospasm 6) Vasculitis 7) Extra axial bleeding 8) Neoplastic pathology
This is Not a Subarachnoid Hemorrhage!

All Day Location: NR Community, Learning Center

Awards
Certificate of Merit

Participants
Elena Lopez Uzquiza, Santander, Spain (Presenter) Nothing to Disclose
Marta Drake Perez, MD, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Maria Diez Blanco, Valladolid, Spain (Abstract Co-Author) Nothing to Disclose
Enrique Marco de Lucas, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Amaya Iturralde Garriz, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Javier de la Calle, Santander, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
A pseudo-subarachnoid hemorrhage is a CT finding that shows SAH-like appearance, in which the cisterns and cerebral sulci appear hyperattenuated relative to the brain parenchyma. The purpose of this exhibit is to expose challenging cases of several neurologic diseases that can mimic this tomographic pattern in order to improve our diagnostic accuracy.

TABLE OF CONTENTS/OUTLINE
The cases will be presented in a quiz format with the differential diagnostic better explained in the discussion of each one.
- Usual SAH on CT and MR
- Severe hypoxic ischemic encephalopathy / Brain death
- Normal newborn brain
- Tumoral infiltration
- Lymphoma
- Meningoencephalitis
- TBC
- Vascular malformation
- Intravascular thrombus
- Aneurysm
- Sturge-Weber
- Meningioangiomatosis
- Subacute ischemic stroke
- Post-embolectomy contrast enhancement
- Status epilepticus
- PRES
- Cortical laminar necrosis
- Ancient intrathecal contrast
- White epidermoid cyst
Meningioma - In and Out
All Day Location: NR Community, Learning Center

Participants
Aruna R. Patil, MD, FRCR, Bangalore, India (Presenter) Nothing to Disclose
Sharath Kumar, Bangalore, India (Abstract Co-Author) Nothing to Disclose
Shrivali Nandikoor, MBBS, Bangalore, India (Abstract Co-Author) Nothing to Disclose
Anuradha Rao, Bangalore, India (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Meningiomas are the most common non-gliarial tumors of the central nervous system. The purpose of this exhibit is to: • Review the types of intracranial, spinal and extracranial meningiomas, their typical and atypical imaging features • Associations, complications and imaging mimics of meningioma • Role of advanced imaging techniques in meningioma

TABLE OF CONTENTS/OUTLINE
The exhibit will cover the following:
Meningiomas based on location: Cranial (cerebral convexity, olfactory lobe, parafalcine, falcotentorial, planum sphenoidale, sellar, tentorial, orbital, cerebello pontine angle, intraventricular), Extracranial (intradiploic, parapharyngeal, temporal) and Spinal.
Associations and complications: Bony changes, perilesional edema, mass effect and Syndromic associations
Atypical meningiomas: Cystic meningioma, Lipoblastic meningioma, Hemangiopericytoma, Meningiomatosis
Mimics: Chloroma, Sarcoidosis, Metastases, lymphoma, schwannoma, Rosai Dorfman disease, plasmacytoma etc.
Advanced imaging: Role of novel MR sequences, Diffusion weighted imaging, Perfusion imaging, MR spectroscopy, Diffusion Tensor Imaging and Conventional angiography in imaging of meningioma.
Brains Gone Awry: Supratentorial Brain Lesions in the Pediatric Population

All Day Location: NR Community, Learning Center

Participants
Neha Gowali, MD, Morristown, NJ (Presenter) Nothing to Disclose
Gunja P. Parikh, MD, Morristown, NJ (Abstract Co-Author) Nothing to Disclose
Nimisha Mehta, MD, Morristown, NJ (Abstract Co-Author) Nothing to Disclose
James R. Hogan, MD, Morristown, NJ (Abstract Co-Author) Nothing to Disclose
Jose C. Rios, MD, PhD, Morristown, NJ (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Learn the differential diagnoses for supratentorial brain lesions in the pediatric population. Review the imaging features of these supratentorial brain lesions. Discuss treatment approaches for these pediatric brain lesions.

TABLE OF CONTENTS/OUTLINE
This presentation will provide a brief review of anatomy. Pediatric supratentorial brain lesions will be presented based on location in a quiz format utilizing images and/or videos. Cases that will be discussed will include (but not limited to): Extra-axial lesions: Arachnoid cyst Dermoid/Epidemoid Lipoma Neurocutaneous melanosis Esthesioneuroblastoma Sellar/Suprasellar lesions: Craniopharyngioma, Rathke's cleft cyst, pituitary adenoma Pineal lesions: germinoma, pineoblastoma, pineocytoma Hamartoma of tuber cinereum Intraventricular lesions: Desmoplastic infantile ganglioglioma Dysembryoplastic neuroepithelial tumor Pilocytic astrocytoma Glioblastoma multiforme Subependymal giant cell astrocytoma Angiocentric glioma Intra-axial lesions: Choroid plexus papilloma Subependymoma
Clinical Utility of Dual-energy CT in the Diagnosis of Brain Tumors

All Day Location: NR Community, Learning Center

Participants
Yoko Kaichi, Hiroshima, Japan (Presenter) Nothing to Disclose
Fuminari Tatsugami, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Toru Higaki, PhD, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Kenji Kajiwara, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
So Tsushima, Otawara, Japan (Abstract Co-Author) Employee, Toshiba Corporation
Kazuo Awai, MD, Hiroshima, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation; Research Grant, Hitachi, Ltd; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Medical Advisor, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Nemoto-Kyourindo; ; ;

TEACHING POINTS

1. The clinical utility of dual-energy CT (DECT) added to conventional CT and MRI for the further assessment of brain tumors yields not only structural- but also new functional information such as the electron density and the effective atomic number. 2. Few brain tumors have been characterized on DECT scans. We present information obtained by DECT on various brain tumors. The highly accurate preoperative diagnosis of brain tumors facilitates their appropriate treatment.

TABLE OF CONTENTS/OUTLINE

1. Principles of DECT - dual-energy analysis methods - image-based analysis - raw data-based analysis
2. Material identification on DECT scans - material decomposition - electron density - effective atomic number
3. DECT evaluation of brain tumors - representative clinical case - differential diagnosis of brain tumors - importance for treatment planning
Dural Hemangiopericytoma? Not so Rare! What Radiologists Should Know about Dural Hemangiopericytoma and Its Differential Diagnosis

All Day Location: NR Community, Learning Center

Participants
Antonio Lorenzo Gorriz, Castellon, Spain (Presenter) Nothing to Disclose
Jose H. Garcia Vila, MD, Castellon, Spain (Abstract Co-Author) Nothing to Disclose
Manuel Cifrian-Perez, MD, Castellon, Spain (Abstract Co-Author) Nothing to Disclose
Volker Schroer, Castellon, Spain (Abstract Co-Author) Nothing to Disclose
Antonio Navarro Ballester, MD, Castellon de la Plana, Spain (Abstract Co-Author) Nothing to Disclose
Soraya Barrachina Hidalgo, MD, Castellon, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this educational poster is:
1. To review the pathology of Hemangiopericytoma.
2. To expose the WHO grades of HPC, and discuss radiologic findings which can provide clues to differentiate the anaplastic form.
3. To review the CT, MR and angiography findings of this tumor, and to correlate pathologic and radiologic findings.
4. To discuss the differential diagnosis between HPC and meningioma, the most common extraaxial tumor.
5. To show what radiologists can offer for treatment and diagnosis of hemangiopericytoma.

TABLE OF CONTENTS/OUTLINE
1. Pathology of HPC.
2. Epidemiology, prognosis and treatments.
3. Anaplastic Hemangiopericytoma (WHO grade III).
4. Review of imaging findings: CT, MRI, Angiography.
5. Differential diagnosis between HPC and meningioma.
6. Key Radiology findings for surgical planification, and usefulness of embolization prior to surgery.
Diagnosing Imaging of Complicated Head and Neck Infections

All Day Location: NR Community, Learning Center

Participants
Daniel T. Ginat, MD, Chicago, IL (Presenter) Nothing to Disclose

TEACHING POINTS
The imaging findings of complicated head and neck infectious processes are reviewed, including a discussion of microbiology, mechanism of spread, and implications for management. The exhibit will familiarize the viewer with challenging cases of head and neck infections and an approach to imaging and interpreting such cases.

TABLE OF CONTENTS/OUTLINE
Overview of appropriate imaging techniques. Overview of microbiology. Review of anatomy relevant to potential pathways of infection spread. Review of specific complex infectious conditions, such as parapharyngeal abscess with development of pharyngocutaneous fistula, masticator space abscess and sinusitis related to buccal mucosa injury, recurrent infections related to branchial apparatus anomalies, superinfected tumors, laryngopyoceles, atypical infections related to immunoscompromised states, and infection syndromes, such as Lemierre syndrome, Ludwig’s angina, Bezold’s abscess, orbital apex syndrome, Pott’s puffy tumor, and Gradenigo syndrome.
Orphan Lesions of the Head and Neck: Ultrasound Evaluation of Uncommon Neck Masses

All Day Location: NR Community, Learning Center

Participants
Courtney M. Tomblinson, MD, Phoenix, AZ (Presenter) Nothing to Disclose
Scott W. Young, MD, Scottsdale, AZ (Abstract Co-Author) Nothing to Disclose
Nirvikar Dahiya, MD, Phoenix, AZ (Abstract Co-Author) Nothing to Disclose
Christine O. Menias, MD, Scottsdale, AZ (Abstract Co-Author) Nothing to Disclose
Maitray D. Patel, MD, Phoenix, AZ (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Review the ultrasound features of non-thyroid, non-carotid head and neck masses
2. Describe an approach for differentiating head and neck masses
3. Improve diagnostic accuracy, which can have implications on treatment

TABLE OF CONTENTS/OUTLINE
1. Introduce a broad differential diagnosis for sonographic evaluation of head and neck masses, excluding typical thyroid and carotid pathology
2. Review the definition, location, presentation, imaging features, differential diagnosis, and treatment of uncommon head and neck entities including paraganglioma, pseudoaneurysm, ranula, sialadenitis, thyroglossal duct cyst, branchial cleft cyst, and more.
3. Present an imaging algorithm of sonographic findings within the described lesions
4. Discuss proper transducer selection and technical considerations in ultrasonography of the head and neck

Summary: Uncommon masses in the head and neck can present a diagnostic dilemma. Understanding the embryologic origin and localizing compartment of head and neck lesions combined with sonographic findings can aid in differentiating these less frequently encountered entities. This is particularly important as attempts to reduce radiation dose have stimulated demand for ultrasound and initial diagnoses often must be made to guide management.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Christine O. Menias, MD - 2013 Honored Educator
Christine O. Menias, MD - 2014 Honored Educator
Christine O. Menias, MD - 2015 Honored Educator
The Radiologist's Role in Shunt Evaluation: A Resident Primer and Review of What the Neurosurgeon Wants to Know

All Day Location: NR Community, Learning Center

Participants
Lauren Pringle, MD, Baltimore, MD (Presenter) Nothing to Disclose
Erick M. Westbroek, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Thangaramadhan Bosemani, MD, FRCR, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Purpose: 1. To review clinical indications for shunting 2. To review the types of shunts and shunt devices and provide photos of select devices and their radiographic correlates 3. To review common clinical scenarios requiring radiographic evaluation of shunts, provide case examples, and review neurosurgical interventions in a shunted patient 4. To review the utility of different modalities/study protocols in shunt evaluation and strengths/weaknesses of each 5. To review specific instances where the radiologist can aid the neurosurgeon in diagnosis and treatment planning for shunted patients

TABLE OF CONTENTS/OUTLINE
Clinical Indications for shunting -Obstructing hydrocephalus -Nonobstructing hydrocephalus Types of shunts -Ventriculoperitoneal, ventriculopleural, ventriculostial, ventriculocisternial -Lumboperitoneal -Subgaleal Examples of commonly used shunt devices Indications for radiologic evaluation of shunts -Concern for shunt malfunction -Assessment of ventricles -Adjustment of shunt settings Modalities and study protocols used for shunt evaluation -Radiographic shunt surveys -CT -MRI and ultrafast MRI -Shunt patency evaluation Specific ways the radiologist can help neurosurgeons in diagnosis and management -Subtle ventricular size changes -Proximal versus distal malfunction -Shunt settings -Study protocol recommendations
Imaging of Dermal and Subdermal Lesions of the Head and Neck

All Day Location: NR Community, Learning Center

Participants
Shannon L. St Clair, MD, MPH, New York, NY (Presenter) Nothing to Disclose
Lawrence E. Ginsberg, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Deborah R. Shatzkes, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
While superficial components of skin abnormalities are typically readily apparent to the examining clinician, the radiologist provides invaluable information by describing the deep components of these lesions, their effect on underlying structures, and their pattern of spread. In particular, a thorough understanding of patterns of perineural tumor spread and lymphatic drainage is necessary to accurately map primary and recurrent cutaneous malignancies.

TABLE OF CONTENTS/OUTLINE
1. Anatomy Gross Microscopic Imaging: CT and MRI
2. Focal skin lesions Malignant - Primary (e.g. SCC, BCC, melanoma, angiosarcoma, mycosis fungoides) - Metastatic - Recurrent - Patterns of spread (lymphatic, perineural) - Resectability issues (orbital, bone involvement) Benign - Vasoformative lesions (e.g. infantile hemangioma, lymphatic malformation, port wine stain) - Congenital lesions (e.g. branchial cleft anomalies) - Mesenchymal lesions (e.g. neurofibroma) - Dermal adnexal lesions (e.g. sebaceous cyst) - Miscellaneous (e.g. Kimura Disease)
3. Diffuse skin processes Infection (cellulitis, necrotizing fasciitis) Angioedema Radiation effects Miscellaneous (e.g. Parry-Romberg Syndrome)
4. Approach to interpretation and reporting of imaging studies
5. Bibliography
When Less is More: Exploiting Vessel Sparsity to improve 4D CEMRA of Dural AV Fistulas

All Day Location: NR Community, Learning Center

Awards
Magna Cum Laude

Participants
Zachary Clark, MD, MS, Madison, WI (Presenter) Nothing to Disclose
Kevin M. Johnson, Madison, WI (Abstract Co-Author) Research support, General Electric Company
Yijing Wu, Madison, WI (Abstract Co-Author) Nothing to Disclose
Myriam Edjlali, Paris, France (Abstract Co-Author) Nothing to Disclose
Oliver Wieben, PhD, Madison, WI (Abstract Co-Author) Research support, General Electric Company
Patrick A. Turski, MD, Madison, WI (Abstract Co-Author) Research support, General Electric Company

TEACHING POINTS
The purpose of this exhibit is: 1. To review the pathogenesis, classification, and imaging characteristics of dural arteriovenous fistulas (dAVF). 2. Illustrate how vessel sparsity in the 3D Volume is advantageous for 4D CEMRA (contrast enhanced magnetic resonance angiography) acceleration methods. 3. Demonstrate how 4D CEMRA imaging utilizing acceleration techniques can be used for dAVF classification and risk stratification.

TABLE OF CONTENTS/OUTLINE
Anatomy and pathogenesis of dAVF-Pathogenesis of dAVF-Overview of arterial anatomy and cortical venous drainage of dAVF-Borden and Cognard Classification of dAVF-Imaging Techniques - Temporal Spatial Acceleration Methods for Advanced 4D CEMRA in cerebrovascular imaging-Overview of 4D CEMRA using constrained reconstruction to provide whole brain coverage with temporal resolution of 0.75 seconds and spatial resolution of 0.7 mm isotropic. Putting it all together-Case examples of dAVF using undersampled radial acquisition and constrained reconstruction to obtain high resolution 4D CEMRA for classification and risk stratification.
Conductive Hearing Loss: I’m Sorry, Can You Repeat That...

All Day Location: NR Community, Learning Center

Participants
Justin La Plante, MD, Sayre, PA (Presenter) Nothing to Disclose
Richard H. Wiggins III, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The purpose of this educational exhibit is to: 1) Review complex temporal bone anatomy utilizing a stepwise anatomic approach. 2) Discuss common pathologic etiologies associated with conductive hearing loss. 3) Correlate patient clinical presentation and otologic findings with specific pathologies. 4) Examine the key features of differential diagnoses related to conductive hearing loss.

TABLE OF CONTENTS/OUTLINE

Essential temporal bone anatomy; Etiologies associated with conductive hearing loss; Clinical presentation and otologic findings; Imaging findings (CT/MRI) and pathophysiology; Differential diagnoses for specific pathologies;

Honored Educators

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Richard H. Wiggins III, MD - 2012 Honored Educator
NR136-ED-X

**Imaging Review of Neurodevelopmental Pediatric Seizure**

All Day Location: NR Community, Learning Center

**Participants**

Joseph Giampa, DO, Morristown, NJ *(Presenter)* Nothing to Disclose
James R. Hogan, MD, Morristown, NJ *(Abstract Co-Author)* Nothing to Disclose
Peter Wynne, MD, Morristown, NJ *(Abstract Co-Author)* Nothing to Disclose
Jose C. Rios, MD, PhD, Morristown, NJ *(Abstract Co-Author)* Nothing to Disclose

**TEACHING POINTS**

Provide an introduction to pediatric seizure and discuss the importance of the role of imaging. Review imaging of congenital causes of pediatric seizure. Discuss pertinent points such as terminology, pathology, and clinical issues for each case.

**TABLE OF CONTENTS/OUTLINE**

Table of Contents/Outline: Seizures represent the clinical expression of abnormal neuronal discharges primarily within the cerebral cortex. Any insult to the cerebral cortex can cause a seizure which may be related to a large variety of etiologies including idiopathic (most common), vascular, traumatic, developmental, infectious, and neoplastic. Following idiopathic, in children under the age of 14 years, developmental causes are most common. Imaging, particularly MRI, has significant impact in the ability to recognize and categorize neurodevelopmental causes of seizure. Neurodevelopmental causes of pediatric seizure can be classified into focal, hemispheric, and diffuse categories. The disorders discussed in this exhibition are listed below.

- Focal Cortical dysplasia
- Schizencephaly
- Hypothalamic Hamartoma
- Mesial Temporal Sclerosis
- Porencephaly
- Hemimegacencephaly
- Sturge-Weber
- Diffuse Lissencephaly
- Tuberous Sclerosis
- Holoprosencephaly
- Focal or Diffuse Gray Matter Heterotopia
- Polymicrogyria
- Pachygyria
Dynamic Parathyroid Computed Tomography (4D-CT) for Preoperative Localization of Parathyroid Adenomas

Participants
Tejas C. Manchandia, MD, Chino Hills, CA (Presenter) Nothing to Disclose
Mark S. Shiroishi, MD, Los Angeles, CA (Abstract Co-Author) Consultant, Guerbet SA; Research Grant, Toshiba Corporation;
John L. Go, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Orest B. Boyko, MD, PhD, Los Angeles, CA (Abstract Co-Author) Speakers Bureau, Bracco Group
Alexander Lerner, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is to educate the radiologist about the clinical presentation, basic pathophysiology, four-dimensional computed tomography (4D-CT) imaging techniques and findings, differential diagnosis and relevant clinical management of primary hyperparathyroidism. The reader will be walked through an anatomic and pathophysiologic refresher, followed by a discussion of optimal CT imaging techniques, including advantages and disadvantages of 4D-CT. A series of imaging based cases demonstrating key findings of hyperfunctioning parathyroid adenomas using 4D-CT will be presented.

TABLE OF CONTENTS/OUTLINE
* Pictorial and imaging anatomy of the parathyroid gland and typical locations of adenomas to improve the radiologist's search pattern* Advantage of 4D-CT over other modalities in localizing parathyroid adenomas* Optimal 4D-CT scan technique and its utility in assessment for parathyroid adenomas* Imaging presentation of various cases of hyperparathyroidism and correlation with surgical results* Optimal reporting method of 4D-CT, including factors which affect the confidence of candidate lesions* References
Spectrum of Imaging Findings in Thalamic Lesions: A Pictorial Essay

All Day Location: NR Community, Learning Center

Participants
Foram B. Gala, MBBS, MD, Mumbai, India (Presenter) Nothing to Disclose
Vasundhara Smiti, MD, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Tejas Gosalia, MBBS, MD, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Bharat M. Gala, MBBS, Mumbai, India (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) To describe the detailed anatomy and functions of thalamus. 2) Describe various pathologies involving thalamus isolated or with other brain structures and their Imaging findings. 3) Differential diagnosis and approach

TABLE OF CONTENTS/OUTLINE
Thalami are paired deep gray matter structures consisting of various nuclei - relaying motor and sensory information from subcortical structures to the cortex. It also plays role in regulation of consciousness, sleep, and alertness. Medial and lateral geniculate bodies are auditory and visual relay nuclei, projecting fibres to auditory and visual cortex of brain respectively. Arterial supply: From P1 and P2 segments of PCA and PCOM. Variations are known like artery of percheron supplying thalamus and midbrain on both sides resulting in paramedic infarcts bilaterally. Venous Drainage: into deep cerebral veins i.e. the internal cerebral veins, vein of Galen and straight sinus. Pathologies: Vascular: Arterial infarcts, Deep Venous thrombosis, Hypertensive haemorrhage, Hypoxic ischemic encephalopathy, Mitochondrial diseases: Leighs disease, Metabolic: Wilson's disease, Fahr's disease, Extrapontine myelinolysis, Wernicke's encephalopathy. Infections: Neurocysticercosis, Tuberculosis, however Toxoplasmosis, flavivirus are classical. Degenerative: Creutzfeldt-Jakob Disease. Tumors: Glioma, lymphoma, metastases.
Thyroid Nodules: Demystifying the Plethora of Guidelines. A Practical Approach to Ultrasound Assessment and FNA

All Day Location: NR Community, Learning Center

Participants
Charlie Sayer, MBBS, FRCR, London, United Kingdom (Presenter) Nothing to Disclose
Susan Jawad, FRCR, MBBS, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Aghi Srikanthan, MBBS, FRCR, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
James M. Pilcher, MBBS, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
E. Jane Adam, MBBS, FRCR , London, United Kingdom (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Familiarization with published guidelines on the diagnostic workup of thyroid nodules.
3. Practical approach to thyroid ultrasound e.g. using a U1-U5 grading system.
4. When to FNA thyroid nodules, combining current guidance with pictorial examples and clinico-cytohistopathological information.
5. New concepts including use of molecular markers in patients with indeterminate biopsies.

TABLE OF CONTENTS/OUTLINE
1. Outline of guidelines
2. Pictorial examples of benign, indeterminate and suspicious nodules as defined by the above guidelines.
3. Examples of when to FNA, follow-up or discharge with pictorial examples.
4. Examples of benign ultrasound (U2) characteristics with clinico-cytohistopathological correlation.
5. Indeterminate or equivocal nodules (U3) - ultrasound features, when to repeat FNA or follow.
6. Suspicious nodules (U4) ultrasound features and management.
7. Malignant nodules (U5) ultrasound features and management.
8. Prognostication and decision making e.g. risk factors, molecular markers in indeterminate biopsies.
Cranial Hypotension Secondary to CSF Fistula: Recognizing the Spectrum of Findings in the Various Imaging Methods to Reduce the Initial Underdiagnosis

All Day Location: NR Community, Learning Center

Participants
Rita de Cassia M. Pincerato, MD, PhD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Cesar Augusto P. Alves SR, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Paula C. Pinho, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Aline Ayres, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Claus F. Grasel, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Assess the radiographic manifestations that can help in the detection of CSF leaks reducing initial misdiagnosis in patients with symptoms of intracranial hypotension. Assess the imaging spectrum of findings in computed tomographic myelography and magnetic resonance myelography.

TABLE OF CONTENTS/OUTLINE
Pathophysiology of cranial hypotension secondary to CSF fistula
Cerebrospinal spinal fluid (CSF) leaks. Review of imaging findings in spine.
- Conventional MRI
- Computed tomographic myelography
- Magnetic resonance myelography
Sample cases and indicative findings of CSF leaks
- Epidural collection
- Spinal meningeal diverticula
- Dilatation of the venous plexus
- Accumulation of contrast medium in the spinal epidural space
- Extradural spreading of contrast medium
Detect the location of the dural leakage to guide blood patch procedure
Non-traumatic Lesions of the Scalp: A Practical Approach to Imaging Diagnosis

All Day Location: NR Community, Learning Center

Participants
Rafael Morcillo Carratala, MD, Madrid, Spain (Presenter) Nothing to Disclose
Elena Capilla, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Isabel Herrera, Toledo, Spain (Abstract Co-Author) Nothing to Disclose
Purificacion Calvo, Toledo, Spain (Abstract Co-Author) Nothing to Disclose
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Raquel Moreno De La Presa, Toledo, Spain (Abstract Co-Author) Nothing to Disclose
Fatima X. Aragon Tejada, MD, Toledo, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To describe the normal anatomy and most common diseases of the scalp To illustrate the radiological features of non-traumatic pathology of the scalp using a multimodality approach with computed tomography (CT) and magnetic resonance (MR) To provide key points of each disease and to discuss the differential diagnosis of these lesions

TABLE OF CONTENTS/OUTLINE
Anatomy of the scalp Semiology of lesions of the scalp Review of imaging findings Trichilemmal Cysts Dermoid Cysts Epidermoid Cysts Lipoma Intraosseous Hemangioma Slow Flow Vascular Malformations Sinus Pericranii Langerhans Cell Histiocytosis Metastasis Lymphoma Plexiform Neurofibroma (pathognomonic for neurofibromatosis type 1) Atypical and Malignant Meningioma Basal Cell Carcinoma and Squamous Cell Carcinoma Others Key points and differential diagnosis Summary and conclusions
NR142-ED-X

Neuroimaging of Joubert Syndrome and Related Cerebellar Disorders: from Fetus to Adult

All Day Location: NR Community, Learning Center

Participants

Sahar Saleem, MD, Cairo, Egypt (Presenter) Nothing to Disclose
Ahmed-Hesham M. Said, MD, PhD, Cairo, Egypt (Abstract Co-Author) Nothing to Disclose
Maha S. Zaki, MD, Cairo, Egypt (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. To discuss the pathogenic mechanism of the ciliopathy Joubert Syndrome and related disorders (JSRD); 2. To discuss prenatal diagnosis of JSRD and highlight the role of fetal MRI; 3. To recognize the neuroimaging heterogeneity in (JSRD); 4. To discuss the utility of MRI (particularly special sequences) in diagnosis and differential diagnosis of Joubert Syndrome and related disorders

TABLE OF CONTENTS/OUTLINE

1. Pathophysiology, classification, and clinical presentations of Joubert Syndrome and related disorders (JSRD). 2. Neuroimaging findings of JSRD, emphasizing on the molar tooth sign as a hallmark for diagnosis, and describing the heterogeneity of the findings. 3. Discussion of the role of prenatal imaging, particularly using MRI, in early in-utero detection of JSRD and as a tool for a better understanding of its pathogenesis. 4. Discussion of the utility of MRI using advanced sequences such as diffusion tensor imaging (DTI) in diagnosis of JSRD. Future directions emphasizing the role of neuroimaging in guidance of in-utero diagnosis and gene therapy of JSRD.
TEACHING POINTS
The petrous carotid canal is an easily identified navigation tool that can be used to reliably learn the bones, foramina and synchondroses of the central skull base and petrous apex. Characterizing the center of a central skull base lesion or the pattern of skull base foraminal involvement is useful to provide a relevant succinct differential diagnosis for central skull base pathology. MRI and CT are complimentary in characterizing central skull base pathology.

TABLE OF CONTENTS/OUTLINE
Demonstrate the central skull base foramina, bones and synchondroses in multiple planes as they relate to the easily identified petrous carotid canal. Review the clinically relevant anatomy of skull base foramina. Provide case based illustrative interactive review of important central skull base and petrous apex pathology including relevant patterns of perineural spread of tumor.
Revisiting Modified Classification and Spectrum of Imaging Findings in Congenital Anomalies of Inner Ear on CT and MRI and Assessing the Feasibility for Cochlear Implant

All Day Location: NR Community, Learning Center

Participants
Isha D. Atre, MBBS, Mumbai, India (Presenter) Nothing to Disclose
Praveen P. Wall, MBBS, DMRD, Bangalore, India (Abstract Co-Author) Nothing to Disclose
Santosh S. Gupta, MD, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Smruti Mulani, MD, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Aniruddha V. Kulkarni, MD, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Jagdish M. Modhe, MD, Mumbai, India (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is-1) To review the imaging anatomy of temporal bone. 2) To gain an awareness of the classification of the congenital cochleo-vestibular anomalies. 3) To learn the technique and spectrum of imaging findings of inner ear anomalies on CT and MRI.4) To assess the feasibility for cochlear implant.

TABLE OF CONTENTS/OUTLINE
Anatomy of temporal bone and inner earEmbryology of inner earImaging techniques - HRCT - MRIImaging findings in inner ear malformations - Michel deformity - Cochlear aplasia - Common cavity deformity - Incomplete partition type I (IP-I) - Cochlear hypoplasia - Incomplete partition type II (IP-II) - Incomplete partition type III (IP-III) - Cochlear nerve deficiency - Isolated cochleaImplications of imaging findings for cochlear implant
The Pterygopalatine Fossa Interchange: An Easy Way to Understand All Routes

All Day Location: NR Community, Learning Center

Awards
Certificate of Merit

Participants
Viviana P. Beltran Salazar, MD, Sabadell, Spain (Presenter) Nothing to Disclose
Mario Prenafeta, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Antoni Rovira-Gols, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Beatriz Consola, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Diego Preciado, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Sandra Perez Aguilera, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Martin Zauner, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To make it easy to understand the different communications through the pterygopalatine fossa by using multiple examples and diagrams. To facilitate the CT and MRI evaluation of the different pathways for perineural spread of head and neck tumor diseases between noncontiguous compartments through the pterygopalatine fossa.

TABLE OF CONTENTS/OUTLINE
The pterygopalatine fossa (PPF) contains multiple nerves and vessels that supply the deep facial structures. It communicates with the middle cranial fossa, orbit, nasal cavity, oral cavity, pharynx, foramen lacerum, and the infratemporal fossa via foramina and canals. We divide our exhibit into: 1. Structure and contents of the pterygopalatine fossa 2. Normal anatomy and relationships 3. Case-based explanation of each canal, foramen, and fissure, showing how they communicate through different structures.

Foramen rotundum- Vidian canal- Inferior orbital fissure- Sphenopalatine foramen- Pterygomaxillary fissure- Pterygopalatine canal. Understanding the PPF represents a challenge for radiologists. We make visualization of this complex interchange easy to understand. Radiologists play a crucial role in detecting perineural spread (40% of patients are asymptomatic). Familiarity with the PPF normal anatomy and its routes of dissemination is essential to ensure the correct diagnosis.
Neuroimaging Following Chiari Type 1 Malformation Surgery

All Day Location: NR Community, Learning Center

Participants
Daniel T. Ginat, MD, Chicago, IL (Presenter) Nothing to Disclose
Michael Rozenfeld, DO, Chicago, IL (Abstract Co-Author) Nothing to Disclose
David Frim, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Gregory L. Katzman, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The various types of surgical options for treating patients with Chiari type 1 malformation are reviewed. The expected and complicated postoperative imaging findings are reviewed.

TABLE OF CONTENTS/OUTLINE
Review of diagnostic criteria for Chiari type 1 malformation. Review of imaging protocols Review of surgical procedures including craniocervical decompression without or with duraplasty, fourth ventricular stenting, endoscopic third ventriculostomy, tonsillar reduction, and syringohydromyelia decompression Review of postoperative complications including pseudomeningocele, infarction, wound infection, arachnoid adhesions, hydrocephalus, and cerebellar slump syndrome.
Diffusion Tensor Imaging of the Spinal Cord

All Day Location: NR Community, Learning Center

Awards
Cum Laude

Participants
Aaron M. Rutman, MD, Seattle, WA (Presenter) Nothing to Disclose
Wendy A. Cohen, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Mahmud Mossa-Basha, MD, Seattle, WA (Abstract Co-Author) Research support, General Electric Company
Dan Peterson, Seattle, WA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. Background and concepts of diffusion tensor imaging (DTI)/diffusion weighted imaging (DWI) of the spinal cord. 2. Clinical and investigational value of spinal cord DTI.

TABLE OF CONTENTS/OUTLINE

Background of DTI/DWI
Concepts of diffusion
Microstructural evaluation
Applications in the brain
How and why spine imaging differs from the brain
Technical aspects of diffusion imaging (techniques, parameters)
Useful clinical scenarios
Diffusion trace imaging
Diffusion tractography
Investigational value
Diffusion tractography
Fractional Anisotropy (FA), Mean Diffusivity (MD), Radial Diffusivity (RD) and Longitudinal Diffusivity (LD) evaluation
Clinical cases
CNS Vasculitis and Vasculopathy: Diagnostic Clues on MR Imaging and the Emerging Role of High Resolution Vessel Wall Imaging

Awards
Certificate of Merit

Participants
Zhixi Li, MD, San Francisco, CA (Presenter) Nothing to Disclose
Soonmee Cha, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. CNS vasculitis is a heterogeneous group of inflammatory disorders affecting the blood vessels of the brain and includes primary and secondary forms. 2. Timely and accurate differentiation between primary CNS vasculitis, secondary vasculitides, and non-inflamatory vasculopathies is a crucial step in guiding clinical management. 3. The purpose of this educational exhibit is to highlight the role of advanced MR imaging techniques, including MRA, diffusion weighted imaging, susceptibility weighted imaging, and high-resolution vessel wall imaging in cases of suspected CNS vasculitis and vasculopathy.

TABLE OF CONTENTS/OUTLINE
We begin with an overview of the terminology of primary CNS vasculitis, secondary vasculitides, and non-inflammatory vasculopathies and organize the underlying etiologies within each category. We then highlight the indirect imaging characteristics of vasculitis and vasculopathy using case based modules from our institutional teaching file to underscore the key differential categories of primary CNS vasculitis. The emerging role of vessel wall imaging is highlighted through three cases of transient cerebral arteriopathy from our institution and a review of the literature, where vessel wall imaging has been used to distinguish reversible cerebral vasoconstriction syndrome (RCVS; noninflammatory vasculopathy) from CNS vasculitis.
'Butterflies in Brain': Analogy of Butterfly Lesions Involving the Corpus Callosum and Nature's Butterflies Aiding in Differential Diagnosis

Participants
Umamaheswara Reddy Venati, MD, MBBS, Nellore, India (Presenter) Nothing to Disclose
Lakshmikanth HK SR, MD, MBBS, Manipal, India (Abstract Co-Author) Nothing to Disclose
Rajagopal Kv, MD, FRCR, Manipal, India (Abstract Co-Author) Nothing to Disclose
Chandan Kakkar, MBBS, MD, Ludhiana, India (Abstract Co-Author) Nothing to Disclose
Satish B. Maddukuri, MBBS, MD, Manipal, India (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
List common and uncommon butterfly lesions of the brain Identify imaging features that may help differentiating them. Improve Aunt Minne approach by comparing butterfly lesions with nature's butterflies.

TABLE OF CONTENTS/OUTLINE
Definition List of butterfly lesions (common and uncommon) Imaging and differentiating features of common butterfly lesions Sample cases with analogy Treatment Bihemispheric lesions involving corpus callosum resemble nature's butterflies and so identified as butterfly lesions (BL's). GBM, lymphoma, demyelination, metastases and toxoplasmosis are common BL's. Rarely oligodendroglioma, PML, dysmyelinating diseases, Kuffs disease etc can show butterfly pattern. Differentiating butterfly lesions requires a methodical imaging approach. Arriving at specific diagnosis is important as treatments differ drastically. Herein we compare nature's butterflies with common BL's. GBM can be compared with (C/W) red butterfly as it shows intratumoral hemorrhage, high rCBV values on perfusion. Lymphoma can be C/W small homogenous blue butterfly as it shows blue round cells on histopathology and moderate rCBV values on perfusion. Metastases can be C/W Question mark butterfly as imaging features are highly variable. Toxoplasma can be C/W eye spot butterfly as it shows multiple target lesions. Demyelination can be C/W glass winged butterfly.
How to Optimize Acquisition Procedure for Imaging the Craniocervical Junction at 7T

All Day Location: NR Community, Learning Center

Participants
Christopher J. Karakasis, MD, Columbus, OH (Presenter) Nothing to Disclose
Eric D. Miller, MD, PhD, Columbus, OH (Abstract Co-Author) Nothing to Disclose
Mary Russell, MS, Columbus, OH (Abstract Co-Author) Nothing to Disclose
Joseph S. Yu, MD, Columbus, OH (Abstract Co-Author) Nothing to Disclose
Michael V. Knopp, MD, PhD, Columbus, OH (Abstract Co-Author) Nothing to Disclose
Petra Schmalbrock, PhD, Columbus, OH (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is to explain: RF wave propagation and resulting flip angles at 7T with and without dielectric pads in the cervical spine using a volume head coil. How to optimize scan parameters given low transmit power and variable flip angles.

TABLE OF CONTENTS/OUTLINE
Clinical Importance of Imaging the Craniocervical Junction, limitations with conventional MRI.
The 7T RF Field: Dependence on RF coil and shape and size of imaged body.
Using dielectric pads for "RF shimming".
Pulse sequences for low RF power with minimal sensitivity to flip angle variability: Demonstration through computer models and in vivo example images of healthy volunteers.
Optimizing contrast and signal to noise: Conventional T1, T2 and proton density and maximal SNR sequences.
Clinically Relevant Image examples
CONCLUSION: Even though the anatomical region of interest is near or outside the physical edge of the coil, a transmit head coil can be used because RF waves propagate outside the coil albeit with a flip angle drop from 100% at the edge to 30% 10cm outside the coil. Tested BaTiO3 and TiO2 dielectric pads slightly alter the RF field. Gradient echo protocols with suitable flip angles produce proton density, T1 and T2 weighting in a defined anatomic region of interest.
The Many Faces Of Orbital Adnexial Lymphoma

All Day Location: NR Community, Learning Center

Participants
Sahar M. Elkhamary, MD, Riyadh, Saudi Arabia (Presenter) Nothing to Disclose
Hind Alkatan, MD, Riyadh, Saudi Arabia (Abstract Co-Author) Nothing to Disclose
Dalia Mounir, Mansoura, Egypt (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To demonstrate the MRI appearance of orbital adnexal lymphoma. To evaluate diagnostic accuracy of conventional MR imaging at 3 tesla in characterization of OAL and correlate the ADC value with histopathological correlation. To outline the common radiological lesion mimics, overlap in lymphoma and to revisit the useful imaging signs with histopathological correlations.

TABLE OF CONTENTS/OUTLINE
We will be using case material review from our tertiary eye Center to illustrate the imaging findings. We have collected imaging data on forty-two patients with orbital adnexal lymphoma with histopathological correlations. To discuss the relationship of diffusion-weighted imaging (DWI) and the final histopathological lymphoma subtype. Prognostic significance of ADC value in lesion characterization.
Schwann or Goose? Exposing Lesions that May Mimic Spinal Schwannomas with a Collection of Interesting Cases

All Day Location: NR Community, Learning Center

Awards
Certificate of Merit

Participants
Jamie C. Williams, MD, Rochester, MN (Presenter) Nothing to Disclose
Jonathan M. Morris, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Felix E. Diehn, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. Schwannomas are well-marginated soft tissue masses that enhance with contrast on both CT and MRI. Adjacent bone remodeling is often seen with CT. With MRI, schwannomas are typically iso/hypointense on T1 weighted imaging and hyperintense on T2 weighted imaging. 2. Since spinal schwannomas can be paraspinal, centered at a neural foramen, or intradural, lesions in all of these locations can be mimics. 3. Multiple lesions can mimic schwannomas, including other nerve sheath tumors, other benign tumors, malignant tumors, and vascular lesions. 4. Some of the most common lesions that can mimic cystic schwannomas include synovial, epidermoid, Tarlov, and perineural cysts.

TABLE OF CONTENTS/OUTLINE

1. Review pathophysiology and common imaging findings of spinal schwannomas 2. Present cases that have mimicked spinal schwannomas and discuss imaging clues that help distinguish these lesions from the more common schwannomas a. Nerve sheath tumors b. Other benign tumors c. Malignant tumors d. Vascular lesions e. Cystic schwannoma mimics
**Imaging of External Auditory Canal Lesions: A Pictorial Essay**

**All Day Location: NR Community, Learning Center**

**Participants**
Foram B. Gala, MBBS, MD, Mumbai, India (Presenter) Nothing to Disclose
Tejas Gosalia, MBBS, MD, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Bharat M. Gala, MBBS, Mumbai, India (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**

1) Describe the imaging anatomy of external auditory canal (EAC).
2) Imaging characteristics of various lesions affecting EAC.

**TABLE OF CONTENTS/OUTLINE**

EAC lesions are usually diagnosed clinically; however imaging is often requested to evaluate the deeper extent of the lesion, to assess middle ear and inner ear, feasibility of surgery and to rule out complications. EAC lesions can be classified as:
- **Congenital**: EAC atresia, branchial cleft cyst type 1
- **Inflammatory/ Infective**: Keratosis obturans, Cholesteoma, Non-Neoplastic Aural Polyp,
- **Malignant Otitis Externa**, osteomyelitis
- **Traumatic**: fractures
- **Neoplastic**: benign - osseous: Exostosis and Osteomangiomma, Malignant: EAC carcinoma (squamous/basal cell carcinoma), melanoma, EAC sarcoma, invasion from parotid malignancy.
- **Miscellaneous**: cerumen accumulation

HRCT temporal bone is the modality of choice for diagnosing EAC pathologies especially in evaluating the bony erosions/destruction. MRI is useful in confirmation of Cholesteotoma and for better evaluation of anatomic spread of infection/ malignancy due to better soft tissue resolution.
Variants and Mimics of Meningioma: Must-Know Facts about the Common Tumor

All Day Location: NR Community, Learning Center

Participants
Akira Kunimatsu, MD, Tokyo, Japan (Presenter) Speakers Bureau, Bayer AG; Speakers Bureau, General Electric Company
Natsuko Kunimatsu, MD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Kouhei Kamiya, MD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
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Harushi Mori, MD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Kuni Ohtomo, MD, Tokyo, Japan (Abstract Co-Author) Research Grant, Bayer AG Research Grant, DAIICHI SANKYO Group

TEACHING POINTS
The purpose of this exhibit is: To review typical imaging findings of meningioma To understand uncommon imaging variants that suggest specific subtypes To recognize the wide variety of meningioma mimics and to learn how to tell them apart from meningioma

TABLE OF CONTENTS/OUTLINE
Clinical features and typical imaging findings of meningioma Imaging variants: Histological variants: psammomatous, microcystic, angiomatous, lymphoplasmacyte-rich, secretory, atypical, and anaplastic meningiomas Atypical locations: intraosseous meningioma and extraneural meningioma Meningioma mimics: Hemangiopericytoma and solitary fibrous tumor Schwannoma Metastatic tumor Inflammatory lesions Hematologic disorders How to differentiate the mimics from meningioma
Participants
Stephen Perrio, MBBS, Frimley, United Kingdom (Presenter) Nothing to Disclose
Emily Daulton, MBCh, Aldershot, United Kingdom (Abstract Co-Author) Nothing to Disclose
Robert P. Barker, FRCR, MRCP, Guildford, United Kingdom (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

TABLE OF CONTENTS/OUTLINE
Outline: The basis of the classical view of CSF hydrodynamics, flaws and inaccuracies. Evidence for a revised view of CSF physiology. Pictorial review of disordered CSF hydrodynamics - Raised pressure and abnormal ventricular spaces i. Obstructive hydrocephalus - At the foramen of Munro - At the third ventricle - At the cerebral aqueduct - At the fourth ventricle - At the foramen magnum ii. Communicating hydrocephalus - SAH/Meningitis iii. CSF Overproduction - Choroid plexus tumours - Raised pressure and normal ventricles i. Idiopathic intracranial hypertension - Normal pressure and abnormal imaging i. Normal pressure hydrocephalus ii. Cerebral atrophy - Low pressure and abnormal imaging i. Intracranial hypotension Therapies for hydrocephalus a. Ventricular shunting 3rd ventriculostomy
MR Sialography at 3T: Improving the Non-invasive Diagnosis of Salivary Duct Diseases

All Day Location: NR Community, Learning Center

Awards
Cum Laude

Participants
Beatriz Sobrino Guijarro, Madrid, Spain (Presenter) Nothing to Disclose
Alvaro Sanchez Barrueco, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
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Julia Montoya Bordon, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Javier del Valle, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Describe 3T MR sialography technique (general considerations, patient preparation and protocol). Illustrate imaging findings in a variety of salivary duct diseases. Compare 3T MR sialography findings with sialendoscopy. Propose the fusion of T1-weighted images and three-dimensional (3D) constructive interference in steady state (CISS) to facilitate image interpretation.

TABLE OF CONTENTS/OUTLINE
'Up Against the Wall' Assessing Cerebrovascular Stroke Risks by Combining 4D Flow MRI and Arterial Wall Imaging

Awards
Certificate of Merit

Participants
Andrew J. Scarano, MD, Madison, WI (Presenter) Nothing to Disclose
Eric Hartman, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
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Yijing Wu, Madison, WI (Abstract Co-Author) Nothing to Disclose
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Warren Chang, MD, MBA, Madison, WI (Abstract Co-Author) Nothing to Disclose
Patrick A. Turski, MD, Madison, WI (Abstract Co-Author) Research support, General Electric Company

TEACHING POINTS
Review pathophysiology by which hostile hemodynamic conditions lead to activation of endothelial inflammatory processes which promote vessel wall inflammation and consequently increase risk of intracranial aneurysm change and rupture. Describe relationship between wall shear stress and promotion of intracranial atherosclerosis. Demonstrate the ability of 4D Flow MRI and contrast-enhanced wall imaging to identify these unfavorable conditions, thus providing a non-invasive means to evaluate for risk of disease progression.

TABLE OF CONTENTS/OUTLINE
General introduction and review of: Intracranial atherosclerotic disease Cerebral aneurysms Pathophysiology of intracranial aneurysm and atherosclerosis development as it relates to: Unfavorable flow dynamics and wall shear stress Vessel wall inflammation Flow conditions associated with cerebral aneurysm Type 1 - well-defined central vortex Type 2 - discrete inflow jet Type 3 - complex flow Type 4 - highly disorganized flow Focused imaging techniques to evaluate: Arterial wall enhancement Vascular flow dynamics
Current and State of the Art Imaging in Multiple Sclerosis: Lesion Characteristics and Enhancement Patterns during MRI

All Day Location: NR Community, Learning Center

Participants
Charbel Saade, PhD, Beirut, Lebanon (Presenter) Nothing to Disclose
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Rayan Bou Fakhredin, Beirut, Lebanon (Abstract Co-Author) Nothing to Disclose
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Bassam El-Achkar, MD, Beirut, Lebanon (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this review is to; Obtain objective evidence of dissemination in time and space of lesions typical of MS Accurate identification between peri arteriolar and perivenular spaces. Understanding the variations between specific and non-specific lesions. Understanding lesion changes over time with gadolinium enhancement

TABLE OF CONTENTS/OUTLINE
Tissue Characteristics Myelin destruction Periarteriolar space and inflammation Perivenular space and inflammation Lesion Patterns Gadolinium and Blood-brain barrier Contrast Enhancement Patterns Scanning Parameters at 1.5 and 3.0T imaging
Germ cell tumors are relatively rare in Western countries, and constitute only 0.3-0.5% of all primary intracranial tumors. However, these tumors are far more common in Northeast Asia. We reviewed CT and MRI findings in proven intracranial germ cell tumors in 23 cases. We exhibit the radiological imaging spectrum of intracranial pure germinoma. We also exhibit the other pathologies which have mimic image findings to intracranial germinoma.

TABLE OF CONTENTS/OUTLINE

Typical image and clinical findings of intracranial germinoma
Locations, Age, Symptoms
CT and MRI findings
Uncommon findings of intracranial germinoma
High Age
Atrophic change of basal ganglia
Cyst formation in brain parenchyma
Images of important differential diagnosis
Teratoma
Choriocarcinoma
Langerhans histiocytosis
Lymphocytic hypophysitis
IgG4 related hypophysitis
Pineal parenchymal tumor
**TEACHING POINTS**

To elucidate typical and atypical multi-modality imaging features of bottom of sulcus focal cortical dysplasias on 3T MRI, diffusion tensor imaging, PET CT and PET MRI coregistration data with illustrative examples with clinical ictal EEG, ECOG and radiopathological correlations. Major features: 1. cortical thickening at the bottom of a sulcus; 2. a funnel-shaped extension of the lesion toward the ventricular surface, commonly with abnormal signal intensity; 3. an abnormal gyral pattern related to the bottom-of-sulcus dysplasia, with a puckered appearance.

**TABLE OF CONTENTS/OUTLINE**

Clinical features semiology of patients manifesting with refractory epilepsy due to BOSD (Bottom of sulcus Dysplasias) are highlighted with emphasis on ictal EEG features. MR imaging features, patterns and signs with protocol design for easy detection and surgeon-friendly image visualization are illustrated. FDG PET, electrocorticography (intraoperative) findings, histopathological features are discussed with emphasis on imaging correlates. The differential diagnosis of bottom of sulcus FCD includes the following: - Bottom of sulcus granuloma - Bottom of sulcus gliosis/Polymicrogyria - Bottom of Sulcus neoplasm - Bottom of sulcus cavernoma/AVM./DVA. The key differentiating features will be discussed.
Neurologic Complications in Oncologic Patients: Beyond Tumor

All Day Location: NR Community, Learning Center

Awards
Cum Laude

Participants
Diego J. Oliveira, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
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Claudia D. Leite, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Researcher, Guerbet SA
Giovanni G. Cerri, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is: 1. To review the pathophysiology and the imaging findings associated with the most common neurologic complications in oncologic patients. 2. To discuss the differential diagnosis among such entities and correlate with clinical scenario.

TABLE OF CONTENTS/OUTLINE

Clinical and epidemiologic data on neurologic emergencies in oncologic patients
Review of the pathophysiology and imaging findings of the major neurologic emergencies in oncologic patients, excluding direct effects of the tumors, such as invasion, compression or extension.
There will be presented:
- Vascular complications (stroke and venous thrombosis)
- Acute neurologic complications of cancer treatment (radiotherapy and chemotherapy)
- Paraneoplastic syndromes
- Metabolic disturbances
Sample cases and differential diagnosis
Summary
Osmotic Demyelination Syndrome: Clues to Identify a Potentially Elusive Disorder

All Day Location: NR Community, Learning Center

Participants
Suely F. Ferracioli, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
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Giovanni G. Cerri, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is:1. To review the pathophysiology of Osmotic Demyelination Syndrome; 2. To discuss the relationship between central pontine myelinolysis and extrapontine myelinolysis, as they may occur together or independently; 3. To show the characteristic findings in MRI that may lead us to the right diagnosis even when there are no clues in the clinical history; 4. To show unusual imaging findings which can be related to a clinical history consistent with ODS so we can corroborate this hypothesis; 5. To discuss and delineate a take-home message. Still nowadays it is a commonly devastating clinical condition, but with variable outcomes, so the role of the imaging is essential.

TABLE OF CONTENTS/OUTLINE

Introduction Methods Literature review Pathology findings Classical imaging findings (institutional cases from our files) CPM EPM Unusual institutional cases from our files Discussion Take-home message
All That Glitters Is Not Gold: False-Positive Non-Echo-planar Diffusion-weighted Imaging in the Evaluation of Cholesteatoma

Participants
Francesco Priamo, MD, New York, NY (Presenter) Nothing to Disclose
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Ray A. Holliday, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Gul Moonis, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Restricted diffusion on Non-Echo-planar Diffusion-weighted imaging (NEPDWI) of the temporal bone does not exclusively represent acquired or recurrent cholesteatoma. As such, it is essential to correlate with additional imaging sequences, other imaging modalities, and operative history to avoid incorrectly diagnosing cholesteatoma and prompting inappropriate surgical intervention. The goals of this exhibit are as follows: 1. Demonstrate the range of neoplastic, non-neoplastic, and inflammatory temporal bone pathology that also display restricted diffusion on NEPDWI. 2. Explain the pathophysiology of non-cholesteatoma lesions that demonstrate restricted diffusion on NEPDWI. 3. Review the utility of NEPDWI in diagnosis of recurrent cholesteatoma in the post-operative setting.

TABLE OF CONTENTS/OUTLINE
Review of the imaging appearance of the acquired and recurrent cholesteatomas. Review of temporal bone disease states and postsurgical changes that also restrict diffusion on NEPDWI. Review of imaging findings in these entities including the following modalities: Temporal Bone CT T1-weighted spin-echo MR T2-weighted steady-state gradient echo MR Illustrative Cases: Cholesterol granuloma Subacute hemorrhage in the tympanomastoidectomy bed Coalescent mastoiditis Lymphoma Fat packing Bone Pâte Surgical clips
Improving the Diagnosis of Creutzfeldt-Jakob Disease: A Review of Usual and Unusual Imaging Patterns and Their Differential Diagnoses

All Day Location: NR Community, Learning Center

Participants
Diego C. Fragoso, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
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Antonio C. Maia Jr, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Antonio Rocha, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is: 1. To review the imaging findings of the Creutzfeldt-Jakob disease 2. To recognize usual and unusual imaging patterns and their differential diagnoses 3. To correlate the classical clinical phenotypes variability and the MR features

TABLE OF CONTENTS/OUTLINE

Pathophysiology of CJD; Review imaging findings of CJD: - Classic - Unusual Relationship between unusual findings and clinical phenotypes; Clinical cases and differential diagnoses of CJD on MR. Conclusion: In vivo, diagnosis of CJD is currently based on imaging features (DWI) however mimicking conditions must be excluded to confirm probable diagnosis of this fatal disease; The patterns of MR signal abnormalities can differentiate CJD from other diseases with high accuracy; The predominant clinical presentation varies in accordance with the imaging pattern.
Participants
Warren Chang, MD, MBA, Madison, WI (Presenter) Nothing to Disclose
Aichi Chien, PhD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Juan P. Villablanca, MD, Los Angeles, CA (Abstract Co-Author) Research collaboration, VasSol, Inc Research collaboration, Toshiba Corporation Research collaboration, Olea Medical

TEACHING POINTS
1. Discussion of 3D imaging findings that increase the risk of rupture.
2. 3D imaging findings that help delineate treatment planning decisions.
3. Review of strengths/weaknesses of current methods used in assessment, follow-up, and treatment planning of aneurysms.
5. A discussion of how coupling hemodynamic analysis and 3D morphology can stratify risk of rupture.

TABLE OF CONTENTS/OUTLINE
1. Current imaging techniques used in for assessment of aneurysms.
2. Review of 3D Imaging Findings and their significance for risk of rupture/treatment planning:
   a) Interval growth: Most significant risk factor for rupture.
   b) Mural Calcification: Can preclude clipping.
   c) Thrombosis: Can prevent effective coil embolization or clipping.
   d) Arterial Incorporation: May preclude both clipping and coiling.
   e) Inflow jet morphology: Associated with growth and rupture.
   f) Wall shear stress and streamline analysis: Can affect morphology.
3. Discussion of strengths/weaknesses of 3D CTA vs 3D/4D-MRA:
   a) CTA: Higher spatial resolution, low scan time, easy 3D reconstruction. Radiation.
   b) MRA: Phase-contrast provides hemodynamic data. No radiation. Scan and 3D reconstruction time consuming.
Principle and Optimization Method of a Double Inversion Recovery Sequence for Diagnosis of Degenerative Diseases

All Day Location: NR Community, Learning Center

Participants
Norio Hayashi, PhD, Maebashi, Japan (Presenter) Nothing to Disclose
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Yukino Hasegawa, Maebashi, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Using a double inversion recovery (DIR) sequence, it leads to a significantly higher sensitivity for the detection of cortical lesions. However, it is difficult to instantly optimize scan parameters. We developed a novel optimization method of scan parameters of the DIR sequence using a T1 map and a developed analysis algorithm. The teaching point of this exhibit is to: Understand the clinical usefulness of the DIR sequence for diagnosis of degenerative diseases Understand the principle of the DIR sequence Understand how to optimize the MRI parameters of the DIR sequence using a novel optimization method.

TABLE OF CONTENTS/OUTLINE
Diagnostic imaging for diagnosis of degenerative diseases Clinical usefulness of the DIR sequence Principle of the DIR sequence Advantage and pitfall of the DIR sequence A novel optimization method for the DIR sequence Outcomes
Many MR Neurographic biomarkers of Chronic Inflammatory Demyelinating Neuropathy

Participants
Rammohan Vadapalli, MD, Hyderabad, India (Presenter) Nothing to Disclose
Meena Ak, MD, PhD, Hyderabad, India (Abstract Co-Author) Nothing to Disclose
Abhinav Siva Ram S. Vadapalli, Pune, India (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Chronic inflammatory demyelinating polyneuropathy (CIDP, also known as chronic inflammatory demyelinating polyradiculoneuropathy) is an acquired disorder of peripheral nerves and nerve roots. To elucidate clinical EMG and MR neurographic features of CIDP (Chronic Inflammatory Demyelinating Polyneuropathy) with Pathological Correlation. Discuss the differential diagnosis and imaging mimics of CIDP with a check list. Diagnostic approach of Polyneuropathies. In classic CIDP, there are symmetric proximal and distal weakness, sensory deficit in both upper and lower extremities and reduced deep tendon reflex. In MMN, limb weakness without sensory loss is asymmetric in the distribution of individual peripheral nerves and the weakness typically begins in the distal upper extremities. It is very important to distinguish between CIDP, MADSAM neuropathy, and MMN by clinical, laboratory, and histological features because of different effective therapeutic strategies.

TABLE OF CONTENTS/OUTLINE
Brief clinical Manifestations of CIDP and its Variants are showcased. MR neurography features of CIDP are enumerated with Differential Diagnosis. Morphological biomarkers of CIDP on MRN are discussed with Radio pathological correlation. Mimics of CIDP namely MADSAM, MMN, MMNCB, HMNPP are introduced with their key features.
Classification, Imaging Spectrum and Differential Diagnosis of Cerebral Vasculitis

All Day Location: NR Community, Learning Center

Participants
Gaurav V. Watane, MBBS, MD, Amravati, India (Presenter) Nothing to Disclose
Isha D. Atre, MBBS, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Shephali S. Pawar, MD, Pune, India (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is-1) To review the epidemiology, clinical presentation and causes of primary and secondary CNS vasculitis2) To study the spectrum of imaging findings in CNS vasculitis and utility of various imaging modalities3) To gain an awareness of differential diagnoses in CNS vasculitis

TABLE OF CONTENTS/OUTLINE
Epidemiology and clinical presentation in CNS vasculitis
Pathophysiology
Classification and causes of CNS vasculitis - Primary vasculitis - Secondary vasculitis
Review of imaging findings in CNS vasculitis
Differential diagnoses and mimics of CNS vasculitis
Pain in the Back: A Review of the Postoperative Complications after Spinal Interventions

All Day Location: NR Community, Learning Center

Participants
Fang Yu, MD, San Antonio, TX (Presenter) Nothing to Disclose
Bundhit Tantiwongkosi, MD, San Antonio, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: To review the fundamental approaches of spine surgery and instrumentation. To illustrate the expected imaging findings after spine interventions. To demonstrate the key imaging features of postoperative complications, particularly in patients with failed back surgery syndrome (FBSS).

TABLE OF CONTENTS/OUTLINE
Describe the normal spinal anatomy at the cervical, thoracic, and lumbar vertebral levels. Provide an overview of the various spinal interventions and their normal appearance on radiography, CT and MRI. Present a case-based discussion of the post-operative complications, to include the clinical signs and symptoms as well as imaging features of: Mechanical processes, such as hardware failure and advanced degenerative change. Non-mechanical processes, such as diskitis-osteomyelitis, arachnoiditis, and soft tissue infections. Summary
Post-traumatic Deafness: What Radiologists Should Know and How 3D CT Can Aid Ossicular Lesion Assessment

Awards
Certificate of Merit

Participants
Olivier Maillot, Grenoble, France (Presenter) Nothing to Disclose
Amaud Attye, MEd, Grenoble, France (Abstract Co-Author) Research Grant, Guerbet SA
Adrian I. Kastler, MD, MSc, Grenoble, France (Abstract Co-Author) Nothing to Disclose
Eric Boyer, Grenoble, France (Abstract Co-Author) Nothing to Disclose
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Romain Perolat, Grenoble, France (Abstract Co-Author) Nothing to Disclose
Sylvie D. Grand, MD, Grenoble, France (Abstract Co-Author) Nothing to Disclose
Sebastien Schmerber, Grenoble, France (Abstract Co-Author) Nothing to Disclose
Alexandre Krainik, MD, PhD, Grenoble CEDEX, France (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Hearing loss is a common audiometry finding after temporal bone fracture. The purpose of this exhibit is: To review the elementary middle ear injuries that lead to conductive hearing loss including incudomalleolar and incudostapedial joint disarticulation. To learn middle ear CT anatomy in hemotympanum condition and inner ear MRI anatomy. To categorize ossicular lesions by comparing 3D images of the ossicular chain with traditional computed tomography (CT) multiplanar reformations as an effective way of arriving at the correct lesion classification. To focus on MRI indications in patients with sensorineural hearing loss and detection of inner ear hemorrhage with 3D FLAIR sequence. Knowledge of this spectrum of disease allows the radiologist to provide an appropriate diagnosis and suggest proper patient management.

TABLE OF CONTENTS/OUTLINE

A/ Normal middle ear anatomy on CT 2D and 3D acquisition
Incudomalleolar joint
Incudostapedial joint
Ossicles
B/ Normal inner ear anatomy on MRI acquisition
Cochlea
Vestibule
Semi-circular canals
C/ Classification of post-traumatic CT lesions
Ossicular disarticulation and isolated fractures
Pneumolabyrinth
Perilymph fistula
D/ Inner ear post-traumatic injuries: overview
Labyrinthine hemorrhage
Perilymph fistula
Labyrinthitis
E/ Go Home messages
Contrast Patterns for Spine Interventions: Expecting the Unexpected

All Day Location: NR Community, Learning Center

Participants
Jason Ginos, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Lubdha M. Shah, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Edwin A. Stevens, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Troy Hutchins, MD, Salt Lake City, UT (Presenter) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is to guide the safe and effective administration of contrast and/or medications during fluoroscopic and CT guided spinal interventional procedures: By teaching the normal fluoroscopic and CT views and anatomic landmarks used for performing common spinal interventional procedures. By demonstrating the expected and unexpected patterns of contrast enhancement while performing these procedures.

TABLE OF CONTENTS/OUTLINE
Fluoroscopic "target" views and CT views with emphasis on relevant anatomy and safety considerations as well as the expected and unexpected patterns of contrast enhancement for each of the following procedures will be covered:
A. Myelogram Lumbar puncture Cervical (C1-2) puncture
B. Epidural Steroid Injection Interlaminar Transforaminal Cervical, thoracic, lumbar
C. Selective Nerve Root Block (Cervical, Thoracic, Lumbar)
D. Facet Injection and Medial Branch Block (Cervical, Thoracic, Lumbar)
E. Sacroiliac Joint Injection
F. Discography
G. Percutaneous Vertebral Augmentation Vertebroplasty Kyphoplasty
Autoimmune Epilepsy: Findings on MRI and FDG-PET

All Day Location: NR Community, Learning Center

Awards
Certificate of Merit

Participants
Julie B. Guerin, MD, Rochester, MN (Presenter) Nothing to Disclose
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Greta B. Liebo, MD, Portland, OR (Abstract Co-Author) Nothing to Disclose
Robert E. Watson Jr, MD, PhD, Rochester, MN (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Teaching Points
1. To review the clinical presentation and pathophysiology of autoimmune epilepsy (AE).
2. To identify MRI and PET findings of the initial presentation of AE.
3. To emphasize that early recognition allows for prompt administration of immunotherapy and/or detection of an underlying neoplasm.
4. To demonstrate the evolution of imaging findings in patients with AE over time.

TABLE OF CONTENTS/OVERVIEW

Outline
Clinical presentation- New onset epilepsy- Other: cognitive impairment, behavior changes, movement disorders
Pathophysiology of AE- Paraneoplastic antibodies, Hu(ANNA1) and CRMP-5, and associated tumors- Non-paraneoplastic antibodies, anti- VGKC, anti-NMDAR, anti-GAD65
Imaging Findings- Limbic encephalitis- Extratemporal findings- Mesial temporal sclerosis and other chronic changes
Summary- T2/FLAIR hyperintensity and enlargement of the amygdalohippocampal complex with corresponding FDG avidity is a common initial imaging presentation in patients with AE.- Without treatment, many AE patients will progress to mesial temporal sclerosis.- The imaging findings of limbic encephalitis should prompt inclusion of autoimmune etiologies in the diagnostic differential to allow for prompt immunomodulating therapy.
Meningiomas have classic imaging features, making a radiological diagnosis possible in most cases. However, the reporting radiologist should, in addition to making the diagnosis, provide the skull base neurosurgeon with key information that may alter the management and impact surgical decisions. This exhibit will aim to: Review classic imaging features of meningiomas, highlighting pertinent findings that help establish the diagnosis, as well as influence the management and decision for surgery. Review common locations of skull base meningiomas and their relationships to key structures. Provide a framework for reporting these lesions, with particular emphasis on what the neurosurgeon needs to know prior to surgery. Demonstrate the importance of this information in guiding treatment strategies, including endovascular neoadjuvant therapies and neurosurgical approaches.

TABLE OF CONTENTS/OUTLINE

Background The role of the reporting radiologist Establishing the diagnosis - a pictorial review of classic imaging features Reporting the location and origin of the lesion Reporting the extent of the lesion and critical anatomical relationships Additional imaging characteristics to guide treatment options and for surgical planning Summary
Mucopolysaccharidoses (MPS) are a heterogeneous group of genetic disorders caused by deficiency of lysosomal enzymes that catalyze degradation of glycosaminoglycans (GAGs). Accumulation of undegraded GAGs causes various manifestations in multiple organs, including the central nervous system. MPS are classified into many types based on their deficient enzymes. Furthermore, each type of MPS has different and wide-ranging manifestations in not only clinical but also neuroimaging findings. Therefore, understanding the neuroimaging findings of MPS is quite challenging. The kinds of accumulated GAGs strongly influence clinical manifestations in respective types of MPS. In the same way, neuroimaging findings can be rearranged based on accumulated substances to some extent, although overlap exists. This knowledge helps radiologists familiarize themselves with complex neuroimaging features of MPS. The purpose of this exhibit is: 1. To review general neuroimaging findings of MPS 2. To rearrange neuroimaging features in various types of MPS, with emphasis on accumulated GAGs

**TABLE OF CONTENTS/OUTLINE**

1. Definition, classification and clinical manifestations in MPS
2. Reviewing general neuroimaging findings of MPS
3. Rearrangement of neuroimaging features in various types of MPS, with emphasis on accumulated GAGs
NR175-ED-X

Where's the Blood? Understanding the Anatomy and Imaging of Scalp Trauma

All Day Location: NR Community, Learning Center

Awards
Cum Laude

Participants
Ivan M. Dequesada, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
John Kim, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Toshio Moritani, MD, PhD, Iowa City, IA (Abstract Co-Author) Nothing to Disclose
Yuji Numaguchi, MD, PhD, Chuoku, Japan (Abstract Co-Author) Nothing to Disclose
Jay Starkey, MD, Tokyo, Japan (Presenter) Nothing to Disclose

TEACHING POINTS

Imaging features of infant scalp injuries related to birth have been well described but adult traumatic scalp lesions have not. We aim to teach scalp gross and imaging anatomy and CT and MRI appearance of traumatic scalp injuries.

TABLE OF CONTENTS/OUTLINE

We present basic terms and basic and advanced scalp anatomy interspersed with demonstrative cases as follows:

- Terms
  - Contusions
  - Hematomas
  - Lacerations

- Scalp Window
  - Optimal window for viewing scalp
  - Examples of why localizing scalp injury is important (missed skull fractures x2)

- Scalp Layers (5 layers) demonstrated on:
  - Schematic
  - Intra-operative close up
  - CT
  - MRI
  - Subgaleal lipomas on MRI/CT demonstrating aponeurosis
  - Pediatric cases of subgaleal and subperiosteal hematoma on MRI
  - Adult subgaleal hematoma demonstrating layers
  - Extent: Anterior, lateral, and posterior margins of subgaleal space
  - Coronal and axial anatomy of the anterolateral scalp and temporal fossa
  - Cases of hematomas at far margins
  - Pitfall: temporalis muscle mimicking hematoma

- Blood Supply
  - ICA, ECA branches on CT and MRI
  - Subgaleal hematoma on MRA demonstrating bleed source

- Cases
  - Laceration with glass foreign body
  - Calcifications mimicking foreign body
  - Cosmetic surgery mimicking trauma
  - Scalping injury
Central Central Nervous System Manifestation of Rheumatologic Diseases: A Pictorial Review

Participants
Akihiko Sakata, MD, Kyoto, Japan (Presenter) Nothing to Disclose
Tomohisa Okada, MD, PhD, Kyoto, Japan (Abstract Co-Author) Nothing to Disclose
Akira Yamamoto, MD, PhD, Kyoto, Japan (Abstract Co-Author) Nothing to Disclose
Yasutaka Fushimi, MD, PhD, Kyoto, Japan (Abstract Co-Author) Nothing to Disclose
Tsutomu Okada, MD, Kyoto, Japan (Abstract Co-Author) Nothing to Disclose
Kaori Togashi, MD, PhD, Kyoto, Japan (Abstract Co-Author) Research Grant, Bayer AG Research Grant, DAIICHI SANKYO Group Research Grant, Eisai Co, Ltd Research Grant, FUJIFILM Holdings Corporation Research Grant, Nihon Medi-Physics Co, Ltd Research Grant, Shimadzu Corporation Research Grant, Toshiba Corporation Research Grant, Covidien AG

TEACHING POINTS
After reviewing this educational exhibit, the learner will understand: 1) Demographics, basic pathophysiology, clinical presentation of rheumatologic diseases and its neurological manifestation. 2) Central nervous system (CNS) imaging patterns most commonly seen in patients with rheumatologic diseases. 3) Other consideration for CNS complications occurred in patients with rheumatologic diseases.

TABLE OF CONTENTS/OUTLINE
Rheumatologic diseases inclusive of auto immune disorders are a heterogeneous group of immunologically mediated inflammatory disorders that may affect various organs. We focus on four major rheumatologic diseases with their known CNS manifestations: systemic lupus erythematosus, rheumatoid arthritis, Sjögren Syndrome and Behçet disease. We also discuss other CNS disorders in patients with rheumatologic diseases, including treatment-related changes such as posterior reversible encephalopathy syndrome, progressive multifocal leukoencephalopathy, and comorbid infectious disorders associated with biologics or other immunosuppressants.
Keep an Eye Out: A Space Based Differential Approach for Orbital Masses in Adults

All Day Location: NR Community, Learning Center

Participants
Michael E. Stone, MD, Detroit, MI (Presenter) Nothing to Disclose
Brent D. Griffith, MD, Detroit, MI (Abstract Co-Author) Nothing to Disclose
Suresh C. Patel, MD, Detroit, MI (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Knowledge of orbital and ocular anatomy is essential in formulating a differential diagnosis when presented with an orbital mass. This exhibit will review the relevant anatomy of the orbit, correlating diagrams with cross sectional imaging.  
2. A compartment-based approach provides a logical method of formulating an accurate and concise differential diagnosis for the orbital mass. This approach will be illustrated with numerous case based examples.  
3. Ancillary findings (intracranial and perineural spread, vascular compromise, etc.) will be reviewed with a focus on findings with prognostic and therapeutic implications.

TABLE OF CONTENTS/OUTLINE
COMPARTMENTAL ORBITAL ANATOMY INTRODUCTION OCCULAR ANATOMY OCCULAR MASS CASES CONAL ANATOMY CONAL MASS CASES INTRACONAL ANATOMY INTRACONAL MASS CASES EXTRACONAL ANATOMY EXTRACONAL MASS CASES ANCILLARY FINDINGS WITH CASE EXAMPLES CONCLUSION
Awards
Certificate of Merit

Participants
Pritish Bawa, MD, Brooklyn, NY (Presenter) Nothing to Disclose
Justin Holder, MD, Brooklyn, NY (Abstract Co-Author) Nothing to Disclose
Deborah L. Reede, MD, Brooklyn, NY (Abstract Co-Author) Nothing to Disclose
Wendy R. Smoker, MD, Iowa City, IA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. Heighten awareness that stroke occur in infants, children and young adults
2. Review the demographics, risk factors and etiologies of strokes in various age groups
3. Learn imaging findings on various modalities (CT, MR, spectroscopy and cranial ultrasound)

TABLE OF CONTENTS/OUTLINE

Material is presented in a quiz format. After a review of the demographics, risk factors and etiologies (in different age groups) of strokes, cases are presented to highlight the imaging findings of acute stroke and the sequela on various imaging modalities. There are age specific differences in the etiologies and clinical manifestations. Examples of common etiologies are presented in the various age groups, neonates and infants less than 1 year of age (hypoxia-ischemia, seizure, hypoglycemia, thromboembolic complications due to congenital heart disease, thrombocytosis, protein c/s deficiency and Vein of Galen Malformation); children between the ages of 1-14 years (Moya Moya, Sickle Cell Disease) and young adults ages 15 -23 years (arterial dissection, drug abuse, patent foramen ovale). Pathophysiology, treatment and additional diagnostic testing will be stressed.
Masticator Space: A Comprehensive Pictorial Review of Anatomy and Pathologies on Cross-sectional Imaging

All Day Location: NR Community, Learning Center

FDA Discussions may include off-label uses.

Participants
Chandan Kakkar, MBBS, MD, Ludhiana, India (Abstract Co-Author) Nothing to Disclose
Kavita Saggar SR, MD, Ludhiana, India (Presenter) Nothing to Disclose
Archana Ahluwalia, MD, Ludhiana, India (Abstract Co-Author) Nothing to Disclose
Ankur Attri, MBBS, Gurdaspur, India (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) Illustrate the cross-sectional anatomy of masticator space on CT and MRI. 2) To define the boundaries of infratemporal fossa and masticator space as per surgeons’ perspective. 3) To discuss and illustrate various pathologies of Masticator space. 4) To develop a comprehensive approach for arriving at a differential diagnosis of masticator space lesions.

TABLE OF CONTENTS/OUTLINE
1) Radiological anatomy of masticator space on CT and MRI highlighting the major contents. Discuss the anatomy of masticator space as per the clinician and surgeons’ perspective. Differentiating infratemporal fossa from the masticator space. 2) To develop an approach to masticator space lesions according to the components and possible lesions arising from them. 3) To illustrate the imaging of primary neoplastic, as well as non-neoplastic pathologies especially patterns of common lesions like infections, mesenchymal tumors as haemangioma, neurofibromas, sarcomas, lymphoreticular diseases. Osseous lesions as ameloblastoma, Ewing's sarcoma, etc. 4) To emphasise the importance of imaging in the secondary involvement of the masticator space by other head and neck pathologies. Illustrate the masticator space involvement by malignancies arising from the sinuses and oral cavity that are detrimental to prognosis.
Children Ischemic Stroke - Not Only a Small Adult

All Day Location: NR Community, Learning Center

Participants
Bruna G. Dutra, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Felipe T. Pacheco, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Renato Hoffmann Nunes, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Antonio C. Maia Jr, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Antonio J. da Rocha, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The purposes of this exhibit are:-To review the main etiologies of ischemic stroke in children-­To review the pathophysiology of ischemic stroke in children-­To demonstrate the imaging finding with sample cases for each etiology-­To exhibit some peculiarities in children that differs from ischemic stroke in adults

TABLE OF CONTENTS/OUTLINE

Some of ischemic stroke's etiologies exposed are: Sickle Cell Disease, Moyamoya Disease, Moyamoya Syndrome, Cervicocephalic Arterial Dissection, Vasculitis, and Cardiac Disease. For each of them will be discussed: -Epidemiology-Pathophysiology-Imaging findings-Best imaging modalities-CT Conventional MRI and advanced techniques. CT angiography and MR angiography

CONCLUSION

WITH MAJOR TEACHING POINTS

The major teaching points of this exhibit are:-T2* or SWI may help to identify the dilated basal collateral arteries for the diagnosis of Moyamoya-­In cases of overt and silent stroke in children, it is necessary to search for Sickle cell disease-­Arterial dissection in children usually is diagnosed after the ischemic stroke, different from adults, that are diagnosed before an ischemic event-­In presence of children stroke without other additional findings, it is important to investigate previous varicella infection
Awards  
Certificate of Merit

Participants  
Ross Holwerda, MD, Kansas City, MO (Presenter) Nothing to Disclose  
Stephane Desouches, DO, Kansas City, MO (Abstract Co-Author) Nothing to Disclose  
Brian M. Chin, MD, MBA, Durham, NC (Abstract Co-Author) Nothing to Disclose  
William E. Holloway, MD, Mission Hills, KS (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. Knowledge of technical artifacts and non-ischemic entities that can result in perfusion abnormalities is important to avoid misdiagnosis or delay of patient care.  
2. Less common causes of stroke like symptoms, such as venous thrombosis, seizure, or vascular malformations, can cause atypical (non-large vessel arterial occlusive) perfusion parameters and patterns.  
3. Correlation of perfusion images with concurrent angiography is important as hypoplastic or aplastic segments or persistent carotid-basilar anastomoses may mimic areas of penumbra.

TABLE OF CONTENTS/OUTLINE

1. Illustrate perfusion imaging of acute, subacute and chronic large vessel arterial occlusion with explanations of the parameters (MTT, CBF, CBV) and the evaluation of ischemic core and penumbra.  
2. Demonstrate technical errors (patient malpositioning, arterial contrast injection) that can mimic arterial-occlusive disease.  
3. Depict and explain how congenital vascular variants or vascular malformations (dAVF, AVM), seizure, and tumors can result in abnormal perfusion parameters.  
4. Describe atypical causes of ischemic perfusion abnormalities, such as cortical vein and deep sinus venous thrombosis and cerebral air embolism.
Paragangliomas are uncommon chromaffin cell tumors arising from paraganglia tissue, more specific origin of the cells remain of neural crest. They can be extra-adrenal or intra-adrenal (in these cases also known as pheochromocytomas). Extra-adrenal paragangliomas can be present throughout the body, the skull base down to the pelvic floor. Extra-adrenal parasympathetic paragangliomas are most commonly found in the neck and head - they may originate from carotid body, vagal body, middle ear, larynx, and orbit. Extra-adrenal sympathetic paragangliomas most commonly arise from tissue around the inferior mesenteric artery and aortic bifurcation, and less commonly from any other chromaffin tissue in the abdomen, pelvis, and thorax. This pictorial essay reviews the most important aspects in extra-adrenal paragangliomas and illustrates the most common local and atypical distribution of the extra-adrenal paragangliomas in select cases of our hospital.

TABLE OF CONTENTS/OUTLINE

Application of High Resolution CT Three-dimensional Volume Reconstruction in Cochlear Implantation

All Day Location: NR Community, Learning Center

Participants
Yuan Jiang, MD, Beijing, China (Presenter) Nothing to Disclose
Jianhui Li, Beijing, China (Abstract Co-Author) Nothing to Disclose
He Wang, MD, Beijing, China (Abstract Co-Author) Research Grant, General Electric Company
Yue Wang, Beijing, China (Abstract Co-Author) Nothing to Disclose
Xiaoying Wang, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To simply review the surgical technology and challenge of cochlear implantation 2. To explain the role of high-resolution CT (HRCT) in presurgical evaluation of cochlear implantation 3. To introduce HRCT scan protocol and the method of three-dimensional volume reconstruction (VR) of facial nerve, chorda tympani nerve, middle and inner ear 4. To reconstruct the simulate path of cochlear implantation which prevent some key structure of middle and inner ear from being damaged

TABLE OF CONTENTS/OUTLINE
A. Technology of cochlear implantationB. Challenge of cochlear implantationC. Role of HRCT in presurgical evaluationD. HRCT scan protocolE. Three-dimensional VR Facial nerve Chorda tympani nerve Middle ear Inner ear F. To simulate cochlear implantation path To mark the key structure To reconstruct the cochlear implantation path G. Further measurement based on simulate path of cochlear implantation
Imaging Head and Neck Cancers: A Checklist Manifesto

All Day Location: NR Community, Learning Center

Participants
Somesh Singh, MBBS, Mumbai, India (Presenter) Nothing to Disclose
Supreeta Arya, MD, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Santhosh K. GeethaVirupakshappa, MD, MBBS, Mumbai, India (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

In the era of multidisciplinary disease management, the role of the radiologist in accurate staging is pivotal. Accurate staging is essential for the management of squamous cell carcinomas (SCCs) of the upper aerodigestive tract. Communicating the radiological stage effectively needs adherence to a checklist of positive and negative findings to be incorporated in a structured report. As structured reporting templates are being designed, a checklist of findings needs to be defined for reporting cancers of each site. This exhibit will attempt to:

1. To describe minimal positive and negative findings that need mention in an optimal cross-sectional imaging report of squamous cell cancers (SCCs) of upper aerodigestive tract (naso-oropharynx, oral cavity, larynx and hypopharynx).
2. To highlight features that not only impact staging, but also prognosis and therapy.

TABLE OF CONTENTS/OUTLINE

1. Spread patterns of SCCs of Nasopharynx, Oropharynx, Oral cavity, Larynx and Hypopharynx will be described in a pictorial essay.
2. A checklist of imaging findings to be included in the reporting for each region, will be provided with its implication on AJCC staging and on therapy.
3. The fallacies of AJCC staging in each region will be alluded to.
**Association White Matter Tracts for Auditory Language Functions**

All Day Location: NR Community, Learning Center

**Participants**

Vivek Yedavalli, MD, Chicago, IL *(Presenter) Nothing to Disclose
Justin M. Honce, MD, Loma Linda, CA *(Abstract Co-Author) Nothing to Disclose
Kaizan Kalyaniwalla, DO, Chicago, IL *(Abstract Co-Author) Nothing to Disclose
Kathan A. Amin, MD, Chicago, IL *(Abstract Co-Author) Nothing to Disclose
Anastasia F. Barron, DO, Chicago, IL *(Abstract Co-Author) Nothing to Disclose
Dheeraj Reddy Gopireddy, MD, MPH, Chicago, IL *(Abstract Co-Author) Nothing to Disclose
Alexander Ree, MD, Oak Park, IL *(Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**

a) Illustrate the main course and subcortical projections of white matter tracts integral in auditory language processing via diffusion tensor imaging (DTI)- specifically, to illustrate the subcomponents of the superior longitudinal fasciculus (SLF II, SLF III), arcuate fasciculus, and ventral white matter projections primarily the extreme capsule using DTI.
b) Review and compare current language models.
c) Highlight the potential role of various white matter tracts in these language models.

**TABLE OF CONTENTS/OUTLINE**

1) Purpose: Review and summarize the current white matter tracts associated with language and their potential roles in current language models. Encourage the routine depiction of these tracts in surgical planning DTI imaging.
2) Background: Anatomic detail of white matter tracts proposed for language processing. Review of the cortical/sulcal projections for these white matter tracts. Proposed function of these cortical/sulcal projections.
3) Describe the Dual Stream Model, Dorsal Phonological Stream, and Ventral Semantic Stream for auditory language processing.
4) Highlight the potential role of various white matter tracts in auditory language processing.
5) Conclusion
NR186-ED-X

Diffusion Weighted Imaging (DWI) and ADC Mapping in Pediatric Encephalitis: to Diagnose, Prognosticate and Follow Up the Disease Activity

All Day Location: NR Community, Learning Center

FDA Discussions may include off-label uses.

Participants
Amit K. Verma SR, MBBS, MD, New Delhi, India (Presenter) Nothing to Disclose
Neera Kohli, MBBS, MD, Lucknow, India (Abstract Co-Author) Nothing to Disclose
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Manoj Kumar, MD, MBBS, Lucknow, India (Abstract Co-Author) Nothing to Disclose
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Rashmi Kumar, MD, MBBS, Lucknow, India (Abstract Co-Author) Nothing to Disclose
Shila Singh, MS, New Delhi, India (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Encephalitis is a major cause of morbidity and mortality in the paediatric age group with viral and tubercular causes contributing the maximum disease burden in Indian subcontinent. The main purpose of this study is:

• To discuss the role of conventional MR imaging with DWI in diagnosis of early encephalitis.
• To correlate the DWI findings and ADC values with the activity, phase and clinical outcome of the disease.

TABLE OF CONTENTS/OUTLINE

• Definition, epidemiology and causes of encephalitis
• Clinical spectrum of presentation
• Imaging options for diagnostic evaluation
• Magnetic Resonance Imaging in encephalitis: Role and imaging protocol
• DWI and ADC mapping: -physiological basis -additional role in assessing the disease activity
• Conclusion
A Diagnostic Dilemma: Optimal Strategies for Identification of Venous Thrombosis and Infarcts from Neonates to Adults

All Day Location: NR Community, Learning Center

Participants
Laura Watson, MD, Boston, MA (Presenter) Nothing to Disclose
Philip Panic, Boston, MA (Abstract Co-Author) Nothing to Disclose
Neel Madan, MD, Boston, MA (Abstract Co-Author) Consultant, Near Infrared Imaging, LLC; Board Member, Quindec Inc

TEACHING POINTS
1. To review the similarities and differences in the pathophysiology, risk factors, and presentation of cerebral venous sinus thrombosis in neonates, children, and adults.
2. To provide an overview of the imaging techniques used to detect cerebral venous sinus thrombosis (including US, CT/CTV, MR/MRV, and DSA) and the advantages and disadvantages of each modality.
3. To discuss venous cerebral anatomy and the more common venous thrombosis patterns.
4. To review mimics of cerebral venous thrombosis.
5. To discuss treatment and outcome.

TABLE OF CONTENTS/OUTLINE
Cerebral venous anatomy Pathophysiology of venous thrombosis Virchow's triad Development of subsequent ischemia and/or infarct Risk factors for development of cerebral venous sinus thrombosis Common etiologies in both children and adults Etiologies specific or more common to children Clinical presentation and incidence of CVST in different ages Imaging modalities used to detect CVST (including US, CT/CTV, MR/MRV, DSA) with case examples Appropriate imaging technique for each modality Pros and cons associated with each modality Common venous thrombosis patterns Common mimics Treatment and outcome
Pediatric Supratentorial Intraventricular Masses: Review of Pathology, Imaging Features, Mimics and Differential Diagnosis

All Day Location: NR Community, Learning Center

Participants
Tejaswini K. Deshmukh, MD, Milwaukee, WI (Presenter) Nothing to Disclose
Hervey D. Segall, MD, Milwaukee, WI (Abstract Co-Author) Nothing to Disclose
Mohit Maheshwari, MD, Brookfield, WI (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Review the anatomy of the ventricular system. Review the pathology and imaging features of pediatric supratentorial intraventricular masses. Provide a differential diagnosis for a supratentorial intraventricular mass in a child and differentiate between various entities.

TABLE OF CONTENTS/OUTLINE
Introduction
Anatomy of the ventricular system
Imaging protocol
Pediatric supratentorial intraventricular masses:
- Lateral ventricles:
  - Trigone: Choroid plexus tumors, Ependymoma, Astrocytoma, Meningioma, Choroid plexus cyst, Xanthogranuloma
  - Body: Astrocytoma, PNET, Teratoma
- Frontal horn and foramen of Monro: Subependymal giant cell astrocytoma, Choroid plexus tumors, Central neurocytomas.
- Third ventricle: Hypothalamic astrocytoma, suprasellar craniopharyngioma, Germ cell tumors, Colloid cyst
Any location: Hematoma, Metastases
The clinical presentation including symptoms of raised intracranial pressure and hydrocephalus is common for all these lesions. Hence imaging plays an important role in the differential diagnosis and in directing patient management. This exhibit will review the imaging features of the above entities and guide the differential diagnosis based on the patient’s age, tumor location and imaging characteristics.
Imaging the Extracranial Region of the Cranial Nerves; Is It Still Challenging?

All Day Location: NR Community, Learning Center

Participants
Hiroyuki Fujii, MD, Shimotsuke, Japan (Presenter) Nothing to Disclose
Akifumi Fujita, MD, Shimotsuke, Japan (Abstract Co-Author) Nothing to Disclose
Karen Buch, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Nana Fujii, Shimotsuke, Japan (Abstract Co-Author) Nothing to Disclose
Osamu Sakai, MD, PhD, Boston, MA (Abstract Co-Author) Speaker, Bracco Group; Speaker, Eisai Co, Ltd; Consultant, Guerbet SA
Hideharu Sugimoto, MD, Shimotsuke, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Cranial nerve deficits are not uncommon and often affect the quality of life in affected patients. It is crucial to investigate the pathologic cause resulting in the cranial nerves deficit highlighting the crucial role of cross-sectional imaging in making the diagnosis of cranial nerve pathology. With the increasing spatial and contrast resolution of MR imaging, the intracranial cisternal segment of the cranial nerves can be readily imaged with heavily T2-weighted sequences, however; imaging of the peripheral branches of the cranial nerves, especially in extracranial segments still remains a clinical challenge. The purpose of this exhibit is to review recent advances in cranial nerve imaging focusing with advanced imaging technologies enabling the assessment of these extracranial regions of the cranial nerves, and discuss the applications for daily clinical practice, focusing on 3D-DESS-WE sequence.

TABLE OF CONTENTS/OUTLINE
1. Review of CT and MR imaging techniques for cranial nerve imaging including 3D-DESS-WE sequence.
2. Review the normal imaging anatomy of the cranial nerves (V, VII, IX, X, XI, XII).
4. Limitations of 3D-DESS-WE sequence for cranial nerve imaging.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Akifumi Fujita, MD - 2015 Honored Educator
Osamu Sakai, MD, PhD - 2013 Honored Educator
Osamu Sakai, MD, PhD - 2014 Honored Educator
Osamu Sakai, MD, PhD - 2015 Honored Educator
Participants
Jacques Romano, MD, New York, NY (Presenter) Nothing to Disclose
Lawrence Cabusora, MD, Bronx, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Introduce nascent field of neuroscience of decision-making
2. Identify critical brain regions involved in decision-making
3. Broadly describe role performed by these regions in decision-making
4. Correlate our functional understanding of decision-making neuroscience with key experimental findings
5. Enhance awareness of functional neuroscience's contributions and limitations toward our broader understanding of decision-making

TABLE OF CONTENTS/OUTLINE
Neuroeconomics is the neuroscience of decision-making
The diffusion model in the activity of LIP (lateral interparietal cortex) neurons explains simple perceptual decisions
Location and function of key brain regions in decision-making and evidence linking structure with function
Nucleus accumbens codes expected values
Amygdala codes for costs
Orbitofrontal cortex integrates multiple inputs
Dorsolateral prefrontal cortex involved in self-control and deliberation
Rational choice decision models are not descriptive of actual behavior—we demonstrate systematic biases
Prospect Theory describes that our loss aversion can overwhelm our avidness for gains contradicting theories of our maximizing expected utility
Role of emotions in decision-making
Contributions and limitations of neuroscience to our broader understanding of decision-making
The Structure of Medullary Veins in the Cerebral Hemisphere and Relating Disorders

All Day Location: NR Community, Learning Center

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Toshiaki Taoka, MD, PhD, Nagoya, Japan (Presenter) Nothing to Disclose
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Shinji Naganawa, MD, Nagoya, Japan (Abstract Co-Author) Nothing to Disclose
Tomoko Ochi, Kashihara, Japan (Abstract Co-Author) Nothing to Disclose
Hisashi Kawai, Nagoya, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Understanding the anatomical structure of medullary vein in the cerebral hemisphere, and get familiar with the disorders in which the medullary veins shows major role for disease development.

TABLE OF CONTENTS/OUTLINE
Anatomy of medullary vein: Medullary veins drain into subependymal veins with four converging zones, and show "comb shaped" distribution adjacent to the body or inferior horn, and "fan shaped" in the frontal horn or trigon of the lateral ventricle. Disorders relating deep medullary veins: In this educational exhibit, we will discuss the disorders relating deep medullary veins, including 1) hemorrhagic disorders related to the medullary veins (Diffuse vascular injury by high energy trauma, Deep medullary vein engorgement/thrombosis in neonate), 2) inflammatory changes spreading along the medullary veins, 3) neoplasms distribute within the medullary vein, 4) the status in which changes in oxygenation can be visualized in medullary vein on SWI, and 5) the anomaly of the medullary veins. When the lesions show "comb shaped" or "fan shaped" distribution, disorders relating deep medullary veins would be on differential diagnosis.
Where's the Beef? Diagnosing Tumors of the Pineal Region on MRI

All Day Location: NR Community, Learning Center

Participants
Yoshihito Kadota, Miyazaki, Japan (Presenter) Nothing to Disclose
Toshinori Hirai, MD, PhD, Miyazaki, Japan (Abstract Co-Author) Nothing to Disclose
Takanori Yano, MD, PhD, Miyazaki, Japan (Abstract Co-Author) Nothing to Disclose
Keiji Kitatani, MD, Miyazaki, Japan (Abstract Co-Author) Nothing to Disclose
Mika Kitajima, MD, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose
Yasuyuki Yamashita, MD, Kumamoto, Japan (Abstract Co-Author) Consultant, DAIICHI SANKYO Group

TEACHING POINTS

The purpose of this exhibit is: 1. To review the WHO classification of tumors of the pineal region (TPR). 2. To explain the utility of MR imaging including diffusion-weighted imaging (DWI) in the diagnosis. 3. To explain how to differentiate the tumors.

TABLE OF CONTENTS/OUTLINE

WHO classification of TPR Review of MR imaging findings and tumor markers- Conventional MRI- Diffusion-weighted imaging- Tumor markers (AFP, hCG) How to differentiate the tumors Summary
Imaging of the Anterior Ocular Adnexal Structures

All Day Location: NR Community, Learning Center

Participants
Leila Ismail, MBChB, London, United Kingdom (Presenter) Nothing to Disclose
Ban Sharif, MBBS, BSc, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Ezra Nigar, MSc, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Vickie Lee, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Ravi K. Lingam, MRCP, FRCR, Harrow, United Kingdom (Abstract Co-Author) Nothing to Disclose
Rajiv Patel, MBChB, MRCS, London, United Kingdom (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) To illustrate and discuss the radiological anatomy of the ocular adnexa anterior to the globe (including the eyelids, conjunctiva and lacrimal gland and drainage system)
2) To review the radiological appearances of the wide variety of disease processes involving the anterior ocular adnexal structures with clinicopathological correlation
3) To discuss the applications, relative merits and drawbacks of the various imaging modalities in evaluating this region.

TABLE OF CONTENTS/OUTLINE
The anterior orbit is unique as a mucocutaneous junction around the orbital rim, consisting of lacrimal gland and drainage system, the conjunctiva, canthi and eyelids. The posterior aspect is bounded by the orbital septum and the globe which delineates the boundary with the posterior orbit. Inflammatory, neoplastic, lymphoid and cystic lesions can present in this region and pathology can also present here from surrounding structures. The salient radiological features of MRI, CT and ultrasound will be discussed with clinicopathological correlation. The limitations and advantages of the various imaging modalities will also discussed in an attempt to evaluate and optimise imaging of this region.
The Many Faces of Central Nervous System Tuberculosis. An Imaging Based Analysis of 100 Cases of Tubercular Involvement of the Brain and Spine

All Day Location: NR Community, Learning Center

Awards
Certificate of Merit

Participants
Avik Banerjee, MBBS, Ludhiana, India (Abstract Co-Author) Nothing to Disclose
Parambir Sandhu, MD, MBBS, Ludhiana, India (Presenter) Nothing to Disclose
Kavita Saggar SR, MD, Ludhiana, India (Abstract Co-Author) Nothing to Disclose
Chandan Kakkar, MBBS, MD, Ludhiana, India (Abstract Co-Author) Nothing to Disclose
Shivam Sahni, Ludhiana, India (Abstract Co-Author) Nothing to Disclose
Satwant S. Khela, MBBS, Ludhiana, India (Abstract Co-Author) Nothing to Disclose
Deepak Kaushal, MBBS, Ludhiana, India (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
TO RECOGNIZE THE VARIOUS TYPICAL AND ATYPICAL IMAGING FEATURES OF CENTRAL NERVOUS SYSTEM TUBERCULOSIS AND ITS COMPLICATIONS
TO TABULATE IMAGING DIFFERENCIAL BETWEEN INTRACRANIAL TUBERCULOMAS VERSUS NEUROCYSTICERCOSIS
TO TABULATE IMAGING DIFFERENTIAL BETWEEN PYOGENIC VERSUS TUBERCULAR INVOLVEMENT OF THE SPINAL COLUMN

TABLE OF CONTENTS/OUTLINE
Diagnosis for Nerve of Origin in Head and Neck Schwannomas: CT and MRI Images with Anatomical Correlation

All Day Location: NR Community, Learning Center

Awards
Certificate of Merit

Participants
Nobuyuki Takeyama, MD, Yokohama, Japan (Presenter) Nothing to Disclose
Toshikazu Shimane, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Nobuyuki Ohike, Yokohama, Japan (Abstract Co-Author) Nothing to Disclose
Jiro Munechika, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Takaki Hayashi, MD, Yokohama, Japan (Abstract Co-Author) Nothing to Disclose
Toshi Hashimoto, MD, Yokohama, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Purpose:
1. Correlate CT and MRI images of head and neck schwannomas diagnosed at surgery with those anatomical features of nerve of origin.
2. Explain nerve-preserving excision technique ‘inter-capular resection’, in which the tumor could be resected between perineurium and tumor capsule.
3. Discuss the role of imaging for diagnosis and treatment in head and neck schwannomas.
Post-irradiated Carotid Blowout Syndrome: Imaging Diagnosis and Endovascular Management

Purpose: To improve the outcomes of post-irradiated carotid blowout syndrome (PCBS). Teaching points: 1. Review the pre-procedural CT/CTA to enhance the early diagnosis of PCBS. 2. Evaluate the complications and their prevention of endovascular management of PCBS. We suggest an algorithm of diagnosis, management and follow-up of PCBS.

TABLE OF CONTENTS/OUTLINE

1. Introduction
2. Classification: 3 groups - Group 1: Branch lesion (ECA), Tx: Embolization - Group 2: Trunk lesion (ICA to CCA)
   Group 2A: Embolization Group 2B: Stent-graft placement
3. Pre-procedural Imaging diagnosis - Vascular lesions of diseased carotid artery: Pseudoaneurysm, loss of axial spherical shape of diseased carotid artery, focal deviation of carotid artery toward the soft tissue lesion - Adjacent soft tissue lesions (trunk and branch lesions) External wound, fistula/sinus tract, necrotic fluid
5. Conclusion

We suggest performing pre-procedural CT/CTA to guide the therapeutic planning. We also suggest taking embolization as a most favorable therapeutic method whenever it is possible.
TEACHING POINTS

1. To correlate MRI images with cervical anatomy in the posterior cervical space (PCS) and surrounding boundaries, including the sternocleidomastoid muscle, trapezius muscles, paraspinal muscles, platysma, and subcutaneous fat.
2. To review the radiological imageries with pathological correlation in 15 differential diseases in the PCS and its surrounding boundaries.
3. To discuss the role of imaging for differential diagnosis and treatment for PCS schwannomas and others.
TEACHING POINTS

The viewer will learn about imaging anatomy of the lateral ventricle. To discuss the key imaging findings of common and uncommon tumors involving this location which help in narrowing the differentials. To distinguish between tumors arising primarily from the lateral ventricle versus those secondarily invading the lateral ventricle with histopathological correlation.

TABLE OF CONTENTS/OUTLINE

MRI is imaging modality of choice to appropriately localize and characterize lateral ventricular lesions. Many of the tumors have typical imaging features which help in narrowing down the differentials. MRI also helps to distinguish between tumors arising primarily from the lateral ventricle versus those secondarily invading the lateral ventricle. Methods: Retrospective review of 80 histopathologically proven cases from 2010 till date, revealed 50 arising from lateral ventricle and 30 invading the lateral ventricles. Common tumors include central neurocytoma, choroid plexus papilloma, meningioma, pilocytic astrocytoma, subependymoma, subependymal giant cell astrocytoma. Rare ones are glioblastoma multiforme, malignant melanoma, anaplastic hemangioendotelioma, intraventricular lymphoma, epidermoid cyst.
3T Magnetic Resonance Vessel Wall Imaging for Characterization of Intracranial Arteriopathies

All Day Location: NR Community, Learning Center

Participants
Cristina I. Olivas Chacon, MD, El Paso, TX (Presenter) Nothing to Disclose
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TEACHING POINTS
1. To illustrate the clinical utilization of 3T MRI vessel wall imaging techniques in demonstrating pathologic changes in patients with primary and secondary intracranial vasculopathic processes.
2. To gain an awareness of combined utilization of high resolution 3D time-of-flight MRA and EKG-gated turbo spin echo double inversion recovery techniques with magnetization preparation to improve the visualization of vessel wall pathology that may be obscured in conventional angiographic luminograms.

TABLE OF CONTENTS/OUTLINE
1. Introduction
2. Limitations of conventional angiographic luminograms
3. Imaging techniques: High resolution 3D TOF MRA Gated TSE DIR T1 Gated TSE DIR T2 Gated TSE DIR PD Gated TSE Triple IR
Intratemporal Facial Nerve Lesions. A Radiological Perspective

All Day Location: NR Community, Learning Center

Participants
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TEACHING POINTS
Review the facial nerve anatomy and its imaging aspects. Review the intratemporal facial nerve lesions and the radiological aspects, such as normal facial nerve enhancement (pseudolesion), inflammatory / infectious involvement of facial nerve (neuritis, Lyme disease, Ramsay Hunt Syndrome), tumors including hemangioma and its pathognomonic radiological aspect, facial nerve Schwannoma, geniculate ganglion meningioma and perineural extension of a parotid malignancy. Explain how to properly use the different imaging methods to evaluate these conditions.

TABLE OF CONTENTS/OUTLINE
Anatomy and Imaging of the facial nerve Classification of the intratemporal facial nerve lesions Pseudolesion: intratemporal facial nerve normal enhancement Infectious lesions: viral neuritis (Bell's Palsy), Lyme disease, Ramsay Hunt Syndrome Neoplasms: Facial nerve Hemangioma, Facial nerve Schwannoma, Geniculate Ganglion Meningioma, Perineural extension of Parotid Tumor Summary
Multimodality Parathyroid Imaging - Anatomy and Review of Pathology

All Day Location: NR Community, Learning Center

Participants
Manjiri K. Dighe, MD, Seattle, WA (Presenter) Research Grant, General Electric Company
Neeraj Lalwani, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Puneet Bhargava, MD, Shoreline, WA (Abstract Co-Author) Editor, Reed Elsevier

TEACHING POINTS
1. The advent of minimally invasive parathyroidectomy has brought with it the need for sensitive and increasingly accurate preoperative imaging. There is currently a wide array of imaging modalities and techniques available but little consensus regarding the optimal imaging protocol. Several complementary investigations now exist for those with equivocal first line imaging or for those whose cases are proving problematic. There is growing support for the use of 4-dimensional CT in this setting but diagnostic algorithms vary between institutions. 2. Review of the anatomy and pathology seen on these various modalities and techniques is presented in this exhibit.

TABLE OF CONTENTS/OUTLINE
1. To review the normal anatomy of parathyroid glands and correlation with embryology. 2. To review the techniques of imaging the parathyroid glands. 3. To review the advantages and limitations of ultrasound, 99mTc-sestamibi scintigraphy, MRI and computed tomography in the imaging of the parathyroid adenoma. 4. To illustrate the typical appearances of a parathyroid adenoma on ultrasound, 99mTc-sestamibi scintigraphy, MRI and 4-dimensional computed tomography. 5. To examine the roles of the various imaging modalities in contemporary parathyroid imaging.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Puneet Bhargava, MD - 2015 Honored Educator
Awards
Certificate of Merit

Participants
Bronwyn E. Hamilton, MD, Portland, OR (Presenter) Nothing to Disclose
Yosef Berlow, MD, Portland, OR (Abstract Co-Author) Nothing to Disclose
William Rooney, PhD, Portland, OR (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. Learn anatomical pathways of the central auditory pathway.
2. Review functional significance of brainstem structures involved in the central audition.
3. Recognize causes of central deafness and explain their rarity.

TABLE OF CONTENTS/OUTLINE

Teaching Points: Central auditory pathway anatomy is poorly seen on clinical MRI. Understanding the neuroanatomy of the central auditory pathway could improve diagnosis and understanding of central auditory disorders. Selected cases will demonstrate how the redundancy of the auditory pathway limits impact of brain pathology on deafness. Outline: 12T MR images of brainstem specimens will illustrate the brainstem auditory pathways. Significant auditory processing occurs within the brainstem. Known functions are reviewed here. 3T images will illustrate the supratentorial auditory pathway, since whole brain specimens do not fit in the 12T scanner bore. Table of contents: 1. Cochlear nuclei 2. Acoustic stria 3. Lateral lemniscus 4. Inferior colliculus 5. Medial geniculate body 6. Auditory radiations 7. Primary auditory cortex

Legend for PDF: inf coll = inferior colliculus; MGN = medial geniculate nucleus; mamm body = mammillary body; sup coll = superior colliculus; MLF = medial longitudinal fasciculus; 4th V = 4th ventricle
NR204-ED-X

CLIPPERS (Chronic Lymphocytic Inflammation with Pontine Perivascular Enhancement Responsive to Steroids): How to Distinguish a Rare but Emerging Clinical Entity with Multiple Mimickers

All Day Location: NR Community, Learning Center

Participants
Samuel Gatzert, MD, Galveston, TX (Presenter) Nothing to Disclose
Gabriel E. Calles, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Jax H. Pham, DO, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Stephen Herrmann, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose
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Tomas E. Uribe, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Review the unique CT and MR findings of CLIPPERS as well as its unique clinical and pathological characteristics. Compare and contrast the CT and MR findings from exampled CLIPPERS mimickers and describe defining clinical and pathological characteristics where appropriate. Divulge common pitfalls in the diagnosis of CLIPPERS. Provide a problem solving approach/algorithm to assist in distinguishing CLIPPERS from a wide-variety of diseases which may appear similar.

TABLE OF CONTENTS/OUTLINE

Describe the following: Historical Background of CLIPPERS Clinical presentation Pathology Describe example CT/MR images of CLIPPERS Describe example CT/MR images of the following diseases which were found to mimic CLIPPERS via CT/MR findings, and clinical or pathological findings when necessary: Multiple Sclerosis Metastatic Disease Primary Angiitis of the CNS (PACNS) Systemic Vasculitis with CNS Manifestations Infectious Diseases of the CNS (e.g. toxoplasmosis, syphilis) Primary CNS Lymphoma (PCNSL) Neurosarcoidosis Describe characteristics of CT/MR presentation that favor a diagnosis of CLIPPERS Describe a diagnostic approach that includes CLIPPERS in the differential when dealing with lesions primarily affecting the pons and immediately adjacent structures.
Imaging Findings in Postoperative Laryngeal Carcinoma: Conservative and Radical Surgery

Awards
Certificate of Merit

Participants
Ula Passos, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
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Daniel M. Ramos, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To review laryngeal anatomy
2. To present the surgical techniques used in the treatment of laryngeal squamous cell carcinoma (SCC)
3. To describe the main post surgical imaging findings after partial or total laryngectomy and different aspects on CT scans, MRI and PET/CT in correlation with schematic illustrations.

TABLE OF CONTENTS/OUTLINE
A. Anatomy of the larynx
B. Different surgical techniques in the treatment of laryngeal SCC - Chordectomy - Vertical partial laryngectomy - Horizontal supraglottic laryngectomy with cricothyroidopexy or cricothyroidoepiglottopexy - Near total laryngectomy - Total laryngectomy
C.Appearances of surgical treatment and post surgical findings on CT scans, MRI and PET/CT technics.
D. Radiologist's role in differentiating postoperative changes from possible residual or recurrent tumor.
Spontaneous Intracranial Hypotension and Spinal CSF Leak - Role of a Neuroradiologist

All Day Location: NR Community, Learning Center

FDA Discussions may include off-label uses.

Participants
Jaykumar R. Nair, MD, Montreal, QC (Presenter) Nothing to Disclose
Isabelle Dupuis, MD, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Kathleen Nguyen, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Carlos I. Torres, MD, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Raquel Del Carpio-O’Donovan, MD, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Jeffrey Chankowsky, MD, Montreal West, QC (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Spontaneous Intracranial Hypotension is one of the most underdiagnosed cause of Positional Headache.2. Role of Neuroradiologist is not limited to diagnosing the condition but has an important role in treatment and management.

TABLE OF CONTENTS/OUTLINE
Content: 1. Understand the pathophysiology of intracranial hypotension, spinal CSF leaks, their clinical presentation and complications.2. Discuss imaging findings of Conventional Brain and Spinal MRI, CT/MRI Myelography and Radio nuclear studies.3. To showcase Illustrative Cases and discuss their findings: 4. Discuss treatment options including conventional conservative treatment, Blood patch and Surgical Intervention.FINDINGS:1. MRI Findings include: A) Brain i) Bilateral subdural collections with diffuse pachymeningeal enhancement. ii) Sagging of the brainstem with tonsillar herniation, crowding and effacement of the suprasellar cisterns with reduction in the mamillo-pontine distance. B) Spine (Post intrathecal injection of gadolinium)) Spinal extradural fluid collection. ii) Dilated perineural root sleeves, thought to be potential site of CSF leakage.2. Radionuclide Study: For delayed leaks.3. CSF opening pressure following Lumbar Puncture: less than 12 cm of H2O at level of the right atrium
State-of-the-Art Imaging of the Pituitary Gland Utilizing Radial-VIBE with GRASP Sequences

Awards
Magna Cum Laude

Participants
Joanne Rispoli, MD, New York, NY (Presenter) Nothing to Disclose
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Camilla Rossi Espagnet, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Kai Tobias Block, PhD, New York, NY (Abstract Co-Author) Royalties, Siemens AG;
Girish M. Fatterpekar, MBBS, New York, NY (Abstract Co-Author) Editor, Reed Elsevier

TEACHING POINTS
- Explore the potential of unique k-space sampling using Radial-VIBE (Radially acquired Volume Interpolated GRE) and combine it with GRASP (Golden-angle Radial Sparse Parallel) MRI to allow State-of-the-Art dynamic imaging of the pituitary gland. - Discuss spatial (submm) and temporal (up to 5 seconds/frame) resolution which allows assessment of permeability characteristics of components of the normal pituitary gland, not appreciated on routine imaging. - Evaluate enhancement-time curves and permeability measures including Area under curve (AUC), Peak, Wash-in/out allowing better definition of underlying pituitary pathology and influencing management.

TABLE OF CONTENTS/OUTLINE
- Overview of Radial-VIBE and GRASP physics, with application to the pituitary. - Evaluation of the optimal dynamic scan duration to assess the pituitary gland, based on permeability characteristics of normal pituitary gland and microadenoma. - Distinguish simple cyst from microadenoma, and proteinaceous Rathke's cleft cyst from a hemorrhagic adenoma. - Assessment of permeability abnormalities in patients with central endocrine disturbances when the pituitary gland appears normal on conventional imaging. - Confirm location of ectopic posterior pituitary gland based on permeability characteristics. - Identify normal pituitary gland from a macroadenoma and discuss surgical implications.
NR208-ED-X

Radiologic Features of Spine Infections

All Day Location: NR Community, Learning Center

Participants
Lina M. Cruz Hernandez, ARRT, Toledo, Spain (Presenter) Nothing to Disclose
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J. M. Garcia Benassi, Toledo, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Infections of the spine, may have neurologically devastating consequences for patients. Its early imaging diagnosis may prevent critical complications, so the purpose of this exhibit is:1. To review pathophysiology and epidemiology of spine infections2. To describe the imaging features at plain films, CT and MR imaging of spine infections3. To illustrate imaging features at MR imaging of direct spinal cord infections4. To expose complications, prognosis and most common differential diagnosis of spine infections

TABLE OF CONTENTS/OUTLINE
Epidemiology and pathophysiology of spine infections
Imaging features at plain films, CT and MR imaging
Pyogenic osteomyelitis
Granulomatous osteomyelitis
Fungal infections
Parasitic infections
Imaging features at MR of direct spinal cord infections
Myelitis
Spinal cord abscess
Facet infection
Epidural abscess and spinal cord injury
Arachnoiditis
Complications and prognosis of spine infections
Epidural abscess and spinal cord injury
Subdural abscess
Paravertebral abscess
Mimics and differential diagnosis of spine infections
**NR209-ED-X**

*Stroke Chameleons: How to Diagnose Infarction as Infarction*

All Day Location: NR Community, Learning Center

**Participants**

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**TEACHING POINTS**

We sometimes misassign strokes as other diseases (stroke chameleons) and other diseases as strokes (stroke mimics). Although there have been several published papers of stroke mimics, the stroke chameleons have rarely been documented. The aims of this exhibit are: To help raising the confidence in diagnosing infarctions To learn about the detailed vascular anatomy and its territories To deepen the knowledge about differential diagnoses

**TABLE OF CONTENTS/OUTLINE**

1. Key points for diagnosing infarctions with confidence - Detailed vascular territories and the knowledge about time course of infarctions 2. Stroke chameleons by clinical symptoms - Strategic infarctions (i.e. precentral cortex with monoplegia, thalamic infarct with dementia) 3. Stroke chameleons on imaging A) Mimicking other severe diseases - Hemorrhagic, optic nerve and medial temporal lobe infarctions can imitate tumor, optic neuritis and limbic encephalitis, respectively. - Subacute infarction can be misassigned to tumor due to its contrast enhancement. B) Symmetrical infarctions - Infarctions in the paramedian thalamus, fornix, tectum of the mid brain and medulla can exhibit symmetric appearance. C) Infarctions that do not seem to fit vascular territories - Infarctions on deep brain areas and air embolism can show unusual shapes.
Radiological Findings after Treatment of Orbital Tumors

All Day Location: NR Community, Learning Center

Participants
Daniel T. Ginat, MD, Chicago, IL (Presenter) Nothing to Disclose
Jeffrey Bonham, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Suzanne K. Freitag, Boston, MA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
It is important to be familiar with the variety of treatment options for orbital tumors. The expected and complicated imaging findings after treatment for orbital tumors are reviewed.

TABLE OF CONTENTS/OUTLINE
The imaging findings of the following types of interventions will be reviewed: Orbital biopsy and nasoseptal flap reconstruction Enucleation, including implants and prostheses Orbital exenteration and reconstruction Radiation therapy The imaging of the following complications will be depicted: Hemorrhage CSF leak Infection/fistula Tumor recurrence Radiation-induced vasculopathy Osteoradionecrosis Radiation-induced brain necrosis Radiation-induced optic neuropathy Radiation-induced malignancy
**What’s the Matter with the White Matter? A Case Based Review of Acquired Demyelinating Diseases and the Differential Diagnostic Considerations Based Upon their Respective MRI Characteristics**

**Awards**

*Certificate of Merit*

**Participants**

Lauren R. Kriger, DO, Morristown, NJ (*Presenter*) Nothing to Disclose  
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Alexander Volovsky, MD, New Providence, NJ (*Abstract Co-Author*) Nothing to Disclose  
Jose C. Rios, MD, PhD, Morristown, NJ (*Abstract Co-Author*) Nothing to Disclose  
Peter Wynne, MD, Morristown, NJ (*Abstract Co-Author*) Nothing to Disclose

**TEACHING POINTS**

1. Review and understand the classification of acquired demyelinating pathology.  
2. Review the anatomy of the brain, and learn the MRI characteristics of the various acquired demyelinating diseases.  
3. Based on specific MRI features and clinical history, learn and understand the differential diagnosis of acquired demyelinating processes.  
4. Learn the appropriate work-up, management, and follow-up of the various acquired demyelinating diseases.

**TABLE OF CONTENTS/OUTLINE**

Case based review of MRI characteristics of acquired demyelinating diseases. After completing this educational exhibit, the reader will be able to recognize MR characteristics of and provide a differential diagnosis for acquired demyelinating disease. The typical clinical presentation, appropriate work-up, follow-up, and natural history/prognosis will also be reviewed. Metabolic: Osmotic demyelination, Subacute combined degeneration  
Infectious/post-infectious: Acute Disseminated Encephalomyelitis, HIV encephalitis, Progressive Multifocal Leukoencephalopathy  
Inflammatory/Autoimmune: Multiple sclerosis, Balo Concetric sclerosis, Tumefactive Multiple Sclerosis, Optic neuritis, Transverse myelitis  
Toxic: Alcohol, Radiation, Drugs, Toxins  
Vascular: CADASIL, Postanoxic encephalopathy, Reversible posterior leukoencephalopathy  
Traumatic: Diffuse axonal injury
Multimodality Imaging of Thyroid Disease

All Day Location: NR Community, Learning Center

Participants
Amit B. Desai, MD, Rochester, NY (Presenter) Nothing to Disclose
Carrie K. Gomez, DO, Rochester, NY (Abstract Co-Author) Nothing to Disclose
Shweta Bhatt, MD, MBBS, Rochester, NY (Abstract Co-Author) Nothing to Disclose
Steven P. Meyers, MD, PhD, Rochester, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Although ultrasound and nuclear imaging are the modalities of choice for evaluating the thyroid, many thyroid lesions are found incidentally on CT and MRI studies. The purpose of this exhibit is to: 1. Review common and uncommon benign and malignant thyroid lesions. 2. Provide CT/MRI correlation with the ultrasound and nuclear medicine studies. 3. Highlight distinguishing imaging features that guide management decisions including follow-up imaging versus surgical intervention.

TABLE OF CONTENTS/OUTLINE

1. Introduction
2. Review of normal thyroid/parathyroid anatomy
3. Case-based review of thyroid lesions including, but not limited to:
   - Benign: Thyroglossal Duct Cyst, Ectopic Thyroid, Thyroid Adenoma, Multinodular Goiter, Colloid Cyst.
   - Malignant: Papillary, Follicular, & Medullary Thyroid Cancer, Anaplastic Carcinoma, Primary Lymphoma, Metastasis.
   - Infections: Acute supplicative thyroiditis, Subacute Thyroiditis.
   - Inflammatory: Graves Disease, Hashimoto's Thyroiditis.
4. Management recommendations based on imaging findings including when patients can be followed conservatively to ensure resolution or stability, as opposed to requiring surgical management.
Cervical Computed Tomography and Magnetic Resonance Angiography: Beyond Atherosclerosis and Dissection

All Day Location: NR Community, Learning Center

Participants
Danilo Giorgio O. Medrado, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Maria Helena T. Rodrigues, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Luis F. Godoy, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Leandro T. Lucato, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Claudia D. Leite, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Researcher, Guerbet SA

TEACHING POINTS
- To recognize differential carotids pathologies at CTA and MRA, beyond atherosclerosis and dissection
- To review physiopathology of stationary waves
- To differentiate imaging findings of stationary waves from dysplasia fibromuscular

TABLE OF CONTENTS/OUTLINE
Review CTA and MRA aspects and make a quick physiopathological summary of some uncommon vascular findings, such as: Carotid webs / dysplasia fibromuscular Carotidynia Intraluminal trombus Carotid Blowout Syndrome Stationary waves Vasculitis Stationary waves vs artefact Stationary waves vs dysplasia fibromuscular Report cases Conclusion
Keeping Pace With The Shifting Paradigm of Autoimmune Encephalitis: A Pictorial Review

All Day Location: NR Community, Learning Center

Awards
Cum Laude

Participants
Luke Dixon, MBBS, BSC, London, United Kingdom (Presenter) Nothing to Disclose
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Maureen Dumba, MBChB, BSC, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Olga Kirmi, MBBS, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Amrith Mehta, MBBS, London, United Kingdom (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Autoimmune encephalitis (AIE) is a catch-all term for an ever expanding, heterogenous group of potentially treatable conditions. Paralleling the advent of advanced imaging and immunoprofiling, the number of reported AIE cases has dramatically increased. To keep up with this evolving paradigm, this exhibit will provide attendees with a(n): Update on the clinical presentation, pathophysiology and aetiology of autoimmune encephalitis. Review of the variable MR imaging characteristics in autoimmune encephalitis. Approach to differentiating autoimmune encephalitis from non-autoimmune mimics. Insight into potential novel imaging techniques that may assist a diagnosis of autoimmune encephalitis.

TABLE OF CONTENTS/OUTLINE
Introduction. Current understanding of AIE will be presented and integrated with a showcase of several variants, such as anti-GAD, anti-NMDAR and anti-VGKC. Non-autoimmune mimics, such as herpes encephalitis, will subsequently be compared and contrasted. Set of quiz cases will then be presented. The presentation will close with a final summary and a spotlight on future imaging avenues.
Comprehensive Review of Intracranial Infections: Causes and Concerns in Classic to Complex Cases

All Day Location: NR Community, Learning Center

Awards
Certificate of Merit

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Sanjaya Viswamitra, MD, Bengaluru, India (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To illustrate common and uncommon MRI appearances of intracranial infections under the headings of bacterial, fungal, viral and parasitic causes. To discuss the utility of certain imaging sequences like CISS, FLAIR, diffusion, perfusion, MRS in the effective diagnosis of specific infections.

TABLE OF CONTENTS/OUTLINE
Prompt diagnosis of intracranial infections can have a significant effect on patient’s morbidity and mortality. Retrospective review of MRIs from 2012 to 2015 revealed 50 intracranial infections, all of which were histopathologically proven or had clinical/ imaging follow up. They are discussed by category of pathogen of cause which include bacterial, fungal, viral and parasitic. The cases include: meningitis, ventriculitis, tuberculosis, pyogenic abscess, neurosyphilis, SSPE, Herpes simplex virus, varicella zoster virus, PML, Dengue, cryptococcus, aspergilloma, TORCH infections, neurocysticercosis, hydatid and creutzfeldt-Jakob disease. Advanced sequences benefit; for example: T2 FLAIR for leptomeningeal meningitis, HSV encephalitis. Diffusion and ADC values in abscess, fungal pathologies and CJD. MR spectroscopy for hydatid disease, tuberculomas. CISS for Neurocysticercosis. Perfusion to differentiate infection from doubtful neoplasms.
Staging Head and Neck Cancer: How We Do It

Awards
Certificate of Merit

Participants
Patricia A. Hudgins, MD, Atlanta, GA (Presenter) Nothing to Disclose
Kriten L. Baugnon, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Amanda S. Corey, MD, Atlanta, GA (Abstract Co-Author) Consultant, RadMD
Ashley H. Aiken, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Establishing a stage for a head and neck tumor is important for determining appropriate treatment and prognosis. Once a diagnosis of malignancy is made, regardless of where the tumor is located, the next step in caring for the patient is to stage the disease. This is a universal and critical step. In our experience, the radiology community is hesitant to participate completely in the staging process. Cases referred to our multidisciplinary Tumor Board rarely include a radiologic stage (RS) and staging has only recently been emphasized in specialty and continuing medical educations courses. This exhibit will review the process of staging a head and neck cancer: 1. Identify the subsite from which the tumor originated 2. Using the current Cancer Staging Manual from the American Joint Committee on Cancer, Seventh Edition, identify the critical characteristics about the mass that should be included in the dictation.

TABLE OF CONTENTS/OUTLINE
Know Your Moves- Look, Locate and Learn: MRI in Movement Disorders

All Day Location: NR Community, Learning Center

Participants
Sunitha P Kumaran, MBBS, MD, Bengaluru, India (Presenter) Nothing to Disclose
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TEACHING POINTS
- To learn the pathophysiology of various abnormal movements.
- To train the radiologist to look for specific anatomical locations in brain when they encounter symptoms of movement disorders.

TABLE OF CONTENTS/OUTLINE
Brief pathophysiology and role of neuroimaging is discussed on different types of abnormal movements which include: hemiballismus, chorea, athetosis, myoclonus, dystonia, essential tremor, resting tremor and intentional tremor. Retrospective review of MRIs in movement disorders from 2012 to 2015, revealed 20 cases which are as follows: Lacunar stroke, Huntington's disease, Wilsons disease, Hallervorden-Spatz disease, Creutzfeldt-Jacob disease, Subacute sclerosing panencephalitis, normal pressure hydrocephalus, mitochondrial cytopathy, Metachromatic Leucodystrophy, parkinsons disease, spino cerebellar ataxia, olivo ponto cerebellar atrophy, chronic alcoholism-related cerebellar atrophy. We illustrate neuroimaging in various abnormal movements which lead to characteristic clinical presentation and present different pathologies in a case-based approach to localize and learn the key diagnostic findings.
The advent of combination antiretroviral therapy (cART) has changed HIV from a fatal illness to a chronic disease. The manifestations of HIV within the central nervous system (CNS) have evolved as a result. Chronic pathologies seen in the general population also co-exist within this complex cohort, posing a significant diagnostic challenge. Awareness of typical and atypical imaging features and therapy-related appearances is required.

Aims: Overview of well-characterized CNS manifestations of HIV/AIDS, focusing on typical imaging findings associated with opportunistic infections, inflammatory disorders and neoplasms. Insight into the highly variable imaging presentations of CNS HIV, highlighting the impact of cART. Appreciation of the challenges in categorizing MR appearances into a defined, established HIV-related diagnosis. A framework that assists in case interpretation, helps narrow the differential diagnoses and guides clinical management.

TABLE OF CONTENTS/OUTLINE

Introduction Characteristic HIV/AIDS CNS appearances Atypical manifestations of HIV/AIDS in the CNS, in particular: Review differentiating imaging features Recognize challenges when there are overlapping features Co-existent non-immune deficient chronic CNS pathology Guidance on approaching unusual cases with examples from our archives Conclusion
**Cranial Nerve Conundrums: A Radiologist’s Primer**

**All Day Location:** NR Community, Learning Center

**Awards**
- **Certificate of Merit**

**Participants**
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- Farah Alobeidi, MBBCHIR, MA, London, United Kingdom (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**

**Aims**
- Review the anatomy and basic function of the cranial nerves (CN)
- Identify CNs on MR imaging
- Provide a systematic approach to diagnosing CN pathology by consideration of common anatomical and pathological disease entities. Salient imaging features will be discussed.

**TABLE OF CONTENTS/OUTLINE**

- Introduction
- Anatomy and Function
  - Detail the course of the CNs and their relationship to important surrounding structures
- Review CN functions
- Radiological anatomy: Discuss useful MR imaging sequences for CN visualization
- Correlate CN anatomy with MR imaging
- Cranial nerve pathology: Pictorial review of common cranial nerve pathologies
- Identify key sites of pathology that may affect multiple CNs
- Review of common differential diagnoses
- Case review: Interactive cases to test and consolidate the readers’ understanding and increase confidence in analyzing CN MR images
- Summary
Value of Ktrans and Perfusion Imaging in Recurrence of Gliomas

All Day Location: NR Community, Learning Center

Participants
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TEACHING POINTS
The treatment for gliomas is surgical resection with radiation therapy which may lead to imaging dilemma whether an enhancing lesion is due to recurrent glioma or radiation necrosis. The purpose of this exhibit is to depict the correlation of ktrans and perfusion imaging in understanding glioma recurrence. To assess independent evaluation by other parameters such as MR spectroscopy and diffusion tensor imaging in evaluation of recurrence.

TABLE OF CONTENTS/OUTLINE
Background
Parameters used for evaluating tumour recurrence versus radiation necrosis ktrans and its pathophysiological basis. MRS (DSC) perfusion MR imaging - relative cerebral blood volume (rCBV), relative peak height (rPH) and percentage of signal-intensity recovery (rPSR). Material and methods and findings
Nine post op glioma patients were evaluated on 3-Tesla MRI machine and following sequences were obtained: T1, T2, Flair
Post contrast T1 fat saturated
Diffusion and Apparent diffusion co-efficient
MR spectroscopy
Perfusion (DSCET2*) ktrans and ve
DTI
Conclusion
The principal parameters that provide useful information about tumour diagnosis and therapeutic response and can guide the surgeon regarding stereotactic radiation therapy are ktrans and CBV. Higher value of ktrans and CBV compared to that of normal tissue is suggestive of recurrence.
Awards
Certificate of Merit

Participants
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TEACHING POINTS
1. Review sinus, orbit and cranial anatomy that facilitate the spread of disease. 2. Describe key imaging and clinical findings of intracranial and orbital complications of sinusitis. 3. Learn an image-based algorithm to facilitate the detection of the complications of sinus infections.

TABLE OF CONTENTS/OUTLINE
Material is presented in a quiz format. Prevalence, imaging findings of acute and chronic sinusitis, relevant anatomy and patterns of disease spread are reviewed. Complications associated with specific sinuses are presented as follows: ethmoid and, less commonly, maxillary (pre and post septal cellulitis, orbital and subperiosteal abscess), sphenoid (cavernous sinus thrombosis and epidural abscess) and frontal (preseptal and orbital cellulitis, Pott Puffy tumor, meningitis, epidural abscess, subdural empyema and cerebral abscess). Immunocompromised patients are also susceptible to infections from unusual pathogens, such as invasive fungal sinusitis. Cases of invasive fungal sinusitis are shown to stress the importance of assessing the soft tissues adjacent to the sinuses and intracranial region for associated complications i.e. optic nerve and brain infarcts. An image-based algorithm is provided to summarize key concepts.
The differential diagnosis of extraocular muscle enlargement is broad and includes inflammatory, neoplastic and traumatic etiologies. Contrast-enhanced CT and MR of the orbits provide valuable information that, along with pertinent clinical information, can assist in narrowing the differential diagnosis. In the setting of orbital trauma, it is important to evaluate for extraocular muscle entrapment. Systemic diseases such as hyperthyroidism and sarcoidosis can rarely manifest with extraocular muscle enlargement as an initial finding on cross-sectional imaging.

**TABLE OF CONTENTS/OUTLINE**

Introduction
Review of normal orbital anatomy
Basic overview of optimal imaging modalities for evaluating orbital pathology
Detailed radiologic and clinical review of etiologies for extraocular muscle enlargement, to include the following entities:
- Inflammatory/infiltrative
- Thyroid-associated orbitopathy
- Inflammatory pseudotumor
- Cellulitis
- Sarcoidosis
- Neoplastic
- Lymphoproliferative lesions / lymphoma
- Metastasis
- Rhabdomyosarcoma
- Traumatic
- Entrapment/hematoma
Conclusion
What We Need to Know About 3D-T2-Weighted Imaging to Evaluate Patients with Cervical Spondylosis

All Day Location: NR Community, Learning Center

Participants
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TEACHING POINTS

It is difficult to evaluate neural foramina in patients with cervical spondylosis using conventional 2D MR imaging. 3D-T2-weighted imaging (3D-T2WI) provides high resolution images and allows us to create high quality multiplanar reformatted images, which enable better delineation of nerve roots, neural foramina, and intraforaminal structures compared to 2D-T2WI. 3D-T2WI at 3T enables us to obtain high-resolution images with a relatively short examination time and has significant advantages when compared to 1.5T. The purpose of this exhibit is 1. To discuss the imaging techniques of 3D-T2WI and advantages at 3T. 2. To review the imaging anatomy of the cervical spinal canal with 3D-T2WI. 3. To review the MR imaging findings in patients with cervical spondylosis and learn the critical findings we need to know in patients with cervical spondylosis.

TABLE OF CONTENTS/OUTLINE

1. Review of the anatomy of the cervical spinal canal (including cadaveric section and corresponding MR imaging). 2. Review of imaging techniques for 3D-T2WI: 1) advantage over 2D-T2WI, 2) review of various 3D-T2WI sequences; pros and cons of each technique, 3) 3D-T2WI at 3.0T vs. 1.5T. Review of representative cases with cervical spondylosis. 4. Discussion about critical findings in cervical spondylosis - we need to know.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Osamu Sakai, MD, PhD - 2013 Honored Educator
Osamu Sakai, MD, PhD - 2014 Honored Educator
Osamu Sakai, MD, PhD - 2015 Honored Educator
TEACHING POINTS

Identify the array of central nervous system (CNS) neoplasms in the hereditary syndromes. Discuss the genetics, molecular biology and diagnostic criteria of hereditary syndromes with intracranial manifestations. Recognize the specific CT and MR imaging characteristics of these tumors. Explain the follow-up and treatment options for these patients with benign and malignant lesions.

TABLE OF CONTENTS/OUTLINE

Overview of genetics and molecular biology of familial syndromes Review of neuroimaging (MRI/CT) and cases: Von Hippel Lindau Tuberous Sclerosis Neurofibromatosis Type 1 Neurofibromatosis Type 2 Familial Schwannomatosis Cowden Disease Multiple Endocrine Neoplasia Type 1 Familial Retinoblastoma Ataxia Telangiectasia Li-Fraumeni syndrome Lynch syndrome Turcot syndrome Gorlin syndrome 3. Treatment options 4. Clinical and radiologic follow-upCONCLUSION: Understanding of genetics and molecular biology in hereditary neoplasms can play a crucial role in the manifestation of similar tumors in different syndromes. Multiple genetic syndromes have characteristic tumors and imaging findings that are necessary for diagnosis. Treatment options for familial CNS tumors are often identical to their sporadic counterparts. Radiation doses may be limited due to increased risk for secondary neoplasm.
Ocular Emergencies: What Every Radiologist Should Know

All Day Location: NR Community, Learning Center

Participants
Raquel A. Moreno, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
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TEACHING POINTS
(1) Make a review of the most important ophthalmic emergencies, including some severe ophthalmologic diseases and life threatening systemic conditions; (2) Describe the main ultrasound, CT and MRI findings of these disorders. (3) Emphasize the imaging aspects that should be reported by radiologists, essentials to early treatment.

TABLE OF CONTENTS/OUTLINE
(1) Ophthalmic emergencies listed herein are common in primary care setting; (2) In some cases, general doctors may require complementary exams, making the accurate radiologic diagnosis essential to early treatment; (3) Radiologist must be alert to ocular anatomy, notably when complaint is related to vision, CNS and sinuses pathologies, and in trauma, inflammatory or infectious diseases; (4) We grouped these emergencies as follows: traumatic (open globe, orbital fractures and intraocular foreign bodies), infectious (pre-septal and post-septal cellulitis, endophthalmitis, abscess), intraocular hemorrhage (vitreous hemorrhage), detachments (retinal, posterior vitreous, choroidal), CNS pathologies (strokes, aneurysms, demyelinating diseases) and systemic conditions (giant cell arteritis, cavernous sinus thrombosis); (5) Radiologists should recognize and report the major imaging aspects of each condition, working along with clinicians on their prompt management, to avoid either ophthalmic or systemic morbidity.
Guidelines for Diagnosis of Intracapsular Pathology in Temporomandibular Joint Using MRI-arthrography. "How, When and Why Do It"

All Day Location: NR Community, Learning Center

Participants
Maria Gonzalez Vazquez, Vigo, Spain (Presenter) Nothing to Disclose
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TEACHING POINTS
- To review the anatomy and pathophysiology of intracapsular disorders in temporomandibular joint.
- To describe technical procedure of MRI-arthrography. Indications, contraindications and possible complications. Advantages and disadvantages.
- How to interpret imaging findings with this technique and your relevance for treatment planification.

TABLE OF CONTENTS/OUTLINE
A) Anatomy of temporomandibular joint.
B) Pathophysiology and biomechanic of intracapsular disorders in temporomandibular joint.
C) Technical procedure of MRI-arthrography:
   - Intraarticular contrast injection under ultrasound guidance in the posterosuperior compartment of the joint.
   - Indications, contraindications and possible complications.
   - Advantages and disadvantages.
D) MRI sequences protocol.
E) Diagnostic imaging findings: disk position and morphology, disk or discal attachment perforations, intraarticular adhesions or fibrosis, cartilage degeneration (chondromalacia), intraarticular loose bodies...
F) Treatment planning: conservative, interventional, arthroscopy or by open surgery.
Participants
James Meletak, Chicago, IL (Abstract Co-Author) Nothing to Disclose
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TEACHING POINTS
Review anatomy of the nasopharynx and skull base relevant to radiation oncology treatment planning and follow up with emphasis on potential pitfalls. Review complications that may be encountered after radiation oncology for tumor involving the nasopharynx and skull base region.

TABLE OF CONTENTS/OUTLINE
Discuss radiation oncology treatment approaches relevant to the nasopharynx and skull base region. Depict CT and MRI nasopharynx and skull base anatomy, including variants and usual presentations of tumor that can be pitfalls for treatment planning. Highlight complications related to radiation therapy in the nasopharynx and skull base and potential mimics with insights for problem solving.
TEACHING POINTS

Describe imaging protocol and impact of this technique on surgical strategy Describe features of parathyroid adenoma on 4D CT Describe common ectopic locations of parathyroid adenoma and their embryological basis Differential diagnosis and features for differentiation

TABLE OF CONTENTS/OUTLINE

Etiology of primary HPT: up to 90% are due to parathyroid adenomas Principle behind the technique of 4D CT: Apart from 3D anatomical localization, it adds dimension of time dependent contrast enhancement of adenomas Patho-physiological basis of technique: Because of rich blood flow, it shows intense arterial enhancement and washout in venous phase Describe imaging protocol of 4D CT and some tips and tricks: Patient positioning and coverage (angle of mandible to carina) Phases acquired and timing: pre-contrast, arterial, venous Volume and rate of contrast injection Dose reduction strategies Appearance of parathyroid adenoma on different phases NCCT - Iso to hypodense Arterial phase - Intense enhancement Venous phase - Washout Show some ectopic locations Differential diagnosis and features which help in differentiation Role of Dual energy CT scan: Role of iodine map and virtual NCCT Show correlation with Sestamibi scan in few cases which may be false negative in some Surgical Impact: planning focused unilateral approach instead of bilateral neck exploration
**Brain Venous Thrombosis: The Nightmare of the on Call Radiology Resident. Emphasis on Difficulties and Common Diagnostic Errors**

**Participants**
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**TEACHING POINTS**
Review the signs and manifestations of brain venous thrombosis. Be familiar with the common errors in the diagnostic process. Discuss CT protocols and MR sequences useful for the diagnosis.

**TABLE OF CONTENTS/OUTLINE**
Introduction: Normal venous anatomy, etiology and clinical presentation. CT and MR protocols we use. Review of the imaging findings on the emergency setting and further diagnostic workup. Common diagnostic errors on the preliminary resident report. Conclusions
Approach to Cystic Intracranial Lesions: What Every Radiologist Should Know

All Day Location: NR Community, Learning Center

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TEACHING POINTS
1. To review the pathologic findings and radiologic appearance in the different techniques.
2. Establish a differential diagnosis of intracranial cysts based on typical location and age of the patient.

TABLE OF CONTENTS/OUTLINE
1. Introduction
2. Normal variations - Cavum septi pellucidi - Cavum veli interpositi - Cavum vergae - Mega cisterna magna - Dandy-walker malformation
3. Cystic lesions of development - Periventricular leukomalacia - Schizencephaly - Venticulomegaly
5. Infectious lesions - Neurocysticercosis - Echinococcosis - Abscesses
6. Tumoral lesions - Hemangioblastoma - Pilocytic astrocytoma - Central neurocytoma - Craniopharingioma - Cystic meningioma
7. Diagnostic algorithm
8. Conclusion
Participants
Elizabeth C. Rebello, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
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TEACHING POINTS
1. This review aims to raise awareness of more accurate diagnostic to these rare tumor types by review the pathophysiology, incidence, preferential behaviour and image findings. 2. To explain the utility of diagnostic methods, specifically fetal and neonate MRI and its role in therapeutic planning and prognosis prediction.

TABLE OF CONTENTS/OUTLINE
Epidemiology of congenital brain tumors. Most common clinical presentations. Pictorial essay: Imaging findings in the most common tumors including teratoma, glial tumors, choroid plexus papiloma and PNET. Differential diagnosis and mimics. Prognostic features including histologic type, size, location and infant status. Future directions and summary, including fetal MRI and genetic perspectives.
Intrarterial Chemotherapy for Intraocular Retinoblastoma

All Day Location: NR Community, Learning Center

Participants
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TEACHING POINTS

The purpose of this exhibit is to: Make a summary of the retinoblastoma, genetics, histology, diagnosis and their main treatments; Understand the indications, contraindications, technique, and complications of intrarterial chemotherapy in the treatment of intraocular retinoblastoma; Explain the technique of super-selective catheterization of the ophthalmic artery, advantages and limitations of the method, based on the experience of thirteen patients treated with this technique in our hospital.

TABLE OF CONTENTS/OUTLINE

A. Retinoblastoma, genetics, histology, and clinical presentations
B. Diagnostic Imaging (US, CT MRI) and Staging
D. Review of Indications, Contraindications of intrarterial chemotherapy
E. To describe the supraselective catheterization of the ophthalmic artery technique. Alternatives to catheterization of ophthalmic artery such as infuse the drug in the internal carotid after the temporary balloon occlusion of this artery, or the catheterization of ophthalmic artery origin arriving through the posterior communicating artery.
F. Complications
G. Follow-up management
Multimodal Ultrasound Imaging in Meningioma Surgery

All Day Location: NR Community, Learning Center

FDA Discussions may include off-label uses.

Participants
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Francesco DiMeco, Milano, Italy (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Intra-operative US (ioUS) is definitely a valuable tool in meningioma surgery as already stated for other brain neoplasm. It ensures a rapid, repeatable, and cost effective real-time intraoperative imaging. Standard B-mode US offers significantly useful morphologic information, which can be further implemented with fusion imaging for better US imaging understanding and orientation. The integration with different Doppler modalities as well as Contrast enhanced US offers incomparable information regarding tumor vascularization and perfusion, thus facilitating the surgical strategy. Elastosonography seems to be a promising tool especially to evaluate tumor borders, eventual parenchymal infiltration, and tumor consistency.

TABLE OF CONTENTS/OUTLINE
We describe all the most relevant ioUS modalities and their intraoperative application to obtain precise and specific information regarding the lesion for a tailored approach in meningioma surgery. For each modality, we present some images based on our routinely use of ioUS for meningioma resection.
Magnetic Resonance Imaging Safety and Practice in Patients with Cochlear Implants

All Day Location: NR Community, Learning Center

FDA Discussions may include off-label uses.

Participants
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Nancy Young, MD, Chicago, IL (Abstract Co-Author) Medical Advisory Board, Cochlear Limited Medical Advisory Board, Advanced Bionics AG

TEACHING POINTS

Many U.S. medical centers do not provide magnetic resonance imaging (MRI) to cochlear implant (CI) patients unless the CI internal magnet/device is surgically removed to avoid imaging artifacts and complications. However, surgical removal can also cause complications and result in compromised medical care. Based on our research, we have developed the following precautions to obtain safe and diagnostic MR images in CI patients: 1) A head wrap placed on patient prior to entry into the MRI bore; 2) Slow entry into the bore; 3) Keeping the entire body flat on the gantry to avoid the proximity to the superior edge of bore; 4) Use of slower gradient modes; and 5) Minimizing table movement during scanning. We hope to share our experience to prevent unnecessary surgeries on CI patients and to facilitate safe and diagnostic MRI in this patient population.

TABLE OF CONTENTS/OUTLINE

We will give a brief cost-benefit analysis of performing MRI in CI patients. Then we will explain the physics of why certain MRI exams put CI patients more at risk for complications. Lastly, we will explain which CI patients are the best candidates for MRI, which MRI exams are diagnostically useful in this population, and what can be done to prevent complications when imaging CI patients. We will provide our workflow of scheduling and performing MRI exams on CI patients.
"Spectral Evidence" The Role of MR Spectroscopy Inleukodystrophies

All Day Location: NR Community, Learning Center

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Alan P. Valente, DMD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Leandro T. Lucato, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Claudia D. Leite, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Researcher, Guerbet SA

TABLE OF CONTENTS/OUTLINE
1. Review spectroscopy fundamentals and methodology
2. Discuss the spectra appearance in normal children, and how do they change over time
3. Limitations of MRS
4. Leukodystrophies and MRS patterns
   - Unspecific: Low NAA Demyelination pattern (similar to MS)
   - Differentiation between hypomyelination and other leukodystrophies
   - Typical MRS patterns
     - Canavan disease
     - Mitochondrial diseases
     - Leukoencephalopathy with brainstem and spinal cord involvement
     - Galactosemia
     - Maple syrup urine disease
     - Nonketotic hyperglycinemia
5. MRS in follow-up
6. Conclusions and take-home message
White Matter Diseases: Radiologic-Pathologic Correlation

All Day Location: NR Community, Learning Center

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James G. Smirniotopoulos, MD, Bethesda, MD (Presenter) Nothing to Disclose

TEACHING POINTS
To understand the pathologic substrate and the neuroimaging features of demyelinating diseasesTo correlate the radiologic-pathologic findings in different diseases

TABLE OF CONTENTS/OUTLINE
We present a broad spectrum of white matter diseases, highlighting the clinical and neuroimaging features whose recognition can help in making the correct diagnosis. This exhibit correlates those radiologic findings with histologic micrographs and gross specimens, in order to better understand their pathologic substrate. Demyelinating diseases of the central nervous system will be classified into four major categories:

I. Primary demyelinating
   1. Autoimmune category-Multiple Sclerosis (MS) and variants
   2. Acute Disseminated Encephalomyelitis (ADEM)
   3. Acute Hemorrhagic Leukoencephalopathy (AHL)

II. Secondary demyelinating
   1. Infectious category-Lyme disease-HIV Encephalitis (HIVE)
   2. Progressive Multifocal Leukoencephalopathy (PML)
   3. Vascular category-Arteriolosclerosis-Cerebral Amyloid Angiopathy (CAA)
   4. Cerebral Autosomal Dominant Arteriopathy with Subcortical Infarcts and Leukoencephalopathy (CADASIL)/Primary Angitis of the CNS (PACNS)
   5. Susac syndrome
   6. Systemic Lupus Erythematosus (SLE)

III. Toxic-metabolic category
   1. Osmotic Myelinolysis
   2. Methotrexate
   3. Heroin
   4. Alcohol
   5. Radiation
Intraoperative Contrast-Enhanced Ultrasound for Brain Tumor Surgery

All Day Location: NR Community, Learning Center

Participants
Francesco Prada, MD, Milan, Italy (Presenter) Nothing to Disclose
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TEACHING POINTS

Intra-operative contrast enhanced ultrasound (iCEUS) during neurosurgical procedures is a safe and fast technique that completes and integrates the information obtained with standard B-mode and color Doppler imaging, providing a better dynamic and continuous real-time visualization and characterization of different brain lesions. iCEUS adds valuable anatomic and biological information such as vascularization, microcirculation, and tissue perfusion dynamic, which will possibly provide further insights into the pathology of brain tumours. Performing iCEUS before tumor removal might help the surgeon to tailor the approach to the lesion, highlighting the lesion, clarifying between tumor and edematous brain tissue, and showing afferent and efferent vessels and hyperperfused areas, thus possibly modifying the intraoperative surgical strategy.

TABLE OF CONTENTS/OUTLINE

How to perform iCEUS in neurosurgery
How to evaluate contrast enhance pattern of different brain lesion
Description of contrast enhancement pattern for the most common brain lesions
A Comprehensive Imaging Solution for Horner Syndrome: Screening CT Protocol and Symptom-based Atlas Minimizes Need for Clinical Input

All Day Location: NR Community, Learning Center

Participants
Bing Wang, MD, Houston, TX (Presenter) Nothing to Disclose
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L. Anne Hayman, MD, Houston, TX (Abstract Co-Author) Founder, Anatom-e XRT Information Systems, Ltd

TEACHING POINTS

1. Review the detailed anatomy related to Horner syndrome
2. Propose a comprehensive CT imaging protocol which reduces the need for the clinical detail. MR protocol is provided for the minority of cases which requires additional imaging of the brain and spinal cord is needed.

TABLE OF CONTENTS/OUTLINE

A. Anatomy: The anatomic structures in and around the 1st, 2nd and 3rd order neurons of the sympathetic pathway which supply the pupil, lid and sweat glands were identified (fig 1-2).
B: Protocol: A CT protocol was developed which would detect the pathologies encountered in each area (fig 3). In negative CT evaluation cases, MR can be performed.
C: Method: Each area of relevant anatomy was highlighted on the deformable anatomic templates of the Anatom-e software (fig 4). Each area was provided text suitable for importing directly into the dictation.
D: Discussion: Adoption of a standardized screening protocol for Horner syndrome workup had two advantages. First it requires no clinical cooperation and second every patient has a systematic imaging evaluation of the entire sympathetic pathway.
E: Summary: The complicated anatomy of the sympathetic pathway can be reduced to a standardized atlas-guided check list and applied to CT images which span the arch to orbit. MR can be employed when needed and the atlas guided dictations employed.
Infectious Emergencies of the Head and Neck: What Every Radiologist Needs to Know to Save Your Life

All Day Location: NR Community, Learning Center

Participants
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TEACHING POINTS
To provide an overview of the epidemiology and pathophysiology of head-and-neck infections, including a systematic description of the cervical and extracervical spaces that can be involved. To describe the role of the various imaging modalities (with a special focus on CT and MRI) in the diagnosis of head-and-neck infections. To illustrate the main imaging findings in head-and-neck infectious emergencies classified on the basis of the cervical spaces involved, as well as their cervical and extracervical complications.

TABLE OF CONTENTS/OUTLINE
Part 1. Introduction and overview of basic anatomy
Head and neck infections: epidemiology and pathophysiology essentials. Cervical spaces, their interconnections and the continuity of vertical spaces outside the head-and-neck region. Part 2. Imaging techniques
CT: when and how to use it, what we can expect from it. MRI: when and how to use it, what we can expect from it. Other imaging modalities (X-ray, ultrasound, digital subtraction angiography). Part 3. Imaging findings of several infectious emergencies classified by anatomic region and their extracervical complications Ear Paranasal sinuses and orbit Parotid glands Pharynx and parapharyngeal spaces Oral cavity, sublingual and submandibular spaces Larynx Extracervical spread and other complications
Imaging Features of Deep Neck Infections

All Day Location: NR Community, Learning Center

Participants
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Lina M. Cruz Hernandez, ARRT, Toledo, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: - To review the deep neck anatomy and its cervical spaces - To describe principal deep neck infections and its distribution by cervical spaces- To explain the main complications of infections in the deep cervical spaces

TABLE OF CONTENTS/OUTLINE
Deep neck infections present significant morbidity and mortality. Familiarity with deep neck spaces and fascial planes is critical, because the development of the diseases depends of the anatomical distribution of the structures in the neck. This paper pictorially illustrates infections of important deep neck spaces, the relevant anatomy, the possible sources of infection of each deep neck space and its complications.

TABLE OF CONTENTS
Our aim is to review the diversity of MRI presentations of primary central nervous system lymphoma (PCNSL), secondary CNS lymphoma and Waldenstrom Macroglobulinemia, from the most classical to the rarest, in immunocompetent patients. All the cases were collected from our neuroimaging centre. We will reason in a topography-based analysis. For each topography, we will focus on the most challenging case(s) to stress the crucial points of MRI analysis. Classical MRI findings are frequently absent, but polymorphic lesions in the same patient with various locations and different patterns of enhancement, should suggest the diagnosis. However in some cases, MR findings really lack specificity even when associated with spectroscopy and MR perfusion.

TABLE OF CONTENTS/OUTLINE

1) Typical findings 2) Subdural presentation* Subdural Primary CNS lymphoma 3) Leptomeningeal presentation* Primary leptomeningeal lymphoma 4) Vascular presentations* Intravascular lymphoma* Cerebral vasculitis5) Parenchymal presentation5.1) Findings on T2-GRE 5.2) Findings on DWI* B-type Bing neel syndrome / pseudo-progressive multifocal leukoencephalopathy5.3) Findings after gadolinium injection * Pseudo-multiple sclerosis* Pseudo-metastasis* Pseudo-abscess * Pseudo-glioblastoma 5.4) Pseudo-CLIPPERS 5.5) Paraneoplastic syndrome
Hemodynamic Analysis for Risk Assessment and Stratification of Intracranial Pathology

All Day Location: NR Community, Learning Center

Participants
Warren Chang, MD, MBA, Madison, WI (Presenter) Nothing to Disclose
Juan P. Villablanca, MD, Los Angeles, CA (Abstract Co-Author) Research collaboration, VasSol, Inc Research collaboration, Toshiba Corporation Research collaboration, Olea Medical
Aichi Chien, PhD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Hemodynamics can be used to assess flow physiology of intracranial stenoses, aneurysms, and arteriovenous malformations and identify hemodynamic patterns associated with increased risk of hemorrhage/rupture.
2. Brief review of the current literature regarding hemodynamics in intracranial pathology and its role in risk stratification.
3. New techniques such as 4D-DSA, 4D-MRA, and PCASL can be used for hemodynamic assessment of intracranial abnormalities.

TABLE OF CONTENTS/OUTLINE
1. Discussion of the different modalities used to obtain intracranial hemodynamic data
   a) Doppler ultrasound
   b) MR angiography
   c) Computational Fluid Dynamics
   d) Digital Subtraction Angiography
2. Discussion of the different intracranial abnormalities and the role of hemodynamics in analysis
   a) Intracranial Stenosis: Wall shear stress (WSS) and pressure gradients associated with degree of stenosis.
   b) Aneurysms: Inflow-jet morphology with high WSS associated with growth/rupture; Low WSS in body can promote growth; role of endothelium.
   c) Arteriovenous malformations: Role of WSS in vessel dilatation/compensation and risk of hemorrhage.
3. New techniques for the assessment of intracranial hemodynamics
   a) PC-ASL: non-contrast
   b) 4D-DSA: can be used via peripheral IV
   c) Accelerated MRA techniques: high spatial resolution and lower scan time.
Skin in the Wrong Place! An Imaging Review of Epidermoid Lesions

All Day Location: NR Community, Learning Center

Participants
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Ata Siddiqui, London, United Kingdom (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Review of the classical appearances of an intracranial epidermoid in expected locations
2. Appreciation of some unusual locations for the tumour, and lesions it can mimic

TABLE OF CONTENTS/OUTLINE
1. Clinical presentation and pathophysiology
2. Common locations and images
   a. Posterior fossa/Cerebellopontine angle
   b. Petrous apex
   c. Middle ear (cholesteatoma)
3. Unusual appearances and locations
   a. Intraventricular
   b. Intradiploic
   c. Intraspinal
4. Summary
Manifestations of Sickle Cell Disease on Neuroimaging

All Day Location: NR Community, Learning Center

Participants
Neha Gowali, MD, Morristown, NJ (Presenter) Nothing to Disclose
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TEACHING POINTS
1. Learn the various ways in which Sickle Cell Disease can manifest in the brain, head/neck, and spine.
2. Review the pathophysiology of Sickle Cell Disease and how this affects imaging appearance.
3. Demonstrate key associated findings to search for when provided with a history of Sickle Cell Disease.

TABLE OF CONTENTS/OUTLINE
The pathophysiology of Sickle Cell Disease will be reviewed. Clinical features and their imaging manifestations will be illustrated and will include the following:
Vascular: Infarct Moyamoya syndrome Hemorrhage Aneurysm Stenosis/Dissection
Osseous: Infarct/Osteonecrosis Osteomyelitis Extramedullary hematopoiesis Marrow expansion
NR248-ED-X

Middle Ear Prostheses and Implants: What the Surgeon Wants to Know from Pre and Post Operative Imaging

All Day Location: NR Community, Learning Center

Participants
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Ian A. Zealley, MD, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Review normal and variant anatomy of middle ear
2. Illustrate common middle ear prosthetic implants correlating with CT appearances with indications for each
3. Present a pre-operative radiology checklist including important anatomical variants and patterns of disease that influence prosthesis selection, surgical planning and risk factors for post-operative complications
4. Demonstrate correct placement of prostheses and illustrate post-operative complications

TABLE OF CONTENTS/OUTLINE
Normal and variant anatomy of the middle ear
Indications and suitability of various middle ear prostheses; prosthetic stapes, incus interposition graft, partial and total ossicular replacement prostheses, Bonebridge, Vibrant Soundbridge and Bone anchored hearing aid
Illustrative cases emphasising the role of radiologist highlighting key anatomical variants and pathological findings. Cases include assessment of facial recess depth and epitympanic space, facial nerve dehiscence, semicircular canal fistula, otosclerosis, persistent stapedial artery, high riding jugular bulb and low middle cranial fossa on pre-operative scans. Radiology checklist to guide surgeons for prosthesis selection, plan surgical approach and assess risk of post-operative complications
Illustrative cases of various prostheses highlighting normal and abnormal postoperative findings
Susceptibility Imaging Revisited: Interpretative Approach and Contribution to the Differential Diagnosis

All Day Location: NR Community, Learning Center

Participants
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TEACHING POINTS
1. Gradient recall echo (GRE) imaging and susceptibility weighted (SWI) imaging are well established techniques that take advantage of intrinsic magnetic field inhomogeneities and their resultant dephasing effects. 2. Fundamentally, there are a limited number of paramagnetic entities that produce characteristic signal loss on GRE and SWI (i.e. hemosiderin, deoxyhemoglobin, iron, calcium, other metals, and air) clinically relevant from a neuroimaging standpoint.3. The appearance, location/distribution, and associated findings can often times help to significantly narrow the differential diagnosis if not arrive at a singular specific diagnosis.4. It is not uncommon to interpret MR imaging in the absence of other cross sectional techniques; thus, recognition of the different causes of dephasing effects and imaging features is paramount.

TABLE OF CONTENTS/OUTLINE
This presentation will focus on characteristic imaging features of GRE and SWI with a brief discussion of the physics involved. The presentation will highlight the clinical usefulness of such imaging over a broad spectrum of intracranial pathology including hemorrhage, thrombosis, neoplasm, infection, metabolic disorders, and post treatment changes. The appearance, distribution, and associated MR imaging findings on such sequences can often aid in the diagnosis of common and uncommon entities.
NR250-ED-X

Lobar Atrophy in its Many Forms: Differential Diagnoses of Gray Matter Loss

All Day Location: NR Community, Learning Center

Awards
Certificate of Merit

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TEACHING POINTS

The diagnosis of neurological disorders manifesting as regional cortical lobar atrophy can pose a difficult diagnostic dilemma with profound consequences for prognosis and treatment. The purpose of this exhibit is to illustrate imaging findings and clinical features that help characterize various disorders involving lobar atrophy as a primary component of the disease, in order to improve diagnostic accuracy.

TABLE OF CONTENTS/OUTLINE

Key examples of various neurological disorders presenting with lobar atrophy will be presented in an interactive exhibit. Discussion of typical and less typical diagnostic features will be highlighted along with discussion of their differential diagnoses. The cases discussed will include:
• Inflammatory, including Rasmussen Encephalitis
• Neurodegenerative: Frontotemporal lobar degeneration (FTLD), including its three subtypes of semantic dementia, nonfluent aphasia, and behavior variant FTLD
• Alzheimer's dementia
• Corticobasal degeneration
• Dementia with Lewy Bodies
• Vascular dementia
• Epilepsy-associated: Volume loss associated with long-standing epilepsy
• Volume loss associated with anti-epileptics
• Congenital/Developmental: Sturge-Weber syndrome
• Dyke-Davidoff-Masson
• Cortical dysplasia
A Little Bit of MSK in the Head and Neck
All Day Location: NR Community, Learning Center

Participants
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Osamu Sakai, MD, PhD, Boston, MA (Abstract Co-Author) Speaker, Bracco Group; Speaker, Eisai Co, Ltd; Consultant, Guerbet SA

TEACHING POINTS
The assessment of craniofacial anatomy and pathology is often overlooked on routine imaging modalities. Multiple pathologies including infectious, inflammatory, neoplasm and vascular diseases can affect the craniofacial bones as localized entities or as a systemic process. The focus of this exhibit is to illustrate key imaging features of various pathologies affecting the craniofacial bones on multimodality imaging including both common and uncommon pathologies. Additionally, we will also illustrate common imaging pitfalls of these pathologies to familiarize the reader with these diseases.

TABLE OF CONTENTS/OUTLINE
1. Multimodality imaging for the assessment of craniofacial anatomy
   1a CT: osseous anatomy of craniofacial bones, aberrations in osseous matrix
   1b MRI: age-related bone changes, pathologic bone marrow signal changes
2. Normal anatomic craniofacial anatomy
   2a Anatomic variants, age-related changes in craniofacial anatomy
3. Key imaging features, differential diagnosis, common pitfalls
   3a Benign tumors: Osteoma, hemangiomas, giant cell tumors, myofibromas, odontogenic tumors
   3b Malignant tumors: Lymphoma, myeloma, sarcoma, ameloblastoma
   3c Tumor-like conditions: fibrous dysplasia, ossifying fibroma, LCH, odontogenic lesions, BRONJ
   3d Hematologic disorders: Sickle cell disease, thalassemia
   3e Others: abscess, osteomyelitis, renal osteodystrophy

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Akifumi Fujita, MD - 2015 Honored Educator
Osamu Sakai, MD, PhD - 2013 Honored Educator
Osamu Sakai, MD, PhD - 2014 Honored Educator
Osamu Sakai, MD, PhD - 2015 Honored Educator
**Vogt-Koyanagi-Harada Syndrome: What the Radiologist Should Know**

All Day Location: NR Community, Learning Center

**Participants**
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Joyce H. Yamamoto, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**
- Explain the syndrome features, including epidemiology information and main clinical presentation (affecting eyes, auditory system, meninges, and skin).
- Describe the disease physiopathology, an autoimmune mechanism resulting in unspecific granulomatous panuveitis.
- Present the criteria to diagnosis and classification (complete, incomplete and probable disease).
- Explain how to properly use the different imaging methods to evaluate this rare condition and the importance of early diagnosis for the treatment.
- Review the radiological findings (such as symmetric choroidal thickening with retinal detachment) and illustrate with CT and MR images.

**TABLE OF CONTENTS/OBJECTIVE**
- Introduction.
- Epidemiology, Clinical Presentation and Physiopathology.
- Classification.
- Imaging features (focusing on ocular CT and MR imaging aspects).
- Summary.
TABLE OF CONTENTS/OUTLINE

In 2011, the different societies came up with consensus guidelines regarding management of patients with extracranial carotid and vertebral disease. The guidelines pertaining to CTA and MRA will be discussed. The different criteria for evaluation of carotid stenosis will be discussed including NASCET, ECST, carotid stenosis index, and direct measurement. Role of CTA and MRA in evaluation of carotid stenosis will be reviewed using case review format including the following: severe arterial tortuosity, high carotid bifurcation, extensive calcifications, cardiac arrhythmias, contralateral carotid disease, subtotal versus complete arterial occlusion, tandem lesions, long segment lesions, effect of intrathoracic or intracranial disease, and post carotid endarterectomy changes. Emerging role of CTA/MRA in identifying patients at high risk for future stroke: Plaque morphology using CTA/MRA. Assessment of cerebrovascular reserve.
What Lies Inside: Tumors in the Ventricular System

All Day Location: NR Community, Learning Center

Participants
Sebastiao Araujo, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
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Renato A. Mendonca, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
- To review the most common intraventricular tumors
- To show a general approach to the diagnosis of intraventricular tumors according to its situation
- To demonstrate the imaging clues to correct diagnosis these tumors

TABLE OF CONTENTS/OUTLINE
- Review imaging findings of intraventricular tumors.
- Tumor approach - according to cells lines.
- The advanced techniques may help us to distinguish some intraventricular tumors (perfusion and spectroscopy).
- To identify the association between clinical syndromes and some intraventricular tumors.
- Differential diagnosis including inflammatory as well as congenital lesions

CONCLUSION: 1) To the correct diagnosis of intraventricular tumors we have to remember that location correlates with cell origin of the lesion. 2) Some important imaging features help us to define a specific tumor inside the ventricular system. 3) The clinical background associated with imaging findings in this tumors allows the radiologist to make a more precise diagnosis.
Cervical Cystic Lesions: The Rationale Behind Diagnosis

All Day Location: NR Community, Learning Center

Participants
Raquel A. Moreno, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Osmar C. Saito, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
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Sandra M. Tochetto, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To review the imaging findings (US, CT and MR) of the most common cervical cystic masses. 2. To describe the clinical, anatomical and radiological findings that can be helpful in their diagnosis. 3. To set up a flowchart to help list differential diagnosis of neck cystic masses based on epidemiological, anatomical and imaging features.

TABLE OF CONTENTS/OUTLINE
Neck cystic lesions might come to attention as either a symptomatic abnormality or an incidental radiologic finding. They may represent a diagnostic challenge, since an overlap in the imaging appearance of cystic lesion with different etiologies is frequent. A flowchart-guided approach based on epidemiological and anatomical features along with the knowledge of the radiologic findings can help to achieve an accurate diagnosis. This exhibit will: 1. Review the imaging findings of the most common cervical cystic masses according to an algorithm based on patient age, lesion location and imaging appearance. 2. Show examples of congenital and acquired cystic lesions (see flowchart). 3. The discussion will emphasize the differential diagnosis with anatomopathological correlation.
Quantitative CT and MR Maxillofacial Imaging: More Than Just Eyeballing

All Day Location: NR Community, Learning Center

Participants
Karen Buch, MD, Boston, MA (Presenter) Nothing to Disclose
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TEACHING POINTS
Historically, oral and maxillofacial imaging has relied on qualitative assessment using intraoral and panoramic radiographs of oral and maxillofacial pathology. Recently, advanced quantitative imaging techniques have been increasingly used in clinical practice enabling a more objective assessment and earlier disease detection. This exhibit will discuss new multimodality quantitative imaging tools for the assessment of maxillofacial pathology and will highlight advantages of these techniques.

TABLE OF CONTENTS/OUTLINE
1 Review of imaging modalities for maxillofacial imaging
   1a. Radiographs: intraoral and panoramic; cephalogram; CT: cone-beam CT and dual energy; MRI
   1b. Qualitative vs quantitative analysis
      2 Normal measurements and age-related changes in maxillofacial bones
         2a. Bone growth and marrow changes of maxillofacial bones
         2b. CT-morphological evaluation, density
         2c. MRI-relaxometry, DWI - red versus yellow marrow
   3 Quantitative evaluation of maxillofacial bone pathologies
      3a. Bone dysplasia and metabolic conditions
         3i. CT-density, texture analysis
         3ii. MRI-relaxometry, DWI (ADC, DTI, IVIM), texture analysis
      3b. Bone healing
         3i. CT-Quantitative analysis of fractures/osteotomy healing/mineralization
         3c. Neoplasms-diagnosis and treatment response/outcome evaluation
         3iii. CT-density, texture analysis, perfusion
         3iv. MRI-relaxometry, DWI (ADC, DTI, IVIM, etc), texture analysis, perfusion

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Hernan Jara, PhD - 2014 Honored Educator
Osamu Sakai, MD, PhD - 2013 Honored Educator
Osamu Sakai, MD, PhD - 2014 Honored Educator
Osamu Sakai, MD, PhD - 2015 Honored Educator
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Certificate of Merit

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TEACHING POINTS
This exhibit aims to teach neuroembryology in a simple, visual format with imaging of the most common/important problems that arise when embryology goes wrong. We briefly discuss gene expression/mutations/syndromes along the way.

TABLE OF CONTENTS/OUTLINE
Cases are presented in an unknown format following demonstration of the relevant embryology. Topics include: Early CNS Development Neural Tube and Notochord Sacrococcygeal teratoma Ecchordosis physaliphora and chordomas Intravertebral notochord rest Meroencephaly - acrania Encephalocele/cranium bifida Spina bifida: cord lesions Spina bifida: adipose lesions Dermal sinuses and cysts, neurenteric cysts Cleavage Failure Holoprosencephaly (alobar, semilobar, lobar) Corpus Callosum anomalies Colpocephaly Hypogenesis, Chiari 2 Hypogenesis, holopresencephaly Posterior Fossa anomalies Dandy-walker malformation Joubert syndrome Rhombencephalosynapsis Branchial anomalies Branchial cleft cysts Branchial sinuses and fistulas Thyroglossal duct cysts Eye malformations Coloboma Persistent hyperplastic primary vitreous Ear malformations Hypoplasia of the semicircular canals Incomplete septation TYPE I and II
Questions of Phonation and Respiration: Imaging Correlates of Acute Laryngeal Trauma

All Day Location: NR Community, Learning Center

Awards
Certificate of Merit

Participants
Marin A. McDonald, MD, PhD, San Diego, CA (Presenter) Nothing to Disclose
Julie Bykowski, MD, La Jolla, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

To describe key anatomic structures relevant in laryngeal trauma and discuss the role of CT and MRI in emergent and nonemergent posttraumatic settings. To provide a comprehensive approach to the radiographic evaluation of acute laryngeal trauma and associated posttraumatic complications.

TABLE OF CONTENTS/OUTLINE

Laryngeal trauma represents a relative rare but potentially life-threatening situation in the acutely injured patient with a wide spectrum of injuries based on trauma mechanism and severity. Prompt diagnosis and management are essential to avoid mortality and long term complications related to airway maintenance, swallowing and speech dysfunction. This exhibit will review the normal laryngeal anatomy and indicators for surgical versus conservative management of laryngeal trauma, with key cases including:

Supraglottic: acute and chronic fractures of hyoid and thyroid cartilages with post-surgical fixation
Glottic: vertical thyroid fractures, vocal cord paralysis, arytenoid separation
Subglottic: Acute and chronic cricoid fractures, acute laryngotracheal separation
Extra-laryngeal: Soft tissue trauma, acute ICA dissection, thyroid gland injury, recurrent laryngeal nerve injury.

Finally, a self assessment quiz will be presented to reinforce a systematic approach to the evaluation of laryngeal trauma and associated sequelae.
Percutaneous Vertebroplasty: Past, Present, and Future

All Day Location: NR Community, Learning Center

Participants
Sergiy Kushchayev, MD, Darby, PA (Presenter) Nothing to Disclose
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TEACHING POINTS
To perform a systematic review of current status of percutaneous vertebroplasty (PV): technical aspects, indications, contraindications. To discuss the undesired effects and possible complications. To summarize current modifications of PV and available augmentation techniques. To outline future perspectives, potential developments and applications of the procedure.

TABLE OF CONTENTS/OUTLINE
Two Visions, One Problem: The Strengths and Pitfalls of Laryngoscopy versus Imaging in the Evaluation of Head and Neck Cancer

All Day Location: NR Community, Learning Center

Participants
Marin A. McDonald, MD, PhD, San Diego, CA (Presenter) Nothing to Disclose
Julie Bykowski, MD, La Jolla, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To outline the strengths and weaknesses of CT and MRI relative to direct visualization techniques in the evaluation of head and neck cancer, To reinforce a systematic approach to the radiographic surveillance of complicated posttreatment head and neck cancer patients.

TABLE OF CONTENTS/OUTLINE
The management of head and neck cancer involves a multidisciplinary approach, with the differentiation of post treatment changes from tumor recurrence predicated on an interplay between surveillance by clinical exam and correlative imaging via CT and MRI. Therefore, we propose to illustrate the strengths and pitfalls of radiographic analysis relative to direct visualization in evaluation of head and neck cancers, including: A brief review of NCCN guidelines for staging of head and neck squamous cell carcinoma Illustrative cases including stage 1 oral, oropharyngeal and laryngeal cancers diagnosed on laryngoscopy with no radiographic correlate. Representative cases with deep tumor extension and nodal metastases undetectable on laryngoscopy. Subtle tumor recurrence within the surgical bed, flap margins and nodal chains only appreciated on imaging. Finally, we will present a self assessment quiz to reinforce a systematic approach to the head and neck cancer patient and the strengths and pitfalls of both direct and radiographic imaging.
"The Day after the Thunder": MRI Findings of the Spectrum Reversible Cerebral Vasoconstriction (RCVS) and Posterior Reversible Encephalopathy (PRES) Syndromes

All Day Location: NR Community, Learning Center

Participants
Daniel Sakuno, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
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Leandro T. Lucato, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The purpose of this pictorial essay is: To illustrate the complications of RCVS, including convexal subarachnoid hemorrhage, intraparenchymal hematomas, ischemic infarcts, and PRES. To review the common underlying pathophysiology of RCVS and PRES and discuss the radiological overlap between these two entities.

TABLE OF CONTENTS/OUTLINE

Multimodal imaging of RCVS: Vascular imaging (string-of-beads appearance) Convexal subarachnoid hemorrhage Intraparenchymal hematomas Ischemic infarcts PRES-like imaging features Pathophysiology of the spectrum RCVS-PRES Radiological overlap between RCVS-PRES. Summary and take-home messages In summary, our study aims to illustrate the complications of RCVS, including PRES-like lesions and to discuss the pathophysiological and imaging overlap between these two entities, possibly reflecting syndromes along a spectrum of vascular dysregulation and endothelial dysfunction.
NR264-ED-X

Pediatric Head and Neck Tumors: How the Radiologist Can Help?

All Day Location: NR Community, Learning Center

Participants
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Marcelo B. Funari, MD, Ribeirao Pires, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Childhood cancer is uncommon, but is the second cause of death in this age group. The distinction between benign and malignant tumors is key to a better prognosis.2. Imaging studies play a fundamental role in the characterization of tumors in the head and neck, in the evaluation of their extension, detection of metastases, and response to treatment.3. The radiologist should be able to recognize the most frequent presentations. This review shows typical findings of the most common tumors in pediatric patients, as well as their follow-up, with data collected retrospectively from the database of our service.

TABLE OF CONTENTS/OUTLINE
1. Imaging findings of the most frequent tumors of childhood.2. Findings which may suggest persistence or recurrence of disease.3. Imaging findings related to treatment.
More Than Meets the Eye: An Integrated "Neurodermatoradiology" Approach to Understanding Vascular Cutaneous Anomalies

All Day Location: NR Community, Learning Center

Participants
Stephanie M. McCann, MD, Chicago, IL (Presenter) Nothing to Disclose
Daniel T. Ginat, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Sarah Stein, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Vascular cutaneous anomalies include a vast and varied collection of abnormalities that have been described in the dermatology and neuroradiology literature. This topic includes and extends beyond the often examined vascular malformations. Radiologists are in a unique position to aid the clinician in synthesizing clinical data and guide the appropriateness of imaging. This educational exhibit will take a multidisciplinary approach to a myriad of vascular cutaneous anomalies with a focus on head and neck imaging. After completing this educational exhibit, the participant should: 1. Be able to accurately differentiate subtypes of vascular cutaneous anomalies. 2. Recognize the constellation of findings in cerebrofacial arteriovenous metameric syndromes and vascular phakomatoses. 3. Accurately recommend what, if any, imaging studies are appropriate to further evaluate various cutaneous anomalies.

TABLE OF CONTENTS/OUTLINE
Review of relevant anatomy with high resolution MRI
Hemangiomas
Vascular malformations
Arteriovenous fistulas
Sinus pericranii
Cerebrofacial arteriovenous metameric syndromes
Vascular phakomatoses
Vascular cutaneous lesions associated with cerebral cavernous malformations
PHACES syndrome
Disseminated intravascular coagulation
Review of multidisciplinary problem solving
Stroke Collateral Score: How to Evaluate and What it Means

All Day Location: NR Community, Learning Center

Participants
Asim F. Choudhri, MD, Memphis, TN (Presenter) Nothing to Disclose
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Mahmud Mossa-Basha, MD, Seattle, WA (Abstract Co-Author) Research support, General Electric Company

TEACHING POINTS
Recent literature has determined CT angiographic collateral scores in thromboembolic stroke with proximal occlusion correlates with infarct volume and patient outcomes. This is a paradigm shift from CT perfusion analysis, and has significant implications for triage of patients for intravenous and intraarterial thrombolytic therapy, as well as clot-retrieval. The importance is furthered by results of recent clinical trials such as MR-CLEAN. Little guidance exists on application of the stroke collateral score. We review the theory of stroke collateral score, the current literature, the imaging appearance of different degrees of collateralization, and how to describe and report these findings.

TABLE OF CONTENTS/OUTLINE
Imaging appearance of stroke-collaterals, including cases with different locations of occlusion and varying degrees of collaterals, selected from a database of more than 100 occlusive stroke cases. Followup imaging studies are included to show differences in stroke evolution by degree of collateral formation. Description of different systems of stroke collateral score grading, including pros and cons. Binary assessment (2-point score, good vs bad). Four point score. Six point score. Techniques for analysis: How and when to create MIP reconstructions, with cases showing where MIPs help and where MIPs introduced artifact.
Evidence Based Review of Best Practices for Epidural Steroid Injections

All Day Location: NR Community, Learning Center

Awards
Certificate of Merit

Participants
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TEACHING POINTS
To review the techniques of epidural steroid injection (ESI), from pre-procedure considerations to post-procedure care, with literature review to provide an evidence based guide to safe, proper and effective technique.

TABLE OF CONTENTS/OUTLINE
NR268-ED-X

It's All About the Base (Imaging of the Central Skull Base)

All Day Location: NR Community, Learning Center

Awards
Certificate of Merit

Participants
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TEACHING POINTS

Central skull base anatomy is complex and thorough knowledge of this complex anatomy is crucial for accurate radiology report. Both CT and MRI are complimentary in the evaluation of skull base pathology. Lesion localization to a particular compartment of the CSB, imaging features, behavior and growth pattern are important in narrowing down the differential diagnosis. Important to describe in detail not only the precise location of the tumor, but also the involvement of the surrounding neurovascular structures and extension (cavernous sinus, orbital and intracranial), which can guide clinicians to the most effective treatment plan with the least morbidity, the best functional outcome and increased survival.

TABLE OF CONTENTS/OUTLINE

Review the relevant normal anatomy of the central skull base. Describe the imaging techniques (CT, MR, CTA/MRA, Conventional angiography and FDG-PET). Describe the important radiologic information that the surgeons need to know. "No-touch" lesions of the CSB. Lesions from each compartment of the CSB - congenital, infectious, inflammatory, neoplastic and vascular. Conclusion: Knowledge of the complex anatomy of the central skull base and lesion localization, knowledge of the imaging features, behavior and growth pattern of the lesion, are essential for accurate interpretation of CSB pathology.
Participants
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Renato A. Mendonca, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purposes of this exhibit are: • To review the clivus embryology and anatomy. • To demonstrate the imaging finding with sample cases for each pathology that involve the clivus. • To describe some particular imaging findings of a lesion involving or arising from the clivus.

TABLE OF CONTENTS/OUTLINE
• To make the pathologic-radiologic correlation of clivus lesions. • To explain the benefits of CT and/or MRI in the diagnosis based on imaging features. • The differential diagnosis of a lesion involving or arising from the clivus may be a big challenge and we have to think in divide lesions according to their origin: • Lesions that arise from the skull base itself (metastasis, plasmacytoma, chordoma, chondrosarcoma, giant cell tumor). • Lesions from the intracranial compartment (invasive macroadenoma, craniopharyngioma). • Lesions from below the base of skull (nasopharyngeal carcinoma, nasopharyngeal rhabdomyosarcoma, mucocele of the sphenoid sinus). 

CONCLUSION: The clivus lesions can be classified based on their histological characteristics, anatomical locations and radiographic appearances. Combination of CT and MRI findings allow the correct diagnostic approach to the clivus lesions.
**Paragangliomas of the Head and Neck: What the Radiologist Needs to Know, A Comprehensive Review**

All Day Location: NR Community, Learning Center

**Participants**
Karuna M. Raj, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Sean D. Raj, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Kim Learned, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Laurie A. Loevner, MD, Gladwyne, PA (*Abstract Co-Author*) Stockholder, General Electric Company; Stockholder, Pfizer Inc; Stockholder, Merck & Co, Inc; Stockholder, Johnson & Johnson; Stockholder, Amgen Inc; Stockholder, GlaxoSmithKline plc

**TEACHING POINTS**
1) To review the imaging features of head and neck paragangliomas with subtype specific discussion on CT, MRI, angiographic, and nuclear medicine studies. 2) To review the treatment modalities and clinical management, including the role of preoperative embolization. 3) To review the clinical implications of the SDH mutation in patients with multiple head and neck paragangliomas.

**TABLE OF CONTENTS/OPTLINE**
We will present a pictorial essay of the imaging features of head and neck paragangliomas, using a location-specific approach. 1) Patient demographics and clinical presentation of paragangliomas. 2) CT, MRI, angiographic, and nuclear medicine appearance of paragangliomas. 3) Paraganglioma mimics and application of imaging modality and location specific strategies for more accurate lesion characterization. 4) Key imaging features that must be reported to aid the clinicians in deciding the optimal treatment strategy. 5) Clinical management of patients with paragangliomas of the head and neck. 6) Implications of the SDH mutation on patient management and outcomes.
Perineural Spread in Primary Head and Neck Squamous Cell Cancers - Highway to Hell and Beyond. What the Radiologist Needs to Know

All Day Location: NR Community, Learning Center

Awards
Certificate of Merit

Participants
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Prema Bhargava, Mumbai, India (Abstract Co-Author) Nothing to Disclose
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Vijay Haribhakti, MBBS, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Karthik Ganesan, MBBS, MD, Mumbai, India (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Understand pathogenesis of perineural spread of head and neck tumors Identify the anatomical landmarks in detecting perineural spread of head and neck tumors Discuss multimodality hybrid approach to imaging of head and neck tumors to look for perineural spread Know key imaging features of perineural spread Discuss differential diagnosis and imaging pitfalls

TABLE OF CONTENTS/OUTLINE
Introduction Concept of Perineural Spread and Pathogenesis What is the difference between perineural invasion and perineural spread Discuss key anatomical landmarks and main neural connections Discuss hybrid imaging protocol Discuss key imaging features of perineural spread Differential Diagnosis Imaging Pitfalls
Percutaneous Rupture of Lumbar Synovial Cysts for Treatment of Back Pain: How We Do It

All Day Location: NR Community, Learning Center

Participants
Yogesh Kumar, MD, Bridgeport, CT (Presenter) Nothing to Disclose
Kusum Hooda, MBBS, Stratford, CT (Abstract Co-Author) Nothing to Disclose
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Nisarg A. Parikh, MD, MBBS, Bridgeport, CT (Abstract Co-Author) Nothing to Disclose
Mark A. Rosovsky, MD, Stamford, CT (Abstract Co-Author) Nothing to Disclose
Michael D. Meszaros, MD, Trumbull, CT (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To review the indications of percutaneous rupture of lumbar synovial cysts.
2. To discuss the various treatment options for lumbar synovial cysts.
3. To describe the techniques and limitations of percutaneous rupture of lumbar synovial cysts.

TABLE OF CONTENTS/OUTLINE
Papillary Glioneuronal Tumors - A Rare Case Series with Advanced Imaging

All Day Location: NR Community, Learning Center

Participants
Bing Wang, MD, Houston, TX (Presenter) Nothing to Disclose
Gregory N. Fuller, MD, PhD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Leena M. Ketonen, MD, PhD, Houston, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To illustrate the imaging findings of papillary glioneuronal tumors (PGNT) with MR spectroscopy (MRS), which to our knowledge has not been systematically evaluated in the literature.
2. Raise awareness of radiologists concerning this rare brain tumor.

TABLE OF CONTENTS/OUTLINE
A. Purpose:
B. Methods:
C. Discussion:
D. Summary:

Methods:
We report here a series of at least 8 tissue-confirmed cases of PGNT, which is a rare low grade brain tumor of mixed neuronal and glial phenotype, originally reported in 1998. We present here the MRS features of these tumors, together with CT and conventional MRI and diffusion imaging (DWI), with selected perfusion and PET imaging. MRS were obtained with echo time of about 144 msec.

Discussion:
7 of our 8 cases arose from the frontal lobe. All of our cases are in children or young adults (ages 11 - 35 years old). On MRI, contrast enhancement is variable and often has no significant surrounding T2 FLAIR hyperintensity to suggest edema. DWI demonstrates no restricted diffusion within the tumor. On MRS, the choline/creatine ratio is greater 2 with low NAA, or NAA/Cho ratio, which is an MRS pattern that is typically seen in high grade tumors.

Summary:
We presented a case series of PGNT, a rare brain tumor with MRS pattern typically seen in high grade tumors even though it is a low grade tumor.
Look Outside the Brain: Extraparenchymal Manifestations of Systemic Disease on Routine Head CT

All Day Location: NR Community, Learning Center

Participants
Amanda L. Steinberger, DO, Darby, PA (Presenter) Nothing to Disclose
Fraser H. Brown, MD, Haverford, PA (Abstract Co-Author) Nothing to Disclose
John J. Manning, MD, Haddonfield, NJ (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. Any extraparenchymal structure can be affected by systemic disease.  
2. Neoplastic and non-neoplastic etiologies cover a wide range of potential pathology that can be incidentally seen on routine head CT which is often performed for a different reason.  
3. Familiarity with the varied appearances of extraparenchymal manifestations of common systemic diseases can help the interpreting radiologist propose or favor a single final diagnosis, when confronted with potentially confusing soft tissue or bony findings.

TABLE OF CONTENTS/OUTLINE

Typical and atypical manifestations of systemic disease will be reviewed, as encountered on routine head CT. Pictorial based illustration of neoplastic and non-neoplastic etiologies which can be seen affecting the orbits, facial musculature, salivary glands, scalp, meninges, and calvarium. In addition to displaying the pertinent neuroradiology finding, additional body imaging related to the primary diagnosis will be shown across multiple modalities to demonstrate the systemic nature of the diagnosis. There will be emphasis on using all available imaging to achieve a unifying diagnosis on routine head CT, with discussion of the differential diagnosis based on the head CT alone. Finally, recommendations will be made for interpreting potentially confusing findings on routine head CT in daily practice.
Sinonasal Tumours - What Do They Look Like? A Closer View at the Radiological Appearance of Tumours of the Sinonasal Tract

All Day Location: NR Community, Learning Center

Participants
Nathania Bonanno, MD, Msida, Malta (Abstract Co-Author) Nothing to Disclose
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Reuben Grech, MD, FRCR, Msida, Malta (Presenter) Nothing to Disclose
Charlene Plumpton, MD, Msida, Malta (Abstract Co-Author) Nothing to Disclose
Adrian Mizzi, MD, Glasgow, United Kingdom (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To showcase the spectrum of sinonasal tumours, both benign and malignant, and their distinguishing radiographic appearance. To delineate the salient imaging features that help the radiologist distinguish between sinonasal inflammatory disease and neoplasm. To define the roles of CT and MRI in the setting of sinonasal tumours; when to use which.

TABLE OF CONTENTS/OUTLINE
- An overview of the pathophysiology, epidemiology and clinical presentation of sinonasal tumours.
- A classification of sinonasal tumours into benign and malignant, with focus on The typical imaging characteristics and behaviour of the more common malignant tumours of the sinonasal tract, Histologically benign but clinically relevant locally aggressive benign tumours (inverted papilloma, angiofibroma, etc), Benign inflammatory and infective disease of the sinonasal cavity that may mimic the appearance of malignant disease on imaging (mucocoele, fungal sinusitis, etc).
- The radiological findings and their clinical implication are discussed; such as, bone changes, masses, mucosal thickening. The imaging features that help distinguish between benign and malignant sinonasal disease are closely examined in our study.
- The roles and limitations of CT and MRI in the investigation and management of sinonasal tumours.
Endophthalmitis is a virulent ocular inflammatory process that develops within the aqueous and/or vitreous humor of the eye. Endophthalmitis can be broadly divided into non-infectious (sterile endophthalmitis) or infectious etiologies, which commonly present with a subchorionicabcess. Approximately 60% of cases of Exogenousendophthalmitis are post surgical. Endogeneousendophthalmitis is usually seen in patients with underlying medical conditions such as: diabetes, intravenous drug abuse and renal failure. Both Exogenous and Endogenous Endophthalmitisare clinical and radiologic emergencies; a delay in diagnosis can result in enucleation or permanent visual loss. Early detection and treatment can preserve vision. In this educational exhibit, we will review the subtypes and clinical features of endophthalmitis. We will present a review of the pertinent imaging findings on both CT and MRI that enable early diagnosis. This is a joint project with the department of Ophthalmology and clinical pictures will be included with this educational exhibit.

TABLE OF CONTENTS/OUTLINE
Endophthalmitis, an introduction 
Classification of endophthalmitis with clinical features 
Important CT findings of acute endophthalmitis with images 
Important MRI findings with recommended pulse sequences and images 
Summary checklists of radiographic findings 
Conclusions
Participants
Keiichi Kikuchi, MD, Toon, Japan (Presenter) Nothing to Disclose
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Shiro Ohue, MD, Onsen, Japan (Abstract Co-Author) Nothing to Disclose
Hitoshi Miki, MD, PhD, Matsuyama, Japan (Abstract Co-Author) Nothing to Disclose
Teruhito Mochizuki, MD, Toon, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Skull base has a complicated anatomy and various pathologies arise from this area. Radiological imaging can provide the surgeon with detailed information about tumor involvement. Although these lesions are not common in clinical radiological practice, the radiologist must be prepared to offer a reasonable differential diagnosis. In this presentation, we exhibit the radiological imaging findings of skull base tumors from common diseases to rare pathologies including CT, MRI and DSA.

TABLE OF CONTENTS/OUTLINE
Chondrosarcoma Chordoma Endolymphatic sac tumor Esthesioneuroblastoma Ewing's sarcoma Fibrous dysplasia Giant cell tumor Invasive pituitary adenoma Langerhans cell histiocytosis Meningioma Neurenteric cyst Osteoblastoma Retrocical ecchordosis physaliphora
Clinical Utility of High-b-value Diffusion-weighted Imaging (DWI) at 3 T

All Day Location: NR Community, Learning Center

Participants
Keiji Kitatani, MD, Miyazaki, Japan (Presenter) Nothing to Disclose
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Hiroshi Nakada, PhD, MD, Miyazaki-City, Japan (Abstract Co-Author) Nothing to Disclose
Yasuyuki Yamashita, MD, Kumamoto, Japan (Abstract Co-Author) Consultant, DAIICHI SANKYO Group

TEACHING POINTS

The purpose of this exhibit is: 1. To explain how the gray-to-white matter contrast in healthy subjects changes on conventional and high-b-value DWI at 3 T. To review the usefulness of high-b-value DWI at 3 T for various brain diseases

TABLE OF CONTENTS/OUTLINE

Understanding the gray-to-white matter contrast in healthy subjects on conventional and high-b-value DWI at 3 T
Review of diagnostic usefulness of various brain diseases on this technique- Acute brain infarction- Acute encephalitis- Creutzfeldt-Jakob disease (CJD)- Dissemination of brain tumors
Clinical role of this technique
TEACHING POINTS

Subtle findings in emergency computed tomography (CT) scans of the brain Review areas for radiology trainees in the interpretation of CT scans of brain in an emergency scenario

TABLE OF CONTENTS/OUTLINE

The emergency presentation of neurological disease is common, often complex and may carry significant morbidity and mortality, particularly when delays in diagnosis occur. Computed tomography (CT) scanning of the brain has become an invaluable tool in the work-up of traumatic and atraumatic neurological emergencies. A diagnostic chain, however, is only as strong as its weakest link. Studies have shown that significant differences exist in the diagnostic accuracy of emergency CT brains between specialist radiologists and trainee radiologists - crucially, it is the latter group who often provides the decisive preliminary report to emergency physicians. This pictorial review aims to illustrate key review areas for resident radiologists in the reporting of emergency CT brains. It also outlines subtle yet important imaging findings that can aid in the timely and accurate diagnosis of certain neurological emergencies including cerebral venous thrombosis, ischaemic stroke, trauma, encephalitis and subarachnoid haemorrhage as well as describing certain important false positive signs.
The Forgotten Lacrimal Gland and Lacrimal Drinage Apparatus: Spectrum of Imaging Findings and Differential Diagnosis

Awards
Certificate of Merit

Participants
Natalia Gorelik, MD, Montreal, QC (Presenter) Nothing to Disclose
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Raquel Del Carpio-O’Donovan, MD, Montreal, QC (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) Lacrimal gland and lacrimal drainage apparatus can be involved by a wide range of pathologies.
2) Careful examination and systematic imaging approach with knowledge of the pathologies is the key to successful patient management.

TABLE OF CONTENTS/OUTLINE
1) To revisit detailed anatomy of the lacrimal gland and apparatus
2) To list the common and uncommon pathologies.
3) Describe the CT and MRI findings of each of these pathologies.
4) To discuss the relevance of imaging as regards patient management.
Pathologies discussed would include but not limited to
A) Lacrimal gland: 1) Inflammatory: a) Dacryoadenitis, b) Sarcoidosis, c) Orbital inflammatory pseudo tumor
2) Neoplastic: a) Pleomorphic adenoma, b) benign reactive lymphoid hyperplasia, c) oncocytoma, d) adenocystic carcinoma, e) adenocarcinoma, f) malignant lymphoma
B) Lacrimal apparatus: 1) Inflammatory: a) Dacryocystitis, b) Dacryocystocele
2) Neoplastic: a) Lacrimal sac and duct invasive squamous cell carcinoma, b) mucoepidermoid carcinoma, c) lymphoma, d) melanoma and e) granulomatous pseudo tumors
The imaging appearances of hematologic disorders (HD) have been well characterized; however, head and neck involvement often is underappreciated, although it is not uncommon, especially in lymphoproliferative disease. Various imaging modalities, including radiography, computed tomography (CT), and magnetic resonance (MR) imaging, are used to evaluate lesions in patients with HD. CT provides rapid image acquisition and is helpful in the acute setting. High-resolution temporal bone imaging is essential for accurate diagnosis of lesions in patients with symptoms of inner ear involvement. However, MR imaging is superior to CT and radiography. In this article, the radiologic manifestations of hematological disorders of the head and neck are discussed. They are categorized according to the following areas of involvement: inner ear, orbit, paranasal sinuses, bone (skull base and maxillofacial bone), lymph nodes, and muscles.

TABLE OF CONTENTS/OUTLINE

Perineural Spread in Head and Neck Lesions: What You Should Know

All Day Location: NR Community, Learning Center

Participants
Fabio A. Dalpra, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
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Bruno C. Olivetti, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Perineural spread (PNS) is the term used when a lesion spreads along the tissues of the neural sheath. This dissemination can be seen on malignant tumors and other pathologic conditions like some infectious diseases. The most commonly involved nerves in PNS of the head and neck are the facial nerve and the maxillary (V2) and mandibular (V3) divisions of the trigeminal nerve (CNV). There are connections between the facial and trigeminal nerves that help tumors travel between these nerves. This kind of spread may change the course of the disease and require a more aggressive approach. Because PNS may be asymptomatic up to radiologist to detect it, knowledge of PNS is essential for radiologists due to its implication in treatment and prognosis. It is considered a pitfall in head and neck imaging. On this exhibit the anatomy of the facial and trigeminal nerves and their connections will be reviewed through color schemes, high resolution MR and CT imaging and illustrated with different clinical cases of PNS in head and neck lesions.

TABLE OF CONTENTS/OUTLINE

Anatomy of common pathways of perineural tumor spread. Imaging findings of PNS from head and neck tumors on computed tomography (CT) and magnetic resonance (MR). Clinical case of PNS along the V1, V2 and V3, facial nerve, great petrosal superficial, chorda tympani and auriculotemporal nerve
Rare But Not Forgotten: Intracranial Findings of Non-Langerhans-Cell Histiocytosis

All Day Location: NR Community, Learning Center

Participants
Renata Bertinha, MD, Cerquilho, Brazil (Abstract Co-Author) Nothing to Disclose
Livia T. Morais, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
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Leandro T. Lucato, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To discuss the pathophysiology of the main non-Langerhans-cell histiocytosis (NLCH): a group of rare benign idiopathic proliferative diseases of phagocytic histiocytes that is immunohistochemically distinct from the more common Langerhans type of histiocytosis.

To review the intracranial involvement on conventional imaging in patients with NLCH who presented to our institution.

TABLE OF CONTENTS/OUTLINE
- Pathophysiology of NLCH
- Review of imaging findings
  - Rosai-Dorfman disease
  - Dural-based extra-axial masses
  - Erdheim-Chester disease
  - Dural-based extra-axial masses
  - Hypothalamic-pituitary axis involvement
  - Brain parenchymal lesions
  - Juvenile Xantogranuloma
  - Dural-based and choroid plexus lesions
  - Brain parenchymal lesions
  - Hemophagocytic lymphohistiocytosis
  - Cerebellar lesions
  - Uncommon subcortical cerebral white matter lesions
- Summary and take-home messages

In summary, the NLCH are a rare group of diseases with a variety of imaging appearances in the CNS. Radiologists should be aware and warn the clinicians when these findings are encountered to avoid delay in diagnosis and inappropriate treatment.
A Tour of Demented Brain: A Visual Guidance

All Day Location: NR Community, Learning Center

Participants
Seunghee Han, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
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Jinhee Jang, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
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Kookjin Ahn, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Bum-Soo Kim, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To review the currently used and widely accepted visual grading and scoring systems for MR imaging of the brain in dementia work-up.
2. To present the visual atlas of structural changes of brain in variable cause of dementia.

TABLE OF CONTENTS/OUTLINE
- Review of visual score/scale of MR in dementia. GCA-scale for Global Cortical Atrophy MTA-scale for Medial Temporal lobe Atrophy
- Fazekas scale for WM lesions Normal ageing Strategic infarctions Koedam score for Parietal Atrophy
- Review of image of structural change of brain in the patients with various causes of dementia. Alzheimer's disease (AD) Vascular disease (in several forms) Dementia with Lewy bodies (DLB) Frontotemporal lobar degeneration (FTLD), Normal pressure hydrocephalus

Summary
## Participants
Rie Masuda, Miyazaki, Japan (Presenter) Nothing to Disclose  
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Minako Azuma, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose  
Yasuyuki Yamashita, MD, Kumamoto, Japan (Abstract Co-Author) Consultant, DAIICHI SANKYO Group

## TEACHING POINTS
The purpose of this exhibit is: 1. To review the diagnosis of intracranial dural arteriovenous fistulas (DAVF) on 3D/4D MRA techniques. 2. To explain the advantage and disadvantage of 3D MRA, 4D MRA with contrast agent and 4D MRA with arterial spin labeling in the diagnosis. 3. To explain clinical role of these techniques

## TABLE OF CONTENTS/OUTLINE
Technical bases of 3D/4D MRA techniques  
Understanding the angioarchitecture of intracranial DAVF  
Review of diagnostic points of intracranial DAVF on these techniques - Feeders - Drainers - Fistula site  
Advantage and disadvantage of these techniques  
Clinical role of these techniques  
Summary
Dysphagia is the most common indication for a barium swallow. Evaluation of the pharynx is including in every barium swallow. Careful examination of the pharynx at barium pharyngography is important for detecting structural and functional abnormalities. Teaching points: 1. Review normal structures seen at barium pharyngography. 2. Exemplify causes of pharyngeal dysphagia. 3. Illustrate normal postoperative appearances and complications following laryngectomy and cricopharyngeal myotomy.

TABLE OF CONTENTS/OUTLINE

Quiz format: Each case will be presented as an unknown at barium pharyngography and CT correlates will be shown as needed. Each case will be followed by pertinent findings and a brief description of the entity. Cases will include normal pharyngeal anatomy, Zenker's diverticulum, cricopharyngeal bar, Killian-Jamieson diverticulum, DISHphagia, squamous cell carcinoma, benign entities such as lymphoid hyperplasia and retention cyst, retropharyngeal abscess, retropharyngeal carotids, postoperative appearance following Zenker's diverticulotomy and diverticulectomy as well as complications, and postoperative appearance following laryngectomy with primary closure and free flap reconstruction as well as complications.
**Imaging Findings after Head and Neck Radiotherapy**

All Day Location: NR Community, Learning Center

**Awards**
Identified for RadioGraphics

**Participants**
Diego J. Oliveira, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
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Maira Sarpi, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is: 1. To review the early and late imaging findings associated with head and neck radiotherapy 2. To review the imaging findings of the most common complications of head and neck radiotherapy 3. To discuss the differential diagnosis between what is expected after radiotherapy and the findings associated with tumor recurrence

**TABLE OF CONTENTS/OUTLINE**

- Explain the technique variations of radiotherapy
- Review of the imaging findings of the changes expected to occur after radiotherapy in skin and subcutaneous tissue, salivary glands, thyroid, larynx and pharynx
- Discuss the finding of osteoradionecrosis and chondronecrosis
- Review the imaging findings of complications of radiotherapy such as enlargement of thyroglossal duct cyst, abscess, orocutaneous fistulas
- Sample cases and differential diagnosis
- Summary
Spinal Epidural Abscess: An Emerging Medicolegal Issue

All Day Location: NR Community, Learning Center

Participants
Amanda L. Steinberger, DO, Darby, PA (Presenter) Nothing to Disclose
Aparna Srinivasa Babu, MD, Darby, PA (Abstract Co-Author) Nothing to Disclose
Michael L. Brooks, MD, JD, Lansdowne, PA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. There has been an increase in litigation involving spinal epidural abscess (SEA). 2. The findings of SEA may be subtle on imaging and without appropriate suspicion, may lead to delayed or missed diagnosis from a clinical or radiologic standpoint. 3. Radiologists can reduce legal risk in practice by being aware of the imaging findings of spinal epidural collections, providing appropriate documentation, and knowing which tests to recommend for additional imaging.

TABLE OF CONTENTS/OUTLINE
1. Brief review of the general principles of medical malpractice. 2. Pictorial demonstration of spinal epidural collections. a. Multiple modalities, with emphasis on subtle findings that if missed could lead to litigation. b. Key points for optimal imaging techniques. 3. Literature detailing appropriate clinical management, documentation, and potential pitfalls resulting in delayed or missed diagnoses. a. Review ACR appropriateness criteria for back pain. Review of ACR-ASNR-SCBT-MR practice parameter for the performance of MRI of the adult spine. Discuss pertinent components of ACR practice parameter for communication of diagnostic imaging findings. b. Present review of legal literature including statistics of cases involving SEA. 4. Strategies for minimizing risk in daily practice for radiologists interpreting SEA will be summarized.
And It’s the History that Made the Difference: Importance of Retrospective Clinical 'History Taking' in Neuroradiology

All Day Location: NR Community, Learning Center

Participants

Umamaheswara Reddy Venati, MD, MBBS, Nellore, India (Presenter) Nothing to Disclose
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TEACHING POINTS

Understand importance of retrospective clinical history in neuroradiology Obtain relevant, brief retrospective clinical history based on imaging findings

TABLE OF CONTENTS/OUTLINE

Introduction Clinical history algorithms based on areas of brain involvement Interesting cases where retrospective history made the difference in arriving to specific diagnosis “Listen to your patients, they are telling you the diagnosis” is an age-old maxim. Not all cases in neuroradiology are Aunt Minnie’s, in such cases history helps us to narrow the differentials and also at times when radiologist is in dilemma with many differentials, retrospective history helps in arriving at a definitive diagnosis. Quite often certain facts are intentionally or unintentionally not communicated to radiologists, underestimating the vital importance of it in arriving at final diagnosis. In modern days even with hospital information systems and advanced neuroimaging techniques, it is the 5 minute talk with patients and their attendees before and after seeing the images which often solves the mystery. Most of the radiologists are practicing this principle on a routine basis; however it is important to reemphasize this principle to the budding radiologists. Herein, we discuss few cases where retrospective history made a difference in clinching the diagnosis or in adding to the diagnosis.
Thyroid Nodule: To Biopsy or Not Biopsy

Participants
Sergiy Kushchayev, MD, Darby, PA (Presenter) Nothing to Disclose
Yevgeniya Kushchayeva, Washington, DC (Abstract Co-Author) Nothing to Disclose
Oleg Teytelboym, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To review current guidelines on thyroid nodule management released by the American Thyroid Association (ATA), the Society of Radiologists in Ultrasound (SRU), and recommendations by newly introduced TI-RADS (Thyroid Imaging Reporting and Data System) by Russ (2011), TI-RADS by Kwak (2013) as well as the Image Reporting and Characterization System (IRCS) by Kwak et al (2013).
2. To learn how to apply the current thyroid nodule guidelines and systems in specific clinical scenarios.
3. To learn suspicious imaging features of thyroid nodules and their influence on risk stratification for malignancy.

TABLE OF CONTENTS/OUTLINE
Perfusion CT or MR in Head and Neck: How, When and Why?

All Day Location: NR Community, Learning Center

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Marcio Ricardo T. Garcia, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
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TEACHING POINTS
1. To understand the relationship between angiogenesis and perfusion functional imaging.
2. To show the different perfusion techniques in computed tomography (CT) and magnetic resonance (MR).
3. Demonstrate how to decrease the radiation dose of CT perfusion, without losing image quality.
4. Understand the difference between perfusion and permeability in MR functional imaging.
5. Describe the steps and the hot topics of image processing on the workstation.
6. Demonstrate how the perfusion aids the detection of squamous cell carcinomas, delimitation and choice of the best site of biopsy, as well as detection of secondary lymph nodes.
7. Understand how perfusion could be a biomarker in predicting response to chemoradiation therapy.
8. To show how MR perfusion predicts the histology of the parotid solid nodules.

TABLE OF CONTENTS/OUTLINE
1. Functional images support the diagnosis and treatment of head and neck tumors.
2. Indications, techniques, findings and clinical applications of head and neck perfusion studies in CT and MR.
Gamut of Lesions Causing Protrusions and Protuberances of Skull and Scalp: A Radiological Review

All Day Location: NR Community, Learning Center

Participants
Vinay Hegde, MBBS, MD, Bangalore, India (Presenter) Nothing to Disclose
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TEACHING POINTS
To educate readers regarding various lesions, imaging appearances involving the scalp and calvarium. A schematic imaging approach is presented for narrowing the differentials.

TABLE OF CONTENTS/OUTLINE
Introduction: Most calvarial and scalp lesions present with obvious palpable masses. Though clinical background is useful in most cases, imaging is necessary in doubtful cases and to define extension. Methods: The spectrum of lesions affecting the calvarium and scalp are analyzed on the basis of following imaging parameters: location, pattern of involvement and periosteal reaction, involvement of adjacent structures and appearance on various MR sequences. Key clinicopathologic characteristics are described. Radiological images of histopathologically proven cases involving the calvarium and scalp. Cases presented are categorized as congenital (encephalocele, dermoid cyst, craniostenosis, lacunar skull) vascular (scalp AVM, hemangioma, sinus pericranii) infectious/inflammatory (osteomyelitis, histiocytosis) tumors (osteoma, osteoblastoma, osteosarcoma, metastasis, multiple myeloma, neurofibroma, desmoid tumor) others (cephalhematoma, leptomeningeal cyst, fibrous dysplasia, Rosai Dorfman disease, aneurysmal bone cyst, intradiploic meningioma and epidermoid).
Awards

RSNA Country Presents Travel Award

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TEACHING POINTS

1. To review the radiological evolution of normal lumbar spine fusion. 2. To describe the usual suspects: Diagnostic imaging findings of pseudoarthrosis with plain films, computed tomography and MRI.

TABLE OF CONTENTS/OUTLINE

Relevant teaching points are illustrated through (620 spinal procedures) in our institution, obtained from a retrospective search from 2010 to 2015. 1. Common lumbar spine surgical procedures. 2. Postoperative imaging findings in plain films, CT and MRI. 3 Algorithm for the correct assessment of normal lumbar spine fusion and early pseudoarthrosis. 4. Role of the radiologist in the diagnosis of this pathology and its clinical impact.
Imaging of CNS Paraneoplastic Syndromes

All Day Location: NR Community, Learning Center

Awards
Certificate of Merit

Participants
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Francesc Graus, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Laura Oleaga, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To review the imaging findings of CNS paraneoplastic syndromes, their major clinical features and main antibodies and malignancies associated with them. To review the CNS imaging differential diagnosis of these syndromes. To review how a paraneoplastic syndrome can herald malignant disease and which protocol of tumor screening (CT, US, PET-CT) should be applied. To show how treatment of the tumor improves or cures the paraneoplastic syndrome and how a relapse can herald a malignant recurrence.

TABLE OF CONTENTS/OUTLINE
Assessing Indeterminate Thyroid Nodules: Role of Elastography and Molecular Diagnosis of Fine Needle Aspirates

All Day Location: NR Community, Learning Center

Participants
Changtian Li, Boston, MA (Presenter) Nothing to Disclose
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TEACHING POINTS
- As many as 60% of patients above the age of 60 will have a thyroid nodule diagnosed by high-resolution ultrasound. - Nodules with suspicious features will typically undergo a fine needle aspiration (FNA) for further evaluation. However, there is an inherent limitation to this algorithm as 15-30% of all FNA’s are categorized as indeterminate at cytology. - A widely accepted consensus system of thyroid cytology reporting, the Bethesda System, addresses this clinical problem to some extent by clearly identifying these indeterminate categories. - Novel imaging techniques like elastography and pathologic techniques such as molecular testing for gene mutations offer added value in managing patients with indeterminate nodules.

TABLE OF CONTENTS/OUTLINE
1. Review of the Bethesda System for reporting thyroid cytopathology with identification of sub-groups that may benefit from novel imaging and molecular diagnostic techniques
2. Synopsis of thyroid elastography and its role in stratifying patients with indeterminate thyroid nodules
3. Discussion of the most common gene mutations in thyroid cancer, including BRAF and RAS mutations
4. How to perform molecular testing of FNA’s in the clinical setting, including discussion of mRNA gene expression classifiers
Typical and Atypical Findings in Nonalcoholic Wernicke Encephalopathy: An Unrecognized Diagnosis Post Gastric Surgery

All Day Location: NR Community, Learning Center

Participants
Elisenda Grive, MD, Barcelona, Spain (Presenter) Nothing to Disclose
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Angel Marin, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Sara Grossi, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To describe the pathogenesis and the many different clinical settings that can lead to WE.
2. To present a review of magnetic resonance features of the typical and atypical imaging findings in WE.
3. To discuss the main differential diagnosis and its imaging findings.

TABLE OF CONTENTS/OUTLINE
Wernicke encephalopathy (WE) is a serious but curable neurologic disease that is caused by a deficit in thiamine; it occurs most commonly in alcoholic patients. However, lately WE manifests in a number of different clinical settings like gastrointestinal surgery, chemotherapy, prolonged therapeutic fasting, prolonged parenteral nutrition and bariatric surgery. Improved recognition by radiologists of the different imaging findings associated with this emergency can optimize the management and help prevent its severe consequences.

2. Review of imaging presentation, including typical and atypical findings in alcoholic and non-alcoholic patients. We emphasize the imaging findings in the setting of post-gastric surgery patients.
3. Challenging cases and mimics.
Participants
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Sanjaya Viswamitra, MD, Bengaluru, India (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Readers will learn various differential diagnoses of dural based T2 hypointense lesions and their imaging appearances. A methodical MRI pattern recognition approach is presented towards the gamut of lesions through a clinicoradiological algorithm.

TABLE OF CONTENTS/OUTLINE
Introduction: Though T2 hypointense dural based lesions are infrequently encountered, an orderly clinicoradiological approach helps in narrowing the differentials and hence improved management of the same. Methods: The various T2 hypointense dural based lesions are analyzed on the basis of following imaging parameters: location, pattern of enhancement, involvement of adjacent structures, concomitant findings, and appearance on other MR sequences. Relevant clinicopathologic characteristics are depicted. Both common and uncommon histopathologically proved dural based T2 hypointense lesions including various meningioma subtypes, infective lesions (TB, fungal granuloma), hypertrophic pachymeningitis, inflammatory pseudotumor, Rosai Dorfman disease, metastatic adenocarcinoma, Non-Hodgkins lymphoma, chloroma, extraskeletal osteosarcoma, rhabdomyosarcoma and meningeal melanoma are presented in this review. Conclusion: This pictorial assay aims to familiarize most of the T2 hypointense dural based lesions and their imaging appearance.
Characterization of Tumors of Head and Neck with Diffusion Weighted MR Imaging and Role of Apparent Diffusion Coefficient Values

All Day Location: NR Community, Learning Center

Participants
Jerry M. Kovoor, MBBS, Iowa City, IA (Presenter) Nothing to Disclose
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Bruno A. Policeni, MD, Iowa City, IA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
In tumors of head and neck, DWI finding has an increasing role and its characterization is helped utilizing ADC values. This study aims to review the various areas of DWI in head and neck pathologies and discuss the clinical applications.

TABLE OF CONTENTS/OUTLINE
Diffusion techniques: Diffusion techniques including single shot EPI DWI with 2 or 3 parallel factors, HASTE DWI, RESOLVE multishot DWI, BLADE DWI and reduced FOV DWI will be demonstrated. Skull and scalp lesions: DWI has shown characteristic features unique to various skull and scalp lesions like epidermoid/dermoid/cholesteatoma, cholesterol granuloma, mucocele, abscesses, and benign (fibrous dysplasia, hemangioma) or malignant (metastasis, lymphoma, leukemia and other hypercellular tumors). Head and neck neoplasms: DWI plays an important role in differentiation of benign from malignant head and neck tumors and lymph nodes. Sinus diseases: Viscus mucus fluid demonstrates low ADC values that should be differentiated from pus collection. Head and neck infections: DWI and ADC maps could be useful to demonstrate the extension of the abscesses. Summary: DWI plays an important role in radiological evaluation of head and neck tumors. An understanding the techniques and limitations helps to improve interpreting the head and neck tumors and monitoring response to treatment non-invasively.
Normal Anatomy, Embryology, Pathology and Imaging Features of the Spinal Vascular Malformations

All Day Location: NR Community, Learning Center

Participants
Prabath K. Mondel, MBBS, MD, Mumbai, India (Presenter) Nothing to Disclose
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Uday Limaye, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Ashlesha S. Udare, MBBS, MD, Mumbai, India (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To describe the embryological development, normal anatomy & anatomical variations of the vascular supply to the spine.
2. To discuss the cross sectional and angiographic anatomy of congenital & acquired vascular malformations of the spine.

TABLE OF CONTENTS/OUTLINE
Embryology: The adult spine is derived from the notochord & recieves segmental supply from a number of arteries. Normal Anatomy:
The segmental arteries have a basic organization:
I. Paravertebral musculature & other neural crest derivatives
II. Vertebral Body
III. Nerve root & spinal canal - radicular
IV. Dura and its derivatives - radiculomeningeal
V. Spinal Cord - radiculomedullary or radiculopial
Venous drainage of the cord:
I. Intrinsic system - sulcal & radial veins, longitudinal veins
II. External system - anterior median & posterolateral spinal veins
Venous drainage of the spine:
I. External plexus
II. Internal plexus
III. Basivertebral veins

Spinal Vascular Malformations - Classification & Pathological Anatomy
Illustrated Cases with examples
Summary
Infratemporal Fossa and its Relation to Masticator and Parapharyngeal Spaces: Can Precise Definitions Have Implications on AJCC Staging and Resectability of Head Neck Cancers?

Participants
Supreeta Arya, MD, Mumbai, India (Presenter) Nothing to Disclose
Somesh Singh, MBBS, Mumbai, India (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Defining infratemporal fossa (ITF) and its relation to the masticator space and parapharyngeal spaces.
2. To bring awareness of the present AJCC TNM staging of nasopharyngeal, oropharyngeal, oral and paranasal sinus cancers.
3. To review the pitfall in the staging of nasopharyngeal cancer resulting from ambiguity of definition of the ITF.
4. To review the varied implication of ITF invasion on resectability and therapy in few relevant suprathyroid neck cancers.

TABLE OF CONTENTS/OUTLINE
Infratemporal fossa (ITF) a nomenclature familiar to the clinician is a non-fascial deep anatomical space in the suprathyroid neck while masticator space (MS) and parapharyngeal space (PPS) are fascia lined spaces, familiar to the radiologist. Literature does not describe the relationship of ITF to MS and PPS.

1. Definitions of infratemporal fossa, masticator space and parapharyngeal space and their relationship to each other.
2. AJCC TNM staging of nasopharyngeal, paranasal sinus and oral cavity cancers.
3. Pitfall in staging of nasopharyngeal cancer due to unclear definition of ITF.
4. Impact of ITF and MS invasion on T staging and resectability/therapy in the above cancers.
How to Do an Ocular Ultrasound: A Resident’s Guide

All Day Location: NR Community, Learning Center

Participants
Roberto Correa Soto, Salamanca, Spain (Presenter) Nothing to Disclose
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Aitor Costales Sanchez, Salamanca, Spain (Abstract Co-Author) Nothing to Disclose
Diego S. Palominos Pose, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Julio S. Gaete, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Using ultrasound eyeball we can describe findings that are not visible by ophthalmoscopy. So what is a vital and quick test to perform, especially when there is a "barrier" (blood, pus, calcium, foreign body, etc.) that doesn't allow observing the fundus. The purpose of this exhibit is: - To describe the technique of performing ultrasonography of the eyeball, the selection and configuration of the ultrasound probe. - To describe the study protocol. - Identify ultrasonographically the different structures of the eyeball. - Characterize the main pathologies of the eyeball evidenced by ocular ultrasound and Doppler ultrasound.

TABLE OF CONTENTS/OUTLINE
Common and Uncommon Etiologies for Enhancement of the Spinal Meninges on MRI

All Day Location: NR Community, Learning Center

Participants
Jeffrey Dorr, MD, San Jose, CA (Presenter) Nothing to Disclose
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Rajul P. Pandit, MD, San Jose, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
- Describe the basis for the appearance of meningeal enhancement (ME) on post-contrast MR images - Review the categories of disease which result in ME, including infectious, inflammatory, neoplastic, and iatrogenic etiologies - Utilize sample cases from each of the above categories of disease in order to accurately identify the presence of ME and distinguish features of specific etiologies

TABLE OF CONTENTS/OUTLINE
- 85 year-old woman with a history of AML. Leptomeningeal enhancement (LME) along the cord (arrows). The inset is an axial slice demonstrating circumferential LME. - 19 year-old female with a history of tuberculosis. Diffuse, thin ME along the thoracic cord consistent with meningitis. - 65 year-old female. Thickened, enhancing pachymeninges (arrows) of the cervical cord. Laboratory testing for a variety of infectious processes was negative. A diagnosis of idiopathic hypertrophic pachymeningitis was made. - 33 year-old female status-post surgical repair of tethered cord. LME about the lumbar cord (arrows). Not well seen on this image are thickened nerve roots traveling peripherally in an enlarged, featureless inferior spinal canal. Findings suggest arachnoiditis due to recent surgery.
NR305-ED-X

Location, Location, Location - Spinal Cord Topographical Anatomy and Its Role in Evaluating Intramedullary Lesions

All Day Location: NR Community, Learning Center

Awards
Cum Laude

Participants
Andrew J. Spain, MD, Detroit, MI (Presenter) Nothing to Disclose
Nik Kolicaj, MD, Detroit, MI (Abstract Co-Author) Nothing to Disclose
Horia L. Marin, MD, Detroit, MI (Abstract Co-Author) Nothing to Disclose
Brent D. Griffith, MD, Detroit, MI (Abstract Co-Author) Nothing to Disclose
Suresh C. Patel, MD, Detroit, MI (Abstract Co-Author) Nothing to Disclose
John J. Corrigan, MD, Detroit, MI (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The spinal cord has a well-defined topographic and functional anatomy, which can be recognized on imaging. Diseases affecting the cord often have specific clinical and imaging features correlating to the anatomic location. This exhibit will:1. Review the topographical anatomy of the spinal cord, including functional anatomy of gray matter and white matter tracts.2. Review the clinical presentation associated with various cord lesion locations and how integrating clinical presentation with imaging can assist in formulating an appropriate differential diagnosis.

TABLE OF CONTENTS/OUTLINE

I. Spinal cord Anatomy
   a. Topographical and functional anatomy of the spinal cord including dorsal columns, corticospinal tracts, and gray matter.
   b. Arterial and venous anatomy of the cord.
II. Case Based Review
   a. Imaging features of various spinal cord disease processes and the importance of lesion location in diagnosis. Cases will include: Subacute combine degeneration due to B12 deficiency and nitrous oxide abuse, Copper deficiency myelopathy, Multiple sclerosis, Transverse myelitis, Spinal cord infarct, Spinal AVM/AVF's, Spinal cord tumors, Syringomyelia, and Trauma.
   b. Clinical presentation, pathophysiology, and appropriate further work-up of each disease process.
Multiparametric Analysis of Intraaxial Brain Lesions on MRI

All Day Location: NR Community, Learning Center

Participants
Nikshita A. Jain, MBBS, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Abhishek Mahajan, MD, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Somesh Singh, MBBS, Mumbai, India (Presenter) Nothing to Disclose
Anshita Rastogi, MBBS, MD, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Santhosh K. GeethaVirupakshappa, MD, MBBS, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Sureshkumar G, MBBS, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Aliasgar Moiyadi, MChir, Mumbai, India (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Functional imaging techniques offer evaluation of brain neoplasms at a molecular level in addition to the morphological details provided by conventional MR sequences. These also help to guide surgeons and oncologists for appropriate therapy with reliable differentiation of benign etiologies thus avoiding unnecessary intervention. In addition to conventional MR imaging, a know how of the advanced MR imaging techniques is essential to provide an accurate diagnosis of an intraaxial brain neoplasm, distinguishing the benign lesions and determining the grade and hemodynamic nature of a malignant tumor.

1. To elaborate the various functional MR imaging sequences available for clinical studies.
2. To assess the utility of advanced MRI sequences in evaluation of various intraxial brain neoplasms.

TABLE OF CONTENTS/OUTLINE

1. Perfusion Imaging: As a tumor grows, its metabolic demands increase which results in recruitment of new blood vessels i.e. neoangiogenesis. The technique of perfusion imaging allows for assessment and quantification of neoangiogenesis of a lesion.
2. Diffusion Weighted Imaging: It exploits the property of random motion of water molecules in normal tissues. In pathologic tissues, this random motion is impeded with lowering of the ADC (apparent diffusion coefficient).
3. MR Spectroscopy: Spectroscopy allows for qualitative as well as quantitative determination of chemical metabolites in a lesion and thus helpful in characterization.
Conventional and CT Myelography: Orphans in the Era of MRI!!!!

All Day Location: NR Community, Learning Center

Participants
Eiman al-Ajni, MD, Montreal, QC (Presenter) Nothing to Disclose
Jaykumar R. Nair, MD, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Kathleen Nguyen, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Natalia Gorelik, MD, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Raquel Del Carpio-O’Donovan, MD, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Carlos I. Torres, MD, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Jeffrey Chankowsky, MD, Montreal West, QC (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) Use of CT myelography is not limited to cases when:a) Metallic implants severely degrade quality of MRI imagesb) Patient is claustrophobic orc) Kyphoscoliosis results in image acquisition and interpretation extremely difficult.2) CT myelography better estimates nerve root compression in the lateral recess.3) CT myelography is more reliable and reproducible for decision making regarding the level/levels for decompression surgery.4) CT myelography had greater sensitivity in detecting cervical root avulsion.

TABLE OF CONTENTS/OUTLINE
1) Review the technique of Conventional and CT myelography as done in our institution.2) Discuss the indications of CT myelography.3) Showcase advantage of using CT myelography over MRI by illustrating cases in different clinical scenario.
Watch Out for the Fracture: Cervical Spine Injuries in Patients with Degenerative Fusion of the C-spine

All Day Location: NR Community, Learning Center

Participants
Melkamu D. Adeb, MD, Bridgeport, CT (Presenter) Nothing to Disclose
Salil Sharma, MD, Bridgeport, CT (Abstract Co-Author) Nothing to Disclose
Yogesh Kumar, MD, Bridgeport, CT (Abstract Co-Author) Nothing to Disclose
Nisarg A. Parikh, MD, MBBS, Bridgeport, CT (Abstract Co-Author) Nothing to Disclose
Mark A. Rosovsky, MD, Stamford, CT (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Discuss the different types of cervical fusions and associated altered mechanics that predisposes to cervical injuries in this patient population. Discuss the common types of cervical fractures in patients with degenerative fusion. Discuss differences in severity of fractures in patients with cervical fusion and those without fusion.

TABLE OF CONTENTS/OUTLINE
Cervical fusion: Definition: what defines a fusion Types of cervical fusion Degenerative: provide different imaging examples. Diffuse idiopathic Skeletal Hyperostosis (DISH) Ankylosing spondylitis Inflammatory arthritis Surgical fusion Mechanisms of injury in cervical fusion: Altered mechanics Differences with trauma in unfused patient Common types of fractures in fused patients:
Imaging of the Central Skull Base—From Anatomy to Disease

All Day Location: NR Community, Learning Center

Participants
Fernando Mas-Estelles, MD, Valencia, Spain (Presenter) Nothing to Disclose
Ariel R. Pacheco Usmayo, Valencia, Spain (Abstract Co-Author) Nothing to Disclose
Alexandre Perez, MD, Valencia, Spain (Abstract Co-Author) Nothing to Disclose
Joan Carreres-Polo, MD, Valencia, Spain (Abstract Co-Author) Nothing to Disclose
Miguel Mazon, MD, Valencia, Spain (Abstract Co-Author) Nothing to Disclose
Almudena Lucas, Valencia, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1-Know the main indications of central skull base (CSB) imaging and related clinical scenarios.
2-Recognize the impact of imaging on diagnosis and treatment.
3-Get familiar with embryology and imaging anatomy of the bony and neurovascular CSB.
4-Identify common diseases and establish a reasonable differential diagnosis.

TABLE OF CONTENTS/OUTLINE
1-Indications for imaging CSB. Relevant information for the surgeon and radiotherapist.
2-Embriology of the notochord, pituitary gland and ossification centers of the CSB. Anatomic variants and related disease entities with cases in imaging.
3-Imaging anatomy: Limits of the CSB. Anatomy of sphenoid bone and CSB limits, skull base foramina, neurovascular structures, and related spaces. Presentation of illustrative cases.
4-Differential diagnosis of CSB lesions based on their location, imaging features, and clinical scenario.
NR371-ED-X

Carotid Stenosis: The Role of Carotid Ultrasound and Common Pitfalls

All Day Location: NR Community, Learning Center

Participants
Ozden Narin, MD, New Haven, CT (Presenter) Nothing to Disclose
Xiao Wu, New Haven, CT (Abstract Co-Author) Nothing to Disclose
David Durand, MD, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Vivek B. Kalra, MD, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Leslie M. Scoutt, MD, New Haven, CT (Abstract Co-Author) Consultant, Koninklijke Philips NV
Ajay Malhotra, MD, Stamford, CT (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
- Discuss guidelines and criteria for sonographic evaluation of carotid stenosis
- Review common pitfalls in sonographic evaluation of carotid stenosis
- Discuss the role of ultrasound beyond evaluation of simple luminal stenosis

TABLE OF CONTENTS/OUTLINE
1. In 2011, different societies came up with consensus guidelines regarding management of patients with extracranial carotid and vertebral disease. The guidelines pertaining to ultrasound will be discussed. 2. The criteria for evaluation of Carotid stenosis as per the Society of Radiologists in Ultrasound Consensus Conference will be reviewed. 3. Pitfalls in US evaluation of carotid stenosis will be reviewed using case review format. This would include severe arterial tortuosity, high carotid bifurcation, extensive calcifications, cardiac arrhythmias, contralateral carotid disease, subtotal versus complete arterial occlusion, tandem lesions, long segment lesions, effect of intrathoracic or intracranial disease, post carotid endarterectomy changes. 4. Emerging role of ultrasound in identifying patients at high risk for future stroke will be discussed; Detection of micro emboli Identification of unstable plaque

Honored Educators
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Leslie M. Scoutt, MD - 2014 Honored Educator
Diagnóstico Precoz por Imagen en la Población el CIR: Sesión del Colegio Interamericano de Radiología (CIR) en Español/Population based Preventive Imaging from CIR: Session of the Interamerican College of Radiology (CIR) in Spanish

Saturday, Nov. 28 1:00PM - 5:00PM Location: E451A

LEARNING OBJECTIVES

1) To review the state-of-the-art of population based preventive imaging
2) To discuss preventive imaging approaches in all major organ systems and key pathologies, ranging from dementia, cardiovascular disease, colon, liver, lung and breast cancer
3) To illustrate the use of different imaging technologies in preventive imaging such as CT, MRI and ultrasound

Sub-Events

SPSP01A  Introducción/Introduction

Participants
Pablo R. Ros, MD, PhD, Cleveland, OH (Moderator) Medical Advisory Board, Koninklijke Philips NV; Medical Advisory Board, KLAS Enterprises LLC; Medical Advisory Committee, Oakstone Publishing; Departmental Research Grant, Siemens AG; Departmental Research Grant, Koninklijke Philips NV; Departmental Research Grant, Sectra AB; Departmental Research Grant, Toshiba Corporation

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSP01B  Parte 1/Part 1

Participants
Dante R. Casale Menier, MD, Ciudad Juarez, Mexico (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSP01C  Presentación de Ponentes/Panel Introduction

Participants
Pablo R. Ros, MD, PhD, Cleveland, OH (Presenter) Medical Advisory Board, Koninklijke Philips NV; Medical Advisory Board, KLAS Enterprises LLC; Medical Advisory Committee, Oakstone Publishing; Departmental Research Grant, Siemens AG; Departmental Research Grant, Koninklijke Philips NV; Departmental Research Grant, Sectra AB; Departmental Research Grant, Toshiba Corporation

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSP01D  Colon: La Colonografía Virtual: ¿Un Método de Escrutinio en la Población?/Colon: Virtual Colonography: A Population Screening Tool?

Participants
Jorge A. Soto, MD, Boston, MA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

Honored Educators

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Jorge A. Soto, MD - 2013 Honored Educator
Jorge A. Soto, MD - 2014 Honored Educator
Jorge A. Soto, MD - 2015 Honored Educator

SPSP01E  Cardiovascular: Cribaje de Enfermedad Cardiovascular por Imagen Medica/Cardiovascular: Diagnostic Imaging in Cardiovascular Screening

Participants
Carlos S. Restrepo, MD, San Antonio, TX (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Carlos S. Restrepo, MD - 2012 Honored Educator
Carlos S. Restrepo, MD - 2014 Honored Educator

SPSP01F Neurología: Diagnóstico Temprano de Demencias: ¿Dónde Estamos?/Neurology: Dementia Early Diagnosis: Where Are We?

Participants
Carlos Zamora, MD,PhD, Chapel Hill, NC (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

Objetivos: 1) Comprender conceptos clínicos básicos para el diagnóstico de los síndromes principales de demencia. 2) Reconocer características anatómicas y metabólicas fundamentales de neuroimagen en los síndromes principales de demencia, con especial atención a enfermedad de Alzheimer. 3) Explorar direcciones futuras y desafíos para el diagnóstico temprano. Learning objectives: 1) Understand basic clinical concepts for the diagnosis of major dementia syndromes. 2) Recognize fundamental anatomic and metabolic neuroimaging features of major dementia syndromes, with special focus on Alzheimer's disease. 3) Explore future directions and challenges for early diagnosis.

SPSP01G Parte II/Part II

Participants

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSP01H Presentación de Ponetes/Panel Introduction

Participants
Miguel E. Stoopen, MD, Mexico City, Mexico (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSP01I Mama: Rol de la RM en el Cáncer de Mama en Mujeres de Alto Riesgo/Breast: Role of MR in High Risk Breast Cancer Patients

Participants
Linei A. Urban, Curitiba, Brazil (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.


Participants
Claudio S. Silva Fuente-Alba, MD, MSc, Santiago, Chile, (csilvafa@alemana.cl) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSP01K Hígado: Cribaje del Hepatocarcinoma en Pacientes de Riesgo: ¿Cómo Hacerlo y a Quién Incluir?/Liver: Hepatocellular Carcinoma Screening in High Risk Patients: How and Whom?

Participants
Carmen Ayuso, MD,PhD, Barcelona, Spain, (cayuso@clinic.ub.es) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Definir la población en riesgo de desarrollar un carcinoma hepatocelular que debe ser incluida en un programa de cribado. 2) Analizar la mejor estrategia para llevar a cabo el cribado del hepatocarcinoma en la población en riesgo de padecerlo. 3) Discutir la conducta a seguir una vez que se detecta un nódulo hepático en pacientes incluidos en un programa de cribado.1) To define the population at risk of hepatocellular carcinoma to be included in a surveillance program. 2) To analyze the best strategy for
surveillance in patients at risk of hepatocellular carcinoma. 3) To discuss how to proceed when a liver nodule is detected in patients on surveillance

SPSP01L Comentarios Finales y Clausura/Closing Remarks

Participants
Dante R. Casale Menier, MD, Ciudad Juarez, Mexico (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.
Participants
Thiru A. Sudarshan, DMRD, FRCR, Dundee, United Kingdom (Presenter) Nothing to Disclose
Avinash K. Kanodia, MD, Perth, United Kingdom (Abstract Co-Author) Nothing to Disclose
Jonathan Weir-McCall, MBCh, FRCR, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose
Anu Kamalasanan, MBBS, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose
Bangalore Anil Kumar, MD, FRCR, Slough, United Kingdom (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1.) Review the diagnosis of a specific condition by using either a single-modality or multimodality approach. 2.) Identify state-of-the-art imaging and methods of treatment for various pathologic conditions. 3.) Assess new research on applications of various imaging and therapeutic modalities.
**SSA12-01 Molecular Imaging Profiling of Treatment Effects in Experimental Multiple Sclerosis**

**Sunday, Nov. 29 10:45AM - 10:55AM Location: S504CD**

**Aims:**
- Evaluate treatment effects of interferon beta (IFN) and glatiramer acetate (GA), two first-line agents used in multiple sclerosis (MS), by conventional MRI.
- Use MPO-Gd, an activatable molecular MR probe specific to myeloperoxidase (MPO), to profile treatment effects on the innate immune response in vivo.

**Materials and Methods:**
- Thirty-five female SJL mice were injected with proteolipid protein to induce experimental autoimmune encephalomyelitis, a mouse model of MS, and treated with IFN (1 μg/day), GA (150 μg/day), MPO inhibitor ABAH (0.8 mg/day), or saline.
- Mice underwent MRI at 4.7T with MPO-Gd at disease peak (day 12).
- Lesion volume, number, contrast-to-noise ratio (CNR), and total MPO-Gd enhancement were quantified on delayed images.
- Mechanistic in vitro experiments were performed.

**Results:**
- CNR (MPO activity in vivo) was decreased with ABAH and IFN, but not with GA.
- Lesion volume, lesion number, and total MPO-Gd enhancement were decreased with all three agents.
- Direct enzymatic inhibition was only found with ABAH, and not with IFN or GA (C).
- IFN decreased activity of the MPO enzyme, similar to ABAH (D), while GA did not have a similar effect (D).
- Neutrophils were incubated with IFN, increased superoxide anion production (as measured by dihydroethidium [DHE] fluorescence) was detected (E).
- Inhibition of superoxide anion production by apocynin resulted in the restoration of MPO activity from stimulated neutrophils (F).
- Spectrophotometry revealed that IFN-mediated superoxide anion production abolished absorbance of MPO at 430 nm, consistent with irreversible destruction of the iron-containing prosthetic group (G).

**Conclusion:**
- Molecular imaging profiling with MPO-Gd reveals differential treatment effects of the two first-line drugs used in the treatment of MS (H), and led to the discovery of a novel mechanism of action of IFN: IFN triggers superoxide anion production in myeloid cells to irreversibly inactivate MPO.

**Clinical Relevance/Application:**
- Molecular imaging profiling with imaging agents that probe the immune response could open up a new avenue to study the effects of current and future novel therapeutic drugs for MS.

**Participants**
- Alexander Drzezga, MD, Cologne, Germany (Moderator) Research Grant, Eli Lilly and Company; Speakers Bureau, Siemens AG; Speakers Bureau, General Electric Company; Research Consultant, Eli Lilly and Company; Research Consultant, Piramal Enterprises Limited; Satoshi Minoshima, MD, PhD, Salt Lake City, UT (Moderator) Royalties, General Electric Company; Consultant, Hamamatsu Photonics KK; Research Grant, Hitachi, Ltd; Research Grant, Nihon Medi-Physics Co, Ltd; Research Grant, Astellas Group; Research Grant, Seattle Genetics, Inc.

**SSA12-02 Microtubule Stabilization Therapeutic Improves Cognition and Acutely Increases Axonal Transport on Manganese-enhanced MRI in Aged Mice with AD Pathology**

**Sunday, Nov. 29 10:55AM - 11:05AM Location: S504CD**

**Aims:**
- To investigate the effects of microtubule stabilization therapy on cognitive function and axonal transport in aged mice with Alzheimer's disease (AD) pathology.

**Materials and Methods:**
- Mice underwent manganese-enhanced MRI to assess axonal transport.
- Cognitive function was assessed to evaluate the therapeutic effects.

**Results:**
- Microtubule stabilization improved cognitive function and increased axonal transport as measured by manganese-enhanced MRI.

**Conclusion:**
- Microtubule stabilization therapy has the potential to improve cognitive function and axonal transport in aged mice with AD pathology.

**Participants**
- Chloe G. Cross, BSc, Seattle, WA (Presenter) Nothing to Disclose.
- Marcella Cline, BS, Seattle, WA (Abstract Co-Author) Nothing to Disclose.
whereas that in a concurrent study using FGS alone was 94.2%.

proportion of SOX2-positive cells (ρ

positive cells (range: 3 - 96% of cells). Cho/NAA, Cho/Cr, and Cho showed strong, statistically significant correlations with the

One-hundred percent of tissue samples from metabolically abnormal regions, even those devoid of T2 abnormality, contained SOX2

RESULTS

METHOD AND MATERIALS

Mice, (3Txg-AD n=10, age =44wks) were treated by intranasal lavage with paclitaxel (TAX: 0.6 mg/kg) or 0.9% saline (SAL) in 5 μl

per nostril at intervals of 2wks. MEMRI was obtained after first treatment to assess acute effect on transport. Scanning (14T

Bruker MR: MDEFT, TR/TE: 5000ms/1.9ms, 0.140x0.140x0.25mm3) pre and immediately after treatment occurred at 100 min.

and from 370-400 min after delivery of 5 μl of 1M MnCl2 intranasally. Images were coregistered stereotactically aligned and normalized

to a mouse atlas. Tracer kinetic analysis based on dispersion model was used to estimate transport. At 56 wks after 5 treatments, mice

were tested in radial water tread maze for memory deficits and compared to age-matched WT (n=5) and at 75 wks after 11

treatments, anxiety was assessed by elevated plus maze.

RESULTS

At 10 mos, 3Txg-AD have amyloid and neurofibrillary tangles. There was a significant acute effect of TAX on transport in the

olfactory tract. Transport rates decreased slightly in SAL (-13%) in the 3wk interval between MEMRI scans however TAX increased

(>100%) transport at 24hrs after administration (p=0.05). Cognition was tested in the water tread maze (memory) and elevated

plus maze (anxiety). TAX had improved memory as compared to SAL and not significantly different from WT (Day 5, 36% dec,

143.8±43 vs 91.5±77s and Day 12, 22% dec, 138.3±42 vs 107.7±75s for SAL vs. TAX, p<0.05). 3Txg-AD mice exhibit anxiety. TAX

spent more time exploring open arms than SAL (Open arm 84% inc, 129.1±80 vs 20.9±31s for TAX vs SAL, p<0.05). There were no

differences in Mn2+ uptake indicating delivery thru activity-dependent Ca2+ channels was not affected by treatment.

CONCLUSION

MEMRI indicated that paclitaxel has an acute effect on axonal transport processes in AD mice. Paclitaxel also improved cognition

and anxiety in AD mice when administered after pathology was well-established.

CLINICAL RELEVANCE/APPLICATION

Microtubule-stabilizing drugs present an exciting new therapeutic option for Alzheimer’s disease.

SSA12-03 Whole-Brain, Volumetric MR Spectroscopic Profiles Identify Infiltrating Glioblastoma Margin for Fluorescence-Guided Surgery

Sunday, Nov. 29 11:05AM - 11:15AM Location: S504CD

Participants

James S. Cordova, BS, Atlanta, GA (Presenter) Nothing to Disclose

Constantinos G. Hadjipanayis, MD, PhD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

Zhongying Lian, PhD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

Lee Cooper, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

Saumya Gurbani, MS, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

StewartNeill, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

Eduard Schreibmann, PhD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

Hui-Kuo G. Shu, MD, PhD, Atlanta, GA (Abstract Co-Author) Speakers Bureau, Varian Medical Systems, Inc; Stockholder, General

Electric Company; Stockholder, Medtronic, Inc; Stockholder, Mylan NV; Stockholder, Apple Inc

Jeffrey Olson, PhD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

Chad A. Holder, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

Hyunsuk Shim, PhD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

PURPOSE

Glioblastoma (GBM) resection based on T1W-contrast enhanced MRI (T1W-CE) results in high rates of local recurrence due to
tumor infiltration beyond contrast enhancing margins. MR spectroscopic imaging (MRSI) maps are thought to identify tumor
infiltration outside of T1W-CE regions more specifically than T2-FLAIR. Thus, coupling preoperative MRSI with real-time
fluorescence-guided surgery (FGS) using 5-aminolevulinic acid (5-ALA) may allow the maximal removal of tumor beyond the
enhancing margin.

METHOD AND MATERIALS

In a trial for new and recurrent GBM (n=20 patients), 3D whole-brain MRSI volumes, including choline (Cho), creatine (Cr), and N-
acetylaspartate (NAA) maps, were acquired and used for surgical planning in patients receiving FGS. Biopsies were collected from
regions with elevated Cho/NAA before bulk resection using 5-ALA fluorescence. Fluorescence of resected tissue was quantified ex
vivo with a hand-held spectrometer, and metabolic data was sampled from MRSI volumes using an 8 mm³ region-of-interest
centered at the point of tissue extraction. Samples were stained for SOX2, a tumor-specific marker, and analyzed to quantify tumor
infiltration using an automated histology image analysis tool. Semi-automated tumor segmentation was used to evaluate extent-of-
tumor resection (EOR) ( Cordova et al. 2014 ).

RESULTS

One-hundred percent of tissue samples from metabolically abnormal regions, even those devoid of T2 abnormality, contained SOX2
positive cells (range: 3 - 96% of cells). Cho/NAA, Cho/Cr, and Cho showed strong, statistically significant correlations with the
proportion of SOX2-positive cells ( p = 0.70, 0.66, and 0.60, respectively; p < 0.05). Ex vivo tissue fluorescence showed a weaker
yet significant correlation with Cho/NAA and Cho ( p = 0.365 and 0.404; p<0.05). Median EOR in MRSI/5-ALA cases was 97.5% whereas
that in a concurrent study using FGS alone was 94.2%.
CONCLUSION
This is the first time that 5-ALA-induced fluorescence has been shown to correlate with MRSI-derived metabolic markers in brain tumors. The correlation of MRSI abnormality with histopathology and quantitative intraoperative fluorescence supports the use of MRSI for identifying regions of tumor infiltration outside of T1W-CE.

CLINICAL RELEVANCE/APPLICATION
As MRSI is independent of contrast diffusion, it defines tumor infiltration more precisely than T1W-CE; and when combined with FGS, results in more complete resections that may extend patient survival.

SSA12-04 Motexafin Gadolinium (MGd) - Enhanced MR and Optical Imaging of Rat Gliomas for Potential Intraoperative Determination of Tumor Margins

Participants
Longhua Qiu, Seattle, WA (Presenter) Nothing to Disclose
Feng Zhang, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Yaoping Shi, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Jianfeng Wang, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Donghoon Lee, PhD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Xiaoyuan Feng, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Xiaoming Yang, MD, PhD, Seattle, WA (Abstract Co-Author) Nothing to Disclose

PURPOSE
To investigate the possibility of using motexafin gadolinium (MGd)-enhanced molecular MR imaging and optical imaging to identify the genuine margins of rat gliomas.

METHOD AND MATERIALS
Rat glioma model was created by inoculating C6 glioma cells in right caudate nucleuses of male Sprague-Dawley rats (160g ± 20g). Thirty six rats with tumors were randomized into six groups (n=6/group). Five groups were euthanized at different time points of 15, 30, 60, 120 and 240 minutes after intravenous administration of 6-mg/kg MGd respectively, while one group received saline as a control. After a craniotomy, ex vivo optical imaging was performed to identify the tumors featuring as MGd-emitting red fluorescence. Then, the whole brains were harvested for ex-vivo T1-weighted MRI (T1WI). Optical photon intensities and MRI signal-to-noise ratio (SNR) were quantified for plotting the times to photon/SNR curves. Tumor extent was demarcated on both optical and MR images. Subsequently, confocal microscopy of brain tissues was performed to confirm the intracellular uptake of MGd by tumor cells and correlate the tumor margins determined on both optical and MR images.

RESULTS
Fluorescent optical imaging could sensitively detect the deep-seated tumors with red fluorescence in rat brains and clearly outlined the tumor margins. T1WI showed the tumors heterogeneous enhancement. Both the photon intensity and the maximal enhancement on T1WI reached the peak at 15 minutes after MGd administration, with a continuing tumor visibility lasting for 2-4 hours. Confocal microscopy confirmed the exclusive accumulation of MGd in tumor cells which was well correlated with imaging findings.

CONCLUSION
Both MGd-enhanced optical imaging and molecular MR imaging can sensitively determine rat glioma tumor margin within the optimal time window of 15~30 minutes post-MGd administration, which pose the potential clinical application for aiding the complete removal of gliomas at a hybrid surgical setting with intraoperative optical and MR imaging capabilities.

SSA12-05 Generation of a Bispecific Antibody for Combined EGFR/CD105 Targeting of High-Grade Gliomas

Participants
Reinier Hernandez, MSc, Madison, WI (Presenter) Nothing to Disclose
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PURPOSE
Our aim was to design and generate a heterodimer [Bs-F(ab')2] using two mAb Fab fragments for dual-targeting of epidermal growth factor receptor (EGFR) and CD105. The synergistic targeting properties of Bs-F(ab')2 were investigated in vitro/in vivo.

METHOD AND MATERIALS
Bs-Fab'2 was synthesized by reacting two mAb fragments (Cetuximab Fab and TRC105 Fab) derivatized with the ‘Click’ chemistry pair tetrazine/trans-cyclooctene. Bs-Fab'2 was purified by size exclusion chromatography, conjugated to NOTA, and labeled with 64Cu for positron emission tomography (PET). In vitro and in vivo dual-receptor binding studies were performed in a U87MG human
RESULTS

Purified Bs-F(ab')2 was confirmed by SDS-PAGE (~100 kDa, >90% pure), whereas the two Fab fragments were each at ~50 kDa. Flow cytometry showed an enhanced fluorescence signal for the heterodimer compared with either Fab. PET of U87MG tumor bearing mice with 64Cu-NOTA-Be-F(ab')2 revealed a strikingly higher tumor uptake (32.0±6.9, 47.5±6.7, 46.0±3.3 and 44.1±9.4 %ID/g) at 3, 15, 24, and 36 h postinjection, respectively; n=3 compared to those observed with 64Cu-NOTA-Cet-Fab and 64Cu-NOTA-TRC105-Fab (both <15%ID/g). Injection of a blocking dose (100mg/kg) of Cetuximab or TRC105 prior to the administration of the tracer resulted in a significantly reduced tumor uptake of 64Cu-NOTA-Be-F(ab')2, which confirmed that Bs-F(ab')2 tumor-uptake was mediated by both EGFR and CD105 expression. Owing to the low tracer uptake in non-target organs (e.g. liver and kidney), we attained excellent tumor-to-normal tissue contrasts.

CONCLUSION

We report the first successful dual-targeting of EGFR and CD105, with a "click" heterodimer featuring two mAb Fab fragments, which led to synergistic enhancement of tumor uptake over either Fab alone. These results may improve future cancer diagnosis and therapeutic efficacy.

CLINICAL RELEVANCE/APPLICATION

Combined EGFR/CD105-targeting provides increased tumor-targeting efficacy and specificity, which may ultimately lead to better diagnostic sensitivity and increased tumor cytotoxicity.

SSA12-07 MRI Contrasts Induced by Direct Saturation: Demonstration in the Central Nerve System

Sunday, Nov. 29 11:45AM - 11:55AM Location: S504CD

Participants
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PURPOSE

A frequency selective saturation RF pulse across a broad frequency range produces a Z-spectrum. This Z-spectrum receives contributions from components mainly including direct saturation (DS) of bulk water, magnetization transfer, chemical exchange saturation transfer, and Nuclear Overhauser Enhancement. When a weak saturation regime is applied, such as B1rms< 50 Hz and duration < 500 ms, the Z-spectrum is mainly attributed to the DS spectrum, characterized by a Lorentzian-shape. The DS magnitude at a given frequency offset has been used to measure iron content in brain. Additionally, the position of maximum DS has been exploited to map B0 field variations (ΔB0). In this study, we investigate additional contrasts revealed by analyzing DS spectrum.

METHOD AND MATERIALS

This study was performed under an approved IRB protocol. DS spectra within ±1 ppm were acquired from the brain and cervical spinal cord of healthy subjects at 3T scanner with a 32 channel head-coil and a 16 channel head and neck spine coil, respectively. The pulse sequence consists of a pre-saturation pulse (B1rms = 12.2 Hz for brain, 24.4 Hz for spinal cord, 200 ms) followed by a 2D single-shot SPGR readout. The DS data was fitted pixel by pixel with a Lorentzian function to produce B0 field, DS line-width, and DS magnitude maps. In addition, simulations with Bloch equations were performed to correlate with experimental data.

RESULTS

Beside the ΔB0 map, the Lorentzian fitting of data obtained from both brain and spinal cord was used to produce new maps based on the DS line-width and magnitude. In the brain and spinal cord respectively, the DS line-width of gray matter is slightly narrower than that of the white matter. As expected, CSF gave the narrowest line-widths. DS amplitude was reversed. Simulation further showed that DS line-width is positively proportional to 1/T2 and inversely proportional to 1/T1. DS magnitude was found to be proportional to proton density.

CONCLUSION

Two quantitative contrasts (DS line-width and magnitude) that reflect tissue relaxation rates and proton density have been demonstrated in the human CNS tissues.

CLINICAL RELEVANCE/APPLICATION

The discovered contrasts induced by DS MRI have the clinically potential for characterization of normal and pathological tissues.

SSA12-08 CD146-based Noninvasive ImmunoPET Imaging of High-grade Gliomas

Sunday, Nov. 29 11:55AM - 12:05PM Location: S504CD

Participants
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PURPOSE

The goal of this study is to establish CD146 as a novel target for in vivo immunoPET imaging of mice bearing orthotopic high-grade gliomas (HGG).

METHOD AND MATERIALS
An improved immunization approach was used to generate YY146, a murine anti-CD146 monoclonal antibody. RT-PCR, western blot, flow cytometry, and immunofluorescence staining studies were conducted to determine in vitro CD146 expression. Subcutaneous (s.c.) U87MG human glioblastoma (CD146+) and PC3 human prostate cancer (CD146-) tumors were induced in athymic nude mice. Additionally, orthotopic U87MG tumors were generated in nude mice and its progression monitored by T2-weighted MRI. YY146 was conjugated to p-SCN-Bn-NOTA and radiolabeled with 64Cu. Sequential PET scans, blocking, histological, and biodistribution studies were carried out to determine in vivo CD146 specificity of 64Cu-NOTA-YY146.

RESULTS
Flow cytometry demonstrated that chelator conjugation to YY146 did not compromise its CD146-binding affinity/specificity. 64Cu-NOTA-YY146 was obtained with high radiochemical purity (>95%) and specific activity, in yields surpassing 90%. MicroPET imaging studies revealed an elevated and persistent uptake of 64Cu-NOTA-YY146 in U87MG (CD146+) s.c. xenografts which peaked at 13.7±0.7 %ID/g, 48h post-injection (n=3). In contrast, significantly lower accumulation was observed in PC3 (CD146-) tumors (<5 %ID/g). Excellent tumor homing was observed from PET/CT imaging of orthotopic U87MG tumors, where 64Cu-NOTA-YY146 was able to infiltrate the brain and accumulate in tumorous tissue (21.5±3.5 %ID/g at 48h post-injection; n=5). The attained exquisite tumor-to-normal brain contrast allowed for the sensitive detection of small malignancies (~2 mm). Biodistribution, blocking experiments, as well as histological examination validated PET data, and confirmed the CD146 specificity of 64Cu-NOTA-YY146.

CONCLUSION
We successfully implemented noninvasive immunoPET imaging of in vivo CD146 expression in an orthotopic human glioblastoma cancer model. The high affinity and specificity of 64Cu-NOTA-YY146 envisages the potential of this novel mAb for targeted HGG diagnosis and therapy.

CLINICAL RELEVANCE/APPLICATION
Herein, we show for the first time that CD146 is a promising tumor-specific target for noninvasive in vivo imaging and targeted therapy of high-grade gliomas.

PURPOSE
To investigate the functional expression of P2X7 receptors in EPCs, role of P2X7 receptors in proliferation and homing to glioma of EPCs.

RESULTS
We confirmed, for the first time, the expression of P2X7 receptors in rat spleen-derived EPCs. Activation of P2X7 receptors in EPCs by BzATP promoted cells proliferation and migration, rather than apoptosis. Compared to the group without BBG treatment, less transplanted EPCs homed to gliomas in the group with BBG treatment, especially integrated into the vessels containing tumor-derived endothelial cells in gliomas. Moreover, western blot showed that CXCL1 expression was downregulated in gliomas with BBG treatment, which meant P2X7 receptors suppression inhibited the homing of EPCs to gliomas through down-regulation of CXCL1 expression. Additionally, MTT assay and MRI revealed that P2X7 receptors exerted no significant promoting effect on C6 glioma cells proliferation, glioma growth and angiogenesis.

CONCLUSION
Taken together, our findings imply the possibility of promoting proliferation and targeting ability of transplanted EPCs to brain gliomas in vivo through P2X7 receptors, which may provide new perspectives on application of EPCs as a therapeutic and imaging probe to overcome antiangiogenic resistance for gliomas.

CLINICAL RELEVANCE/APPLICATION
Apply EPCs as a therapeutic and imaging probe to overcome antiangiogenic resistance for gliomas.
**PURPOSE**

Parotidectomy with facial nerve (VII) sacrifice is often necessary in patients with malignant tumor. In all parotid masses, diagnosis of perineural spread is important as a prognosis biomarker since patients may have asymptomatic nerve invasion. Recently, the feasibility of intraparotid VII tractography was assessed to identify nerve contact with parotid tumors. The aim of this study was to determine if VII fractional anisotropy (FA) was linked to histologic grade in patients undergoing surgery for parotid tumors.

**METHOD AND MATERIALS**

Study ethics approval was obtained from our institutional review board (IRB 5891). Patients aged 18 or over, were including in this prospective study if they had:(a) A history of parotid tumors, requiring surgical management between December 2013 and April 2015(b) Undergone MR scans with diffusion acquisition and post-processing tractography(c) Surgical intraoperative checking of the intraparotid facial nerve Patients underwent MR scans with VII tractography calculated with the constrained spherical deconvolution model. We performed scans on a 3T MRI Philips ACHIEVA® 3.0T TX with a 32 channel head coil. The post-processing steps were performed using MRtrix package software. The parameters of the diffusion sequence were: b-value of 1000 s/mm², 32 directions, voxel size: 2 mm isotropic, scan time: 9’31”.

**RESULTS**

Twenty patients (mean age: 53 years, 5 women) were enrolling in this study. The first group (n=10) referred with a benign tumor without facial nerve compression or invasion as checked by surgical team. The second group (n=10) referred with a malignant tumor and included three patients with clinical facial nerve palsy. The VII mean FA value was estimated as being 0.53±0.06 in patients with benign tumors and 0.37±0.08 in malignant tumor group. Mean FA value was significantly lower in the second group (t-test, p≤0.05) and was also reduced in patients free from clinical facial palsy with surgically evidence of VII perineural spread (n=3).

**CONCLUSION**

In these preliminary results, MRI using diffusion tractography was a promising procedure to assess parotid tumor histologic grade and potential perineural spread.

**CLINICAL RELEVANCE/APPLICATION**

A reliable imaging biomarker of histologic grade and perineural spread in cases with parotid tumors may help to better inform and manage patients.
Preserved Cochlear T2 Signal is an Important Predictor for Hearing Preservation in Patients Treated for Vestibular Schwannoma

Sunday, Nov. 29 11:15AM - 11:25AM Location: N226

Participants
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Grish M. Fatterpekar, MBBS, New York, NY (Abstract Co-Author) Editor, Reed Elsevier

PURPOSE
Hearing preservation is a therapeutic goal for many patients with vestibular schwannoma (VS). We examined the relationship between pre-treatment MRI and post-treatment hearing status in an effort to define factors that may influence management.

METHOD AND MATERIALS
From September 2010 through January 2014, consecutive cases of VS treated with stereotactic radiosurgery (SRS) or microsurgery were reviewed. Preoperative MRIs were analyzed by two readers with respect to three dimensional tumor size, shape (round vs. oval), cochlear T2 signal, relationship of tumor to internal auditory canal (IAC), and presence of necrosis. Patients were excluded if they had prior treatment or no pre-treatment MRI within one year. "Serviceable" hearing was defined as speech discrimination score (SDS) ≥70% or AAO-HNS class A/B. Post-treatment hearing "preservation" was defined as maintenance or development of serviceable hearing after SRS or microsurgery using non-translabyrinthine approach. Bivariate statistics were calculated.

RESULTS
191 cases were reviewed; 68 patients met criteria for inclusion. A majority underwent SRS (69%), had tumors in the distal IAC (52%), oval shape (56%), without confluent necrosis (68%), and median volume of 0.95 mL. Of these patients, 55 and 30 had pre- and post-treatment audiology, respectively; 56% and 67% had "serviceable" pretreatment hearing on SDS and AAO-HNS, respectively. People without serviceable pre-treatment hearing on SDS had significantly larger (p=0.05) and round (p=0.02) tumors. Reduced cochlear T2 signal trended towards worse hearing on AAO-HNS (p=0.12). Preserved cochlear T2 signal was the only variable significantly associated with post-treatment hearing preservation as measured by SDS or AAO-HNS in all tumors (p<0.001 and p=0.01, respectively) or SDS for those in the distal IAC (p=0.02). Interobserver agreement measuring cochlear T2 signal was 92%.

CONCLUSION
Preoperative MRI identified patients more likely to have better hearing outcomes, thus aiding clinicians in pretreatment counseling. Decreased cochlear T2 signal may indicate close association with the cochlear neurovascular bundle, influencing endolymph protein concentration and negatively influencing hearing outcome.

CLINICAL RELEVANCE/APPLICATION
Pre-treatment cochlear T2 signal is associated with hearing outcomes after treatment for vestibular schwannoma. Use of thin section MRI has the potential to better inform treatment decisions.
In the control group, 3 healthy subjects were found with EH in either cochlea or vestibule with these criteria. EH prevalence was

RESULTS

the Student's t-test.

irregular dilatation of endolymphatic canal and VH recorded as present when more than 50% of the vestibule have been occupied

radiologists performed blind, semi-quantitative evaluations of MRI scan. Cochlear EH have been noted as present if nodular or

METHOD AND MATERIALS

With IRB approval and informed consent, nine patients with pathologically suspected and subsequently confirmed vestibular

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approximately estimated as being 85%, 50%, 40% and 40% in MD, SHL, RPV and rBPPV groups respectively. The results showed a significantly higher average number of hydrops localizations in the MD group when compared to other groups (t-test, p<0.01). Cochlear EH was found in 36% and 38% of RPV and rBPPV patients. Vestibular EH was displayed in 20% of SHL patients.

CONCLUSION

MRI criteria for EH allowed to distinguish pathology from healthy condition. However, EH appeared as a chronic disease rather than directly responsible of patient symptoms.

CLINICAL RELEVANCE/APPLICATION

We aimed to better explain pathophysiology of inner ear disorders, allowing better patient information and adapted therapeutic strategies in patients with endolymphatic hydrops.

SSA16-07 Superiority of Heavily T2-weighted 3D-FLAIR Over Regular 3D-FLAIR for the Detection of Cochlear Lymph Fluid Signal Abnormality in Patients with Sudden Sensorineural Hearing Loss

Sunday, Nov. 29 11:45AM - 11:55AM Location: N226

Participants
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Mitsuru Ikeda, MD, Nagoya, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE

To compare the signal increase of cochlear lymph fluid on 3D-FLAIR in patients with sudden sensorineural hearing loss (SNHL) between the regular contrast 3D-FLAIR (FL) and heavily T2-weighted 3D-FLAIR (HF).

METHOD AND MATERIALS

25 patients with unilateral sudden SNHL and 8 healthy volunteers were included. Patients were divided into mild group of 9 patients, average hearing level of 60 dB or less; and severe group of 16 patients, hearing level of more than 60dB. All patients and healthy volunteers underwent a MR cisternography (MRC) for anatomical reference of the fluid space, FL and HF at 3T. Region of interest (ROI) was manually drawn on mid-modiolar section of MRC around cochlea. ROI for noise was drawn in the air area. ROIs were copied onto FL and HF. Contrast-to-noise ratio (CNR) between affected and non-affected ear was measured in patients’ group and CNR between right and left ear was measured in control group. Differences in CNR on FL and HF among 3 groups were tested by one-way analysis of variance (ANOVA).

RESULTS

There was a statistically significant difference in the mean of CNR on HF among the three groups (p < 0.001). Further, from the pairwise comparisons among them, there was a statistically significant difference with each other in the mean of CNR on HF (p < 0.05). There was no statistically significant difference in the mean of CNR on FL among the three groups (p = 0.074).

CONCLUSION

HF is more sensitive to signal alteration of cochlea with sudden SNHL than FL.

CLINICAL RELEVANCE/APPLICATION

Heavily T2-weighted 3D-FLAIR (HF) is more sensitive to high signal of cochlea in the ears with sudden sensorineural hearing loss (SNHL) than regular contrast 3D-FLAIR (FL) .

SSA16-08 Three-Dimensional Fluid-Attenuated Inversion Recovery Signal Changes as a Prognosis Predictor in Idiopathic Sudden Sensorineural Hearing Loss

Sunday, Nov. 29 11:55AM - 12:05PM Location: N226

Participants
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Jiing-Feng Lirng, MD, Taipei, Taiwan (Abstract Co-Author) Nothing to Disclose

PURPOSE

To investigate the relationship of 3D FLAIR findings and outcome in patients with idiopathic sudden sensorineural hearing loss (ISSNHL).

METHOD AND MATERIALS

We retrospectively reviewed consecutive 66 patients presenting with unilateral ISSNHL from June 2013 to September 2014. Before treatment, all patients underwent MRI exams, including 3D-FIESTA, and 3D-FLAIR without gadolinium enhancement. One blind observer registered 3D-FIESTA and 3D-FLAIR on a dedicated workstation and drew ROIs to measure the signal intensity of cochlea in both affected and unaffected ears on 3D-FLAIR.

RESULTS

The ratio of the cochlear signals between the affected and unaffected ears showed significant correlation with the severity of pre-treatment hearing loss and the clinical outcome (Siegel criteria) after treatment. The increased FLAIR signal intensity is a specific prognostic predictor of poorer outcome (Siegel grade III/IV) after treatment. (sens./spec: 32%/86% (cutoff value: 1.2) and 5%/91% (cutoff value, 1.4)).
CONCLUSION
This study demonstrated a correlation between cochlear FLAIR signal and pre-treatment hearing level, and post-treatment outcome. Increased FLAIR signal is a specific prognostic predictor of poorer outcome after treatment.

CLINICAL RELEVANCE/APPLICATION
The causes of sudden deafness now are still idiopathic. In general, labyrinthitis caused by viral infection, blood circulation disorders, or ruptures of the inner ear membrane are believed to cause sudden deafness. The unpredictability of idiopathic sudden sensorineural hearing loss (ISSNHL) presents a challenge to preventive care. Prognosis can be predicted that the patients poor post-treatment outcome from the high intensity signal inner ear of 3D FLAIR sequence on MRI.

SSA16-09  Flat Panel CT in Diagnosis of Superior Canal Dehiscence. A Really New Diagnostic Approach?
Sunday, Nov. 29 12:05PM - 12:15PM Location: N226

Participants
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Martin Westhofen, Aachen, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE
Superior canal dehiscence (SCDS) is a rare defect, caused by a thinning or complete absence of temporal bone overlying superior semicircular canal of vestibular system. Treatment of choice is covering the defect with ceramic implant. Flat panel CT is an innovative technique that permits visualization of the complex anatomy of temporal bone with high spatial resolution. The utility of flat panel CT has been demonstrated in multiple disease states including neurovascular disease, peripheral vascular disorders and oncology. We therefore evaluated flat panel CT in diagnosis of SCDS.

METHOD AND MATERIALS
30 patients (m = 18/ f = 12) age 36 - 63 (m= 48,2) with symptoms of SCDS underwent flat panel CT examination between January 2013 and January 2015. 13 patient underwent MSCT imaging before, these images were assessed as normal. Flat panel CT was performed by Siemens Axion Artis, rotation 220°. Postprocessing was done at Siemens leonardo workstation with reconstructions in bone window in 3D projection and adapted to superior semicircular canal. Applied Radiation dose inbetween flat panel CT and MSCT was compared.

RESULTS
In 5/ 17(29%) patients who underwent flat panel CT imaging SCDS was confirmed. In 6/ 13 (46%) patients who underwent MSCT and flat panel CT defect of temporal bone overlying superior semicircular canal was found and SCDS was intraoperatively confirmed. Applied radiation dose was nearly equal (flat panel CT 276, 5mGy/ cm / MSCT 277,4mGy/ cm).

CONCLUSION
Flat panel CT should be performed in cases with symptoms SCDS when MSCT is assessed normal. It is a reliable diagnostic tool and a new diagnostic approach in diagnosis of SCDS.

CLINICAL RELEVANCE/APPLICATION
Flat panel imaging is a reliable tool in imaging temporal bone and inner ear structures and can improve preoperative virtual planning.
PURPOSE
Carotid intraplaque hemorrhage (IPH) is associated with a high risk of future stroke. The gold standard for IPH detection is MRI with heavily T1-weighted sequences. This study was undertaken to determine essential CTA imaging predictors of carotid IPH.

METHOD AND MATERIALS
In this IRB-approved retrospective cross sectional study, 172 patients (244 carotid arteries) were studied having undergone carotid disease workup with both MRA and CTA from 2009-present. IPH was detected with the Magnetization Prepared Rapid Acquisition Gradient-recalled Echo (MPRAGE) sequence. CTA predictors included the presence or absence of calcification, type of calcification (rim, adventitial or bulky), percent diameter stenosis, mm stenosis, maximum plaque thickness, ulceration, and intraluminal thrombus. Clinical covariates included age, male sex, diabetes, hypertension, hyperlipidemia and body mass index. Cardiovascular medication confounders included antihypertension, antiplatelet, anticoagulation and statin medication classes. A mixed effects multivariable Poisson regression model was used accounting for 2 vessels per patient. A backwards-elimination method was used to determine the final model, in which prevalence ratios were reported and all remaining predictors had a p<.10. ROC analysis was used to determine discriminatory power measured by area under the curve (AUC).

RESULTS
The final model for carotid IPH prediction included the rim sign (prevalence ratio, PR=8.6, p<.001, 95%CI: 4.0,18.5) and maximum plaque thickness (PR=1.2, p=.001, 95%CI: 1.1,1.4). In the final model, no other imaging criteria were significant predictors of IPH. The discriminatory value of the final model was extremely high (AUC=93.9%), significantly higher than the rim sign alone (86.1%, p<.001), thickness alone (85.2%, p<.001), NASCET stenosis (78.4%, p<.001), mm stenosis (77.7%, p<.001) or ulceration (71.0%, p<.001).

CONCLUSION
The carotid CTA rim sign is highly predictive of carotid IPH.

CLINICAL RELEVANCE/APPLICATION
Because most patients undergoing acute stroke workup receive lumen imaging with CTA, MRI is often not performed and IPH is ignored. The CTA rim sign and maximum plaque thickness allow high discrimination of carotid IPH. Future prospective studies may be envisioned to determine if the rim sign indicates a higher future stroke risk.
using age, sex, hypercholesterolemia, and peripheral vascular disease (AUC 0.781, 95% CI 0.747 to 0.815). Optimal threshold sensitivity and specificity was 81.8% and 62.4%, respectively. The addition of carotid stenosis grade improved discrimination of patients (AUC 0.826, 95% CI 0.795 to 0.856), and improved optimal threshold specificity to 72.8% without a significant change in sensitivity.

CONCLUSION
Patients prone to high-risk carotid plaque, containing intraplaque hemorrhage, may be identified using a simple clinical risk prediction model of cardiovascular risk-factors and carotid stenosis grade.

CLINICAL RELEVANCE/APPLICATION
The model provides an opportunity for targeted carotid MRI screening in patients not already undergoing neurovascular MRI, but external validation studies are required.

SSA17-03 Identification of the Vulnerable Carotid Plaque Using Dynamic Contrast Enhanced Ultrasound

Sunday, Nov. 29 11:05AM - 11:15AM Location: N227

Participants
Brahman Dhammarajah, MBBS, MRCS, London, United Kingdom (Presenter) Nothing to Disclose
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Damianos Christofides, MSc, Nicosia, Cyprus (Abstract Co-Author) Nothing to Disclose
Ankur Thapar, MBBS, MRCS, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Alan Davies, FRCR, London, United Kingdom (Abstract Co-Author) Nothing to Disclose

PURPOSE
Carotid atherosclerosis is implicated in 15-20% of all strokes. Dynamic contrast enhanced ultrasound (DCEUS) is a simple adjunct to color Doppler ultrasound for the assessment of carotid atherosclerosis. It has been identified that DCEUS can demonstrate perfusion within carotid plaques of greater than 50% stenosis with some differentiation observed between symptomatic and asymptomatic patients. In this study the perfusion of carotid plaques is evaluated both qualitatively and quantitatively to evaluate carotid perfusion of symptomatic and asymptomatic patients.

METHOD AND MATERIALS
After ethical approval, the carotid arteries of 24 patients were imaged using the L9-3 probe of the Philips iU22 ultrasound platform. Patients were injected with a bolus of 2ml of Sonovue with subsequent dynamic phase imaging acquisition. Offline blinded analysis was performed using DICOM data transferred to QLAB commercial analysis software. Qualitative perfusion assessment used binary grading: 0 represented less than 50% of carotid plaque area contained moving microbubbles and 1 represented more than 50% of carotid plaque area contained moving microbubbles. Static reflectors were not considered as valid microbubble signal. For quantitative DCEUS analysis, a region-of-interest (ROI) was drawn around the plaque. Plaques were delineated from the lumen signal to remove potentially large amplitude differences between the plaque and lumen signal intensity. A time intensity curve (TIC) was derived from the dynamic phase ROI signal with mean plaque intensity signal calculated from the TIC.

RESULTS
The qualitative analysis results showed that 75% (9/12) of asymptomatic patients had >50% carotid plaque perfusion in comparison to only 33% (4/12) of symptomatic patients. After quantitative image analysis, the mean DCEUS intensity signal from the TIC of the carotid plaques was again significantly higher for asymptomatic patients than symptomatic patients (P<0.05).

CONCLUSION
Contrary to previous studies, this study suggests that patients with greater carotid plaque perfusion are more likely to have an asymptomatic carotid symptom status where as those with reduced perfusion are more likely to be symptomatic from their carotid disease.

CLINICAL RELEVANCE/APPLICATION
In patients with greater than 50% carotid stenosis, reduced plaque perfusion on DCEUS may represent vulnerable, symptomatic carotid atherosclerosis.

SSA17-05 Advanced Atherosclerotic Disease with Intraplaque Hemorrhage is Present in Non-Stenotic Carotid Arteries of Diabetic Patients

Sunday, Nov. 29 11:25AM - 11:35AM Location: N227

Participants
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David Jenkins, Toronto, ON (Abstract Co-Author) Nothing to Disclose

PURPOSE
Diabetic patients have an increased risk of ischemic cerebrovascular events with worse outcomes than the non-diabetic population. Carotid artery stenosis currently stratifies patient risk but, even without significant stenosis, intraplaque hemorrhage (IPH) may predict cerebrovascular events. We report the prevalence of IPH in an asymptomatic diabetic population without carotid artery stenosis, using 3-dimensional (3D) magnetic resonance imaging (MRI) and investigate its association with carotid artery wall...
METHOD AND MATERIALS

Patients were recruited from a prospective dietary trial between 2010 and 2013, with a carotid intima-media thickness (IMT) > 1.2mm and non-stenotic carotid arteries on ultrasound. All were asymptomatic type 2 diabetic patients who underwent baseline 3D T1-weighted black blood imaging for visualization of intraplaque hemorrhage (3D-MRIPH) and 3D- time of flight imaging. Carotid artery vessel wall (VW) volumes and IPH volumes were determined bilaterally for a standard 32 mm segment centered at each carotid bifurcation, using a validated approach with the software, VesselMASS (Medis, Netherlands). Descriptive statistics as well as repeated measures linear regression analyses were performed.

RESULTS

159 patients were included with mean age 63.1 ± 7.9 years, 62.3% male, 17.9% with a smoking history and 69.2% on hypertensive medication. The prevalence of IPH was 23.3% (n=37) with five patients exhibiting IPH in both carotid arteries. VW volume of the IPH positive carotid arteries was found to be significantly different from IPH negative arteries (β=0.15mm³ SE=0.03, p<0.01) and independent from other factors that affected VW volume - age (β=0.01yrs SE=0.002, p<0.01), sex (β=0.21 SE=0.04, p<0.01), BMI (β=0.22 SE=0.10, p=0.03) - when adjusted (none significant) for disease duration, smoking, blood pressure, and medications (statins, anti-hypertensive, anti-platelet).

CONCLUSION

IPH can be found in the absence of carotid artery stenosis in asymptomatic diabetic patients and is associated with an increased carotid artery wall volume as measured by 3D-MRI. It represents a biomarker of advanced atherosclerotic disease and may identify individuals at higher risk of cardiovascular disease.

CLINICAL RELEVANCE/APPLICATION

3D MRI can identify high risk cardiovascular biomarkers, such as intraplaque hemorrhage, in diabetic patients before onset of stenosis.

**SSA17-06** Feasibility of High-resolution MR Imaging for the Diagnosis of Posterior Inferior Cerebellar Artery Dissection

Participants
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Yoolim Baek, MD, Suwon, Korea, Republic Of (Presenter) Nothing to Disclose

PURPOSE
To evaluate the feasibility of HR-MR imaging diagnosing posterior inferior cerebellar artery (PICA) dissection and to find most useful imaging findings suggesting dissection

METHOD AND MATERIALS

We retrospectively reviewed 104 patients suspected of having arterial dissection involving posterior cerebral circulation and underwent HR-MR imaging between March 2012 and March 2015. 66 patients were diagnosed with arterial dissection involving posterior cerebral circulation and 16 patients among them (24.2%) were diagnosed with isolated PICA dissection by the consensus among neuroradiologists, neurointerventionist and neurologist after reviewing all clinical and paraclinical investigations available at hospital discharge (initial CT, MR, DSA images and etiologic work-ups) and follow up. Two neuroradiologists independently reviewed the HR-MR images of patients finally diagnosed as PICA dissection and looked for evidence of dissection (mural hematoma, dissection flap, outer diameter enlargement on T2WI) on each sequence of HR-MRI (PDWI, T2WI, T1WI and CE-T1WI). Inter- and intraobserver agreement for detecting evidence of dissection was estimated using the Cohen’s kappa coefficient.

RESULTS

Dissection flaps were seen in all cases on T2WI (100%) and secondly detected on CE-T1WI (81.3%). Outer-diameter enlargement of the steno-occlusive lesions on angiography was detected in most of cases (81.3%). A mural hematoma was best detected on CE-T1WI (50.0%). The two reviewers showed substantial to almost perfect agreement for detecting dissection signs on every sequence (Cohen’s kappa coefficient: 0.63 ~0.94)

CONCLUSION

HR-MR imaging could be a useful and non-invasive diagnostic tool for PICA dissection and dissection flap with outer wall enlargement on T2WI is most confident sign for suggesting dissection.

CLINICAL RELEVANCE/APPLICATION

HR-MR imaging can demonstrate direct findings of dissection and be non-invasive useful diagnostic tool for the diagnosis of posterior inferior cerebellary artery dissection

**SSA17-07** Correlation of Carotid Plaque Features with Acute Cerebral Infarction in Type 2 Diabetic Patients - A Magnetic Resonance Imaging Study

Participants
Beibei Sun, Shanghai, China (Presenter) Nothing to Disclose
Huilin Zhao, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Xiaosheng Liu, PhD, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Ye Cao, Shanghai, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the feasibility of HR-MR imaging diagnosing posterior inferior cerebellar artery (PICA) dissection and to find most useful imaging findings suggesting dissection

METHOD AND MATERIALS

We retrospectively reviewed 104 patients suspected of having arterial dissection involving posterior cerebral circulation and underwent HR-MR imaging between March 2012 and March 2015. 66 patients were diagnosed with arterial dissection involving posterior cerebral circulation and 16 patients among them (24.2%) were diagnosed with isolated PICA dissection by the consensus among neuroradiologists, neurointerventionist and neurologist after reviewing all clinical and paraclinical investigations available at hospital discharge (initial CT, MR, DSA images and etiologic work-ups) and follow up. Two neuroradiologists independently reviewed the HR-MR images of patients finally diagnosed as PICA dissection and looked for evidence of dissection (mural hematoma, dissection flap, outer diameter enlargement on T2WI) on each sequence of HR-MRI (PDWI, T2WI, T1WI and CE-T1WI). Inter- and intraobserver agreement for detecting evidence of dissection was estimated using the Cohen’s kappa coefficient.

RESULTS

Dissection flaps were seen in all cases on T2WI (100%) and secondly detected on CE-T1WI (81.3%). Outer-diameter enlargement of the steno-occlusive lesions on angiography was detected in most of cases (81.3%). A mural hematoma was best detected on CE-T1WI (50.0%). The two reviewers showed substantial to almost perfect agreement for detecting dissection signs on every sequence (Cohen’s kappa coefficient: 0.63 ~0.94)

CONCLUSION

HR-MR imaging could be a useful and non-invasive diagnostic tool for PICA dissection and dissection flap with outer wall enlargement on T2WI is most confident sign for suggesting dissection.

CLINICAL RELEVANCE/APPLICATION

HR-MR imaging can demonstrate direct findings of dissection and be non-invasive useful diagnostic tool for the diagnosis of posterior inferior cerebellary artery dissection
Early Atherosclerotic Disease Detected by MRI and CT in the Carotid and Coronary Arteries in Low-moderate Risk Individuals

Sunday, Nov. 29 11:55AM - 12:05PM Location: N227

Participants
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David A. Bluemke, MD, PhD, Bethesda, MD (Presenter) Research support, Siemens AG

PURPOSE
We examined the relationship between positive remodeling in the carotid and coronary arteries and investigated determinants of remodeling in a population with low-moderate risk of cardiovascular disease.

METHOD AND MATERIALS
Study subjects >55 years old with history of hypercholesterolemia underwent high resolution black blood carotid MRI using dedicated surface coils at 3T. In addition, CT angiography was performed using 320 slice scanning. Arterial wall area (outer vessel area-lumen) and the remodelling index (RI) (wall area/outer vessel area) were measured by observers blinded to clinical status. Data were analyzed using Spearman's correlation coefficient and multivariate linear regression analysis adjusted for sex, age, height and weight.

RESULTS
In 201 individuals (mean age 65.3±6.5, 64% men) with a low-moderate risk (Framingham Risk Score 7.8±7.6%), we found a strong association between wall area and outer vessel area in both the carotid (r=0.80; p<0.001, adjusted beta 1.67 [95%CI 1.43-1.92]) as well as the coronary arteries (r=0.82; p<0.001, adjusted beta 1.48 [95%CI 1.24-1.72]). This association was stronger when we compared the third tertile of lumen area to the first tertile, indicating more outward remodeling. The RI of the right and left carotid artery in a study subject was strongly correlated (r=0.75, p<0.001), whereas intra-individual RI between carotid and coronary artery was weak (r=0.20, p<0.001). In multivariate analysis, hypercholesterolemia, height and CAC score were associated with the RI of the coronary arteries.

CONCLUSION
This study is the first to combine MRI and CT imaging to investigate positive remodeling in the carotid and coronary arteries of low-moderate risk individuals from the general population. Early atherosclerosis was associated with positive remodeling with larger diameter in the coronary and carotid arteries. Positive remodeling was not the same for different vascular beds.
Detection of positive remodeling and understanding its role in early atherosclerotic disease could improve prevention strategies and management of stroke and coronary heart disease.

**SSA17-09 Characterization of Restenosis after Carotid Endarterectomy Using Contrast-Enhanced Black Blood MRI**

**Sunday, Nov. 29 12:05PM - 12:15PM Location: N227**

**Participants**
Huan Yang, Baltimore, MD (Presenter) Nothing to Disclose
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Bruce A. Wasserman, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To characterize restenosis after carotid endarterectomy (CEA) using high-resolution contrast-enhanced black blood MRI (CEMRI) and compare with primary atherosclerotic lesions.

**METHOD AND MATERIALS**
17 consecutive patients (10 male; mean age 73.4±11.9 years) with carotid restenosis (13 unilateral; 4 bilateral) after CEA underwent CEMRI at 3T. The median interval between surgery and CEMRI was 16.5 months (IQR, 9.3-95.5 months). Patients were matched with 20 asymptomatic patients with primary carotid atherosclerosis (19 unilateral; 1 bilateral) by age and luminal stenosis. All MRI images were de-identified and interpreted by two readers who were blinded to the history of CEA. The presence of plaque and plaque components was recorded for each lesion based on previous criteria on CEMRI. The lesions were classified as plaques or intimal hyperplasia based on the presence/absence of plaque features on CEMRI. The MRI morphological measurements included wall thickness (WT), area, normalized wall index and eccentricity (maximum WT - minimum WT)/maximum WT), and the signal measurements included heterogeneity (defined by coefficient of variation of signal intensity) and contrast-enhancement (%CE, the percent change in signal intensity from the pre- to post-contrast images).

**RESULTS**
A total of 42 carotid lesions from 37 patients were analyzed, and classified as primary plaques (n=21), recurrent plaques (n=13) and intimal hyperplasia lesions (n=8). Compared with plaques (both primary and recurrent), lesions with intimal hyperplasia exhibited smaller eccentricity (0.48 vs. 0.74, p<0.001), lower signal heterogeneity (20.0% vs. 27.2%, p=0.004) and higher % CE (88.4% vs 43.9%, p=0.002). Recurrent plaques had similar MRI characteristics when compared with primary plaques. However, recurrent lesions demonstrated higher CE (57.5% vs 35.4%, p=0.046) and more frequently involved in the medial wall of the internal carotid artery, an uncommon location for a plaque formation (recurrent vs. primary; 38.5% vs 4.8%, p<0.001).

**CONCLUSION**
Carotid restenosis from intimal hyperplasia demonstrated distinct imaging characteristics on CEMRI compared with atherosclerotic lesions.

**CLINICAL RELEVANCE/APPLICATION**
The phenotype of the restenotic lesions after CEA imposes different stroke risks. CEMRI imaging allows for the differentiation of these lesions and may provide insight into the treatment of restenosis.
Neuroradiology (New Techniques in Brain Tumor Imaging)

Sunday, Nov. 29 10:45AM - 12:15PM Location: N229

SSA18-01 Electrical Conductivity Characteristics of Glioma and Potential Usefulness of Noninvasive Electrical Conductivity Measurement in Evaluation of Glioma

Sunday, Nov. 29 10:45AM - 10:55AM Location: N229

Participants
Eu-Meng Law, MBBS, Los Angeles, CA (Moderator) Speakers Bureau, Toshiba Corporation; Medical Advisory Board, Bayer AG; Medical Advisory Board, Bracco Group; Medical Advisory Board, FUJIFILM Holdings Corporation; Rivka R. Colen, MD, Houston, TX (Moderator) Nothing to Disclose

Sub-Events

PURPOSE
Direct electrical conductivity measurements to identify tumor location, before the era of CT and MRI, had documented difference in electrical conductivity values of tumors from normal brain parenchyma and among tumor types. Recent advances in MRI have allowed noninvasive measurement of electrical conductivity values. This study aimed to noninvasively determine the electrical conductivity characteristics of glioma and evaluate potential usefulness of noninvasive electrical conductivity measurement in glioma evaluation.

RESULTS
The contrast-enhanced tumor component of grade III gliomas had higher mean and mode of electrical conductivity histograms than the non-contrast-enhanced tumor component and normal-appearing brain parenchyma (P<0.017). The non-contrast-enhanced tumor component of grade II gliomas had higher mean electrical conductivity than the normal brain parenchyma (P=0.012). Mode of electrical conductivity histograms for both components of grade IV tumors were higher than grade III tumors (P<0.017).

CONCLUSION
The electrical conductivity characteristics of glioma were determined noninvasively by MRI. Electrical conductivity difference of gliomas from the normal brain parenchyma and between tumor grades suggests potential usefulness of noninvasive electrical conductivity measurement in glioma evaluation.

CLINICAL RELEVANCE/APPLICATION
Information about tissue electrical conductivity can be obtained noninvasively by MRI; and this information can be beneficial in distinguishing gliomas.

SSA18-02 Symptomatic Seizures in Primary Glioblastoma: A Radiogenomic Approach towards a Possible Prognostic Factor

Sunday, Nov. 29 10:55AM - 11:05AM Location: N229

Participants
Vera C. Keil, MD, Bonn, Germany (Presenter) Nothing to Disclose
Tunc F. Ersoy, Bonn, Germany (Abstract Co-Author) Nothing to Disclose
Dariusch R. Hadizadeh Kharrazi, MD, Bonn, Germany (Abstract Co-Author) Nothing to Disclose
Hans H. Schild, MD, Bonn, Germany (Abstract Co-Author) Nothing to Disclose
Matthias Simon, Bonn, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE
In patients with primary glioblastoma (pGB), tumor-induced seizures (TIS) are a common symptom and are possibly a positive prognostic factor for progression free and overall survival (PFS, OS). Explanations of the pathogenesis of TIS range from tumor location and pressure effects to neurochemical particularities based on the genetic profile of the tumor. This study evaluates if TIS in pGB can be correlated with imaging or genetic aspects of the lesion.

METHOD AND MATERIALS
Retrospective analysis of pre-operative 3 T MRI brain scans (Achieva TX; Philips Healthcare) of 64 pGB patients (29 with TIS; 35 without seizures). Analysis criteria: gender, age, PFS and OS, genetic profile (TERT mutation/rs2853669 polymorphism, MGMT promoter status), midline shift, subventricular pGB growth, bilaterality, multifocality as well as multiple volume ratios. Volumetry of contrast-enhancing (vital) tumor (CER), central necrosis (CN) and peri-focal FLAIR hyperintensities was based on 3D contrast-enhanced T1w, T2w and FLAIRw maps. MRI were analyzed with post-processing software (Philips Intellispace) by three readers.
independently. Statistic analyses were performed with SPSS 22.0 with TIS as the independent variable.

RESULTS
OS was significantly longer in pGB patients with TIS (p=0.004). There was a tendency for longer PFS in this group (p=0.08; mean 13.3 vs. 8.3 months). In pGB patients with TIS, total tumor volume was significantly smaller (p=0.017; 50.3 v. 29.4 cm³) and the tumor was significantly more often found in the subventricular zone, yet surprisingly not in the hippocampal area. TIS was not associated with any of the tested genetic markers known to be associated with longer OS and PFS.

CONCLUSION
TIS in pGB patients could significantly be correlated with distinct imaging aspects of the tumor (size and location) as well as with longer OS and PFS. Commonly analyzed genetic markers for OS and PFS (MGMT, hTERT) were yet not associated with TIS.

CLINICAL RELEVANCE/APPLICATION
While TIS proved a prognostic factor for OS and PFS, this is not correlated with MGMT and hTERT status in pGB, but TIS does correlate with distinct imaging aspects on MRI. Whether TIS lead to earlier diagnoses of pGB and hence longer OS/PFS due to smaller tumor volume remains an intricate question to solve.

SSA18-03 Investigation into the Effect of Diagnostic Ultrasound and Microbubble on the Blood-Brain Tumor Barrier Permeability of C6 Glioma

Participants
Jinlong Zhang, PhD, Chongqing, China (Presenter) Nothing to Disclose
Weiguo Zhang, Chongqing, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To explore the effect of microbubble-enhanced diagnostic ultrasound (MEUS) on the blood-brain tumor barrier permeability and the possible mechanism.

METHOD AND MATERIALS
C6 Glioma-bearing Sprague-Dawley rats were assigned to 3 separate groups; the microbubble-enhanced continued diagnostic ultrasound group (CMEUS), the microbubble-enhanced intermittent diagnostic ultrasound group (IMEUS) and the control group. Rats were sonicated through skull with low-frequency diagnostic ultrasound and injected with Evans Blue (EB) dye and microbubbles through their tail veins to test changes in capillary permeability. Confocal laser scanning microscopy was used to observe the deposition of red fluorescence-dyed EB in tumor tissues. HE staining and MRI SWI were used to evaluate whether MEUS can damage normal brain tissue. The distribution and expressing levels of JAM-1 and calcium-activated potassium channels (Kca channels) was detected by western blot and immunohistochemical.

RESULTS
In the MEUS groups, EB exudation exhibited a significant increase in the tumor tissue compared with the control group. While the IMEUS group had more EB exudation than the CMEUS group. LSCM showed that a bright red fluorescence of EB was extensively distributed in the tumor interstitium. Western blot and immunohistochemical revealed MEUS significantly increased Kca channel protein expression and reduced JAM-1 expression in glioma tissue. And this changes were more obvious in the IMEUS group than the CMEUS group.

CONCLUSION
MEUS could effectively increase blood-brain tumor barrier permeability without causing damage to normal nerve tissue. The mechanism might be up-regulation of Kca channels expression in glioma tissue and affecting the formation of tight junction in blood-brain tumor barrier by reduction of JAM-1 expression. These findings might provide some new guidance to find a therapeutic option to site-specific open the BTB and deliver anti-cancer agents to glioma.

CLINICAL RELEVANCE/APPLICATION
These findings might provide some new guidance to find a therapeutic option to site-specific open the BTB and deliver anti-cancer agents to glioma.

SSA18-04 Improved Clinical DCE-MRI Pipeline for High Resolution, Whole Brain Imaging: Application to Brain Tumor Patients

Participants
Krishna S. Nayak, PhD, Los Angeles, CA (Presenter) Nothing to Disclose
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PURPOSE
To develop novel DCE-MRI acquisition, reconstruction, and processing approaches that are targeted towards providing complete clinical assessment of brain tumors

METHOD AND MATERIALS
A novel DCE-MRI acquisition, reconstruction, and processing scheme which is able to complete whole brain DCE-MRI
A clinical prospective evaluation of a novel sparse sampling and constrained reconstruction scheme to enable whole brain DCE-MRI imaging (22x22x20 cm³ coverage at spatial resolution of 0.9x0.9x1.9mm³) is demonstrated. Our approach uses multiple sparsity constraints in the spatial and temporal domain, which are spatial wavelet, spatial total variation and temporal finite difference, all with low weights, to mitigate potential bias from any one constraint. We compare with a current clinical scan (Rate 2 SENSE: 22x22x4.2cm³ at spatial resolution of 0.9x1.3x7mm³) on 15 brain tumor (BT) patients. PK parameters (Ktrans, vp) were derived, and image quality scores (4 point Likert scale) from two experienced neuroradiologists were used to evaluate the anatomic images and PK maps. We also propose two novel constraints that leverage knowledge from the PK model, to improve the above constraints, and obtain reduced dependence on free parameters; these are evaluated in a retrospective undersampling study of 10 BT patients.

RESULTS
We obtained higher image quality scores with our experimental scan compared to the clinical scan. The combined radiologists scores for each of the time-resolved, post-contrast, Ktrans images, respectively for the accelerated and clinical scans were 1.2± 0.6 v/s 2.2±0.7 (p<0.001). Fig1 demonstrates two examples of improved volume coverage in imaging a patient with a 6cm glioblastoma multiforme tumor, and a patient with 14 metastatic lesions spread throughout the brain. In the retrospective study, the novel PK derived constraints achieved improved PK parameter map depiction at acceleration rates greater than 20; (not shown)

CONCLUSION
A novel high resolution whole brain DCE-MRI method using constrained reconstruction that is clinically feasible is demonstrated; which constituted a substantial 36 fold improvement in resolution and coverage compared to current clinical scans

CLINICAL RELEVANCE/APPLICATION
The combined use of modern sparse sampling, and constrained reconstruction techniques enables whole brain isotropic resolution DCE-MRI which greatly improves the clinical value of DCE-MRI in characterizing brain tumors (eg. guaranteed imaging of large tumors, multiple small lesions, assessment of anti-angiogenic therapies for brain tumors).

SSA18-05 Two-dimensional Localized Correlated Spectroscopy (2D L-COSY) at 7T for Detection of 2-hydroxyglutarate in Gliomas with IDH Mutations

Participants
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Rajakumar Nagarajan, PhD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose

PURPOSE
Mutations in the isocitrate dehydrogenase (IDH) 1 and 2 genes in oligodendrogioma, astrocytoma and secondary glioblastoma are associated with better prognosis. Previous magnetic resonance spectroscopy (MRS) studies have suggested the oncometabolite 2-hydroxyglutarate (2HG) as a potential biomarker for these mutant gliomas. Two-dimensional localized correlated spectroscopy (2D L-COSY) has demonstrated unambiguous and reliable measurement of several brain metabolites, including 2HG. Spectroscopy at ultra-high fields affords proportionally higher signal quality and spectral separation resulting in improved sensitivity and specificity. In this study we demonstrate the utility of 2D L-COSY for detection of 2HG in human gliomas.

METHOD AND MATERIALS
Seven brain tumor patients with prior magnetic resonance imaging/spectroscopy (MRI/MRS) scans at 3T were studied using 2D L-COSY on a 7T body-scanner with a 32-channel transmit/receive head coil. Scan parameters were as follows: TE = 20 ms, TR = 2 s, 8 averages, 64 x 11 increments of 0.4 ms, 2048 x 12 points with F2 bandwidth = 4000 Hz and F1 bandwidth = 2500 Hz, scan time 17 min. Voxels were localized using T2-weighted fluid-attenuated inversion recovery (FLAIR) imaging and ranged from 11-15 mL. L-COSY data were reconstructed offline using a custom MATLAB-based post-processing algorithm and quantified through peak volume integration. IDH1/2 mutation status was subsequently determined with pathology.

RESULTS
2D L-COSY detected 2HG peaks in two of the seven patients. A third patient was prospectively declared inconclusive due to artifact ridging in the region where 2HG would be expected. Pathology results confirmed IDH1 mutation in these three patients and the absence of mutation in the remaining four. 2D L-COSY further demonstrated the unambiguous separation of other metabolites including choline-containing metabolites like phosphocholine (PC) and glycerophosphocholine (GPC) and separation of lactate (Lac) from background lipid signal.

CONCLUSION
This study using 2D L-COSY represents the unambiguous detection of 2HG in vivo at 7T, which could serve as an biomarker for malignant progression in brain tumors.

CLINICAL RELEVANCE/APPLICATION
Pre-surgical detection of 2HG could alter treatment strategies as both an early marker for malignant progression and as an endpoint for targeted therapy (AGIOS 121 drug) against IDH1 mutation.
Habitat on Treatment-naïve MRI Predict Clinical Survival in Glioblastoma Patients

Computer Extracted Texture Descriptors from Different Tissue Compartments within the Tumor

Sunday, Nov. 29 11:35AM - 11:45AM Location: N229

Participants
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Hao Yu, Guangzhou, China (Abstract Co-Author) Nothing to Disclose
Yufa Li, Guangzhou, China (Abstract Co-Author) Nothing to Disclose
Zhibo Wen, Guangzhou, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To show the ability of using the novel amide proton transfer-weighted (APTW, sensitive to mobile proteins, such as those in the cytoplasm), as well as conventional magnetization transfer (MT, sensitive to semi-solid macromolecules) MRI signals as imaging biomarkers to differentiate primary CNS lymphomas (PCNSLs) from high grade gliomas (HGGs), and evaluate the correlations between APTW and MT imaging signals and nuclear-cytoplasm (N/C) ratios.

METHOD AND MATERIALS
Eleven patients with lymphomas and 21 patients with HGGs were studied. MT spectra over an offset range of ±6 ppm (eight acquisitions at ± 3.5 ppm to increase the signal-to-noise ratio) and the conventional MT ratio (MTR) at 15.6 ppm (2 kHz) were acquired. The multiple APTW signals and MTR signal were obtained and compared between PCNSLs and HGGs. The diagnostic performance was assessed with the receiver-operating-characteristic (ROC) analysis. Image analysis software (Image-Pro Plus) was applied to calculating N/C ratios on HandE sections.

RESULTS
The PCNSLs usually showed more homogeneous APTW hyperintensity (spatially compared to the normal brain tissue) than the HGGs. The maximum APTW signal (APTWmax) and APTW signal inhomogeneity (APTWmax-min = APTWmax - APTWmin) within a lesion were significantly lower (P < 0.05 and 0.001, resp.), while the MTR signal was significantly higher (P < 0.01) in PCNSLs than in HGG lesions. APTWmax-min had the highest area under the ROC (0.963) and accuracy (94.1%) in differentiating PCNSLs from HGGs. There were significantly larger N/C ratios in PCNSLs (1.69 ± 0.72) than in HGGs (0.55 ± 0.21; P < 0.01), consistent with the APTW and MTR measurements. There was a strong, significantly negative correlation between APTWmax and N/C ratio (R = 0.576, P < 0.01), and there was a moderate positive correlation between MTR and N/C ratio (R = 0.326, P < 0.084).

CONCLUSION
The endogenous protein-based APTW signal would be a valuable MRI biomarker that can provide an additional value to identify PCNSLs and HGGs presurgically.

CLINICAL RELEVANCE/APPLICATION
The addition of APT imaging to the currently used MRI protocol (including the conventional and advanced MRI sequences) would enhance the differential diagnostic accuracy of MRI between PCNSLs and HGGs ultimately.

Computer Extracted Texture Descriptors from Different Tissue Compartments within the Tumor

Sunday, Nov. 29 11:45AM - 11:55AM Location: N229

Participants
Pallavi Tiwari, PhD, Cleveland, OH (Presenter) Nothing to Disclose
Jay B. Patel, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Sasan Partovi, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Prateek Prasanna, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Anant Madabhushi, MS, Piscataway, NJ (Abstract Co-Author) Research partner, Siemens AG Research partner, General Electric Company Research partner, F. Hoffmann-La Roche Ltd Founder and President, IBiRIS, Inc

PURPOSE
Glioblastoma Multiforme (GBM) is a highly aggressive and heterogeneous brain tumor. Currently all GBM patients are given "one-dose-fit-all" treatment. Identification of prognostic markers can allow for personalized therapy options for GBM. The underlying hypothesis of this study is that the heterogeneity in GBM (due to subtle variations in tumor enhancement, cellular density, fibrosis, necrosis that are not visually appreciable on volumetric analysis of MRI) is prognostic and can be captured using computerized texture descriptors extracted from within different tumor compartments (enhancing tumor, necrotic core, edema). These compartments together define tumor "habitat", and computerized texture features from within the habitat can be predictive of short-term (STS) (overall survival (OS) <6-months) from long-term survival (LTS) (OS>24-months).

METHOD AND MATERIALS
A total of 62 3 Tesla MRI studies (27 STS, 35 LTS) with Gd-T1C, FLAIR, and T2w protocols were obtained from the TCIA repository. Enhancing tumor, and necrotic regions on Gd-T1 and edematous region jointly on T2-w and FLAIR, were manually segmented by an expert using Slicer 3D. 135 2-D texture descriptors on a per-voxel basis (e.g. co-occurrence matrices, gray-level dependence matrices, Gabor), and volumetric measurements were extracted from each of tumor, necrosis, edema compartments on every MRI protocol. Feature selection was used to identify most discriminative features with a random forest classifier trained via 3-fold cross validation. Kaplan-Meier (KM) curves were used for survival analysis, with correction for multiple hypothesis testing to identify features that were significantly (p<0.05) correlated with survival.

RESULTS
Contributions from top 18 texture features within the tumor habitat, (from edema, necrotic core, enhanced tumor), when analyzed together, were most significantly associated with survival, across Gd-T1-C (p=0.003), FLAIR (p=0.006), and T2-w (p=0.02) as compared to individual features, and volumetric measurements from the tumor habitat.
Computerized texture features when jointly interrogated across compartments within the tumor habitat appear more prognostic of clinical survival in GBM than features from enhancing tumor and tumor volume alone.

CLINICAL RELEVANCE/APPLICATION

Identifying MRI differences in survival characteristics for patients with long term and short-term survival can allow for designing personalized therapeutic decisions for GBM.

SSA18-08 Using Pre-Operative Dynamic Contrast-Enhanced MRI to Evaluate Tissue Factor Expression: A Potential Role in Prediction of Glioma Malignancy

Sunday, Nov. 29 11:55AM - 12:05PM Location: N229

Participants
Tian Xie, Chongqing, China (Presenter) Nothing to Disclose
Xiao Chen, Chongqing, China (Abstract Co-Author) Nothing to Disclose
Wei Xue, Chongqing, China (Abstract Co-Author) Nothing to Disclose
Weiguo Zhang, Chongqing, China (Abstract Co-Author) Nothing to Disclose

PURPOSE

To correlate dynamic contrast-enhanced MRI (DCE-MRI) parameters with tissue factor (TF) expression for assessing glioma malignancy

METHOD AND MATERIALS

Thirty-two patients with histopathologically diagnosed supratentorial glioma received DCE-MRI. Extended Tofts linear model based parameters (Ktrans, Kep, Ve, Vp) were obtained, which were analyzed by hot-spot and whole tumor cross-sectional method, as well as histogram. Four serial paraffin sections were stained with TF, CD105, CD34 and α-SMA, respectively. Percentage area of TF was calculated at 200 × magnification. Microvascular parameters were calculated at 100 x magnification, including microvascular density (MVD), microvascular area (MVA), proliferating capillary index (PCI), and microvessel pericyte coverage index (MCI), Pearson correlation was performed between TF and multiple microvascular indexes, DCE-MRI parameters.

RESULTS

TF was associated with glioma grade and significantly correlated with proliferating capillary index (PCI), microvascular pericyte coverage index (MCI) (r=0.798, p<.001; r=0.835, p<.001) and also showed moderate correlation with microvascular area (MVA) and microvessels density (MVD). Volume transfer constant from plasma to tissue (Ktrans) hot-spot value best correlated with TF (r=0.886, p<.001), followed by 90th percentile Ktrans value (r=0.801, p<.001). Moreover, histogram analysis of Ktrans value demonstrated that weak TF expression was associated with less heterogeneous and positively skewed distribution.

CONCLUSION

Correlation of TF with microvascular indexes indicated that TF tightly linked with glioma malignancy. And Ktrans parameters provided reliable estimation of TF expression in glioma patients.

SSA18-09 Chemical Shift Imaging (CSI) for Detection of 2-Hydroxyglutarate (2HG) in Human Gliomas at 3T

Sunday, Nov. 29 12:05PM - 12:15PM Location: N229

Participants
Gaurav Verma, PhD, Philadelphia, PA (Presenter) Nothing to Disclose
Harish Poptani, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
MacLean Nasrallah, MD, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Michael A. Thomas, PhD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Arati Desai, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Suyash Mohan, MD, Philadelphia, PA (Abstract Co-Author) Consultant, ACR Image Metrix; Investigator, Rad Dx

PURPOSE

The "oncometabolite" 2-hydroxyglutarate (2HG) has been shown to be an ideal biomarker for detection of isocitrate dehydrogenase (IDH) mutated gliomas. The presence of IDH mutation may be an early genetic marker of malignant transformation in gliomas and non-invasive detection of 2HG may aid in better treatment planning of these tumors. Chemical Shift Imaging (CSI) at 3T has been proposed for detection of 2HG and this study was performed to prospectively detect 2HG in tumors suspected of gliomas on imaging.

METHOD AND MATERIALS

Five patients were studied on a 3T scanner with a 12-channel receive head coil. Scan parameters were: TE=97 ms, TR=1.7s, NEX=3 with weighted phase-encoding, 1024 complex points, bandwidth=2000 Hz, 16x16 matrix, scan time 7 min. Voxel were localized using FLAIR or contrast enhanced images and were each 1 x 1 x 3 cm3. CSI data were reconstructed offline and quantified using the LCModel prior-knowledge based fitting program. A Cramer-Rao lower bound (CRLB) of 40% was used along with the criteria that multiple neighboring voxels show presence of 2HG. IDH1/2 mutation status was subsequently determined on pathology.

RESULTS

2HG resonance was detected in three patients who were later found to be: low grade (WHO Grade II, n=2) and high grade (WHO Grade III, n=1). The remaining two patients did not show a 2HG peak and were found to be: WHO grade IV, n=1; metastases, n=1. Presence of mutant IDH mutation was subsequently confirmed on pathology in all three patients where 2HG was detected while the
remaining two patients were IDH mutation negative.

CONCLUSION

LCModel fitting of CSI data successfully detected 2HG, confirming previous studies. This study further confirms the role of 2HG as a marker for malignant transformation indicating that IDH positive low grade gliomas where 2HG is detected should be treated more aggressively and can be ideal candidates for IDH targeted therapies.

CLINICAL RELEVANCE/APPLICATION

In vivo 2HG detection has significant translational implications: Early biomarker of malignant progression, treatment response and recurrence Endpoint for therapy (AGIOS 121 drug) targeted against IDH1
**LEARNING OBJECTIVES**

A radiologist attending this session will learn:
1. The stages of cortical development.
2. The malformations associated with abnormal neuronal proliferation and/or apoptosis.
3. The malformations associated with abnormal neuronal migration.
4. Learn the malformations associated with abnormal postmigrational development.

**ABSTRACT**

This presentation will review the stages of normal cerebral cortical development. Malformations of cortical development will be organized according to abnormal development at each stage: proliferation/apoptosis, migration, and postmigrational organization.

Tubulinopathies (e.g., polymicrogyria) and defects in the mTOR pathway (e.g., Tuberous Sclerosis) will illustrate emerging knowledge tying genotype to endophenotype.

**Active Handout:** Robert C. McKinstry


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**PURPOSE**

To evaluate the performance of monoexponential, biexponential, and continuous time random walk (CTRW) diffusion models for differentiating low-grade (LG) and high-grade (HG) pediatric brain tumors.

**METHOD AND MATERIALS**

With IRB approval, 54 children (4 months to 13 years old) with brain tumors were enrolled in the study and underwent MRI scans at 3T. The imaging protocol included pre-/post-contrast T1, T2, FLAIR, and diffusion-weighted imaging with 12 b-values (0 to 4000 s/mm²). The parameters of the mono-exponential (apparent diffusion coefficient, $D$), biexponential (fast and slow diffusion coefficients, $D_f$ and $D_s$; fast diffusion fraction, $f$) and CTRW (diffusion coefficient, $D_m$; fractional powers of the waiting time and jump length, $\alpha$ and $\beta$) models were estimated from the diffusion data. Surgical biopsy or surgery was performed to determine the tumor grade histopathologically according to the WHO guidelines, resulting in 24 patients with LG and 30 with HG tumors. The mean values of all parameters over the tumor ROIs were compared between the two groups using a Mann-Whitney-Wilcoxon U-test. A k-means clustering algorithm was employed to differentiate LG and HG tumors based on the biexponential or CTRW parameters, followed by a comparison using histopathology as a reference.

**RESULTS**

Significant differences between the two tumor groups (LG vs. HG) were observed in the parameters of any of the three models with $p$-values < 0.001 ($D$: $0.90 \pm 0.34$ vs. $0.56 \pm 0.17$ in monoexponential; $D_f$: $2.6 \pm 1.1$ vs. $1.8 \pm 0.5$, $D_s$: $0.58 \pm 0.1$ vs. $0.31 \pm 0.1$, $f$: $0.73 \pm 0.11$ vs. $0.59 \pm 0.09$ in biexponential; $D_m$: $1.5 \pm 0.5$ vs. $0.75 \pm 0.2$, $\alpha$: $0.95 \pm 0.04$ vs. $0.90 \pm 0.03$, $\beta$: $0.92 \pm 0.07$ vs. $0.81 \pm 0.06$ in CTRW, with $D$'s in units of $\mu m^2/ms$, $f$, and $\alpha$ and $\beta$ in units of $\mu m^2/msec$). The combination of CTRW parameters produced better accuracy (85% vs. 79%), sensitivity (87% vs. 83%), and specificity (83% vs. 75%) than the combination of biexponential parameters for identifying tumor grades. Both models outperformed the monoexponential model in accuracy (75%) and specificity (54%).

**CONCLUSION**

The CTRW diffusion model performed the best in determining pediatric brain tumor malignancy when compared with the monoexponential and biexponential models.
CONCLUSION

hernhage, with no statistically significant difference between these or the remaining evaluated features.

1.86, 2.16) (p<.0001).

PAs.

the cerebellar hemisphere. All PA-GGs predominantly involved midline structures (vermis, medulla, midbrain), compared to 13 of 34

Location differed significantly between PAs and PA-Gs (Pearson Chi-Square, p=0.0194); 16/34 PAs, but no PA-GGs, were centered in

thalamus).

RESULTS

were evaluated by two neuroradiologists blinded to pathologic diagnosis for tumor location and gross morphology; presence of

hemorrhage or calcification; circumscription; degree of enhancement, edema, and %cyst/necrosis; and minimum rADC (compared to

were evaluated by two neuroradiologists blinded to pathologic diagnosis for tumor location and gross morphology; presence of

hemorrhage or calcification; circumscription; degree of enhancement, edema, and %cyst/necrosis; and minimum rADC (compared to

METHOD AND MATERIALS

Pre-operative MRIs (and CTs where available) of 42 children (3mo-15 years, mean 7.11±3.8 years; 57% male; 8 PA-GG, 34 PA) were
evaluated by two neuroradiologists blinded to pathologic diagnosis for tumor location and gross morphology; presence of

hemorrhage or calcification; circumscription; degree of enhancement, edema, and %cyst/necrosis; and minimum rADC (compared to

thalamus). Data for PA-GG and PA were compared.

RESULTS

Location differed significantly between PAs and PA-Gs (Pearson ChiSquare, p=0.0194); 16/34 PAs, but no PA-GGs, were centered in

the cerebellar hemisphere. All PA-GGs predominantly involved midline structures (vermis, medulla, midbrain), compared to 13 of 34

PAs. Minimum rADC was significantly lower in PA-GGs (mean 0.95±0.21; 95%CI 0.73, 1.17) than in PAs (mean 2.01±0.38; 95%CI

1.86,2.16) (p<.0001). 24/34 PAs and 1/8 PA-GGs had “cyst-nodule” morphology, 7/34 PAs and 4/8 PA-GGs had evidence of

hemorrhage, with no statistically significant difference between these or the remaining evaluated features.

CONCLUSION

VSPD11-03 Evaluation of Pediatric Intracranial Tumors with Intravoxel Incoherent Motion MR Imaging

Sunday, Nov. 29 11:15AM - 11:25AM Location: S100AB

Participants

Kazufumi Kikuchi, MD, Fukuoka, Japan (Presenter) Nothing to Disclose
Ako Hwataishi, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Osamu Togao, MD, PhD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Koji Yamashita, MD, PhD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Tomoyuki Okuaki, RT, Chuo-Ku, Japan (Abstract Co-Author) Employee, Koninklijke Philips NV
Hiroshi Honda, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE

Intravoxel incoherent motion (IVIM) is a non-invasive MR imaging technique to measure microcirculation and diffusivity

simultaneously. The purpose of this study was to evaluate the utility of perfusion fraction (f) and diffusion coefficient (D) derived

from IVIM to characterize pediatric intracranial tumors.

METHOD AND MATERIALS

This retrospective study included 16 children (M: F = 9: 7; age range 2 month-19 year-old, median 5 year). There were 6 high-

grade tumors (HGTs; 3 anaplastic ependymoma, 1 glioblastoma, 1 medulloblastoma, and 1 atypical teratoid/rhabdoid tumor), 9 low-
grade tumors (LGTS; 4 pilocytic astrocytoma, 2 craniopharyngioma, 1 diffuse astrocytoma, 1 choroid plexus papilloma, and 1

subependymoma) and 1 germinoma. IVIM imaging was obtained using single-shot SE-EPI sequence with 13 b-factors (0, 10, 20, 30,

50, 80, 100, 200, 400, 600, 800, 1000 s/mm²). Other parameters of IVIM were as follows: TR/TE = 2500/70 ms, FA = 90, FOV

= 230 x 230 mm², matrix = 128 x 126, slice thickness = 5 mm, slices = 11, average = 1. The signal equation: S = S0·[(1-f) exp(-

bD)+f exp(-BD*)] was fitted to obtain f pixel-by-pixel. The f and D were measured in the three hot spot regions-of-interest in a

tumor in each map. Histopathologic vascular density was measured in three microscopic fields (x200) of the most intense

vascularization on CD-31-immunostained histopathologic specimens. Statistical analysis was performed with the Pearson

correlation coefficient and receiver operating characteristic (ROC). A p value less than .05 was considered significant.

RESULTS

The f-value (4.2-27.1%) was significantly correlated (r = 0.72, P = 0.0018) with vascular density (0.60-13.4%). The f of HGTs

(19.1±4.6%) was significantly higher than LGTs (7.7±4.0%; P = 0.0047). The D of HGTs (0.93±0.34 x 10^-3/mm²) was significantly

lower than LGTs (1.70±0.34 x 10^-3/mm²; P = 0.0032). ROC analysis showed high Az values with f (0.94) and D (0.96) without a

statistically significant difference (P = 0.74).

CONCLUSION

The f-value derived from IVIM significantly correlated with vascular density of pediatric brain tumors. Both f and D parameters could

discriminate HGTs from LGTs.

CLINICAL RELEVANCE/APPLICATION

Using IVIM, we could simultaneously evaluate flow and diffusivity in pediatric brain tumors. The f-value derived from IVIM

significantly correlated with vascular density. Both f and D could discriminate HGTs from LGTs.

VSPD11-04 rADC and Location Differ between Posterior Fossa Pilocytic Astrocytomas with and without Gangliocytic Differentiation

Sunday, Nov. 29 11:25AM - 11:35AM Location: S100AB

Participants

Julie Harrell, MD, Memphis, TN (Presenter) Nothing to Disclose
Scott N. Hwang, MD, PhD, Memphis, TN (Abstract Co-Author) Nothing to Disclose
Ibrahim Qaddouri, MD, Memphis, TN (Abstract Co-Author) Nothing to Disclose
David W. Ellison, MD, PhD, Memphis, TN (Abstract Co-Author) Nothing to Disclose

PURPOSE

Pediatric gangiogliomas (GG) are rare (≤4% of pediatric brain tumors), and only ~5% of gangliogliomas occur in the posterior fossa.

A recently defined GG variant, histopathologically resembling pilocytic astrocytoma but with focal gangliocytic differentiation (PA-

GG) that can be overlooked, can be mistaken for the common pilocytic astrocytoma (PA). We investigated whether MRI features

could differentiate posterior fossa PA-G from PA.

METHOD AND MATERIALS

This retrospective study included 16 children (M: F = 9: 7; age range 2 month-19 year-old, median 5 year). There were 6 high-

grade tumors (HGT; 3 anaplastic ependymoma, 1 glioblastoma, 1 medulloblastoma, and 1 atypical teratoid/rhabdoid tumor), 9 low-
grade tumors (LGTH; 4 pilocytic astrocytoma, 2 craniopharyngioma, 1 diffuse astrocytoma, 1 choroid plexus papilloma, and 1

subependymoma) and 1 germinoma. IVIM imaging was obtained using single-shot SE-EPI sequence with 13 b-factors (0, 10, 20, 30,

50, 80, 100, 200, 400, 600, 800, 1000 s/mm²). Other parameters of IVIM were as follows: TR/TE = 2500/70 ms, FA = 90, FOV

= 230 x 230 mm², matrix = 128 x 126, slice thickness = 5 mm, slices = 11, average = 1. The signal equation: S = S0·[(1-f) exp(-

bD)+f exp(-BD*)] was fitted to obtain f pixel-by-pixel. The f and D were measured in the three hot spot regions-of-interest in a

tumor in each map. Histopathologic vascular density was measured in three microscopic fields (x200) of the most intense

vascularization on CD-31-immunostained histopathologic specimens. Statistical analysis was performed with the Pearson

correlation coefficient and receiver operating characteristic (ROC). A p value less than .05 was considered significant.

RESULTS

The f-value (4.2-27.1%) was significantly correlated (r = 0.72, P = 0.0018) with vascular density (0.60-13.4%). The f of HGTs

(19.1±4.6%) was significantly higher than LGTs (7.7±4.0%; P = 0.0047). The D of HGTs (0.93±0.34 x 10^-3/mm²) was significantly

lower than LGTs (1.70±0.34 x 10^-3/mm²; P = 0.0032). ROC analysis showed high Az values with f (0.94) and D (0.96) without a

statistically significant difference (P = 0.74).

CONCLUSION

The f-value derived from IVIM significantly correlated with vascular density of pediatric brain tumors. Both f and D parameters could
discriminate HGTs from LGTs.

CLINICAL RELEVANCE/APPLICATION

Using IVIM, we could simultaneously evaluate flow and diffusivity in pediatric brain tumors. The f-value derived from IVIM

significantly correlated with vascular density. Both f and D could discriminate HGTs from LGTs.
Minimum rADC and location appear to differ significantly between posterior fossa PAs with or without gangliocytic differentiation.

CLINICAL RELEVANCE/APPLICATION
For differentiation between posterior fossa PAs with and without gangliocytic differentiation, location and minimum rADC may be a useful adjunct to histopathologic diagnosis, which is subject to sampling error.

VSPD11-05 Systematic Comparison of MR Imaging Findings in Pediatric Ependymoblastoma with Ependymoma and CNS-PNET NOS

Sunday, Nov. 29 11:35AM - 11:45AM Location: S100AB

Participants
Johannes Nowak, MD, Wurzburg, Germany (Presenter) Nothing to Disclose
Carolin Seidel, Wurzburg, Germany (Abstract Co-Author) Nothing to Disclose
Torsten Pietzsch, Bonn, Germany (Abstract Co-Author) Nothing to Disclose
Balint Alkonyi, Wurzburg, Germany (Abstract Co-Author) Nothing to Disclose
Taylor Laura Fuss, Charlestown, MA (Abstract Co-Author) Nothing to Disclose
Carsten Friedrich, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Katja von Hoff, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Stefan Rutkowski, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Monika Warmuth-Metz, Wurzburg, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE
Ependymoblastoma (EBL), ependymoma (EP), and primitive neuroectodermal tumors of the central nervous system (CNS-PNET NOS = not otherwise specified) are pediatric brain tumors that can be differentiated by histopathology in the clinical setting. Recently, we first described specific MRI features of EBL. In this study, we compare standardized MRI characteristics of EBL with EP and CNS-PNET NOS in a series comprising of 22 patients in each group.

METHOD AND MATERIALS
We systematically analyzed the initial cranial MRI scans at diagnosis according to 25 standardized criteria, and paired comparison was performed for EBL and EP, as well as for EBL and CNS-PNET NOS. All 66 cases of this multi-center study were centrally reviewed regarding histopathology, MR imaging and multimodal therapy.

RESULTS
We found differences between EBL and EP regarding age at diagnosis, MR signal intensity, tumor margin and surrounding edema, presence and size of cysts, and contrast enhancement pattern. Although MRI appearance of EBL shares many features with CNS-PNET NOS, we revealed significant differences in terms of age at diagnosis, tumor volume and localization, tumor margins, edema, and contrast enhancement.

CONCLUSION
We systematically analyze and compare MRI characteristics of pediatric EBL with EP and CNS-PNET NOS in a series of 22 centrally reviewed cases of each group. A definite differentiation of these entities with MRI seems to be difficult; however, we identify particular imaging features that might help distinguishing these histologically distinct tumor types.

CLINICAL RELEVANCE/APPLICATION
This is the first study that systematically compares multiple parameters of MR imaging in pediatric EBL with findings in EP and CNS-PNET NOS. Since EBL is very rare, our data provides important information that might help differentiating EBL from other pediatric brain tumor entities in the clinical setting.

VSPD11-06 Quantitative Approach to the Posterior Cranial Fossa and Cranio-cervical Junction in Asymptomatic Children with Achondroplasia

Sunday, Nov. 29 11:45AM - 11:55AM Location: S100AB

Participants
Rosalinda Calandrelli, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Marco Panfili, MD, Rome, Italy (Presenter) Nothing to Disclose
Gabriella D'Apolito, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Giuseppe M. Di Lella, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Cesare Cosimino, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE
Achondroplasia, the best-known form of congenital dwarfism, is caused by a disturbance of endochondral bone formation. We proposed a MRI-based quantitative morpho-volumetric approach to the posterior cranial fossa and cranio-cervical junction to understand posterior cranial fossa changes responsible of ventriculomegaly and life-threatening medullary compression.

METHOD AND MATERIALS
We analyzed brain MRI of 12 children with a diagnosis of achondroplasia (mean age 39 ± 16 months) and no surgical treatment. 3DFSPGR T1weighted images were used for: 1) evaluation of the posterior fossa synchondroses; 2) volumetric analysis of the posterior fossa (posterior cranial fossa volume=PCFV, posterior cranial fossa brain volume=PCFBV, PCFV/PCFBV ratio, hemispheres’ cerebellar volume=Ce.V, cerebellar vermis volume=Ve.V, brainstem volume, CSF spaces volume, JV ventricle volume); 3) morphometric analysis of the posterior fossa (clivus, supraocciput, exocciput lengths, tonsillar herniation, tentorial angle) and cranio-cervical junction (A-P and LL diameters of the foramen magnum); 4) measurements of foramen magnum and jugular foramina areas; 5) volumetric analysis of supratentorial ventricles. These patients were compared with age-matched control group.

RESULTS
All patients showed synostosis of spheno-occipital synchondroses while six patients showed synostosis of anterior and posterior
intra-occipital synchondroses, cervical myelopathy without swelling cord. Compared to control group, clivus and exocciput lengths, L-L and A-P diameters of the foramen magnum, foramen magnum area and jugular foramina area were significantly reduced; supraocciput length, tentorial angle, PCFV, PCFBV, CeV, Ve, brainstem volume and supratentorial ventricular system volume were significantly increased (p<0.05) while PCFV/PCFBV ratio, the subarachnoid spaces volume of the PCF and IV ventricle volume were not significant (p>0.05).

CONCLUSION
The quantitative approach to the posterior fossa and cranio-cervical junction modifications shows a complex relationship among the maldevelopment of the posterior cranial fossa, the foramen magnum stenosis, the development of ventriculomegaly and medullary compression.

CLINICAL RELEVANCE/APPLICATION
Posterior cranial fossa changes and foramen magnum stenosis should be evaluated together to the status of synchondroses in order to plan the prophylactic cervicomedullary decompression.

VSPD11-07 Congenital Spine Anomalies: Diagnosis and Classification

Sunday, Nov. 29 11:55AM - 12:15PM Location: S100AB

Participants
Erin S. Schwartz, MD, Philadelphia, PA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Understand the embryologic derangements behind the more common congenital spinal anomalies encountered in clinical practice.
2) Be able to apply a clinical-radiological classification to facilitate the interpretation of imaging studies of patients with spinal dysraphism.

ABSTRACT
Encouraging imaging studies on patients with congenital spinal anomalies can be intimidating for radiologists, particularly when pediatric imaging and/or neuroimaging are not a large part of your practice. A clinical-radiological classification system developed by Tortori-Donati, et al (Neuroradiology, 2000), remains a valuable approach to correctly diagnosing these children, largely dividing entities into open or closed spinal dysraphism based on the absence or presence of overlying skin, respectively. Closed spinal dysraphism is further subdivided into those lesions that present with a subcutaneous mass versus those that do not. Lesions without a subcutaneous mass can be further subdivided into simple and complex, and may be associated with other cutaneous stigmata such as hemangioma, skin dimple, and/or focal hairy patch.
NR309-SD-SUA1  Hemorrhagic Carotid Atherosclerotic Plaque in Patients with Severe Stenosis is not a High Risk Factor for Cerebral Embolism during Protected Carotid Artery Stenting

Station #1

Participants
Pratik Mukherjee, MD, PhD, San Francisco, CA (Moderator) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company;

Sub-Events

PURPOSE
Carotid artery stenting (CAS) in patients with hemorrhagic atherosclerotic plaque (HAP) remains controversial because of high incidence of cerebral embolism after the procedure. The aim of this study was to determine if HAP is a high risk factor for cerebral embolism during CAS.

METHOD AND MATERIALS
This prospective study assessed 94 consecutive patients with severe carotid stenosis. These patients underwent preprocedural carotid magnetic resonance imaging and postprocedural diffusion-weighted imaging (DWI) after CAS. HAP was defined as the presence of high signal intensity within the carotid plaque, that is greater than 200% of that from the adjacent muscle on magnetization-prepared rapid acquisition with gradient echo (MPRAGE). We then analyzed the incidence of postprocedural ipsilateral ischemic events on DWI and primary outcome such as hyperperfusion syndrome, stroke, and death within 30 days of CAS.

RESULTS
Forty-three patients (45.7%) had HAP on MPRAGE image. Maximal wall thickness was greater in the HAP group than in the non-HAP group (6.2 ± 1.4 mm vs 5.0 ± 1.4mm; P < 0.001). There was no significant difference in the incidence of postprocedural ipsilateral ischemic events and primary outcome between the HAP and the non-HAP group. However, postprocedural ipsilateral ischemic events were more frequently observed in the symptomatic group than in asymptomatic group (41.5% vs 15.1%; P = 0.005).

CONCLUSION
The results of this study indicate that HAP in patients with severe carotid stenosis is not a high risk factor for cerebral embolism during CAS. Symptomatic patient should receive more careful treatment during CAS because of higher risk of postprocedural ipsilateral ischemic events.

CLINICAL RELEVANCE/APPLICATION
The protected carotid artery stenting is a safe procedure to patients with severe carotid stenosis, regardless of the existence of hemorrhagic atherosclerotic plaque.

NR310-SD-SUA2  Development of a New Method for Improving Depiction of Blood Vessels Using Low-Dose 4D-CT Angiography

Station #2

Participants
Toru Hirano, RT, Sapporo, Japan (Presenter) Nothing to Disclose
Masahiko Wanibuchi, MD, PhD, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose
Satoshi Ikoshi, MD, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose
Takashi Tsutsumi, RT, Otawara, Japan (Abstract Co-Author) Employee, Toshiba Corporation
Yoshihiro Ikeda, Otawara, Japan (Abstract Co-Author) Employee, Toshiba Corporation
Syogo Misumi, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose
Syuichi Hattori, RT, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose
Masamitsu Hatakenaka, MD, PhD, Sapporo, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation

PURPOSE
Area detector CT (ADCT) has led to innovations in head CT. 4D data acquired at a low dose by ADCT permits perfusion analysis of the entire brain and allows CT angiography (CTA) images like those obtained by conventional multi-detector row CT to be generated by temporal averaging (T-Ave). However, CTA with T-Ave suffers from problems such as blurring of blood vessels and poor contrast. We have developed temporally weighted MIP of 4D data (T-MIP) to generate high-resolution CTA images. In this study, we evaluated depiction of the fine cerebral blood vessels in CTA using T-MIP and assessed the clinical usefulness of this method.
METHOD AND MATERIALS

An ADCT system was used (Aquilion ONE, Toshiba). Depiction of the fine vessels was evaluated by both basic and clinical assessment, and CTA images obtained using T-MIP and T-Ave were compared. Dynamic scanning was performed during injection of contrast medium into blood vessel phantoms (internal diameter: 1.6, 1.4, 1.2, 1.0, 0.8 mm), and the CT number, image SD, and contrast-to-noise ratio (CNR) in the blood vessels were compared between T-MIP and T-Ave (Wilcoxon test). The scan conditions were 0.5 mm × 320 rows, 1 s/rot., 1-s intervals, and 20 phases, with 20 mL of diluted contrast medium injected at a rate of 2 mL/s. The subjects were 74 patients with cerebrovascular disease who underwent preoperative CT studies. CTA images were generated from the acquired dynamic scan data using T-MIP and T-Ave, and a total 148 segments in the distal ACA and MCA were evaluated in the same manner as for basic assessment.

RESULTS

1. T-MIP showed higher values than T-Ave: 2.9±0.68 times higher (P=0.00) for CT number, 1.2 times higher (P=0.05) for image SD, and 2.4±0.88 times higher (P=0.00) for CNR. 2. T-MIP showed significantly higher CT numbers (P=0.00) in the ACA and MCA than T-Ave (ACA; T-Ave:226±41.2HU, T-MIP:258±45.4HU, MCA; T-Ave:246.7±44.8HU, T-MIP:285.5±46.3HU respectively). T-MIP clearly depicted peripheral branches, unlike T-Ave.

CONCLUSION

Depiction of fine cerebral blood vessels is significantly improved with high-resolution CTA using T-MIP at a low dose, demonstrating the clinical usefulness of this method.

CLINICAL RELEVANCE/APPLICATION

High-resolution CTA using T-MIP at a low dose clearly depicts fine cerebral blood vessels (which is not possible with conventional CTA using T-Ave), providing useful preoperative information.

PURPOSE

To investigate the effect of spectral CT optimal monochromatic imaging for improving image quality of the collateral circulation in middle cerebral artery with severe arterial stenosis or occlusion.

METHOD AND MATERIALS

31 patients with severe arterial stenosis or occlusion in middle cerebral artery were retrospective analyzed. All of patients underwent head CTA with spectral CT monochromatic imaging. Images of quality check (QC), monochromatic 70keV and optimal monochromatic series were acquired and compared. Collateral circulation was evaluated by using VR and MIP images among three groups. In each group, image noise and contrast noise ratio (CNR) were measured, image quality were also assessed and compared by two radiologists using a five-points scale. The differences of image noise and CNR among the three groups were compared by one-way analysis of variance and multiple comparisons. The difference of image quality among the three groups were statistically analyzed by Kruskal-Wallis H.

RESULTS

Optimal monochromatic energy level was (55.3±1.0) keV. CNR of artery in optimal 55 keV, 70keV and QC data sets were (50.47±9.12), (45.00±8.18) and (38.11±7.67),respectively. CNR in optimal 55 keV group was significantly higher than that of 70keV and QC data set (P < 0.001). Image noise in optimal 55 keV, 70keV and QC data sets were (16.23±1.46), (8.62±0.81) and (10.09±1.18), respectively. Noise of 70keV images was significantly lower than that of 55keV and QC data set. Image quality subjective scores in optimal 55keV group was significantly higher than that of 70keV and QC data set.

CONCLUSION

Spectral optimal monochromatic images for head CT Angiography can improve the overall image quality of the collateral circulation in middle cerebral artery with severe arterial stenosis or occlusion.

CLINICAL RELEVANCE/APPLICATION

Monochromatic spectral CT imaging of low keV combined with ASIR can provide good image quality and has the potential ability to reduce radiation dose.
PURPOSE
To determine pretreatment Apparent Diffusion Coefficient (ADC) values, measured by diffusion magnetic resonance (dMR) imaging, and its association with gene and microRNA networks in GBM tumors.

METHOD AND MATERIALS
We retrospectively identified 37 treatment-naïve glioblastoma patients from The Cancer Genome Atlas (TCGA) whom had gene expression profiles and corresponding dMR imaging available in The Cancer Imaging Archive (TCIA). ADC mean were measured in edema/tumor invasion of GBM tumor and contralateral normal brain tissue. To normalize ADC values, ADC mean of edema/tumor invasion regions were divided by the contralateral ADC means. Using decision tree clustering method, patients categorized based on normalized ADC mean into high vs low group. Kaplan-Meier survival analysis was used to determine the difference of overall survival between the two groups of patients. Imaging genomic analysis was subsequently performed using GenePattern Comparative Marker Selection module (Broad Institute). To identify the associated gene network, the top 100 most positively and the top 100 most negatively correlated genes in the high group versus the low group were then analyzed with Ingenuity Pathway Analysis.

RESULTS
Based on decision tree analysis, normalized ADC mean cutoff of 19.48 was used to categorize patients to high (n=6) versus low (n=31) groups. Kaplan-Meier analysis showed the patients with high normalized ADC mean had significantly (p=0.02) better overall survival than the patients with low normalized ADC mean. Median survival in high and low group was 747 and 394 days, respectively. There was a significant genomic signature, associated with high vs low groups. The validation of these analyses was done in a separate group of glioblastoma patients.

CONCLUSION
We demonstrate that dMR characteristics can identify highly significant survival differences and specific genomic signature.

CLINICAL RELEVANCE/APPLICATION
Identification of gene expression signatures based on restricted versus facilitated GBM edema and associated survival benefits.

TEACHING POINTS
The purpose of this exhibit is:- To review definition, clinical findings, epidemiological factors and pathophysiology of pseudotumor cerebri syndrome (PTCS).- To review the role of CT and MRI in the differential diagnosis of patients with suspected PTCS.- To explain radiologic signs of PTCS.- To discuss the role of neuroradiologists in the new proposed diagnostic criteria and treatment.

TABLE OF CONTENTS/OUTLINE
DEFINITION
CLINICAL FINDINGS
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EPIDEMIOLOGY: TYPICAL AND ATYPICAL PATIENTS
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MRI: DIFFERENTIAL DIAGNOSIS
Venous sinus thrombosis
- Slow flow due to styloidigenic jugular venous compression
RADIOLOGIC FINDINGS IN PSEUDOTUMOR CEREBRI SYNDROME:
- Pituitary fossa findings
- Orbital findings
- Transverse sinus stenoses: intrinsic vs extrinsic
- Other new radiological findings
ROLE OF IMAGING FINDINGS IN 2013 NEW PROPOSED DIAGNOSTIC CRITERIA
TREATMENT:
- Classic treatment
- Role of endovascular neuroradiology
- Transverse sinus stenting
**NR314-SD-SUB1**

**What is the Diagnostic Value of Brain MRI after Negative Head CT in Emergency Department Patients Presenting with Symptoms Atypical of Stroke?**

**Station #1**

Participants
Pratik Mukherjee, MD, PhD, San Francisco, CA (*Moderator*) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company;

Sub-Events
**NR314-SD-SUB1**

**PURPOSE**
Head CT is the first-line imaging examination for patients presenting to the ED with acute symptoms atypical of stroke to exclude intracranial pathology. For patients with a normal CT and no clinical evidence of acute stroke, MR imaging is often performed to exclude ischemia, hemorrhage or mass. Our aim was to investigate how often clinically relevant acute findings are detected on MRI after an initial negative head CT in the ED.

**METHOD AND MATERIALS**
We reviewed the radiology reports of 165 consecutive patients who underwent imaging for symptoms atypical of acute stroke (such as dizziness, headache and seizure) with a negative head CT followed by head MRI within 24 hours of the initial CT, from January 2012 to December 2014. The findings and suspected etiology documented in the radiology report were recorded for each patient. Data was analyzed using Pearson's correlation test followed by logistic regression (SPSS v22).

**RESULTS**
19 of 165 (12%) patients included in the study had abnormal findings on head MRI indicating acute or subacute infarction, not identified on the initial head CT. Statistically significant correlation was found between positive MRI results and the following variables: age (p=0.001), history of hyperlipidemia (p=0.016), hypertension (p=0.004), anticoagulation use (p=0.013), prior TIA/CVA (p=0.00). Logistic regression demonstrated a trend towards significance in the following patient variables suggesting an association with positive MRI findings: age (p=0.086) and history of TIA/CVA (p=0.129).

**CONCLUSION**
For patients presenting to the emergency department with acute neurological complaints atypical of stroke, if an initial head CT does not reveal acute pathology, the positive yield of subsequent MRI is high at 12%. A follow up MRI may especially be considered in patients with history of hyperlipidemia, hypertension, anticoagulation use, and prior TIA/CVA. Further analysis is required to determine which patient factors are associated with a higher likelihood of acute pathology detected on MRI in order to better target these patients with imaging resources.

**CLINICAL RELEVANCE/APPLICATION**
Judicious utilization of advanced imaging in the emergency department is important in an era of rising healthcare costs. However, CT may miss clinically important findings in patients with cardiovascular risk factors presenting with nonspecific neurologic symptoms. In these cases, further evaluation with MRI may be warranted.

**NR316-SD-SUB3**

**Magnetic Resonance Imaging and Neuropsychological Abnormalities in Survivors of Herpes Simplex Encephalitis**

**Station #3**

Participants
Gorky Medhi, MBBS, MD, Bangalore, India (*Presenter*) Nothing to Disclose
Jitender Saini, Bangalore, India (*Abstract Co-Author*) Nothing to Disclose
Arun K. Gupta, Bangalore, India (*Abstract Co-Author*) Nothing to Disclose
Keshav Kumar, Bangalore, India (*Abstract Co-Author*) Nothing to Disclose
Netravathi M, Bangalore, India (*Abstract Co-Author*) Nothing to Disclose
Dhanya C, Bangalore, India (*Abstract Co-Author*) Nothing to Disclose

**PURPOSE**
One of the most common neurobehavioral sequelae of herpes simplex encephalitis (HSE) is memory impairment. We hypothesized that follow up imaging of patients with HSE would show less anisotropic diffusion in the medial temporal lobe including those tracts involved in memory processing. The purpose of our study was to explore white matter tissue integrity in patients who had suffered from HSE, neuropsychological evaluation to detect cognitive deficit and to correlate diffusion tensor imaging findings with cognitive deficit.

**METHOD AND MATERIALS**
It was a single institutional prospective study. We included patients who had suffered from HSE in the past - PCR positive or positive for HSV IgG antibody in CSF (Titres>625). Nine patients and 15 age - gender matched controls were recruited. MRI was performed in a 3T scanner using axial T2W, FLAIR, SWI, T1MPRAGE and 16 direction DTI. Neuropsychological assessment was conducted using selective subtests of the Wechsler Memory Scale. Data analysis was performed using FMRIB Software Library tools (www.fmrib.ox.ac.uk/fsl) version 5.1.7. All FA, MD, RD, DA images were used for further analysis using Tract Based Spatial Statistics. Spearman's correlation was done to identify relation between the neuropsychological scores and FA values of different tracts.

RESULTS

Significantly (p<0.05 [FWE corrected]) decreased FA was noted in corpus callosum, corona radiatae, left posterior thalamic radiation, cingulum, superior longitudinal fasciculus, fornix, inferior longitudinal fasciculus, inferior fronto occipital fasciculus, uncinated fasciculus. Impaired face recognition significantly correlated with reduction in FA of right uncinate fasciculus, right inferior longitudinal fasciculus, splenium-genu of corpus callosum. FA value of left cingulum significantly correlated with logical memory, auditory verbal learning. FA value of fornix correlated with visual recognition; FA value of left uncinate fasciculus with auditory verbal learning and delayed recall.

CONCLUSION

The study demonstrated microstructural abnormality in several white matter tracts compared to healthy controls. All these tracts and structures are functionally related to visual or verbal learning and memory, memory for faces directly or indirectly.

CLINICAL RELEVANCE/APPLICATION

The pathophysiology of the memory impairment following HSE is not well understood. This study may help to prognosticate the patient suffered from HSE by identifying the structures involved.

NR317-SD-SUB4

Three-Dimensional Black-Blood T1-Weighted Turbo Spin-Echo Techniques for the Diagnosis of Cerebral Veinous Thrombosis in Comparison With Magnetic Resonance Venography

Station #4

Participants
Yang Liu, MD, Changchun, China (Presenter) Nothing to Disclose
Huimao Zhang, Changchun, China (Abstract Co-Author) Nothing to Disclose
Kaining Shi, Liaoning, China (Abstract Co-Author) Nothing to Disclose
Hongwei Zhou, Changchun, China (Abstract Co-Author) Nothing to Disclose
Wenjing Lan, MD, Changchun, China (Abstract Co-Author) Nothing to Disclose

PURPOSE

MR Venography (MRV) is essential for early diagnosis of the cerebral venous thrombosis (CVT). However, there are some potential pitfalls and the accurate diagnosis for isolated cortical vein thrombosis is still challenging. The aim of this study was to prospectively evaluate the feasibility of a novel 3-dimensional turbo spin-echo (TSE) technique with isotropic resolution for the diagnosis of CVT in comparison with MRV.

METHOD AND MATERIALS

20 consecutive patients confirmed as CVT by definite clinical evidence and CT Venography (CTV) were recruited in this study. All patients underwent 3.0T MRI exam with the protocol including time of flight (TOF) MRV and T1-WI volumetric isotropic TSE acquisition (T1-VISTA). A junior reader and a senior reader reviewed all MR images independently and made decision together. The image quality and diagnostic confidence were assessed on a 4-point scale. The thrombosed veins and dural sinuses on T1-VISTA were evaluated and compared with TOF MRV (t test).

RESULTS

The involving veins and dural sinuses of all patients including cortical veins, cerebral deep veins, superior sagittal sinus, sinus rectus, transverse sinus, sigmoid sinus and internal jugular vein. The total thrombosed veins and sinuses visualized by T1-VISTA and TOF MRV were 97 and 61, including 42 and 16 cortical veins respectively, and the difference was significant (P<0.05). Both readers made false negative diagnosis of 2 patients with isolated cortical vein thrombosis by TOF MRV, but made positive diagnosis by T1-VISTA. The difference of image quality and diagnostic confidence level between T1-VISTA and TOF MRV was not significant (3.75±0.65 vs. 3.30±0.44 and 3.81±0.41 vs. 3.50±0.60, P>0.05).

CONCLUSION

CVT could be well diagnosed and evaluated by T1-VISTA. More importantly, T1-VISTA was superior to TOF MRV in the visualization of cortical vein thrombosis.

CLINICAL RELEVANCE/APPLICATION

T1-VISTA is an alternative imaging method for diagnosis of CVT. It is helpful for patients with suspicion of CVT, especially for those with isolated cortical veins thrombosis.
RC105

Difficult Diagnoses in Neuroradiology

Sunday, Nov. 29 2:00PM - 3:30PM Location: S406B

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Christopher P. Hess, MD, PhD, Mill Valley, CA, (christopher.hess@ucsf.edu) (Moderator) Research Grant, General Electric Company; Research Grant, Quest Diagnostics Incorporated; Research Grant, Cerebrotech Medical Systems, Inc; Vincent P. Mathews, MD, Milwaukee, WI (Moderator) Nothing to Disclose

Sub-Events

RC105A Pituitary Lesions: Not as Easy as They Seem

Participants
Michael N. Brant-Zawadzki, MD, Newport Beach, CA, (mbrant@hoag.org) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Appreciate the prevalence of "incidental" lesions within the pituitary gland, and their origin. 2) Differentiate intrinsic pituitary gland lesions from non-pituitary lesions simulating intrinsic disease. 3) Utilize common MRI parameter choices to help specify pathology in the pituitary region.

ABSTRACT
The pituitary gland's size, important function, and detailed surrounding anatomy of disparate structures makes it an "acid test" for the accuracy and specificity of any imaging modality. The multiplicity of intrinsic lesions, as well as the plethora of surrounding structural histology produces a wide bandwidth of abnormalities in the pituitary fossa and its environs. A systematic approach to analyzing lesions of the pituitary region will be presented, common pitfalls explored, and atypical examples utilized to review the approach to a targeted differential diagnosis for lesions of this region.

RC105B Is it Vasculitis?

Participants
Daniel M. Mandell, MD, Toronto, ON, (danny.mandell@uhn.ca) (Presenter) Research funded, General Electric Company;

LEARNING OBJECTIVES
1) Appreciate the spectrum of imaging findings in CNS vasculitis. 2) Appreciate findings that help differentiate among related conditions. 3) Understand the role of imaging relative to other tests (CSF sampling, biopsy etc...).

ABSTRACT
Abstract: Central nervous system (CNS) vasculitis is relatively uncommon. However, multifocal abnormalities on CT/MRI and/or intracranial arterial narrowing on CTA/MRA often leads to consideration of this diagnosis. I will discuss the spectrum of imaging findings in CNS vasculitis, including brain parenchymal and meningeal findings, angiographic findings, and the emerging role of vessel wall MRI. I will then focus on the differential diagnosis, and findings that can help differentiate among conditions that mimic vasculitis. Finally, we will consider how imaging fits into the broader clinical work-up which may include cerebrospinal fluid sampling and biopsy.

RC105C Spontaneous Intracranial Hypotension

Participants
William P. Dillon, MD, San Francisco, CA, (william.dillon@ucsf.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Understand the clinical presentation, variations thereof, and MR and CT featurs of SIH. 2) Understand the approach to treatment of SIH with autologous blood patch. 3) Understand the potential complications of SIH, and blood patch.

ABSTRACT
Spontaneous intracranial hypotension (SIH) is a syndrome of low cerebrospinal fluid volume and or pressure that typically results from either a spinal dural defect at a perineural cyst or from an osteophyte/ disc penetrating through the ventral dura. Postural headache is the most common symptom. Other reported symptoms include nausea, vertigo, cranial nerve palsy, visual impairment, quadriplegia, and coma. Because of the nonspecific nature of symptoms, the diagnosis may be missed or mistaken for other disease entities. These patients may be surgically treated for subdural fluid collections or 'Chiari 1 malformations' instead of the underlying spinal cause of intracranial hypotension. Patients with connective tissue disorders - such as Marfan syndrome, Ehlers-Danlos syndrome, and autosomal dominant polycystic kidney disease - are at increased risk of SIH. The most appropriate therapy for SIH is an epidural blood patch, which ideally should be directed to the location of the leak, if it is known. If the location of the leak is unknown, then the epidural blood patch can be placed in a nonselective fashion. Described imaging findings of SIH include diffuse pachymeningeal enhancement, subdural fluid collections, cerebellar tonsillar herniation, distention of the dural venous sinuses, enlargement of the pituitary gland and downsloping of the floor of the third ventricle. C1 guided epidural blood patch following detection of the CSF fistula is the most efficient and appropriate first line of therapy. The diagnostic findings, complications of
untreated SIH, and the approach to the patient with suspected CSF fistula of the spine will be discussed.
Anatomy and Pathology of the Pharynx and Larynx

Sunday, Nov. 29 2:00PM - 3:30PM Location: E450A

PARTICIPANTS

Sub-Events

RC106A Imaging the Nasopharynx

Participants
Nancy J. Fischbein, MD, Stanford, CA, (fischbein@stanford.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the normal anatomy of the nasopharynx. 2) Illustrate the appearance and patterns of spread of nasopharyngeal carcinoma. 3) Describe additional pathologies of the nasopharynx, along with imaging pearls and pitfalls.

ABSTRACT

The nasopharynx is the uppermost portion of the upper aerodigestive tract, and it is located posterior to the nasal cavity, inferior to the sphenoid sinus, and anterior to the clivus and craniovertebral junction, above the level of the soft palate. Given its intimate relationship with the central skull base, detailed knowledge of the anatomy of the central skull base, including its canals and foramina, is critical to understanding the spread of disease in this region. Though CT is helpful in imaging diseases of this region, a good knowledge of MR anatomy, and an understanding of optimal MR imaging protocols, is essential to proper imaging and imaging interpretation of diseases of the nasopharynx. We will spend some of our time discussing nasopharyngeal carcinoma, including its demographics, staging, and imaging appearance, but we will also review benign pathologies of the nasopharynx, and other malignant entities. We will also review some imaging pearls for each entity, and also imaging pitfalls, as there are many ways in which the unwary radiologist can overlook or misinterpret significant pathology in the nasopharynx.

RC106B Imaging the Oropharynx

Participants
Suresh K. Mukherji, MD, Northville, MI (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the normal anatomy of the oropharynx. 2) Illustrate the normal spread patterns of tumors involving various subsites of the oropharynx. 3) Describe the appearance of various infectious and inflammatory processes involving the oropharynx.

ABSTRACT

Imaging plays a crucial role in evaluating the oropharynx. This talk will review the normal anatomy and malignancies involving the oropharynx. The presentation will also review various inflammatory and infectious processes that involve different parts of the oropharynx.

RC106C Imaging the Larynx and Hypopharynx

Participants
Peter M. Som, MD, New York, NY (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) The registrants will learn the intimate relationship between the larynx and hypopharynx. 2) The anatomy of the larynx and hypopharynx will be reviewed. 3) The major pathology of these structures will be reviewed.

ABSTRACT

The larynx is situated within the hypopharynx and thus their intimate relationship. The anatomy of the larynx and the hypopharynx will be reviewed, especially as it pertains to neoplasms. The scope of inflammatory and neoplastic diseases that affect these structures will be reviewed with particular attention to what should be included in the radiologist’s report to create a pertinent and meaningful report.
LEARNING OBJECTIVES

Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

Sub-Events

**RC111A  Practical Approach for Interpreting Head and Neck PET/CT**

Participants
Rathan M. Subramaniam, MD, PhD, Baltimore, MD, (rsubram4@jhmi.edu) (Presenter) Travel support, Koninklijke Philips NV

**LEARNING OBJECTIVES**

1) To understand the value of PET/CT in the care process of managing head and neck cancer. 2) To learn common pathways of tumor spread in head and neck. 3) To review illustrative cases and pitfalls of interpretation.

**ABSTRACT**

FDG-PET/CT provides valuable information in the assessment of the patient with cancers of the head and neck. The metabolic information determined by FDG is complimentary and additive to the anatomic information from CT, and can be used to direct surgery, plan radiation therapy, and evaluate response to systemic or localized treatment. In this presentation, the role of FDG-PET/CT in the management of head and neck cancer will be presented, using case examples to illustrate the utility of PET as well as common pitfalls.

**Honored Educators**

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Eric M. Rohren, MD, PhD - 2015 Honored Educator

** RC111B  PET/CT for Head and Neck Cancer: Clinical Applications and Case Studies**

Participants
Eric M. Rohren, MD, PhD, Houston, TX (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review head and neck anatomy and physiologic sites of FDG uptake. 2) Review the impact of FDG-PET/CT on the management of patients with head and neck malignancies.

**ABSTRACT**

FDG-PET/CT provides valuable information in the assessment of the patient with cancers of the head and neck. The metabolic information determined by FDG is complimentary and additive to the anatomic information from CT, and can be used to direct surgery, plan radiation therapy, and evaluate response to systemic or localized treatment. In this presentation, the role of FDG-PET/CT in the management of head and neck cancer will be presented, using case examples to illustrate the utility of PET as well as common pitfalls.

**RC111C  The Head and Neck Surgeon’s Perspective: What I Need to Know**

Participants
Nishant Agrawal, MD, Baltimore, MD (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review the indications of PET/CT in head and neck cancer. 2) Review the impact of PET/CT on staging in head and neck cancer. 3) Review the role of PET/CT in the evaluation of the unknown primary. 4) Review the role of post-treatment PET/CT.
RC120

**Fundamentals of Imaging for the Radiation Oncologist**

Sunday, Nov. 29 2:00PM - 3:30PM Location: S102C

Participants
Simon S. Lo, MD, Cleveland, OH *(Moderator)* Research support, Elekta AB;

Sub-Events

**RC120A**  
**Fundamentals in Radiation Oncology Imaging of Head and Neck Cancer**

Participants
Hilda E. Stambuk, MD, New York, NY *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) Define key anatomy and understand pathways of tumor spread for head and neck cancers. 2) Identify radiographic features of the patterns of tumor involvement. 3) Understand the implications of radiographic imaging in treatment planning.

**ABSTRACT**

Radiographic imaging is integral to diagnosis, extent of disease assessment, treatment planning and post-treatment surveillance in patients with head and neck cancer. Since the overwhelming majority of cancers of the head and neck are squamous cell carcinoma, these tumors will be the primary focus of the lecture. In addition, choosing the appropriate imaging modality is of vital importance in effective evaluation and therefore the pros and cons of imaging modalities in particular subsites will be presented. The patterns of tumor spread depend on the site of origin of the tumor and will be discussed in detail for some of the common sites such as nasopharynx and oropharynx that are treated primarily with radiation. The implications of pathways of tumor involvement including perineural spread on treatment planning will be emphasized. This lecture will provide radiation oncologists a basic understanding of the role of imaging and will highlight pearls and pitfalls that can influence management.

**RC120B**  
**Fundamentals in Radiation Oncology Imaging of Thoracic Malignancies**

Participants
Matthew M. Harkenrider, MD, Maywood, IL *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) To review the normal imaging changes after precision radiotherapy for lung cancer. 2) To discuss methods of distinguishing recurrence vs. fibrosis after stereotactic radiotherapy. 3) To highlight difficult imaging cases in assessing response after radiotherapy.

**ABSTRACT**

**RC120C**  
**Fundamentals in Radiation Oncology Imaging of Skull Base Tumors**

Participants
Jason Rockhill, MD, Seattle, WA *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identifying imaging techniques to help delineate target volumes for skull based tumors. 2) Discuss the challenges of determining target volumes for skull based tumors in the resected and non-resected patient. 3) Review key features to follow by imaging of skull based tumors after radiation therapy.

**RC120D**  
**Imaging and RT QA in Cancer Clinical Trials: The Advanced Technology Consortium (ATC), the Quality Assurance Review Center (QARC), and the Imaging and Radiation Oncology Core (IROC)**

Participants
Thomas J. Fitzgerald, MD, Worcester, MA *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe diagnostic imaging and radiation therapy utilization in clinical trials. 2) Describe the role of quality assurance in imaging and radiation therapy in clinical trials. 3) Describe future QA strategies in the National Clinical Trials Network (NCTN).
**Pediatric MR: Normal or Not?**

Sunday, Nov. 29 2:00PM - 3:30PM Location: N228

**Participants**
Geetika Khanna, MD, MS, Iowa City, IA (Moderator) Nothing to Disclose

**LEARNING OBJECTIVES**
1) Differentiate normal and abnormal signal intensity patterns of abdominal structures in children. 2) Recognize normal developmental variants that can simulate abdominal pathology.

**ABSTRACT**

**RC124A  Musculoskeletal MR**

Participants
Nancy A. Chauvin, MD, Philadelphia, PA, (chauvinn@email.chop.edu) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
1) Describe the MR appearance of normal marrow conversion in the developing skeleton. 2) Identify common pediatric marrow pitfalls that might be mistaken for pathology. 3) Describe the MR appearance of common bone marrow abnormalities in children.

**RC124B  Brain and Spine**

Participants
Tina Y. Poussaint, MD, Boston, MA (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
1) Assess MR features associated with normal brain and spine development and maturation. 2) Identify abnormal MR imaging features associated with specific brain diseases and disorders of development in childhood.

**ABSTRACT**

In pediatric neuroradiology, magnetic resonance imaging is used to assess central nervous system (CNS) disease in the infant, child, and teenager. This requires 1) an understanding of normal brain development and maturation from gestation through adolescence; 2) a technical mastery of the neuroimaging techniques that are used in evaluating brain diseases of childhood; and 3) an overall grasp of the imaging features of numerous brain pathologies, both acquired and congenital. This lecture will focus on the common MR imaging features of the normal pediatric brain and spine and will compare and contrast with MR imaging features in specific brain diseases and disorders of development.

**RC124C  Abdominal MR**

Participants
Geetika Khanna, MD, MS, Iowa City, IA (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
1) Differentiate normal and abnormal signal intensity patterns of abdominal structures in children. 2) Recognize normal developmental variants that can simulate abdominal pathology.
Participants
Ronald L. Arenson, MD, San Francisco, CA (Presenter) Nothing to Disclose

Sub-Events

PS12A Report of the RSNA Research and Education Foundation

Participants
Burton P. Drayer, MD, New York, NY (Presenter) Advisor, Hologic, Inc

Abstract
The RandE Foundation - Our Future is Now This year marks the 100th anniversary of the RSNA’s founding. As radiology looks toward the future, one wonders what the next 100 years will look like for our specialty and whether the central role of radiologists in healthcare will be sustained. Analogous to our clinical radiology mantra, if we are not at the radiology research table we will be on the menu. As a leading global force in radiology, the RSNA is poised to lead the specialty into the next century and exceed the incredible success of the past 100 years. The RandE Foundation will play a key role in radiology’s future by continuing its support of inspiring investigators and those pursuing innovative approaches to education. To meet these research and education needs head-on, the Foundation launched Inspire-Innovate-Invest, The Campaign for Funding Radiology’s Future® at last year’s annual meeting. This bold campaign seeks to raise $17.5 million to fund grants in radiologic research and education, bridging the gaps in funding for promising investigators and educators. To date our campaign has been a success with individuals, private practice and corporate donors generously pushing us to the mid-way point in our goal. There is still a long way to go. The future of our specialty depends on the commitment and generosity of each of us, the members of the imaging community. This year, the Foundation will fund 92 grants totaling $3.6 million. The RandE is funding 25% of our ever increasing number of excellent grant applications. While pleased with these achievements, imagine what the RandE Foundation could fund with additional support from all of us as radiology colleagues? During the meeting week, please take time to visit the RandE Foundation Booth, located on Level 3 of Lakeside Center to learn more about how you can be a part of the campaign and support the RandE Foundation and the future robustness of our specialty.

PS12B Image Interpretation Session

Participants
Jonathan B. Kruskal, MD, PhD, Boston, MA (Presenter) Author, UpToDate, Inc
Donald P. Frush, MD, Durham, NC (Presenter) Nothing to Disclose
Bruce B. Forster, MD, Vancouver, BC (Presenter) Travel support, Siemens AG; Travel support, Toshiba Corporation;
Christine M. Glastonbury, MBBS, San Francisco, CA (Presenter) Author with royalties, Reed Elsevier
Michelle M. McNicholas, MD, Dublin, Ireland (Presenter) Nothing to Disclose
Melissa L. Rosado De Christenson, MD, Kansas City, MO (Presenter) Author, Thieme Medical Publishers, Inc; Author, Reed Elsevier;
Author, American Registry of Pathology; Author, Oxford University Press; ; ;
Jorge A. Soto, MD, Boston, MA (Presenter) Nothing to Disclose

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Melissa L. Rosado De Christenson, MD - 2012 Honored Educator
Jorge A. Soto, MD - 2013 Honored Educator
Jorge A. Soto, MD - 2014 Honored Educator
Jorge A. Soto, MD - 2015 Honored Educator
Jonathan B. Kruskal, MD, PhD - 2012 Honored Educator
ED009-MO

Neuroradiology Monday Case of the Day
Monday, Nov. 30 7:00AM - 11:59PM Location: Case of Day, Learning Center

AMA PRA Category 1 Credit™: .50

Participants
Thiru A. Sudarshan, DMRD, FRCR, Dundee, United Kingdom (Presenter) Nothing to Disclose
Avinash K. Kanodia, MD, Perth, United Kingdom (Abstract Co-Author) Nothing to Disclose
Jonathan Weir-McCall, MBCh, FRCR, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose
Anu Kamalasanan, MBBS, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose
Bangalore Anil Kumar, MD, FRCR, Slough, United Kingdom (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1.) Review the diagnosis of a specific condition by using either a single-modality or multimodality approach. 2.) Identify state-of-the-art imaging and methods of treatment for various pathologic conditions. 3.) Assess new research on applications of various imaging and therapeutic modalities.
LEARNING OBJECTIVES

1) The participant will be introduced to a series of radiology case studies via an interactive team game approach designed to encourage "active" consumption of educational content. 2) The participant will be able to use their mobile wireless device (tablet, phone, laptop) to electronically respond to various imaging case challenges; participants will be able to monitor their individual and team performance in real time. 3) The attendee will receive a personalized self-assessment report via email that will review the case material presented during the session, along with individual and team performance. This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.
Participants

Sub-Events

**MSRO24A**  Imaging of Larynx and Hypopharynx: Applied Anatomy

Participants
Suresh K. Mukherji, MD, Northville, MI (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review the normal anatomy of the larynx. 2) Discuss the spread patterns of the different primary sites of the larynx. 3) Explain the information that imaging provides that directly affects staging and management.

**ABSTRACT**

This session will demonstrate the value of laryngeal imaging. This talk will review the normal anatomy of the larynx. The talk will also discuss the spread patterns of the different primary sites of the larynx and illustrate the information that imaging provides that directly affects staging and management of laryngeal cancer.

**MSRO24B**  Current Concepts and Controversies in Contouring for Treating Laryngeal Carcinoma

Participants
Sung Kim, MD, New Brunswick, NJ (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review anatomy of larynx as it relates to patterns of spread of squamous cell carcinoma. 2) Discuss how patterns of spread affects how to contour larynx for radiation therapy.

**MSRO24C**  QandA

Participants

**MSRO24D**  Imaging of the Oral Cavity and Oropharynx: Applied Anatomy

Participants
Suresh K. Mukherji, MD, Northville, MI (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review the normal anatomy of the oral cavity and oropharynx. 2) Illustrate the normal spread patterns of the various subsites of the oral cavity and oropharynx. 3) Explain the information that imaging provides that directly affects staging and management.

**ABSTRACT**

Imaging plays a crucial role in evaluating the evaluating the primary site. The information provided on pre-treatment imaging directly affects the stage of the tumor and provides information regarding management and treatment that cannot be ascertained through physical exam or staging. This talk will review the normal anatomy and malignancies involving the oral cavity and oropharynx. The presentation will also provide information on technique and provide a “checklist” of information that should be included in the radiologist’s report that will help determine treatment and management.

**MSRO24E**  Current Concepts and Controversies in Contouring and Treatment of Oral Cavity/Oropharynx Carcinoma

Participants
Clifton D. Fuller, MD, PhD, Houston, TX, (cdfuller@mdanderson.org) (Presenter) In-kind support, General Electric Company; Research Grant, Elekta AB;

**LEARNING OBJECTIVES**

1) Review imaging anatomy of or pharynx as it relates to patterns of spread of squamous cell carcinoma. 2) Discuss oropharyngeal contouring patterns for radiation therapy. 3) Discuss treatment indications for surgery, radiotherapy, and chemoradiotherapy and the requisite contouring guidelines across oropharynx cancer staging.

**MSRO24F**  QandA

Participants
Participants
Michael N. Brant-Zawadzki, MD, Newport Beach, CA (Moderator) Nothing to Disclose
Gordon K. Sze, MD, New Haven, CT (Moderator) Investigator, Remedy Pharmaceuticals, Inc

LEARNING OBJECTIVES
1) The learner will be able to identify the major specificity fault of spine imaging.
2) The learner will be able to describe the major sensitivity fault of spine imaging.
3) The learner will be able to describe the utility of spine imaging in the acute presentation of back or limb pain.
4) The learner will be able to describe appropriate utilization of spine imaging in the back / limb pain patient based on guidelines published by major specialty societies.

ABSTRACT
Abstract
Spine imaging rightfully has a pivotal role in the evaluation of the patient with back or limb pain, primarily in the exclusion of systemic disease as a cause of symptoms. Unfortunately, imaging is frequently over utilized, providing no measurable benefit to the patient while incurring significant societal cost and potential patient harm. It is imperative to examine the literature to understand the appropriate interpretation, value to the patient, and evidence-based utilization of spine imaging. Systemic disease underlies only 5% of back or limb pain presentations; most imaging findings are categorized as "degenerative." This constitutes the primary specificity fault of spine imaging: the vast majority of reported "degenerative" changes involving the spinal articulations, the disc and facet joints, are asymptomatic and reflect only expected age-related change. They are not a degenerative disease; labeling them as such is misleading. Spine imaging also suffers a sensitivity fault: most advanced imaging is done in a recumbent position, without axial load and physiologic posture. This renders imaging insensitive to dynamic structural alterations present only in the upright patient. Reliance on anatomic structural changes alone must ultimately yield to imaging identification of the local inflammatory processes that are necessary for spine nociception. Utilization of spine imaging must occur as a risk / benefit calculation. The benefits of diagnosis of systemic disease, or guiding therapeutic intervention for truly symptomatic structural/inflammatory changes, must be weighed against the harms of inappropriately labeling the patient as suffering from a degenerative disease, radiation exposure, patient / societal cost, and the precipitation of interventions that are often poorly based on evidence. Evidence-based guidelines for imaging utilization, in combination with an evidence-based understanding of its interpretation, can help physicians employ this powerful tool more effectively and efficiently.

PURPOSE
We report the prevalence of ossification of the posterior longitudinal ligament (OPLL) in the cervical spine on computed tomography (CT) in the North American population using the original and newer classification systems proposed by the Japanese Ministry of Public Health and Welfare (JMPHW).

METHOD AND MATERIALS
We retrospectively reviewed CT examinations of the cervical spine in adult patients performed from January 1st, 2009 through March 31st, 2010 at our institution. OPLL type, prevalence, and thickness were recorded. The OPLL types as described in the original JMPHW classification scheme were: continuous, segmental, mixed, and circumcresed. The CT classification comprised of two schemes: A or axial. Classification A described OPLL as bridging or nonbridging. In the axial classification, the location of the OPLL at the level of maximal stenosis on axial imaging was characterized as central or lateral.

RESULTS
We reviewed CT scans on 837 patients, 555 males (66%), with average age of 44.1 years (ranged from 18 to 100 yrs). We
detected 39 OPLL lesions in these 837 patients (4.7%). The OPLL types based on the original classification were 28 segmental, 8 circumscribed, 2 mixed, and 1 continuous. According to the classification A, 31 were nonbridge (79%). According to the axial classification, 34 were central (87%). Of the 28 patients with segmental OPLL, 20 (71%) were male. Of the 8 circumscribed OPLL, only 5 (63%) were male. The two patients with mixed type were female.

CONCLUSION

We found the prevalence of OPLL to be 4.7% which is higher than previously reported. Additionally, although prevalence among males was higher than females, we discovered that in the cervical spine that this sex difference is not uniform and depends on type of OPLL.

CLINICAL RELEVANCE/APPLICATION

Ossification of the posterior longitudinal ligament is a well-known cause of spinal stenosis and neurologic dysfunction. The reported prevalence of OPLL based on radiography ranges between 0.1-1.7% in Europe and US, 0.4-3% in Asia excluding Japan, and 1.9-4.3% in Japan. However, we found the prevalence of OPLL to be much higher than previously reported. Given the wide spread use of CT in today's clinical practice, radiologists will identify incidental OPLL in asymptomatic patients. We believe recognition of OPLL and knowledge of its natural history will be important for guiding patient management.

RC205-03  CT Findings Predict Clinical Outcome after Dynamic Posterior Stabilization in Patients with Painful Segmental Instability of the Lower Spine

Monday, Nov. 30 9:10AM - 9:20AM Location: N228

Participants
Benedikt J. Schwaiger, MD, San Francisco, CA (Presenter) Nothing to Disclose
Alexandra S. Gersing, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Michael Behr, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Claus Zimmer, Muenchen, Germany (Abstract Co-Author) Nothing to Disclose
Florian Ringel, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Jan S. Kirschke, MD, Muenchen, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE

Although clinical results after dynamic posterior stabilization in patients with painful degenerative segmental instability of the lower spine are promising, few is known about preoperative CT imaging parameters to select patients who will benefit from this procedure. Purpose therefore was to identify CT findings that predict post-surgical outcome.

METHOD AND MATERIALS

63 patients (age 66±11.7; 38 women) treated with dynamic stabilization for painful segmental instability with/without spinal stenosis were identified. Preoperative MDCT scans were assessed for quantitative and qualitative parameters defining degenerative changes of the thoracolumbar spine. BMD measurements were performed in asynchronously calibrated MDCT. For clinical follow-up at 24 months, visual analogue scale (VAS), Oswestry Disability Index (ODI), Short Form 36 physical (PCS) and mental (MCS) component summaries were assessed. For statistical analysis classification and regression trees, linear regression and non-parametrical tests were used.

RESULTS

At follow-up, all clinical scores showed significant improvement compared to preoperative values (delta VAS 4.1±2.9, delta ODI 32.1±17.2, delta PCS 4.9±2.3 and delta MCS 4.2±1.7; P<0.001, respectively). PCS improvement was significantly decreased in patients with higher grades of disc herniation (P<0.001) and spondylolisthesis (P=0.011) as well as with larger cross-sectional area (CSA) of the dural tube at disc level (P=0.043). PCS improvement was significantly higher in patients with high intervertebral disc height (P=0.006) and high grades of vertebral body sclerosis (P=0.002). Patients with high BMD and initially low AP diameter of intervertebral foramina showed a significantly higher improvement of ODI (P<0.05).

CONCLUSION

In patients treated with dynamic posterior stabilization, postoperative clinical improvement was predicted by the following CT parameters: high grades of vertebral body sclerosis, spondylolisthesis or disc herniation, high BMD and disc space height, larger CSA of the dural tube and AP diameter of intervertebral foramina. Preoperative evaluation of these CT parameters therefore may improve therapy selection for patients with degenerative disease of the lower spine.

CLINICAL RELEVANCE/APPLICATION

The identified CT parameters predict post-surgical outcome and therefore support appropriate therapy selection for patients with painful degenerative segmental instability of the lower spine.

RC205-04  Accuracy and Efficacy of Fluoroscopic guided Pars Interarticularis Injections on Immediate and Short-Term Pain Relief

Monday, Nov. 30 9:20AM - 9:30AM Location: N228

Participants
Lloyd M. Kersh, MD, Charlottesville, VA (Abstract Co-Author) Nothing to Disclose
Nicholas C. Nacey, MD, Charlottesville, VA (Abstract Co-Author) Nothing to Disclose
James Patrie, MS, Charlottesville, VA (Abstract Co-Author) Nothing to Disclose
Michael G. Fox, MD, Charlottesville, VA (Presenter) Stockholder, Pfizer Inc;

PURPOSE

To determine the accuracy and short-term efficacy of fluoroscopic guided steroid and anesthetic injections for symptomatic pars interarticularis (pars) defects.

METHOD AND MATERIALS

Following IRB approval, all fluoroscopically guided injections of symptomatic pars defects at a single institution from June 2010 to
Fluoroscopically guided intra-pars injections for symptomatic spondyloysis can be performed accurately in ~90% of cases with minimum fluoroscopic time. There is statistically significant pain reduction immediately following the procedure, with a trend in pain reduction at one week.

**CONCLUSION**

Fluoroscopically guided intra-pars injections for symptomatic spondyloysis can be performed accurately in ~90% of cases with minimum fluoroscopic time. There is statistically significant pain reduction immediately following the procedure, with a trend in pain reduction at one week.

**CLINICAL RELEVANCE/APPLICATION**

Symptomatic pars interarticularis defects can be successfully injected with limited fluoroscopic time in ~90% of cases with significant immediate pain relief, obviating the need for CT to perform these injections.

**RC205-05  Acute Myelopathy Following Epidural and Spinal Anesthesia**

Monday, Nov. 30 9:30AM - 9:40AM Location: N228

Participants

Ruth Eliahou, MD, Philadelphia, PA (Presenter) Nothing to Disclose
Alexander Losus, Jerusalem, Israel (Abstract Co-Author) Nothing to Disclose
Eliel Ben-David, MD, Jerusalem, Israel (Abstract Co-Author) Nothing to Disclose
John M. Gomori, MD, Jerusalem, Israel (Abstract Co-Author) Consultant, Medymatch Technology Ltd
Asaf Honig, MD, Jerusalem, Israel (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Spinal and epidural anesthesia (E-SA) are widely used and generally considered as safe procedures. However, rarely, myelopathy may develop acutely and may result in permanent neurological sequela. This study suggests three different mechanisms of post-procedure myelopathy including direct cord injury, toxic/allergic myeloradiculitis and cord ischemia.

**METHOD AND MATERIALS**

Over 300 medical files of an acute myelopathy were reviewed. Patients presenting acute myelopathies appearing within 24 hours after E-SA were included.

**RESULTS**

A total of 57 procedures (106 pars injections) were performed on 41 patients (mean age 37; 21M,20F). Exact agreement between the 2 readers was present in 86% (49/57) of the procedures with a consensus intra-pars location recorded in 91.5% (97/106) of injections. The mean pre-injection and 5-10 minute post-injection pain scores for the all intra-pars procedures was 5.9 and 2.9, respectively with a mean change in pain of -3.0 (95% CI -3.8, -2.2; p<0.001). For the all intra-pars procedures with a 1-week post-injection pain score recorded (n=18 pts; 34 pars), the mean 1-week post-injection change in pain was -0.8 (95% CI -1.8, 0.2; p=0.10). The mean pre-injection and 5-10 minute post-injection pain scores for the 9 peri-pars/partially-in procedures were 6.1 and 3.4, respectively with a mean change in pain of -2.7 (95% CI -4.5, -0.9; p<0.004).When accounting for radiologist performing the procedure, the mean fluoroscopic time per pars injected was 43 s (CI 37, 50) for the all intra-pars group versus 73 s (CI 52, 103) for the peri-pars injections (p=0.001).

**CONCLUSION**

Acute myelopathy may develop following E-SA due to direct traumatic cord injury, toxic/allergic response or cord ischemia, with possibility of permanent neurological damage. Focal syringomyelia as a late sequel is typical.Characteristic MRI findings aid with the diagnosis and management.

**CLINICAL RELEVANCE/APPLICATION**

Acute myelopathy following spinal and epidural anesthesia is a rare but serious complication with potential for permanent neurological sequelae. SWI and DWI-MRI sequences aid the diagnosis and help characterize the mechanism of injury.

**RC205-06  Epidural Steroid Injections for Spinal Stenosis: Helpful or Harmful?**

Monday, Nov. 30 9:40AM - 10:10AM Location: N228

Participants

Jeffrey G. Jarvik, MD, MPH, Seattle, WA, (jarvikj@uw.edu) (Presenter) Co-founder, PhysioSonics, Inc; Stockholder, PhysioSonics, Inc; Intellectual property, PhysioSonics, Inc; Consultant, HealthHelp, LLC; Author, Springer Science+Business Media Deutschland GmbH; Advisory Board, General Electric Company; Consultant, Alphabet Inc

**LEARNING OBJECTIVES**

1) Review the rationale and design of the Lumbar Epidural Steroid injections for spinal Stenosis (LESS) study. 2)Examine the results of the LESS study. 3) Discuss the limitations of LESS study. 4) Discuss the policy implications of the LESS conclusion: in the
treatment of lumbar spinal stenosis symptoms, epidural steroid injections offered minimal to no benefit compared to epidural injections of lidocaine at six weeks.

ABSTRACT

The Lumbar Epidural Steroid injections for spinal Stenosis (LESS) study was double-blind study comparing epidural steroid injections (ESIs) with lidocaine to lidocaine injections alone. The study included 400 patients with back and leg pain from lumbar spinal stenosis who were randomized to receive either an epidural injection containing lidocaine or an epidural injection containing lidocaine plus a glucocorticoid. Sixteen U.S. centers participated in the study. Compared to injections with local anesthetic alone, injections with glucocorticoids provided these patients with minimal or no additional benefit. The primary outcomes were the Roland-Morris Disability Questionnaire and a leg pain numerical rating scale. Patients who received glucocorticoid reported greater satisfaction with treatment, with 67% of those patients reporting being very satisfied or somewhat satisfied compared to 54% of those who received lidocaine alone reporting the same level of satisfaction with the treatment. There were more adverse events in the patients who received the injections that included glucocorticoid. Furthermore, patients receiving the combination injections were more likely to have low morning serum cortisol levels at 3 weeks and 6 weeks after the injection, suggesting that the corticosteroid may have a broad systemic effect. In conclusion, for the treatment of lumbar spinal stenosis symptoms, ESIs offered minimal to no benefit compared to epidural injections of lidocaine at six weeks.

RESULTS

From 09/01/2001 to 12/31/2013, there were 340 spine MRIs demonstrating at least one epidural mass of oncologic etiology with a body CT performed within 30 days. An epidural mass reported on MRI was clearly visible in 244 (71.7%) of the 340 body CTs. Of these 244 body CTs representing 129 unique patients, 61 CT reports (25.0%) did not mention the presence of an epidural mass, even in some cases wherein an MRI examination preceded and reported its presence (27 of 61 cases; 44.3%). There was no statistically significant correlation with respect to the omission of CT reporting and patient gender, age, primary diagnosis, epidural mass location, reporting radiologist, CT or MR scanner, or preceding MRI diagnosis of an epidural mass (univariate chi-squared analysis; p < 0.05).

CONCLUSION

In this retrospective analysis, body CT is 71.7% sensitive in detecting an epidural mass of oncologic etiology which is demonstrable on MRI. Additionally, oncologic epidural masses are commonly (25.0%) unreported on body CT, even in cases where there is preexisting imaging evidence to confirm their presence.
**RC205-09  Lumbar MR Imaging: Does Epidemiologic Data in Radiology Reports Affect Patient Management and Outcomes in the Primary Care Setting?**

**Participants**
Jessica G. Fried, MD, Lebanon, NH (Presenter) Nothing to Disclose  
Brook I. Martin, MPH, Lebanon, NH (Abstract Co-Author) Nothing to Disclose  
David A. Pastel, MD, Lebanon, NH (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
A significant challenge to the appropriate diagnosis and management of low back pain is that lumbar MRI commonly reveals numerous findings that can be considered pathologic, even in asymptomatic individuals. Referring primary care providers may not understand the epidemiologic significance of the findings in the lumbar MRI reports they use to make patient-care decisions, potentially leading to unnecessary specialist referrals and overly aggressive treatment plans.

**METHOD AND MATERIALS**
A verified epidemiologic statement regarding prevalence rates of common findings in asymptomatic patients was included in all relevant lumbar MRI reports beginning July 01, 2013 at a single academic medical center. Patients referred for lumbar MRI by in-network primary care providers for uncomplicated low-back pain were followed prospectively for one year. Chart-review was utilized to capture health care utilization rates following MRI, including physical therapy referral, narcotic prescription, specialist referral, and spine surgery. A pre-statement-implementation cohort was compared to a post-statement-implementation cohort.

**RESULTS**
There were 323 patients who met inclusion criteria for the study, with 154 in the pre-statement cohort and 169 in the post-statement cohort. There was no significant difference in baseline demographic characteristics between the two cohorts. After one year of follow-up, there was a trend in decreased referral to spine specialists (53.6% v. 46.0%, p=0.234) and lumbar spine surgeries performed (10.9% v. 7.1%, p=0.290) when comparing the pre-statement cohort to the post-statement cohort. There were no apparent differences in referral for physical therapy or narcotic prescription rates in the study.

**CONCLUSION**
While the study is limited by small sample size, the trend in decreased referral to spine specialists by primary care physicians and fewer surgeries performed with the implementation of the statement motivates further investigation into the utility of enhancing imaging reports with epidemiologic information. This simple intervention may have meaningful impact on the management of these patients by referring primary care physicians.

**CLINICAL RELEVANCE/APPLICATION**
The addition of a simple, verified epidemiologic statement to lumbar MRI reports may impact the medical management of low-back pain in the primary care setting.

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**RC205-10  Open Surgical Biopsy of Degenerated Discs with Correlation of Associated MRI Modic Changes**

**Participants**
Mark Georgy, Escondido, CA (Presenter) Nothing to Disclose  
Mark Stern, MD, Escondido, CA (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
Recent publication had suggested evidence of chronic infection of degenerated disc spaces with Propionibacterium Acnes (PA) as a cause of chronic back pain that linked to type I Modic changes. Researches had advocated for antibiotic treatment of patients with chronic back pain. This had created extensive debate in the medical community. We are presenting our pilot data as a part of larger NIH prospective study of serial biopsies of degenerative disc spaces during open surgery.

**METHOD AND MATERIALS**
An IRB approval was obtained to conduct this retrospective study in a multicenter single neurosurgery practice over a 9-month period. Biopsies were obtained from the disc space during open surgery when possible for all patients who underwent surgery for degenerative disc disease. Biopsy materials were sent for gram stain and culture in all cases. Pre-operative MRI images were evaluated for the presence of Modic changes.

**RESULTS**
Complete data were available from 21 lumbar disc surgeries, 10 of them (48%) had a positive culture. 5 levels were positive for PA, one level was positive for S. Aureus, one level was positive for Actinomycen and three levels were positive for S. Epidermis. There were a total of 7 cases with Modic changes and none of them were positive for PA. Biopsies were collected from 26 cervical cases, and 9 of them (35%) showed a positive biopsy. There were 16 cases with Modic changes that included 6 (37.5%) of the positive cultures. Three of the positive cultures showed no Modic changes. 10 cases with Modic changes had a negative culture.

**CONCLUSION**
Our results concur with the published date of high incidence of PA infection of the degenerated nucleus. However, we did not show any constant relationship to Modic changes which could be due to the small sample size. The etiology of Modic changes may be related to factors other than infectious processes. Furthermore, the pathophysiology of the Modic changes in the cervical and lumbar spine could be different. Further evaluation of these results with a larger prospective controlled study is underway.
Neurography image. Acute axonal nerve lesions cause a hyperintense signal on T2-weighted images at and distal to the lesion site. MRI findings may be related to nerve, muscle or compressive etiology (tumor, pathoanatomy or predisposing variant). Normal (e.g. nerve avulsion for pre-surgical planning), to evaluate unexplained neuromuscular symptoms (e.g. extra-spinal sciatica with a diagnosis (e.g. brachial neuritis), elucidating pathoanatomy (e.g. thoracic outlet syndrome), establishing the location of a lesion for and is complementary to electrodiagnostic testing (e.g. electromyography). Broad categories of indications include confirming a concept of a "target zone" is useful to tailor protocols for high resolution portions. The size is to evaluate feasibility of 3D nerve-sheath signal increased with inked rest-tissue rapid acquisition of relaxation enhancement Imaging (3D SHINKEI) in the ganglions and the nerves of lumbar plexus in patients with chronic inflammatory demyelinating polyneuropathy (CIDP).

**METHOD AND MATERIALS**

This study included 12 patients with CIDP (9 males and 3 females; age range 14-66 year-old; median 34 year) and 13 normal subjects (10 males and 3 females; age range 27-81 year-old; median 53 year). 3D SHINKEI is a turbo spine echo with a diffusion-weighted prepulse called improved motion-sensitized driven equilibrium. The imaging parameters were as follows; TR/TE = 2500/90 ms, FOV = 280 x 280 mm, voxel size = 0.98 x 0.98 x 2.0 mm³, b = 10 s/mm², acquisition time = 5 min 48 s. Regions of interests (ROIs) were placed at the ganglions and nerves from T12 to L5 bilaterally. Signal-to-noise ratio (SNR) and contrast-radio (CR) were calculated. The size of the ganglions and the nerves was also measured. Statistical analyses were performed with Mann-Whitney U test. P-values less than 0.05 were considered significant.

**RESULTS**

The size of the ganglions and the nerves was larger in patients with CIDP (6.80 ± 1.90 mm and 5.81 ± 2.72 mm) than in normal subjects (5.22 ± 1.15 mm and 4.25 ± 1.08 mm, P < 0.0001, respectively). SNR of the ganglions and the nerves was larger in patients with CIDP (539.73 ± 789.57 and 519.31 ± 882.72) than in normal subjects (89.85 ± 91.29 and 44.03 ± 55.19, P < 0.0001, respectively). CR of the ganglions and the nerves was larger in patients with CIDP (0.74 ± 0.11 and 0.66 ± 0.16) than in normal subjects (0.72 ± 0.10 and 0.48 ± 0.16, P < 0.05 and P < 0.0001, respectively).

**CONCLUSION**

With 3D SHINKEI we could obtain high-resolution MR neurography. CIDP could be discriminated from normal subjects on 3D SHINKEI.

**CLINICAL RELEVANCE/APPLICATION**

With 3D SHINKEI we can evaluate the size and signal intensity of the lumbar plexus and can discriminate patients with CIDP from normal subjects.
corresponding to Wallerian degeneration. Denervation produces a non-specific muscle edema-like signal alteration. Muscle signal alteration occurs within a few days (as early as 72 hours) of denervation. Muscle atrophy is a late finding likely reflecting disuse. Fatty replacement (retained bulk and contour of muscle with fibers replaced by fat) is associated with neuromuscular etiologies (neurogenic or myogenic) or inflammatory myopathies. The MRI signal changes are reversible when the recovery of motor function occurs as a result of further muscle innervation. Tumor related neuropathy may be caused by a primary nerve neoplasm or a lesion compressing or infiltrating the nerve. Peripheral nerve sheath tumors (PNST) include neurilemmoma (schwanoma) and neurofibroma. The majority of PNST lesions are benign. Malignant PNST (MPNST) typically occurs in the setting of neurofibromatosis. It may be difficult for MRI to distinguish benign from malignant PNST and currently FDG PET has a role showing increased uptake in malignancies. Larger heterogeneous appearing lesions that have changed over time, either by clinical symptoms or imaging features suggests MPNST. Compressive lesions include non-neoplastic tumors (ganglions, hematoma), benign neoplasms (osteochondromas) or malignant neoplasm (sarcoma) that residing along the course of a nerve or within a fibro-osseous tunnel. Nerve infiltration and invasion may occur from lymphoma or metastatic neoplasm.

Honored Educators

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John A. Carrino, MD, MPH - 2013 Honored Educator
John A. Carrino, MD, MPH - 2015 Honored Educator
Head and Neck Top Five: Important Anatomy, Missed Diagnoses and Imaging Pearls

Monday, Nov. 30 8:30AM - 10:00AM Location: E450A

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC206A Important Head and Neck Anatomy

Participants
Hugh D. Curtin, MD, Boston, MA, (Hugh_Curtin@meei.harvard.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) The participant will be able to identify the key 'fat pads' at the exit points of those cranial nerves most often affected by perineural spread. 2) The participant will be able to describe the fascial organization of the parapharyngeal region. 3) The participant will be able to locate the laryngeal ventricle using axial and coronal imaging.

ABSTRACT
Important Anatomy Head and neck imaging relies heavily on an understanding of the intricate and often difficult anatomy. The session will focus on identification of anatomy that is crucial in defining the margins and patterns of spread of pathology. Other landmarks that are key to description of the location of lesions are also covered. For instance, there is a small amount of fat located just external to each neural foramen through which perineural spread of carcinoma may pass. The most important of these primary 'fat pads' are located in the pterygopalatine fossa (external to foramen rotundum), just inferior to foramen ovale (trigeminal fat pad), and the stylomastoid foramen (facial nerve) fat pad. These fat pads should be examined for potential obliteration as tumor approaches the foramen. The laryngeal ventricle is key to the organization of the larynx and reports should localize lesions related to this important structure. The ventricle may not be directly visible depending on the phase of respiration of an imaging scan. However the lateral wall of the larynx transitions from fat to muscle at the level of the ventricle. The ventricle is located at the upper margin of the thyroarytenoid muscle that makes up the bulk of the true vocal cord. The parapharyngeal spaces are crossed by several substantial fascial layers. The fascia organize the region into compartments that help the radiologist predict the identity of tumors in that location. Specifically, the anatomy makes it possible to separate tumors that are almost certainly of salivary origin from those that are not. Other specific anatomic points useful in interpretation or characterization will also be discussed.

RC206B Missed Diagnoses in the Head and Neck

Participants
Phillip R. Chapman, MD, Birmingham, AL (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify some of the most common mistakes radiologists make when evaluating MRI or CT scans of the neck and skull base. 2) Identify different patterns of perineural tumor spread (PNTS) and understand the subtle CT and MRI changes that indicate early PNTS. 3) Recognize atypical patterns of metastatic nodal disease and how it can be missed on routine CT scans. 4) Identify changes in the nasopharynx and skull base that indicate invasive infectious or neoplastic process. 5) Identify easily missed superficial lesions of the dermis that might represent primary cutaneous tumor or dermal metastases. 6) Understand the basic anatomy of the oral cavity including specific anatomic subunits, the appearance of oral cavity neoplasms and pitfalls in imaging oral cavity cancers.

ABSTRACT
This presentation will highlight some of the most common mistakes and misdiagnoses that radiologists make when interpreting head and neck studies, including MRI and CT examinations. Many 'misses' are difficult, and rely on identifying subtle changes in small structures in the complex landscape of the neck and skull base. Other misses are difficult because they are relatively rare and may not be on the radar of most radiologists. Some misdiagnoses are the result of satisfaction of search, and are observed in complex cases, especially complex head and neck cancer. Post treatment changes in the neck impose additional limitations on imaging of the head and neck. This lecture will identify some common mistakes that are made in both private and academic practices. Cases will be presented using a case-based approach. They keys to identifying the pertinent findings and making each diagnosis will be highlighted.

RC206C Head and Neck Imaging Pearls

Participants
Christine M. Glastonbury, MBBS, San Francisco, CA, (Christine.glastonbury@ucsf.edu) (Presenter) Author with royalties, Reed Elsevier

LEARNING OBJECTIVES
1) To learn the key points that create a succinct imaging differential diagnosis while appreciating the 'big picture' in Head & Neck imaging. 2) To recognize the imaging findings of critical disease and what to do or recommend next with your patient.

ABSTRACT
This session will review some important pearls in head and neck imaging. These tips and tricks will review some important aspects of
imaging in the head and neck to help with protocoling studies, as well as techniques for imaging and interpretation. Important imaging differentials will also be reviewed and discussed.
Interventional Stroke Treatment: Practical Techniques and Protocols (An Interactive Session)

Monday, Nov. 30 8:30AM - 10:00AM Location: S402AB

Participants
Joshua A. Hirsch, MD, Boston, MA (Moderator) Shareholder, Intratech Medical Ltd

LEARNING OBJECTIVES
1) Describe the diagnostic evaluation and decision making algorithms leading to urgent endovascular treatment of acute stroke. 2) Review endovascular techniques for the treatment of acute stroke from microwire catheter set up to intraarterial thrombolysis to mechanical thrombectomy. 3) Discuss case examples of endovascular treatment including patient selection, technique, and pitfalls.

ABSTRACT
Rapid advances in the evaluation, selection, treatment and management of the acute stroke patient necessitates an ongoing educational event highlighting the newest information, techniques and strategies for obtaining the best outcomes for our patients. In this session, all of these topics will be covered in a practical 'how to' and case based approach which is designed to help the practitioner implement best practices. The course is useful for those performing imaging, treatment or both. Analysis of the latest ongoing trials, devices and techniques will be presented. Endovascular tips and tricks will be discussed, as well as pitfalls in the treatment of these patients.

Sub-Events

RC250A  A Birdseye View to the Interventional Approach to Acute Stroke Therapy

Participants
Allan L. Brook, MD, Bronx, NY (Presenter) Advisor, Johnson & Johnson Advisor, Medtronic, Inc

LEARNING OBJECTIVES
View learning objectives under main course title.

RC250B  Data, Data, and More Data: Endovascular Therapy Is the Proven Treatment for Large Vessel Occlusion

Participants
David J. Fiorella, MD, PhD, Stony Brook, NY (Presenter) Institutional research support, Siemens AG; Institutional research support, Sequent Medical, Inc; Research support, MicroVention Inc; Consultant, Medtronic, Inc; Consultant, Cardinal Health, Inc; Consultant, Penumbra, Inc; Owner, Vascular Simulations LLC; Owner, TDC Technologies; Owner, CVSL;

LEARNING OBJECTIVES
View learning objectives under main course title.

RC250C  Optimizing Patient Selection with Imaging

Participants
Ramon G. Gonzalez, MD, PhD, Boston, MA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Understand the essential ischemic stroke physiology parameters that are essential in selecting patients for endovascular treatment of a large vessel occlusion. 2) Be familiar with the imaging methods that can measure ischemic stroke physiology parameters and their relative accuracy. 3) Use the best available evidence, recognize the optimal imaging approach to select patients with acute ischemic stroke for endovascular treatment.

ABSTRACT
Properly selected patients with acute ischemic stroke caused by large vessel occlusion (LVO) may be effectively and safely treated endovascularly with modern thrombectomy devices. We have developed a high-precision imaging tool for selecting such patients. It is an experience and evidence-based clinical triage tool that uses advanced imaging to identify INDIVIDUAL patients most likely to benefit from endovascular stroke therapy. It was based on over a decade of using advanced imaging to identify INDIVIDUAL patients most likely to benefit from endovascular stroke therapy. It was based on over a decade of using advanced imaging to identify INDIVIDUAL patients most likely to benefit from endovascular stroke therapy. It was based on over a decade of using advanced imaging to identify INDIVIDUAL patients most likely to benefit from endovascular stroke therapy.
Participants
John R. Leyendecker, MD, Dallas, TX (Director) Nothing to Disclose

LEARNING OBJECTIVES
1) Understand the role of MRI in diagnosing abnormalities of the breast. 2) Be familiar with the MRI appearance of select cardiothoracic abnormalities. 3) Effectively use MRI to diagnose disorders of the head and neck. 4) Distinguish between a variety of brain lesions based on MRI appearance.

ABSTRACT
This session will help attendees recognize and manage select, commonly encountered breast, cardiothoracic, head and neck, and brain abnormalities based on their MRI appearances using a case-based, interactive format.

Sub-Events

MSCM22A  Breast MRI

Participants
Fiona J. Gilbert, MD, Cambridge, United Kingdom (Presenter) Medical Advisory Board, General Electric Company; Research Grant, GlaxoSmithKline plc; Research Grant, General Electric Company

LEARNING OBJECTIVES
View learning objectives under main course title.

MSCM22B  Cardiothoracic MRI

Participants
Suhny Abbara, MD, Dallas, TX (Presenter) Author, Reed Elsevier; Editor, Reed Elsevier; Institutional research agreement, Koninklijke Philips NV; Institutional research agreement, Siemens AG

LEARNING OBJECTIVES
View learning objectives under main course title.

ABSTRACT
Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Suhny Abbara, MD - 2014 Honored Educator

MSCM22C  Head and Neck MRI

Participants
Daniel W. Williams III, MD, Winston Salem, NC (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

MSCM22D  Brain MRI

Participants
Mauricio Castillo, MD, Chapel Hill, NC (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Review the differential diagnosis and imaging features of intraventricular masses in children and adults. 2) Review the cerebral complications of treatment vascular malformations. 3) Review the differential diagnosis and imaging features of masses arising in the cerebello-pontine angle region. 4) Review the differential diagnosis of cerebral microbleeds.
**Overview of MI in Neurology**

Participants
Satoshi Minoshima, MD, PhD, Salt Lake City, UT (Moderator)
Royalties, General Electric Company; Consultant, Hamamatsu Photonics KK; Research Grant, Hitachi, Ltd; Research Grant, Nihon Medi-Physics Co, Ltd; Research Grant, Astellas Group; Research Grant, Seattle Genetics, Inc;

**MI in Dementia**

Participants
Alexander Drzezga, MD, Cologne, Germany (Presenter)
Research Grant, Eli Lilly and Company; Speakers Bureau, Siemens AG; Speakers Bureau, General Electric Company; Speakers Bureau, Piramal Enterprises Limited; Research Consultant, Eli Lilly and Company; Research Consultant, Piramal Enterprises Limited;

**MI in Movement Disorders**

Participants
Kirk A. Frey, MD, PhD, Ann Arbor, MI (Presenter)
Consultant, MIM Software Inc; Consultant, Siemens AG; Consultant, Eli Lilly and Company; Stockholder, General Electric Company; Stockholder, Novo Nordisk AS; Stockholder, Bristol-Myers Squibb Company; Stockholder, Merck & Co, Inc; Stockholder, Medtronic, Inc

**Clinical Translation and Approval**

Participants
Peter Herscovitch, MD, Bethesda, MD (Presenter)

**Learning Objectives**

1) Learn recent development of molecular imaging in the field of neurosciences. 2) Understand technologies used in molecular brain imaging. 3) Discuss opportunities and challenges in molecular brain imaging.

**Learning Objectives**

1) Gain overview on types of molecular neuropathology involved in the development of different forms of dementia and understand currently discussed disease concepts. 2) Learn about the currently available methods for imaging molecular pathology such as amyloid-deposition and tau-aggregation in dementia and their current status of validation. 3) Gain insights on the clinical value of the individual available methods and their combination with regard to earlier detection, more reliable diagnosis and therapy monitoring of disease.

**Learning Objectives**

1) Discuss the FDA approval process for diagnostic radiopharmaceuticals Describe the current status of CMS coverage for diagnostic radiopharmaceuticals. 2) Describe the current status of CMS coverage for amyloid PET radiopharmaceuticals and coverage with evidence development (CED).

**Abstract**

The final steps in clinical translation of molecular imaging radiopharmaceuticals for neurological studies are approval by the U.S. Food and Drug Administration (FDA) for marketing and by insurance carriers for reimbursement. Given the age of patients most likely to require brain imaging studies for neurodegenerative disorders, coverage approval by the U.S. Centers for Medicare and Medicaid ("Medicare") is crucial. This talk will discuss the steps required that lead to FDA approval of a radiopharmaceutical, including the IND process and Phase 1, 2, and 3 clinical trials. It should be noted that FDA approval does not necessarily lead to Medicare approval, especially for PET agents. The CMS approval process will be outlined, including the increasing need to demonstrate the ability of PET imaging to provide improved health outcomes. CMS coverage with evidence development (CED) of PET amyloid imaging agents will be described.
Participants
Jonathan E. McConathy, MD, PhD, Saint Louis, MO, (mcconathyj@mir.wustl.edu) (Presenter) Research Consultant, Eli Lilly and Company; Research Consultant, Blue Earth Diagnostics Ltd; Research Consultant, Siemens AG; Research support, GlaxoSmithKline plc

LEARNING OBJECTIVES
1) Participants will be familiar with newer molecular imaging approaches to dementia including tracers targeting tau, alpha-synuclein, and neuroinflammation as well as simultaneous PET/MRI which is particularly well-suited to neuroimaging.

ABSTRACT
Imaging biomarkers for Alzheimer's disease (AD) and other neurodegenerative diseases are playing increasingly important roles in both research and patient care. Many neurodegenerative diseases involve the deposition of characteristic proteins including amyloid, tau, and alpha-synuclein which are target for molecular neuroimaging and potentially for therapy. Additionally, processes such as neuroinflammation appear to contribute to the pathophysiology of many neurodegenerative diseases including AD. In this talk, these newer approaches to molecular neuroimaging in dementia will be discussed including their potential clinical applications in patients with cognitive impairment and dementia.
**Neuroradiology (Traumatic Brain Injury)**

**SSC08-01 The Association between Football Exposure, Position, and Concussion History on White Matter Integrity**

*Participants*

Pratik Mukherjee, MD, PhD, San Francisco, CA (Moderator) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company; 
Michael M. Zeineh, PhD, MD, Stanford, CA (Moderator) Research funded, General Electric Company

**Purpose**

Diffusion tensor imaging has emerged as an important tool for quantitative analysis of white matter (WM) integrity following sport-related concussion. The primary purpose of this project was to investigate the variances in WM integrity in retired college and professional football athletes based on concussion history, duration of playing career, and playing position.

**Method and Materials**

32 former college and 31 former professional players were matched on age, concussion history, and playing position. All subjects were cognitively normal for age on a battery of neuropsychological tests. MRI scans were obtained and all diffusion-weighted images were analyzed using Tract Based Spatial Statistics. Our primary outcomes were fractional anisotropy (FA) and mean diffusivity (MD). A permuted, voxel-wise 3x2 ANOVA was performed on the WM skeleton to investigate the main and interaction effects of three fixed variables on WM integrity. These variables were concussion history (3+ vs. 0-1), football exposure (College vs. Professional), and playing position (Speed vs. Non-speed). Threshold-free cluster enhancement was used to identify clusters of significantly different FA or MD and post-hoc univariate analyses were used to determine the direction of interaction effects. Our a priori α was set at 0.05 after correction for multiple comparisons.

**Results**

Three clusters in the forceps minor and genu of the corpus callosum were identified as having significant differences in FA for the concussion by position interaction. Post-hoc analysis of the peak voxels within each of the three clusters revealed consistently lower FA for non-speed players with 3+ concussions as compared to those with 0-1 concussions (Cohen’s d: 0.89, 0.95, and 1.29; P<0.05). No other main effects or interaction effects were observed for FA or MD.

**Conclusion**

Our results suggest a history of multiple concussions is associated with lower FA in former non-speed position players compared to speed players, particularly in frontal white matter tracts. Additionally, we did not observe main or interaction effects of football exposure, suggesting that without concussive injuries, added football exposure does not account for variances in FA or MD. A limitation of these results is the lack of a control group without history of football participation.

**Clinical Relevance/Application**

Multiple concussions and playing a non-speed position are associated with lower FA in frontal white matter tracts.

**SSC08-02 Reduced Cerebral Blood Flow Detected after Clinical Recovery in Acute Sports-related Concussion**

*Participants*

Yang Wang, MD, Milwaukee, WI (Presenter) Research Grant, Siemens AG; Research Grant, General Electric Company 
Lindsay D. Nelson, PhD, Milwaukee, WI (Abstract Co-Author) Nothing to Disclose 
Ashley A. LaRoche, Milwaukee, WI (Abstract Co-Author) Nothing to Disclose 
Adam Y. Pfaller, BS, Milwaukee, WI (Abstract Co-Author) Nothing to Disclose 
Andrew S. Nencka, PhD, Milwaukee, WI (Abstract Co-Author) Nothing to Disclose 
Michael A. McCrea, PhD, Milwaukee, WI (Abstract Co-Author) Research Grant, General Electric Company

**Purpose**

Sport-related concussion (SRC) is a major health problem, affecting millions of people each year. While the clinical effects of SRC (e.g., symptoms and impairments in neuropsychological functioning) typically resolve within several days, increasing evidence suggests persistent neurophysiological abnormalities beyond the point of clinical recovery after injury. This study was aimed to evaluate cerebral blood flow (CBF) changes in acute SRC, as measured using advanced arterial spin labeling (ASL) MRI.
METHOD AND MATERIALS

We compared CBF maps assessed using 3D pCASL (pseudo continues ASL) MRI in 18 concussed football players (age 17.8 ± 1.5 years) obtained within 24 hours and at 8 days after injury, in comparison to a control group of 19 matched non-concussed football players at the same interval. Clinical assessments including the Sport Concussion Assessment Tool 3 (SCAT3) and Standardized Assessment of Concussion (SAC) were obtained at each time point.

RESULTS

While the control group did not show any changes in CBF between the two time points, concussed athletes demonstrated a significant decrease in CBF at 8 days relative to 24 hours (p<0.01, FWE corrected). Moreover, scores on the clinical symptom (SCAT3) and cognitive (SAC) measures demonstrated significant impairment (versus pre-season baseline levels) at 24 hours (SCAT p < 0.0001, SAC p < 0.01) but returned to baseline levels at 8 days.

CONCLUSION

Our preliminary results suggest that advanced ASL MRI method might be useful for detecting and tracking the longitudinal course of underlying neurophysiological recovery from concussive injury.

CLINICAL RELEVANCE/APPLICATION

Abnormal CBF was found using 3D pCASL MRI in acute concussed patients even after clinical recovery, which might have important implication for clinical decisions on return-to-play after concussion.

Abnormal Radial Diffusivity Predicts Worse Cognitive Function One Year Following Concussion (Mild Traumatic Brain Injury)

Monday, Nov. 30 10:50AM - 11:00AM Location: N226

Participants

Sara B. Rosenbaum, MD, Bronx, NY (Presenter) Nothing to Disclose
Namhee Kim, PhD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Margo Kahn, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Hannah Scholl, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Jennifer Provataris, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Craig A. Branch, PhD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Michael L. Lipton, MD, PhD, Bronx, NY (Abstract Co-Author) Nothing to Disclose

Purpose

Abnormally low FA is related to worse cognitive outcomes in concussion (mild traumatic brain injury; mTBI). Some studies demonstrate that diffusion perpendicular to the principal direction of the diffusion tensor, or radial diffusivity (RD), may largely drive changes in FA, reflecting more severe transaxonal pathology such as axotomy. The purpose of this study is to examine the relationship between regional abnormalities of RD within 2 weeks of mTBI and cognitive function 1 year later.

METHOD AND MATERIALS

31 uncomplicated mTBI subjects were recruited from a local emergency center. 3T DTI was performed within 2 weeks of injury, and cognition was tested at 1 year post-injury. Voxelwise assessment was used to identify clusters of voxels demonstrating abnormally high RD (p(individual voxel)<0.05, p(cluster size corrected for multiplicity)<0.01) in each subject by comparing each subject to a cohort of 40 healthy controls. Each subject was then classified according to presence or absence of abnormally high RD within the following regions: left frontal, right frontal, left temporal, right temporal and corpus callosum. T-tests were used to compare cognitive outcomes between subjects with or without abnormally high RD in each region.

RESULTS

Subjects with abnormally high RD in the left temporal and right temporal lobe performed worse on tasks of executive function at 1 year (t(18)=-2.607, p=0.018 and t(18)=-2.495, p=0.023, respectively). There were no significant differences in cognitive function between those with and without abnormally high RD in the frontal lobes or corpus callosum.

CONCLUSION

Abnormally high RD in the temporal lobes within two weeks of injury is significantly associated with worse executive function 1 year following uncomplicated mTBI. RD, a putative imaging correlate for transaxonal injury, may reflect more severe early axonal or myelin pathology, which heralds persistent deficits in mTBI patients.

CLINICAL RELEVANCE/APPLICATION

These preliminary findings suggest that RD might provide an early imaging biomarker for worse long-term outcomes in mTBI, to guide patient management and inform treatment trials.

Diffusion Tensor MRI Reveals Gender-based Risk for Traumatic Brain Injury in Soccer Players

Monday, Nov. 30 11:00AM - 11:10AM Location: N226

Participants

Eva Catenaccio, BA, Bronx, NY (Presenter) Nothing to Disclose
Roman Fleyscher, PhD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Namhee Kim, PhD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Weiya Mu, BA, New York, NY (Abstract Co-Author) Nothing to Disclose
Liane Hunter, BA, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Molly Zimmerman, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Mark E. Wagshul, PhD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Tamar Glattstein, BA, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Maika Zugschaft, BA, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Walter Stewart, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

Purpose

Abnormal CBF was found using 3D pCASL MRI in acute concussed patients even after clinical recovery, which might have important implication for clinical decisions on return-to-play after concussion.

METHOD AND MATERIALS

31 uncomplicated mTBI subjects were recruited from a local emergency center. 3T DTI was performed within 2 weeks of injury, and cognition was tested at 1 year post-injury. Voxelwise assessment was used to identify clusters of voxels demonstrating abnormally high RD (p(individual voxel)<0.05, p(cluster size corrected for multiplicity)<0.01) in each subject by comparing each subject to a cohort of 40 healthy controls. Each subject was then classified according to presence or absence of abnormally high RD within the following regions: left frontal, right frontal, left temporal, right temporal and corpus callosum. T-tests were used to compare cognitive outcomes between subjects with or without abnormally high RD in each region.

RESULTS

Subjects with abnormally high RD in the left temporal and right temporal lobe performed worse on tasks of executive function at 1 year (t(18)=-2.607, p=0.018 and t(18)=-2.495, p=0.023, respectively). There were no significant differences in cognitive function between those with and without abnormally high RD in the frontal lobes or corpus callosum.

CONCLUSION

Abnormally high RD in the temporal lobes within two weeks of injury is significantly associated with worse executive function 1 year following uncomplicated mTBI. RD, a putative imaging correlate for transaxonal injury, may reflect more severe early axonal or myelin pathology, which heralds persistent deficits in mTBI patients.

CLINICAL RELEVANCE/APPLICATION

These preliminary findings suggest that RD might provide an early imaging biomarker for worse long-term outcomes in mTBI, to guide patient management and inform treatment trials.
PURPOSE
Female athletes are thought to be at increased risk for sports-related mild traumatic brain injury (mTBI) and worse mTBI outcomes, relative to males. Heading in soccer represents a source of repetitive subconcussive head impacts. Previous research shows that heading exposure above a threshold of approximately 1000 headers/year is associated with microstructural brain damage (lower fractional anisotropy; FA) detectable on diffusion tensor imaging (DTI). This study assesses the role of gender as a predictor of mTBI-associated changes in white matter in a cohort of amateur soccer players.

METHOD AND MATERIALS
Forty-one females and 41 age- and educated-matched males (ages 18-52) were drawn from an ongoing longitudinal study of mTBI in amateur soccer players. Number of prior concussions and frequency of heading in the prior 12 months was quantified. Subjects underwent 3.0T DTI. After registration to the Johns Hopkins University template, we analyzed the results with a voxelwise general linear model with 3 predictors of interest: (1) gender to assess baseline gender differences in FA, (2) reported heading to assess heading-related declines in FA and (3) a term representing the interaction of gender and heading to assess for gender-dependent sensitivity to heading. Nuisance covariates for the analysis included age, education, and number of prior concussions. Significance was determined by a statistical threshold of p<0.01 and a cluster size of 100 voxels.

RESULTS
The analysis revealed regions showing statistically significant effects from all 3 predictors of interest in the bilateral corona radiata and right frontal lobe white matter, in which (1) women had lower baseline FA, (2) where both genders showed heading-related declines in FA and (3) where there was a differential gender-based sensitivity to heading-related changes in FA.

CONCLUSION
Our finding of significant overlapping changes in white matter abnormalities may indicate that baseline sexual dimorphisms in brain microstructure are the basis for a gender-specific response to repetitive trauma. Future work should focus on associating these imaging findings with gender-specific clinical outcomes.

CLINICAL RELEVANCE/APPLICATION
Gender-based vulnerability of amateur athletes to TBI pathology, revealed through DTI, may provide new bases for the development and implementation of preventive interventions.

SSC08-05 Quantitative Assessment of Optic Nerve Injury Longitudinally Using Manganese-enhanced MRI

Participants

Jun Yang JR, BA, Kunming, China (Presenter) Nothing to Disclose
Yingying Ding, MD, Kunming, China (Abstract Co-Author) Nothing to Disclose
Chengde Liao, MD, Kunming, China (Abstract Co-Author) Nothing to Disclose
qing q. Li, Kunming, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate manganese (Mn2+)-enhanced MRI(MEMRI) in a longitudinal quantitative study of rat optic nerve injury.

METHOD AND MATERIALS
Forty Sprague Dawley rats were divided into 3 group: Group A / with manganese-enhanced MRI (n=15), Group B / with retrograde labeled fluoro-gold and pathology (n=15), and control group C (n=10). Group A and B were underwent left optic nerve crush (ONC) at 2mm back to the eyeball. Using fluoro-gold from superior colliculus and lateral geniculate nucleus to retrograde label RGCs was performed before ONC 7days. A total of 3 mL of 90 nmol MnCl2 was unilaterally injected into the vitreous body 24h before MRI. MEMRI (group A) and retinal ganglia cells (RGCs) count (group B) were performed at 3, 7 and 14 day-post-lesion (dpl). Each 5 rats in group C were underwent the same process as group A and B respectively, but no ONC. The contrast-to-noise ratio (CNR) of retina and optic nerve, the results of RGCs count were compared between groups at different time points.

RESULTS
In the control groups, the intact visual pathway, from the retina to the contralateral superior colliculus, was visualized by MEMRI. The overall impression of ONC group at the different time point (3, 7, 14dpl) after the injury was that Mn2+ enhancement was seen in the retina and ON proximal to the lesion site. No Mn2+ enhancement was observed distal to the lesion site at 3, 7 and 14 dpl. The Mn2+ enhanced signal was reduced from 3dpl to 14dpl in the ON proximal to the lesion site compared to that seen in the control group (P<0.05), while no signal was detected distal to the ONC. At 7 and 14dpl, the Mn2+-enhanced signal was decreased significantly in the ON proximal to the crush site, compared to the signal observed at 3dpl (P<0.05). The RGCs drop rate was 6.84%, 45.31%, and 72.36% at 3dpl, 7dpl and 14dpl, respectively. The apoptosis of RGCs was most obvious after ONC at 14dpl.

CONCLUSION
MEMRI in the rat optic injury has a certain value in vivo experimental research, it can be used to observe the structure and function changes of optic nerve after injury. It is possible to detect the severity of the optic nerve by MEMRI examination.

CLINICAL RELEVANCE/APPLICATION
It is possible to use MEMRI to monitor the severity of the optic nerve injury in human by injecting mico-MnCl2 in the future.

SSC08-06 'Black Dipole' or 'White Dipole': Using Susceptibility Phase Image to Differentiate Cerebral Microbleed from Intracranial Calcification

Participants
The purpose of the study was to evaluate the role of susceptibility phase image in differentiation of cerebral microbleed (CMB) from intracranial calcification.

METHOD AND MATERIALS

The study was conducted upon 21 patients who received both brain CT and MRI within 3 days after acute infarct. MRI was performed in a 3T scanner, with susceptibility weighted angiography (SWAN) and susceptibility phase image generated from SWAN. Lesions that were 1) black, 2) round or ovoid, 3) less than 5 mm in SWAN were included. Two radiologists independently categorized each lesion, based on the SWAN phase image, into six axial patterns (1: total black, 2: total white 3: black with white core, 4: white with black core, 5: heterogenous black, 6: heterogenous white) and two coronal patterns (1: black dipole, 2: white dipole). Agreement of phase pattern was determined, including kappa statistics. Each lesion was interpreted as CMB or calcification based on coronal (pattern1 as CMB; 2 as calcification) and axial (pattern 1,3,5 as CMB; 2,4,6 as calcification) phase image respectively. In all the cases, CT was used as the gold standard for the presence/absence of calcification.

RESULTS

A total of 141 lesions were included. 60, 15, 17, 5, 32, 12 lesions were classified into axial phase pattern 1, 2, 3, 4, 5, 6, respectively, while 97 and 44 lesions into coronal phase pattern 1 and 2, respectively. The interobserver agreement was perfect (κ = 1) in coronal pattern, while moderate (κ=0.73; 95% CI, 0.65-0.81) in axial pattern. CT confirmed 97 lesions as CMBs and 44 as calcifications. The sensitivity and specificity for detecting calcification were 91.8% and 54.6% for axial phase image and 99.0% and 93.2% for coronal phase image. Among lesions < 2mm, the sensitivity and specificity for detecting calcification increased to 97.3% and 80.0% for axial phase image, while 88.3% and 47.1% among lesions > 2mm.

CONCLUSION

Coronal phase image better demonstrated the susceptibility property of the paramagnetic CMBs as black dipoles, which expanded along the direction of the main magnetic field, and the diamagnetic calcifications as white dipoles, with higher diagnostic accuracy than axial phase image.

CLINICAL RELEVANCE/APPLICATION

The ability of susceptibility phase image to differentiate cerebral microbleed from calcification in MRI study is gaining clinical importance, especially in patients with cerebrovascular disease.

SSC08-07 Correlation between Optic Nerve Sheath Diameter Measured Using Computed Tomography and Marshall's Scale in Adult Patients with Acute Traumatic Brain Injury

Monday, Nov. 30 11:30AM - 11:40AM Location: N226

Participants

Haider N. Al-Tameemi, MBChB, MD, Al-Najaf, Iraq (Presenter) Nothing to Disclose
Saatat R. Al-Esawi, MBChB, PhD, Najaf, Iraq (Abstract Co-Author) Nothing to Disclose
Ali Alyassari, Al-Dywania, Iraq (Abstract Co-Author) Nothing to Disclose

PURPOSE

To study the correlation between ONSD measurements using CT scan with the severity of TBI according to Marshall's scoring system.

METHOD AND MATERIALS

A cross-sectional analytic study was conducted on 60 adult patients (52 males, 8 females) with acute TBI referred by the neurosurgeon for brain CT examination over period of 8 months between February 2014 and September 2014. Children (<18 years), patients with orbital pathology and orbital trauma were excluded. After initial general evaluation of brain CT images, the score of TBI was assessed according to Marshall's scale (1 to VI). The transverse ONSD of both right and left sides was then manually measured on axial CT image at 3mm distance behind eye globe. Statistical analysis was done using scientific package of social statistics (SPSS) with the correlation was considered significant if P value less than 0.05. The Institutional Ethical Review Committee approved the study.

RESULTS

The means of all, right-sided and left-sided ONSD were 4.695mm, 4.606mm and 4.785mm respectively. There was statistically significant and a strongly positive linear correlation (p value <0.001, r = 0.662) between the mean of ONSD measured by CT scan and Marshall's score. When the ONSD measurements of the right and left sides were analyzed separately, the correlation was also significant and strongly positive (p value <0.001, r = 0.594 for the right side and p value <0.001, r = 0.699 for the left side). ONSD showed weakly negative and statistically not significant correlation (p value= 0.571, r = -0.075) with the duration between onset of the trauma and time of CT examination. There was no significant difference between mean ONSD measurements when correlated with the laterality of TBI, age or gender (p values 0.392 0.328 and 0.462 respectively).

CONCLUSION

ONSD measured on CT scan is strongly correlated with the severity of TBI as assessed by Marshall's scale. Because Marshall's scale has prognostic implication, ONSD may also have a prognostic value during assessment of patients with TBI.

CLINICAL RELEVANCE/APPLICATION

Measurement of ONSD using CT scan is correlated with higher scores of Marshall's classification of acute TBI and may be an indirect indicator of raised ICP. It is recommended to be included in the routine evaluation of patients with acute TBI.
Small Traumatic Subarachnoid Hemorrhages: Is Routine ICU Admission Necessary?

**Participants**
- Paul J. Albertine, MD, Washington, DC (Presenter) Nothing to Disclose
- Samuel Borofsky, MD, Washington, DC (Abstract Co-Author) Nothing to Disclose
- Derek Brown, MS, Washington, AR (Abstract Co-Author) Nothing to Disclose
- Smita Patel, Washington, DC (Abstract Co-Author) Nothing to Disclose
- Woojin Lee, Washington, DC (Abstract Co-Author) Nothing to Disclose
- Anthony Caputy, MD, Washington, DC (Abstract Co-Author) Nothing to Disclose
- M. Reza Taheri, MD, PhD, Washington, DC (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Traumatic subarachnoid hemorrhages (tSAH) are a common type of intracranial hemorrhage that occurs in the setting of acute traumatic brain injury (TBI). It is estimated that more than 1.5 million Americans suffer from a TBI per year resulting in over 300,000 hospital admissions and an estimated financial cost of 17 billion dollars. In our current clinical setting, any form of intracranial traumatic brain injury (mTBI) have not been previously examined. The purpose of this study is to investigate longitudinal changes in cortical thickness in mTBI patients from average 22 days to 1 year after injury and compare to controls.

**METHOD AND MATERIALS**

This retrospective cohort study is based on 63 patients evaluated between 2011-2014 who presented to a Level I trauma center emergency room for acute traumatic injuries that were found to have tSAH on CT examination. Results were obtained through medical records and imaging results. Blood volumes of the subarachnoid hemorrhages were evaluated using Fisher, Modified Fisher and Claassen classification systems. Data gathered on the hospital course included several neurological and medical complications that have been associated with tSAH. Information regarding patient outcomes was based chart review.

**RESULTS**

Of the 63 total patients, 33 (52%) patients had low-grade tSAH which were classified as Fisher grade ≤ 2, 40(63%) Modified Fisher grade ≤ 2, and 41(65%) Claassen grade ≤ 2. None of these patients with low-grade tSAH demonstrated neurological decline, medical decline, or seizures while they were hospitalized (all findings are significantly lower [p<.05] when compared to the patients...
with higher grade tSAH). Patients with low grade tSAH had significantly shorter stays in the ICU (p<.05) and better clinical outcome based on GOS compared to the other patients (p<.01).

CONCLUSION
In this study, none of the patients with small low-grade tSAH demonstrated neurological decline, seizures, or medical decline during their hospitalization. All of these patients spent significantly less time in the intensive care unit and had good clinical outcomes.

CLINICAL RELEVANCE/APPLICATION
Patients with small low-grade tSAH rarely experience medical decline, neurological decline or seizures as a result of their injuries and may not necessitate intensive care unit admission.
**SSC09**

**Neuroradiology/Head and Neck (Thyroid and Parathyroid Imaging)**

Monday, Nov. 30 10:30AM - 12:00PM Location: N229

**PURPOSE**

To evaluate the role of core-needle biopsy (CNB) as a first-line diagnostic tool for initially detected thyroid nodules.

**METHOD AND MATERIALS**

This observational study was approved by the institutional review board and informed consent was obtained from all patients. From October 2008 to December 2011, we evaluated 632 initially detected thyroid nodules from 632 consecutive patients who underwent CNB. CNB readings were categorized into the same six categories of the Bethesda System. Final malignant results were diagnosed after surgery or CNB. Final benign results were diagnosed by surgery, twice of benign biopsy results, or benign cytology with a stable size at one year follow-up. The incidences of non-diagnostic, inconclusive results, diagnostic performance, unnecessary surgery, and complications were evaluated. Subgroup analysis according to nodule size was performed. The risk factors of inconclusive results were evaluated by multivariate logistic regression analysis.

**RESULTS**

CNB achieved 1.3% of non-diagnostic and 5.9% of inconclusive results. The diagnostic accuracy, sensitivity, specificity, positive predictive value and negative predictive value for diagnosis of malignancy were 97.6%, 90.5%, 100%, 100% and 92.7%, respectively. The unnecessary surgery was 0.6% and complication rate was 0.2%. Subgroup analysis showed that diagnostic performance was not significant according to nodule size. There were no independent risk factors associated with inconclusive results.

**CONCLUSION**

Our study demonstrated that CNB achieved low non-diagnostic, inconclusive results and high diagnostic accuracy for patients with initially detected thyroid nodules. CNB also minimize unnecessary surgery. Therefore, CNB seems to be a promising diagnostic tool for patients with initially detected thyroid nodules.

**CLINICAL RELEVANCE/APPLICATION**

CNB can be an alternative to FNA for patients with initially detected thyroid nodules to minimize non-diagnostic, inconclusive results and unnecessary surgery. CNB seems to be a promising diagnostic tool for patients with initially detected thyroid nodules.

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**SSC09-02**

**Optimal Follow-up Interval and Follow-up Management of Initial Non-diagnostic Thyroid Nodules 10 mm or Larger in Size**

Monday, Nov. 30 10:40AM - 10:50AM Location: N229

**PURPOSE**

To evaluate the optimal follow-up interval in initial non-diagnostic thyroid nodules 10 mm or larger on ultrasonography-guided fine needle aspiration (US-FNA).

**METHOD AND MATERIALS**

This retrospective study was approved by the Institutional Review Board, and informed consent was waived. A total 228 nodules were classified into the 3, 6, and 12 months groups according to when the first follow-up US was performed or the length of the...
US-FNA intervals, within 3 months, from 3 to 9 months, and 9 months after initial US-FNA. Nodules were classified according to size change. US features were reassessed using the Thyroid Imaging Reporting and Data System (TI RADS). Malignancy detection rate, malignancy risk, and clinico-pathological characteristics were compared among 3, 6, and 12 months groups and according to size change.

RESULTS
Seven (3.1%) were malignant. Malignancy detection rates, extrathyroidal extension and lymph node metastasis were not significantly different among the three groups. 13 (5.7%) of 228 showed increased size at least 10.7 months after initial US-FNA. One (7.7%) of the 13 was minimally invasive follicular carcinoma without lymph node metastasis found at 63.2 months. Of 177 without change, six papillary thyroid carcinomas less than 20 mm (3.4%) were found at a mean 10.4 months. The malignancy risk of 177 nodules with TI RADS category 3, 4a, 4b, and 4c were 1.7%, 0%, 3.3%, and 21.4%. None of the 38 nodules with decreased size were malignant. and 9 months after initial US-FNA.

CONCLUSION
The follow-up of initial non-diagnostic thyroid nodules 10 mm or larger in size can be performed around 12 months with US. The decision to perform repeat US-FNA can be made based on initial and follow-up US features.

CLINICAL RELEVANCE/APPLICATION
dealing with non-diagnostic thyroid nodules) 'The follow-up of initial non-diagnostic thyroid nodules 10 mm or larger in size can be performed around 12 months with US'

PURPOSE
Aim of this study was to evaluate the safety and the efficacy of ultrasound-guided percutaneous RFA in the treatment of benign thyroid nodules, and in selected cases of recurrent thyroid cancers (RTC).

METHOD AND MATERIALS
This study included 40 patients: 30/40 affected by nodular goiter contraindicated to surgery; 10/40 affected by RTC and excluded from surgery/ radiometabolic therapy. Pre treatment diagnostic protocol included a CT and US examinations performed within 1 month, in order to evaluate lesions' volumes. All RFA procedures were performed under US guidance by using a 18-gauge electrode, with a single 1-cm active, internally cooled, tip. Response to therapy was evaluated by means of contrast enhanced ultrasound in benign goiters (follow-up ranging from 6 to 18 months) and by means of CT in RTCs (follow-up ranging from 3 to 12 months). Mean Volume Reduction Rate (MRVV) was evaluated in respect to the pre-treatment lesions' volumes.

RESULTS
RFA was well tolerated by all patients: significant complication (permanent, laryngeal nerve lesion) was observed only in one patient. MVRV in goiters at 6, 12 and 18 months resulted to be 71.9±13.3%, 75.8±14.3% and 83.0±6.5% respectively; RCTs' MRRV at 3, 6 and 12 months were 57.2±27.5%, 82.4±13.0%, and 75.4±6.6% respectively.

CONCLUSION
All multinodular goiters showed excellent volume reduction; all patients presented a reduction of the compression symptoms. The neoplastic lesions demonstrated a good therapeutic response with slowing of disease progression.

CLINICAL RELEVANCE/APPLICATION
RFA is a reliable alternative to surgery in patients affected by benign goiter; moreover RFA might be considered as a valid approach for the debulking of RTC in non surgical cases.

PURPOSE
The follicular variant of Papillary thyroid carcinoma (FVPTC) is the second common subtype of Papillary thyroid carcinoma. FVPTC harbors two common genetic mutations; BRAF and RAS, and nodules with BRAF mutations are more aggressive. The purpose of the study was to identify demographic and US features that might be useful for differentiating BRAF and RAS positive FVPTC's.
**METHOD AND MATERIALS**

The data of 61 patients with > 1 cm FVPTCs diagnosed between November 2000 and April 2011 were reviewed retrospectively. The patients were divided by mutation status into 3 groups: (1) BRAF positive group, (2) RAS positive group and (3) mutation negative group. Two radiologists with more than 10 years of thyroid sonography experience reviewed the sonographic characteristics of the FVPTC nodule while blinded to the results of the genetic analysis. Ultrasound features and patient demographics were compared.

**RESULTS**

The BRAF mutation was detected in 16 (26.2%) patients. The RAS mutation was detected in 25 (41%) patients. Patients with RAS positive FVPTC were significantly younger than patients in the BRAF mutation group (p=0.022) and the no mutation group (p=0.034). The nodule longest dimension of the BRAF group was smaller than the RAS group (p=0.036) and no mutation group (p=0.002). An indistinct nodule border was more common in the BRAF group than in the RAS group in both radiology assessments (p=0.002, p=0.002 respectively, Kappa value 0.610, p=0.000). An indistinct nodule border was more common in the BRAF group than in the no mutation group too (p=0.030, p=0.030 respectively, Kappa value 0.468 p=0.005). One of the two Radiologists found the BRAF group to appear spiculated more commonly than the other groups (BRAF group (6/16) vs. the RAS group (0/25) p=0.002; BRAF group (6/16) vs. no mutation group(0/20) p=0.004), and one of the two Radiologists found echogenicity to be significantly lower in the BRAF group (BRAF group vs. RAS group p=0.000; BRAF group vs. no mutation group p=0.007). No significant differences were found between gender, tall/wide, halo sign, heterogeneity, calcification in nodule, or vessel in and around the nodule.

**CONCLUSION**

An indistinct sonographic boundary is associated with the BRAF mutation, and larger nodule size is associated with the RAS mutation in FVPTCs.

**CLINICAL RELEVANCE/APPLICATION**

Demography and ultrasound features may be helpful to differentiate BRAF and RAS positive in FVPTCs.

**SSEC09-05 Role of Screening Thyroid Ultrasonography in Healthy Population and Imaging Analysis of Screening-detected Thyroid Cancer**

**PURPOSE**

Objective: To evaluate the role of screening ultrasonography (US) in healthy population and analyze the US features of screening-detected thyroid cancer (SDTC).

**METHOD AND MATERIALS**

A total of 1845 persons participated in the study among 1923 healthy population who underwent screening thyroid US from March through August 2012 at our screening center; those who were lost to follow up (n=60) and those who underwent the previous operation on thyroid (n=18) were excluded. We evaluated detection rate of thyroid cancer and the average cost for detecting each cancer patient. (Presumed cost: $100 for thyroid US and $150 for fine-needle aspiration). We also analyzed the US features of screening-detected thyroid cancer.

**RESULTS**

Among 1845 participants 973 had benign disease (52.74 %, 63 by FNA and 910 with no change in 2 year-follow-up); 29 had thyroid cancer (1.57 %, 27 proven by FNA and 2 by surgery); 28 had PTC and 1 had follicular carcinoma. The cancer patients were predominantly women (69.0 %) and the mean age was 50.9±9.825. Imaging features that significantly differentiated malignant nodules from benign nodules were solid composition (100 % in malignant nodules), hypoechogenicity (100 %), taller than wide axis (82.8 %) and indistinct margin (86.2 %). Among 18 patients who underwent thyroidectomy, 14 (77.8 %) had pathologic tumor staging of T1 and 12 (85.71 %) had nodal staging of N0. The estimated average cost for detecting each cancer patient was $6,838.

**CONCLUSION**

Screening thyroid US enables detection of early stage thyroid cancer in asymptomatic healthy population. The majority of screening-detected thyroid cancer was micropapillary carcinoma and showed solid and hypoechoic nodule on US.

**CLINICAL RELEVANCE/APPLICATION**

The majority of screening-detected thyroid cancer was micropapillary carcinoma. Screening thyroid US enables detection of early stage thyroid cancer in asymptomatic healthy population.

**SSEC09-06 Malignant Thyroid Nodule with Chronic Lymphocytic Thyroiditis: The Value of Core-Needle Biopsy**

**PURPOSE**

The detection and diagnosis of thyroid cancer can be more difficult in patients with chronic lymphocytic thyroiditis (CLT). The aim of this study is to compare the diagnostic accuracy of fine-needle aspiration biopsy (FNAB) and core-needle biopsy (CNB) for malignant thyroid nodule in CLT patients.
### Method and Materials

Institutional review board approved and waived informed consent for this retrospective study. From January 2010 to April 2014, 1815 CLT patients (183 men, 1632 women; mean age, 53.6 years; age range, 11-87 years) who underwent ultrasound-guided FNAB (FNAB group, 993 nodules in 970 patients; 90 men, 880 women; mean age, 55.5 years; age range, 18-87 years) or CNB (CNB group, 912 nodules in 845 patients; 93 men, 752 women; mean age, 52.1 years; age range, 11-86 years) for thyroid nodule were included. Final diagnosis with surgical resection was obtained for 353 nodules. Chi-square test was used to compare the inconclusive results from both groups. Diagnostic accuracy, sensitivity, specificity, positive predictive value, and negative predictive value for the diagnosis of thyroid cancer were calculated on the basis of binomial probabilities.

### Results

The rate of inconclusive results (nondiagnostic specimen or atypia of unknown significance) were significantly lower in CNB group (FNAB group, n=306 (30.8%); CNB group, n=33 (3.6%); p<0.001). With correlation to final surgical pathology, the sensitivity and negative predictive value of FNAB were lower than CNB (49.5%, 18.9% vs. 83.5%, 63.6%).

### Conclusion

Inconclusive results were significantly lower with CNB. CNB showed better diagnostic accuracy for thyroid cancer in patients with CLT.

### Clinical Relevance/Application

CNB can reduce the rate of inconclusive result in patients with CLT.

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### SSC09-07  Three-Dimensional Sonography more Accurately Localizes Preoperative Parathyroid Adenomas than Conventional 2D Sonography and Sestamibi

**Participants**

Susan J. Frank, MD, Bronx, NY (Abstract Co-Author) Nothing to Disclose  
Adam Goldman-Yassen, MD,MS, Bronx, NY (Presenter) Nothing to Disclose  
Tova C. Koenigsberg, MD, Bronx, NY (Abstract Co-Author) Nothing to Disclose  
Mordecai Koenigsberg, MD, Flushing, NY (Abstract Co-Author) Nothing to Disclose

**Purpose**

Single parathyroid adenomas are the most common etiology of primary hyperparathyroidism. If a single, enlarged parathyroid gland can be accurately identified before surgery, unilateral surgical dissection can be attempted, which has a lower morbidity than four-gland exploration. Two-dimensional ultrasound (2D US) and sestamibi scans are routinely used to evaluate patients with suspected primary hyperparathyroidism. Three-dimensional ultrasound (3D US) provides the surgeon with a coronal view, similar to a surgical perspective, and evaluates the typical vascularity of abnormal parathyroid glands. We compared the preoperative imaging of patients who underwent parathyroidectomy for primary hyperparathyroidism to determine the improvement of 3D US over 2D ultrasound and sestamibi for preoperative gland localization.

**Method and Materials**

We conducted a retrospective review of patients that underwent parathyroid surgery at our institution. We reviewed operative notes and pathology reports to identify final localization of abnormal parathyroid glands based on pathology and decrease in parathyroid hormone by 50% after gland excision in the OR. We evaluated preoperative ultrasound and sestamibi scan reports for gland localization.

**Results**

118 patients underwent surgery for primary hyperparathyroidism and underwent both preoperative ultrasound and sestamibi examinations at our institution between 2010 and 2014, 37 using 3D US. 3D US correctly identified the side of the abnormal parathyroid adenoma in 95% of cases (CI 81%-99%), compared with 57% of 2D US (CI 45%-68%), and the precise site of the abnormal gland in 81% of cases (CI 64%-92%), compared with 52% for 2D US (CI 40%-63%). Sestamibi scans correctly lateralized 82% of cases in our cohort (CI 73%-88%). 3D US and sestamibi concordantly lateralized the abnormal parathyroid in 92% of cases (CI 72%-96%), compared with 49% in 2D US cases (CI 38%-61%).

**Conclusion**

3D US is more sensitive than 2D US for correctly identifying the side and precise location of abnormal parathyroid glands in patients with primary hyperparathyroidism. 3D sonography may help provide more accurate gland localization before parathyroidectomy.

**Clinical Relevance/Application**

Accurate localization of abnormal parathyroid glands before parathyroidectomy can reduce surgical morbidity and complications.

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### SSC09-08  Most Thyroid Cancers Lack Intranodular Vascularity on Color Doppler

**Participants**

Grace C. Yang, MD, New York, NY (Abstract Co-Author) Nothing to Disclose  
Karen O. Fried, MD, New York, NY (Presenter) Nothing to Disclose

**Purpose**

‘Intranodular hypervascularity’ has been reported to be associated with thyroid cancers in radiology literature. The aim of this study is to test this assumption with detailed pathology follow-up.

**Method and Materials**

Over a period of 8 years, 149 ultrasound-guided thyroid fine needle aspiration biopsies had both ultrasound images and histology...
Role Played by Elasticity Imaging in the Evaluation of the Thyroid Nodule

Monday, Nov. 30 11:50AM - 12:00PM Location: N229

slides for review. Color Doppler images were reviewed and intranodular vascularity was graded from 0 to 3+ (0:no color). Recuts from index nodule were reviewed and divided into malignant and benign categories and tumor subtype recorded.

RESULTS
There were 99 thyroid cancers (size: 0.6-7 cm, mean 2.1, medium 1.8), and 50 benign nodules (size 0.4-9 cm, mean 3.06, medium 2.9). The malignant nodules from 22 males and 77 females included 78 papillary carcinomas (PTC), 6 medullary carcinomas (MTC), 6 Hürthle cell carcinomas (HTC), 5 follicular carcinomas (FTC), and 4 poorly differentiated thyroid carcinomas (PDTC). Benign nodules from 11 males and 39 females included 32 follicular adenoma/adenomatoid nodules (FA), 13 Hürthle cell adenoma/adenomatoid nodules (HA) and 5 hyalinizing trabecular adenomas (HHA). As shown in Table 1, there were 58 (93.5%) cancers (50 PTC, 5 MTC, 2 PDTC, 1 FTC) and 4 (6.5%) benign nodules (3 HA, 1 FA) with no intranodular vascularity; 15 (88.2%) cancers (9 PTC, 1 MTC, 4 HTC, 1 PDTC) and 2 (11.8%) benign nodules (2 HA) had 1+ intranodular vascularity; 14 (93.3%) cancers (10 PTC, 2 HTC, 2 FTC) and 1 (0.7%) benign nodules (1 HA) had 2+ intranodular vascularity; 12 (21.8%) cancers (9 PTC, 2 FTC, 1 PDTC) and 43 (78.2%) benign nodules (31 FA, 7 HA, 5 HHA) had 3+ intranodular vascularity.

CONCLUSION
Most thyroid cancers have no intranodular vascularity and most hypervascular thyroid nodules are benign. This finding is not surprising, since most thyroid cancers are PTC, which is a tumor rich in lymphatic vessels. Follicular tumors are rich in blood vessels, but FTC is much less common than PTC.

CLINICAL RELEVANCE/APPLICATION
'Absence of intranodular vascularity' is recommended as one of the suspicious features of thyroid ultrasound that include hypoechoic, 'taller than wide', 'blurred margins' and 'microcalcifications'

PURPOSE
To evaluate conventional ultrasonography (US) including color doppler and elasticity imaging (EI) in thyroid nodule malignancy prediction.

METHOD AND MATERIALS
This prospective study included 399 patients (mean age, 51.9 years; range 13-83 years), 294 women (86.7%) and 45 men (13.3%). In 426 nodules (N) US, doppler color, EI and fine needle acquisition (FNA) were performed. The cytological results were classified according to the Bethesda System. No-apt sample and atypia or follicular proliferation of uncertain origin, were excluded (60N). 339 nodules in 335 patients were studied, divided in a non-surgical group (benign or T2, 292N) and a surgical group (follicular neoplasm-T4, 33N; suspicious for papillary carcinoma-T5, 9N; and Papillary carcinoma-T6, 5N). Comparison among US, vascularization, EI and cytology was performed, by using the χ2 tests and the non-parametric Mann-Whitney U test, for categorical variables (statistical significance <0.05). Multivariate logistic regression analysis was performed to assess the independent variables for surgical group prediction.

RESULTS
Findings associated to surgical nodules are heterogeneity (24/51%; odds ratio (OR):2.584), very hypoechoic (4/8.5%; OR:5.195), Hypoechoic (24/51.1%; OR:4.160), increased vascularization (12/27.9%; OR:3.233), infiltrative margin (8/17%; OR:6.450), irregular border (5/10.6%; OR:4.211), hard in EI (19/40.4%; OR:2.073). Findings linked to benignity are to be isoechoic (197/67.5%) and spongiform (153/52.4%). In the multivariate regression analysis only very hypoechoic and hypoechoic are independent criteria related for the surgical group (p<0.05), whereas spongiform is the only independent criteria associated to benignity.

CONCLUSION
EI could help in combination with the other US features to choose the nodule to perform FNA, but it does not seem to be independent criteria to indicate FNA

CLINICAL RELEVANCE/APPLICATION
EI properly used is a helpful tool, to be considered always in combination with US features, to indicate FNA.
NR319-SD-MOA1

Left Hemisphere Dominance of fMRI Resting State Connectivity between the Pre-SMA and Language Areas in Right-Handed Persons

PURPOSE
This study utilizes a seed-based approach to assess strength and laterality of resting state functional connectivity between the pre-SMA and language areas.

METHOD AND MATERIALS
Anatomical and resting state data for 30 right-handed healthy subjects were downloaded from the 1000 Functional Connectomes Database. Images were aligned, pre-processed, and converted to Talairach space using AFNI. A symmetric pre-supplemental motor area (pre-SMA) region of interest (ROI) was drawn in each subject for seed analysis; pre-SMA boundaries were defined by the vertical anterior commissure line (posterior), vertical line drawn from the genu of the corpus callosum (anterior), cingulate gyrus (inferior), and brain surface (superior). For each subject, voxel-wise Z-score maps of the entire brain were generated by correlating the average time-course signal in the pre-SMA ROI with that of each brain voxel. Z-score maps were averaged and a single T-score map was created, which represented correlation strength between brain voxel and the pre-SMA as a function of T-scores. Laterality indices \( LI = (L-R)/(L+R) \) using threshold-dependent voxel activation counts in left and right hemispheres were defined as significant when \( |LI| \) is greater than or equal to 0.2.

RESULTS
The pre-SMA had statistically significant resting state functional connectivity with language areas bilaterally, but connectivity strength was consistently greater in the left hemisphere. Among language areas, statistical significance (T>2.46; p<0.01) was seen in Broca's (L8.1, R7.2), Wernicke's (L6.5, R5.9), middle frontal (L7.1, R6.5), supramarginal (L7.6, R6.6), and angular (L6.7, R5.7) regions. Voxel activation was consistently left lateralized at higher T-score ranges; at T>8, Broca LI=0.33, Wernicke LI=0.36, left middle frontal LI=0.51, and angular LI=0.20.

CONCLUSION
The pre-SMA has resting state functional connectivity with brain language areas, with strongest connectivity to the left Broca's area in right-handed persons. Pre-SMA functional connectivity to language areas is consistently left-lateralized in right-handed persons.

CLINICAL RELEVANCE/APPLICATION
When evaluating neurosurgical candidacy, pre-SMA resting state connectivity may be able to inform language localization and laterality task-free, thus eliminating the most problematic step experienced in paradigm-driven fMRI.
Healthcare) at 4 time points: 1) before DBS surgery, 2) after surgery with DBS off, 3) after surgery with DBS on, and 4) 19 months post-surgery. 15min brain PET was acquired in 55 minutes post FDG i.v. and reconstructed as 2mm in 128x128. Quantitative assessment of regional brain metabolism was performed using MIMSoftware (MIM Software Inc., Cleveland, OH). 43 normal 18F-FDG PET brain data sets were used as the standard comparison set. Statistical z-scores were calculated on a voxel-by-voxel basis for patient PET to identify metabolic regional variations and examine the cerebral hypo-metabolism characteristics in AD. Z-scores differences between restaging PETs and staging PET were calculated, co-registered to presurgical 3T MRI and displayed in 3D stereotactic surface projection (SSP).

RESULTS
Low dose FDG Brain PET obtained in all subjects showed desired image quality. Quantitative z-score mapping clearly identified hyper- and hypo-metabolic regions of the brain and patterns of brain metabolism changes by comparing patient PET with healthy group. Areas of statistically significant z-scores differences were extracted and highlighted with color-coded overlays to remove distracting areas that are subtle or not large enough to be considered statistically. Through z-score SSP, areas of decreased FDG tracer uptake as well as increased tracer accumulation (reduced hypometabolism) in patients after therapy were identified. The majority of areas with reduced hypometabolism concentrated in Brodmann areas 9, 10, 11 and orbitofrontal cortex regions.

CONCLUSION
Low dose FDG Brain PET is feasible to serve as a noninvasive, quantitative imaging methodology to monitor response to DBS therapy and enable a neuro metabolic insight into induced changes. The developed quantitative methodologies appear promising for the quantitative evaluation of response to therapy and potentially individual prognosis in AD patients.

CLINICAL RELEVANCE/APPLICATION
Low dose FDG Brain PET was shown to be a feasible, reproducible and quantitative imaging methodology to assess changes in brain metabolism after deep brain stimulation.

NR321-SD-MOA3 Reproducibility of GABA Measurements from MR Spectroscopy using MEGA-PRESS; The Effect of Different Voxel Placement and Increased Scanning Time

Participants
Maiken Kirkegaard Brix, Bergen, Norway (Presenter) Nothing to Disclose
Lars Ersland, PhD, Bergen, Norway (Abstract Co-Author) Stockholder, NordicNeuroLab AS Board member, NordicNeuroLab AS Consultant, NordicNeuroLab AS
Monika K. Beyer, MD, PhD, Oslo, Norway (Abstract Co-Author) Nothing to Disclose
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John C. Evans, Cardiff, United Kingdom (Abstract Co-Author) Nothing to Disclose
Ralph Noeske, Berlin, Germany (Abstract Co-Author) Nothing to Disclose
Alexander R. Craven, Bergen, Norway (Abstract Co-Author) Nothing to Disclose

PURPOSE
The MEGA-PRESS MRS sequence for measurement of GABA in the human brain has become increasingly popular in examining conditions such as epilepsy, depression, schizophrenia etc. The present study addresses ongoing questions of reproducibility, focusing on optimizing the number of repetitions for two locations in the human brain.

METHOD AND MATERIALS
Two 20 minute long MEGA-PRESS acquisitions were performed: one from a 21ml volume in the mid anterior cingulate cortex (ACC) and one from a 12 ml volume in the left Broca's area in 21 healthy male volunteers (age 32.3 years ± 6.5(SD)). All subjects were scanned twice with identical protocols, one week apart. Subjects abstained from caffeine, alcohol, nicotine, chocolate, exercise and sex for the twelve hours prior to each examination. Data were acquired on a 3T GE Discovery 750 scanner with a 32-channel head coil. Each location (with randomized order) was examined with a MEGA-PRESS sequence (TE=68ms, TR=1800ms) for 328 repetitions..Spectroscopy data were partitioned into shorter sections, numerically equivalent to scans of progressively increasing duration, and compared between sessions. Data were preprocessed using in-house software, and quantified with LCMModel version 6.3-1H; additional quality control prompted rejection of ACC data from two subjects.

RESULTS
In both regions, increasing the number of repetitions showed notable improvements in between-session reproducibility up to 218 repetitions. Further increases resulted in only modest gains, and actually decreased reliability beyond 262 repetitions (16 minutes), particularly in the ACC. This is likely the result of cumulative subject motion towards the end of the long scan. Best reproducibility for GABA in the ACC was coefficient-of-variation (CV) 10.4% (218 scans), compared with 4.7% in Broca's area (328 scans, vs 5.6% at 218 scans). Measurement of Glx (glutamate + glutamine) proved more reliable, with a CV of 6.0% in the ACC (246 scans) and 3.2% in Broca's area (246 scans).

CONCLUSION
Based on these findings, we can recommend an optimal number of repetitions between 220 and 256 (13-15 minutes) for MEGA-PRESS in either of these regions. We also suggest an upper bound on scan times, of 16 minutes.

CLINICAL RELEVANCE/APPLICATION
Establishing reliability of measurements while minimizing acquisition times is crucial for effective clinical application of quantitative MR spectroscopy.
NR322-SD-MOA4
Perimedullary Spinal Vein Enlargement Sign: Added Value for Differentiation between Intradural-Extramedullary and Intramedullary Tumors at MR Imaging

Station #4

Participants
Tao Gong, Jinan, China (Abstract Co-Author) Nothing to Disclose
Guangbin Wang, MD, Jinan, China (Presenter) Nothing to Disclose
Li Yang, MD, PhD, Shanghai, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To determine sensitivity and the specificity of the perimedullary spinal vein enlargement sign at MR Imaging in helping distinguish intramedullary tumors from intradural-extramedullary tumors.

METHOD AND MATERIALS
This study was approved by the ethics committee, for the retrospective nature, informed consent was waived, included a total of 124 consecutive patients (age range, 2-77 years; mean age, 46±8 years) with spinal intradural tumors: 112 tumors located in intradural (mean age, 45±7 years) and 12 extramedullary(mean age, 47±15 years), with histopathologic confirmation. The perimedullary venous enlargement sign around the tumor was evaluated at conventional T2 weighted MR Imaging and contrast enhanced MR Imaging sequence. Two readers independently assessed the venous enlargement sign, which were described and indicated as extramedullary-intradural tumors, both diagnostic sensitivity, specificity, accuracy and intra- and inter-observer agreement for the sign were calculated.

RESULTS
The spinal perimedullary venous enlargement sign was easier to find out at the contrast enhanced MR images than T2 weighted images. Reader 1 found one of 12 intramedullary tumors, thirty-five of 112 extramedullary-intradural tumors demonstrated the venous dilation sign, in which schwannoma accounted for 25(69%), meningioma 6(17%), teratoma 4(11%), ependymoma 1(4%). Thirty-one venous enlargement sign were found by reader 2, which were all found out around extramedullary-intradural tumors, schwannoma accounted for 24(75%), meningioma 4 (12%), teratoma 4(12%). The sensitivity, specificity and accuracy of the venous dilation sign for differentiating extramedullary-intradural tumors from intradural tumors were 31.4%, 91.7% and 61.9% by reader 1; 28.5%, 100%, and 60.2% by reader 2. Intraobserver agreement (κ = 1) and interobserver agreement (κ = 0.946) were excellent.

CONCLUSION
The perimedullary spinal vein enlargement sign has high specificity for extramedullary-intradural tumors, and is useful for spinal intradural tumors to differentiate extramedullary (especially schwannoma) from intramedullary.

CLINICAL RELEVANCE/APPLICATION
The presence of the perimedullary vein enlargement sign around the intradural spinal tumors at the T2 weighted images and contrast enhanced MR images was highly predictive for the presence of extramedullary tumors, especially of myoschwannoma. The sign is useful to differentiate extramedullary from intramedullary.

NR323-SD-MOA5
Large (≥3cm) Thyroid Nodule with Benign Cytology: Can Thyroid Imaging Reporting and Data System be Helpful in Predicting False Negative Cytology?

Station #5

Participants
Sejin Nam, MD, Incheon, Korea, Republic Of (Presenter) Nothing to Disclose
Jin Young Kwak, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hee Jung Moon, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jung Hyun Yeon, MD, Seongnam, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Eun-Kyung Kim, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the false negative rate of fine needle aspiration (FNA) of large thyroid nodule and validate the usefulness of Thyroid Imaging Reporting and Data System (TIRADS) in predicting false negative cytology for large thyroid nodule with benign cytology.

METHOD AND MATERIALS
From January 2010 to August 2014, 632 thyroid nodules with more than 3cm size (mean size, 40.0±9.1mm; range, 30-100mm) and subsequent benign cytology on US-FNA were included. Reviewing clinical features, false negative rate of cytology was evaluated. US features of internal composition, echogenicity, margin, calcifications, shape were evaluated, and thyroid nodules were classified according to TIRADS. TIRADS category 3 included nodules without any suspicious features of solidity, hypoechogenicity or marked hypoechogenicity, microlobulated or irregular margins, microcalcifications, and taller-than-wide shape. Category 4a, 4b, 4c, and 5 included nodules with one, two, three or four, or five suspicious US features. The malignancy risk was calculated. US feature associated with malignancy for these lesions were analyzed.

RESULTS
Of the 632 lesions, 26 lesions (4.1%) were malignancy and 606 (95.9%) were benign, suggesting 4.1% of false negative rate of FNA cytology. Of the 26 malignant lesions, the final pathology consisted mainly of follicular carcinoma minimally invasive (15 of 26) and follicular variant of papillary carcinoma (9 of 26). One case was a conventional papillary carcinoma and another one case was a malignant lymphoma. The malignancy risks of categories 3, 4a, 4b, and 4c nodules were 1.3%, 5.1%, 11.2% and 11.8%, respectively. In the 164 nodules with surgery, the malignancy risks of category 3, 4a, 4b, and 4c nodules were 5.1%, 20.8%, 29.0%, and 50.0%.

CONCLUSION
Large thyroid nodule with benign cytology results had relatively high false negative risk of 4.1% and TIRADS was helpful in
predicting false negative cytology for these lesions. If the large thyroid nodule with benign cytology has any suspicious US feature, it should be considered as image-cytology discordance and additional work up such as core biopsy or surgery should be recommended.

**CLINICAL RELEVANCE/APPLICATION**

If the large (≥3cm) thyroid nodule with benign cytology has any suspicious US feature, additional work up such as core biopsy or surgery should be recommended.

**NR324-SD-MOA6**  
**Stent-Based Thrombectomy versus Intravenous Tissue Plasminogen Activator in Acute Ischaemic Stroke - A Systematic Review and Meta-Analysis**

Station #6

Participants
- Reuben Grech, MD, FRCR, Msida, Malta (Presenter) Nothing to Disclose
- Mark Schembri, Msida, Malta (Abstract Co-Author) Nothing to Disclose
- John Thornton, Dublin, Ireland (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To date only a few studies have compared the effectiveness and functional outcomes of stent retrievers versus intravenous thrombolysis in acute ischaemic stroke. Our aim was to identify and collate all the available data and to assess for statistical differences in patient outcomes between the two treatments.

**METHOD AND MATERIALS**

We performed a systematic review and meta-analysis of studies with a randomized controlled design which utilised stent retrievers and intravenous thrombolysis in acute ischaemic stroke.

**RESULTS**

Seven randomised controlled studies published or presented between 2013 and 2015 were identified. The first three studies namely IMS-III, MR RESCUE and SYNTHESIS Expansion utilised a stent-based device in less than 15% of cases. Conversely only second generation devices were utilised in the four RCTs (MR CLEAN, ESCAPE, EXTEND-IA and SWIFT PRIME) that followed. Because of excessive sub-group heterogeneity, only the last four trials were included in our meta-analysis. 46.6% of patients treated with stent retrievers achieved an independent functional outcome (mRS<2) at 90 days compared with 26.1% of those treated with intravenous thrombolysis with an odds ratio of 2.50 (p=0.00). A lower mortality rate was observed with stent retrievers (14.7%) compared to intravenous thrombolysis (19.3%). Stent retrievers were also associated with a lower risk of symptomatic intracranial haemorrhage. The differences in functional outcomes and safety profiles were statistically significant.

**CONCLUSION**

Stent retrievers can achieve a high rate of recanalisation and functional independence in acute ischaemic stroke and have a relatively good safety profile. Our meta-analysis demonstrates a clear benefit of an intra-arterial mechanical approach versus standard treatment.

**CLINICAL RELEVANCE/APPLICATION**

‘Our meta-analysis demonstrates a clear benefit of an intra-arterial mechanical approach versus standard treatment in acute ischaemic stroke’

**NR325-SD-MOA7**  
**Qualitative Comparison of 7 Tesla and 3 Tesla MRI in Drug Resistant Epilepsy**

Station #7

Participants
- David R. Pettersson, MD, Portland, OR (Presenter) Nothing to Disclose
- Bronwyn E. Hamilton, MD, Portland, OR (Abstract Co-Author) Nothing to Disclose
- Gonzalo A. Romero, MD, Portland, OR (Abstract Co-Author) Nothing to Disclose
- Justin Meuse, Portland, OR (Abstract Co-Author) Nothing to Disclose
- William Rooney, PhD, Portland, OR (Abstract Co-Author) Nothing to Disclose
- Neil Roundy, Springfield, OR (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To compare 7 Tesla (7T) and 3 Tesla (3T) MRI in evaluation of patients with drug resistant epilepsy (DRE).

**METHOD AND MATERIALS**

Between March and July 2013, 10 patients with DRE were imaged using both 3T (Siemens Tim Trio) and 7T (Siemens Magnetom) MRI scanners, including isotropic (1 mm³ or smaller) T1 MPRAGE and T2 weighted imaging. Two neuroradiologists graded each scan for normal tissue contrast, technical artifacts, motion artifacts, and lesion conspicuity, using a 4-point scale. A specific diagnosis was made if possible. Blinded independent reviews and unblinded consensus reviews were performed. References standards for potential epileptogenic lesions consisted of surgical pathology when available or consensus judgment of a multidisciplinary epilepsy team after review of relevant clinical data.

**RESULTS**

Ten subjects (mean age 28; age range 11-46) were included. Consensus review found 7/10 subjects had lesions on MRI including 3 focal cortical dysplasias (FCD), 2 mesial temporal sclerosis (MTS), and 2 encephaloceles; the remaining 3 subjects had inconclusive MRI scans. Surgical pathology confirmed 2 MTS and 1 FCD. For the remaining 4/7 subjects with lesions identified on research MRI scans, EEG, clinical history, and non-research imaging studies corroborated the diagnoses. Independent blinded reviews found normal tissue contrast was improved significantly (p<0.001), and technical artifacts worsened significantly (p<0.05) on 7T MRI compared to 3T. Independent review scores of lesion conspicuity of FCDs were improved in all 3 cases (figure 1) (p=0.064). Consensus review scores of lesion conspicuity of the 2 skull base encephaloceles was greatly decreased on 7T MRI, relating to
artifactual signal drop-out around the skull base (p<0.001).

CONCLUSION

Significantly improved tissue contrast was found at 7T MRI and likely contributed to the improved conspicuity of FCDs seen in 3 of the 10 subjects. Significantly worse technical artifacts were seen on the 7T scans, including signal drop-out around the skull base. Larger investigations of 7T MRI are needed to characterize the diagnostic accuracy of 7T MRI in evaluation of each of the several known epilepsy-related pathologies.

CLINICAL RELEVANCE/APPLICATION

7T MRI may outperform 3T MRI in identification and delineation of FCDs in patients with epilepsy. Signal drop-out around the skull base is a shortcoming of 7T MRI.
NR326-SD-MOB1  White Matter Changes and its Correlation with Post-operative Cognition Disorders in Elderly Patients: Evidence from Diffusion Kurtosis Magnetic Resonance Imaging  
Station #1

Participants
Pratik Mukherjee, MD, PhD, San Francisco, CA (Moderator) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company;

Sub-Events

PURPOSE
To explore the abnormalities of white matter (WM) in elderly patients with post-operative cognition disorders (POCD) using diffusion kurtosis magnetic resonance imaging (DKI).

METHOD AND MATERIALS
Participated in this 91 patients aged 70 to 93 years, scheduled for elective orthopedic, urologic, general or vascular surgeries, under general or regional anesthesia. All the patients were evaluated with the Mini-Mental State Examination (MMSE) for cognitive function in the day before surgery (Day 0). MMSE was applied again 3 days after surgery (Day 3). POCD was defined as MMSE score below 20/30 or as a difference equal to or above 4 as compared to Day 0. The DKI data of all the participants were obtained in Day 3 using a 3T MR scanner and postprocessed using DKI software package, Fractional anisotropy (FA), mean diffusivity (MD), axial diffusivity (AD), radial diffusivity (RD), mean kurtosis (MK), axial kurtosis (AK) and radial kurtosis (RK) were calculated. Tract-based spatial statistics (TBSS) analyses of WM tracts were performed with MK, MD, FA, AD, RD and RK in POCD patients and controls.

RESULTS
POCD was observed in 19 patients (20.9%). The values of right superior longitudinal fasciculus (higher RD, lower MK, lower KA), left superior longitudinal fasciculus (lower MK, lower KA), left anterior limb of internal capsule (lower MK, lower RK), right anterior limb of internal capsule (lower MK, lower RK), right posterior limb of internal capsule (lower FA, higher MD, higher RD, higher AD, lower MK, lower AK, lower RK), left posterior limb of internal capsule (lower FA, higher MD, higher AD, lower MK, lower AK, lower RK), right retrolenticular part of internal capsule (lower MK, lower KA), left retrolenticular part of internal capsule (lower MK, lower KA), bilateral cerebral peduncle (lower FA), bilateral hippocampus cingulum (higher MD, higher RD) and bilateral sagittal stratum (higher RD, lower MK, lower KA) were significantly different in POCD patients from in controls (P<0.05, FWE corrected).

CONCLUSION
The changes of microstructure of superior longitudinal fasciculus, internal capsule, cerebral peduncle, hippocampus cingulum and sagittal stratum might involved in the onset and progression of POCD.

CLINICAL RELEVANCE/APPLICATION
The changes of microstructure of superior longitudinal fasciculus, internal capsule, cerebral peduncle, hippocampus cingulum and sagittal stratum might be associated with POCD.

NR327-SD-MOB2  Magnetization Transfer Imaging in Treatment Resistant Depression  
Station #2

Participants
Wei Peng, Chengdu, China (Presenter) Nothing to Disclose
Ziqi Chen, Chengdu, China (Abstract Co-Author) Nothing to Disclose
Huawei Zhang, Chengdu, China (Abstract Co-Author) Nothing to Disclose
Zhiyun Jia, Chengdu, China (Abstract Co-Author) Nothing to Disclose
Qiyong Gong, Chengdu, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
Major depressive disorder (MDD) is a common psychiatric disorder and about 30% patients are not responding to the standard antidepressant treatment, defined as treatment resistant depression (TRD). The study aims to detect biophysical changes in TRD patients by magnetization transfer imaging (MTI), which is sensitive to subtle neurobiological alterations.

METHOD AND MATERIALS
The study was approved by the local ethical committee and written informed consent was obtained. Totally 39 MDD patients (mean
PURPOSE
To determine the incremental value of amide proton transfer (APT) imaging to MR perfusion imaging for differentiating tumor progression (TP) from treatment-related effect (TE) in patients with newly diagnosed glioblastoma.

METHOD AND MATERIALS
54 patients with enlarging contrast-enhancing lesions after concurrent chemoradiotherapy were assessed using 90th percentile histogram parameters of normalized cerebral blood volume (nCBV90) and APT images (APT90). APT imaging was performed using a gradient-echo multishot echo-planar imaging with thirty frequency offsets from +5.0 to -5.0 ppm. The diagnostic performance was determined by using area under the receiver operating characteristic curve (AUC), leave-one-out cross validation and net risk improvement (NRI). Interreader agreement was assessed using intraclass correlation coefficient (ICC).

RESULTS
There were statistically significant differences of the mean APT90 between TP and TE groups (4.3% versus 1.4%; P < .001). The cross-validated AUCs and accuracies of the combination of nCBV90 with APT90 were 0.90 and 87.0%. Compared with nCBV90 alone, the addition of APT90 to nCBV90 significantly improved the diagnostic accuracy for differentiating between TP and TE (NRI, 1.16). The interreader agreement was excellent for the measurements of APT90 (ICC, 0.95).

CONCLUSION
Adding APT imaging to MR perfusion imaging significantly improves diagnosis of recurrent glioblastoma beyond that achieved using MR perfusion imaging alone.

CLINICAL RELEVANCE/APPLICATION
Adding APT imaging to MR perfusion imaging significantly improves diagnostic performance for differentiating tumor progression from treatment-related effect, as well as provides guidance for determining treatment planning.

Participants
Bingbing Gao, Dalian, China (Abstract Co-Author) Nothing to Disclose
Wei-Wei Wang, MD, PhD, Dalian, China (Presenter) Nothing to Disclose
Yanwei Miao, Dalian, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To exploit the clinical application value of susceptibility weighted imaging (SWI) on brain microstructure damage in PD.

METHOD AND MATERIALS
This prospective study was approved by the hospital ethics committee. Thirty-five clinically confirmed PD patients were included (18 males and 17 females, mean age 67.00±8.76 years). Twenty-three age and gender matched healthy volunteers were recruited.
as control group (12 males, 11 females, mean age 66.48±5.2 years). All patients performed conventional MRI and SWI sequence.

RESULTS

Compared to the HC group, the Phase value decreased in substantia nigra, red nucleus, globus pallidus and the head of caudate nuclei while increased in putamen. The biggest area under ROC curve (AUC) value of 0.887 belongs to Phase value in substantia nigra. In turn, the AUC of 0.702, 0.698 and 0.664 was attributed to the Phase value in the head of caudate nuclei, globus pallidus and red nucleus. The Phase value in substantia nigra showed significant positive correlation with it of red nucleus, globus pallidus, the head of caudate nuclei and thalamus, among which, the phase value between substantia nigra and red nucleus has the best correlation ($r=0.451$, $P=0.000$). Correlation analysis found that the Phase value in substantia nigra and globus pallidus has kind of positive correlation with MMSE score, in which the substantia nigra has the better correlation ($r=0.349$, $P=0.030$).

CONCLUSION

The iron overload exists in every gray matter nucleus of the extrapyramidal system in PD patients, and there are some effects among them. The ROC analysis found that the Phase value in substantia nigra could be as the best individual biomarker of differentiating PD patient to control.

CLINICAL RELEVANCE/APPLICATION

SWI is a valuable method in assessing the brain iron overload of PD.

NR331-SD-MOB6

Relationship between Remnant Mesial Temporal Structures and Memory Outcomes after Stereotactic Amygdalohippocampectomy and Anterior Temporal Resection

Station #6

Participants

Hana Malíková, MD, Prague, Czech Republic (Presenter) Nothing to Disclose
Lenka Kramská, Prague, Czech Republic (Abstract Co-Author) Nothing to Disclose
Roman Liscák, PhD, Prague, Czech Republic (Abstract Co-Author) Nothing to Disclose

PURPOSE

Mesial temporal lobe epilepsy (MTLE) is the most common focal epilepsy diagnosis in adults. Surgical therapy of intractable MTLE is an effective and well established treatment with long term seizure relief rendering between 50-70%. Standard microsurgical anterior temporal resection (ATL) is the most common treatment for MTLE. Stereotactic radiofrequency amygdalohippocampectomy (SAHE) is an alternative mini-invasive therapy. It causes only partial destruction of target mesial temporal structures (hippocampus and amygdala). The last modification of SAHE achieved the same clinical outcomes as open microsurgical approaches. Memory impairments after standard epilepsy surgery are well known; especially left sided operations bring verbal memory decline. The aim of the study was to study the relation between MRI volumetry data of remnant hippocampus and amygdala and changes in memory parameters in patients treated by ATL and SAHE.

METHOD AND MATERIALS

68 MTLE patients were included; 37 SAHE (10 right, 27 left) and 31 ATL (20 right, 11 left-sided) subjects. Patients underwent MRI examinations including hippocampal and amygdalar volumetry and neuropsychological evaluation preoperatively and 1 year after surgery. Spearman correlation analysis was used and data are presented as the correlation coefficient $r$ and the p-value.

RESULTS

We found significant correlation results only in SAHE group. Larger left sided hippocampal reduction in SAHE group was associated with worse Verbal memory outcome ($r/p = -0.38/0.047$). On the contrary, the improvement of Global Memory Quotient (MQ) was positively related to the right side hippocampal reduction ($r/p = 0.66/0.04$). Similarly, positive correlations between right amygdalar reduction and Verbal MQ ($r/p = 0.74/0.02$) and Global MQ change ($r/p = 0.69/0.03$) were found. Larger right hippocampal and amygdalar reduction was associated with higher Global and Verbal MQ change after SAHE.

CONCLUSION

Larger left sided hippocampal reduction was associated with worsening of verbal memory, which is in accordance with the memory specific model. Improvement of verbal and global memory in larger right-sided amygdalo-hippocampal complex reduction might point to contralateral functional hypertrophy.

CLINICAL RELEVANCE/APPLICATION

Our study improves understanding of memory mechanisms.

NR187-ED-MOB7

Pediatric Orbital Mass: A Pictorial Essay

Station #7

Participants

Ellen Cheang, MD, Sacramento, CA (Presenter) Nothing to Disclose
Peter Shen, MD, Brooklyn, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Since the orbit comprises of many compartments (extraconal, intraconal, optic nerve/sheath and occular) and individual components (extra-ocular muscles, orbital fat, optic nerve/sheath, orbital globe and bony orbit), therefore a wide spectrum of orbit mass pathology can arise. Orbital abnormalities in pediatric population are very different from adult population. This pictorial essay introduces a systemic approach to orbital pathology in pediatric patients based on orbital anatomy including ocular, optic
nerve/sheath complex, intraconal/conal and extraocular spaces. The characteristic findings of pediatric orbital pathology, including developmental lesions, inflammatory disorder, vascular malformation, and benign vs. malignant masses will be discussed. In the pediatric population, CT and MRI are the imaging modalities of choice and they are very useful to assess for compartmental localization as well as subtle imaging findings that may differentiate between benign and malignant pathology. When malignant orbital masses are suspected, it must be evaluated for intracranial, sinonasal and skull base extensions.

**TABLE OF CONTENTS/OUTLINE**

1. Review of orbital anatomy
2. Introduce anatomy-based approaches for pediatric orbital masses
3. Pictorial review of pediatric orbital mass and mass-like lesions.
Participants
Suresh K. Mukherji, MD, Northville, MI (Presenter) Nothing to Disclose
Sung Kim, MD, New Brunswick, NJ (Presenter) Nothing to Disclose
Carol R. Bradford, MD, Ann Arbor, MI (Presenter) Nothing to Disclose
Francis P. Worden, MD, Ann Arbor, MI (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Review common tumors of the head and neck. 2) Review imaging findings in head and neck malignancies that specifically change staging. 3) Review the value of imaging in directly affecting management and treatment.

ABSTRACT
This session will be tumor board that includes a head and neck radiologist, head and neck surgeon, medical oncologist and radiation oncologist. We will discuss a variety of head and neck cancer cases and illustrate the value-added benefits and highlight of imaging affects staging, treatment and management.
**SSE16**

**Nuclear Medicine (Endocrine and Gastrointestinal Imaging)**

Monday, Nov. 30 3:00PM - 4:00PM Location: S505AB

**Participants**
M. Elizabeth Oates, MD, Lexington, KY (Moderator) Nothing to Disclose
Samuel E. Almodovar-Reategui, MD, Birmingham, AL (Moderator) Nothing to Disclose

**Sub-Events**

**SSE16-01**  
*Parathyroid Imaging with Simultaneous Acquisition of Tc-99m-Sestamibi and I-123: The Relative Merits of Pinhole Collimation and SPECT-CT.*

Monday, Nov. 30 3:00PM - 3:10PM Location: S505AB

**Purpose**
To determine the relative localization utility of three state-of-the-art parathyroid imaging protocols: 1) single time point simultaneous acquisition of Tc-99m-sestamibi and I-123 images with pinhole collimation in the anterior and bilateral anterior oblique projections, 2) single time point simultaneous acquisition of Tc-99m-sestamibi and I-123 images with SPECT-CT, and 3) the combination of protocols one and two.

**Method and Materials**
Fifty-nine patients with surgical proof of parathyroid adenomas were evaluated retrospectively. All three protocols included perfectly co-registered subtraction images created by subtracting the I-123 images from the Tc-99m-sestamibi images, plus an anterior parallel hole collimator image of the neck and upper chest. The pinhole protocol was performed first followed by the SPECT-CT protocol. Three image sets were derived from each study in each patient according to the above protocols. Two experienced observers recorded the size, location and degree of certainty of any identified lesion.

**Results**
The 59 patients had sixty-one adenomas. For the two observers combined, the localization success rate was 88% for the pinhole protocol, 69% for the SPECT-CT protocol, and 81% for the combined protocol. The pinhole protocol detected more adenomas than the SPECT-CT protocol and missed fewer adenomas than either the SPECT-CT protocol or the combined pinhole and SPECT-CT protocol (P < 0.01). The two protocols that included SPECT-CT provided superior anatomic information relative to the location and size of the parathyroid adenomas.

**Conclusion**
Overall, the pinhole protocol localized significantly more adenomas than the SPECT-CT protocol. However, the protocols that included SPECT-CT provided more anatomic information than pinhole imaging alone.

**Clinical Relevance/Application**
Accurate preoperative identification and localization of parathyroid adenoma(s) allows surgeons to perform image guided minimally invasive surgery with improved success rates, shorter operating times, and less morbidity. Consequently, it is important to optimize the accuracy of preoperative imaging in determining the presence, size, and location of parathyroid adenomas. Our hope with this study is to determine the most accurate imaging protocol with current available imaging modalities to overall optimize patient outcomes.

**SSE16-02**  
*Influence of Multigland Parathyroid Disease on Tc-99m-Sestamibi SPECT/CT Sensitivity*

Monday, Nov. 30 3:10PM - 3:20PM Location: S505AB

**Purpose**
Tc-99m-sestamibi (MIBI) imaging is a mainstay for preoperative parathyroid lesion localization in pts with primary hyperparathyroidism (PHP). Decreased sensitivity in multigland disease (MGD) compared to single gland disease (SGD) is a well recognized phenomenon for planar and SPECT protocols, but few data are available on the effect of MGD on the sensitivity of MIBI parathyroid SPECT/CT.

**Participants**
Kenneth Nichols, PhD, New Hyde Park, NY (Presenter) Royalties, Syntermed, Inc;
Gene G. Tronco, MD, New Hyde Park, NY (Abstract Co-Author) Nothing to Disclose
Christopher J. Palestro, MD, New Hyde Park, NY (Abstract Co-Author) Nothing to Disclose
METHOD AND MATERIALS

We retrospectively analyzed 272 pts (220 female pts, 52 male pts, age = 59±13 years) with PHP who underwent preoperative MIBI SPECT/CT. We used surgical and pathology reports to confirm numbers and weights of excised parathyroid lesions. Two experienced physicians read SPECT/CTs on 2 separate occasions without reference to each other's readings or final diagnoses. Lesion certainty was graded on a 5-point scale (0 = normal, 1 = probably normal, 2 = equivocal, 3 = probably abnormal, 4 = definitely abnormal). Mean scores were obtained for the 2 observers. Readings were compared for MGD and SGD lesions matched by weight and location.

RESULTS

230 pts had SGD, 42 had MGD (28 pts with 2 lesions, 11 pts with 3 lesions and 3 pts with 4 lesions). Lesion weight decreased progressively with increasing numbers of lesions (888±941 mg for 1 lesion, 436±570 mg for 2 lesions, 395±686 mg for 3 lesions, 89±120 mg for 4 lesions, \( p = 0.43, p < 0.0001 \)). It was possible to match equal numbers of SGD and MGD lesions by weight for 132 lesions, with similar mass (526±678 versus 525±686 mg, \( p = 0.99 \)), and similar location distributions (\( p = 0.47 \)). Despite being matched by weight and location, reading confidence was significantly lower for SGD than MGD lesions (2.0±1.4 versus 3.4±0.8, \( p < 0.0001 \)); confidence decreased progressively with increasing lesion numbers (2.2±1.3 for 2 lesions, 1.8±1.5 for 3 lesions, 1.0±0.9 for 4 lesions, \( p = -0.51, p < 0.0001 \)). Sensitivity was significantly lower for SGD than MGD lesions (64% versus 98%, \( p < 0.0001 \)); sensitivity decreased progressively with increasing lesion numbers (67% for 2 lesions, 65% for 3 lesions, 25% for 4 lesions, \( p = -0.45, p < 0.0001 \)).

CONCLUSION

As with planar and SPECT MIBI, in PHP, Tc-99m-MIBI SPECT/CT reading confidence and sensitivity are significantly lower in multigland disease than in single gland disease.

CLINICAL RELEVANCE/APPLICATION

MIBI SPECT/CT is less sensitive for detecting lesions in MGD than in SGD and therefore it must be used together with rapid intraoperative parathyroid hormone assay to ensure that all offending lesions are removed.

SSE16-03 Prognostic Value of FDG-PET/CT in Papillary Thyroid Cancer with the TENIS Syndrome

Monday, Nov. 30 3:20PM - 3:30PM Location: S505AB

Participants
Kunihiro Nakada, Sapporo, Japan (Presenter) Nothing to Disclose
Hiroki Sugie, MD, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose
Yusushi Furuta, MD, PhD, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose
Hiromasa Takahashi, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose
Naoya Hattori, MD, PhD, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose
Masayuki Sakurai, Sapporo, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE

Postsurgical papillary thyroid cancer (PCA) with thyroglobulin elevation and negative iodine scintigraphy (TENIS) generally show resistance to high-dose I-131 therapy. However, prognostic factors for PCA with the TENIS syndrome have not been well established... The aim of the study was to determine whether FDG uptake is linked with clinical behavior of the tumor in the TENIS syndrome.

METHOD AND MATERIALS

93 patients with PCA, who had previously undergone total thyroidectomy and remnant tissue ablation and were diagnosed as the TENIS syndrome, underwent FDG-PET/CT. Serum Tg levels at PET/CT ranged 2.9-225.4(ng/ml). Uptake of FDG was visually assessed and classified as positive or negative. When FDG uptake was positive, semi-quantitative analysis (SUVmax) was performed. If a patient had multiple tumors, average of SUVmax in the 2 largest tumors was used for evaluation. Patients were followed up for 28-83 months (median 46). Tg levels were measured at least 5 times or more after imaging of FDG-PET/CT. to determine Tg doubling time (Tg-DT). As a rule, changes in the tumor size were evaluated based upon RECIST1.1.

RESULTS

Of 93 patients, 74 showed positive FDG uptake while the remaining 19 showed negative FDG uptake. In the FDG positive group, 21 (28%) showed Tg-DT of < 1yr. Progressive disease (PD) was observed in 32 pts. (42%). SUVmax was significantly higher in patients with PD than others (6.7 vs.4.1, \( p<0.01 \)). 5 pts. died of PCA. In contrast, all patients in the FDG negative group had Tg-DT of either >= 3yrs. or minus value regardless of baseline Tg value. PD was seen in only 1(5%). Cancer-associated death was not observed in any of the patients. There was an inverse correlation between SUVmax and Tg-DT in the positive FDG uptake group (\( r=-0.56 \)).

CONCLUSION

Positive FDG uptake in the TENIS syndrome indicates shorter Tg-DT and higher risk of PD. In contrast, negative FDG uptake is associated with longer Tg-DT and gentle behavior of the tumor. FDG-PET/CT is helpful in characterizing prognosis of postsurgical PCA with the TENIS syndrome.

CLINICAL RELEVANCE/APPLICATION

In patients with TENIS who have high FDG uptake, early start of additional therapies such external radiation, local ablation therapy such as RFA or PEI, or chemotherapy using sorafenib or lenvatinib may improve their prognosis. In contrast, the majority of patients with negative FDG uptake do not require aggressive additional treatments.

SSE16-04 Effectiveness of Semi-quantitative Analysis in I-123 Metaiodobenzylguanidine Scintigraphy for Diagnosing Pheochromocytoma

Monday, Nov. 30 3:30PM - 3:40PM Location: S505AB

Participants
Yoshiyuki Kitamura, Fukuoka, Japan (Presenter) Nothing to Disclose
SSE16-06 In low risk patients with thyroid cancer, our findings may support low dose consideration prior to radioiodine ablation.

CLINICAL RELEVANCE/APPLICATION

Semi-quantitative method using SPECT/CT was more sensitive and specific than visual evaluation in the diagnosis of pheochromocytoma in patients with adrenal tumor.

CONCLUSION

Semi-quantitative method using SPECT/CT was more sensitive and specific than visual evaluation in the diagnosis of pheochromocytoma in patients with adrenal tumor.

SSE16-05 Postablation Radioiodine Scintigraphy SPECT/CT: Functional and Anatomic Correlation

Monday, Nov. 30 3:40PM - 3:50PM Location: S505AB

Participants

Ana M. Franceschi, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Robert Matthews, MD, Stony Brook, NY (Presenter) Nothing to Disclose
Lev Bangiyev, DO, Stony Brook, NY (Abstract Co-Author) Nothing to Disclose
Dinko Franceschi, MD, Stony Brook, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE

SPECT/CT was utilized to localize radioiodine uptake in thyroid carcinoma patients status post radioiodine ablation. Anatomic correlation with central neck uptake evident on planar I-131 scintigraphy was assessed.

METHOD AND MATERIALS

In this retrospective study, one nuclear medicine physician and one neuroradiologist reviewed SPECT/CT findings to assess accuracy of radioiodine uptake localization on planar whole-body images in the central neck region. Inclusion criteria included thyroid carcinoma patients at our institution who underwent postablation planar and SPECT/CT I-131 scintigraphy from October 1, 2013 to June 1, 2014. Radioiodine dose was 50-200 mCi.

RESULTS

44 consecutive patients were included in the study (10 male, 34 female). Age range was 20 - 74. Most of the patients, 40 (91%) had obvious foci of radioiodine uptake in the central neck on planar SPECT imaging, while remaining 4 patients had no significant radioiodine uptake in the neck. Of the patients with radioiodine uptake in the neck, 12 (27%) had uptake within the thyroid bed region only, 13 (30%) had focal uptake corresponding just to the thyroglossal duct remnant, and 15 (34%) had uptake within both, thyroid bed region and thyroglossal duct remnants. Therefore, majority of the patients with central neck uptake 28/40 (70%) had visualization of the thyroglossal duct remnant activity.

CONCLUSION

The anatomic CT correlation with planar and SPECT images demonstrated the majority of the focal radioiodine uptake to be located exclusively within the thyroid bed and thyroglossal duct remnant.

CLINICAL RELEVANCE/APPLICATION

In low risk patients with thyroid cancer, our findings may support low dose consideration prior to radioiodine ablation.

SSE16-06 Evaluate Correlation of Duodenogastric Reflux Detected on Tc-99m Mibefradil Hepatobiliary Scintigraphy with Symptomatic Gastroesophageal Reflux Disease: A Retrospective Study
PURPOSE

GERD is thought to result primarily from gastric acid reflux. Recent literature suggests that symptomatic GERD also occurs from duodenogastric reflux of bile acids. This has been termed alkaline variant GERD and appears to be more damaging to the esophagus and has a more symptomatic clinical course. We aim to evaluate whether the presence of duodenogastric reflux (DGR) seen on Tc-99m mebrofenin hepatobiliary scintigraphy (MHBS) correlates with presence of clinical GERD and whether degree of DGR seen correlates with clinical severity of GERD.

METHOD AND MATERIALS

300 Tc-99m MHBS exams conducted from January 2011-December 2014 were included in this study and were evaluated for presence of DGR. Patients’ chart were reviewed to identify for clinical diagnosis of GERD and the severity of GERD that was determined using clinical data points including endoscopic evaluation of GERD, oral medications for treatment of GERD and presence/absence Barrett’s esophagus, etc.

RESULTS

83 patients (45 females and 38 males) with mean age 47.9 (range: 13 - 93 years old) were identified to have evidence of DGR. Of these patients, 31.3% patients were diagnosed with cholecystitis and 7.2% patients were diagnosed with biliary colic. 25.3% patients had only clinical history of GERD and no additional significant history. Of the patients with clinical evidence of GERD, 42.9% patients had evidence of severe DGR, 38.1% had moderate DGR and 19% had mild DGR noted. 4.7% patients with GERD and severe DGR had histopathologic evidence of Barrett’s esophagus.

CONCLUSION

DGR is easily detected and frequently identified on Tc-99m MHBS. Our study shows 25% of patients with otherwise unremarkable Tc-99mHBS scintigraphy have evidence of DGR and majority of these have moderate to severe GERD. As emerging literature is demonstrating stronger correlation between bile acid reflux and symptomatic GERD, DGR is an important diagnostic consideration as the cause of patients presenting symptoms in an otherwise normal HIDA study.

CLINICAL RELEVANCE/APPLICATION

DGR is easily detected and frequently identified on Tc-99m MHBS and a significant proportion patients with scintigraphic evidence of DGR have GERD. Reporting severity of reflux in report can facilitate patient management by alerting clinician to DGR as an important diagnostic consideration as the cause of patients presenting symptoms in an otherwise normal HIDA study.
SSE17

Neuroradiology (Parkinson Disease)

Monday, Nov. 30 3:00PM - 4:00PM Location: N228

NR BQ

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Christopher P. Hess, MD, PhD, Mill Valley, CA (Moderator) Research Grant, General Electric Company; Research Grant, Quest Diagnostics Incorporated; Research Grant, Cerebrotech Medical Systems, Inc; Jay J. Pillai, MD, Baltimore, MD (Moderator) Medical Advisory Board, Prism Clinical Imaging, Inc; Author with royalties, Springer Science+Business Media Deutschland GmbH; Author with royalties, Reed Elsevier

Sub-Events

SSE17-01 A Voxel-based Evaluation of Parkinson’s Disease Using Quantitative Susceptibility Mapping and Neuromelanin Imaging

Monday, Nov. 30 3:00PM - 3:10PM Location: N228

Participants
Hiroto Takahashi, MD, Suita, Japan (Presenter) Nothing to Disclose
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PURPOSE
To assess dopaminergic neurodegeneration with iron deposition of the substantia nigra pars compacta (SNpc) in patients with Parkinson’s disease (PD) in a quantitative and reproducible fashion.

METHOD AND MATERIALS
This study included 14 patients with PD (Group A) and 14 normal controls (Group B) who underwent quantitative susceptibility mapping (QSM), neuromelanin (NM) imaging and three-dimensional (3D) T1W imaging on a 3T magnetic resonance imager. Both QSM and NM values of the SNpc were calculated using a region of interest (ROI) based automated segmentation system with the voxel-based morphometric technique. Images were preprocessed as follows (Figure): All QSM and NM images were coregistered with 3D T1-weighted structural images and were spatially normalized using Statistical Parametric Mapping, thus allowing voxel-based measurement with automatic setting of the ROI encompassing the SNpc. The spatially normalized images of all subjects were smoothed. Finally, the SNpc ROI was set on the QSM-NM fused image. Signal to noise ratio (SNR) of the SNpc in the NM images was calculated on the basis of mean value of the automatically segmented background region (tegmentum in the midbrain). The significance of intergroup differences in each QSM value and NM area of higher SNR than that of the background region was tested using Mann-Whitney’s U test.

RESULTS
For mean QSM value of the SNpc, no significant difference was shown between both groups [Group A/B: mean value (ppb) = 75.72/64.62, SD = 21.24/27.75]. But when comparing the highest 5% of QSM values in each group, the mean in Group A was significantly larger than that in Group B [Group A/B: mean value (ppb) = 175.21/133.33, SD = 45.44/41.75] (P < 0.05). The NM area of higher SNR in Group A was significantly less than that in Group B [Group A/B: mean value (pixel) = 85.79/104.07, SD = 13.66/13.56] (P < 0.05).

CONCLUSION
An automatic measurement system for structural and functional changes in the SNpc with voxel-based analysis can provide clinically useful information in the diagnosis of PD.

CLINICAL RELEVANCE/APPLICATION
SNpc is a small region, but can be assessed quantitatively and reproducibly with voxel-based analysis in the diagnosis of Parkinson’s disease.

SSE17-02 Drug-induced Parkinsonism versus Idiopathic Parkinson’s Disease: Diagnostic Utility of Nigrosome 1 MRI at 3T

Monday, Nov. 30 3:10PM - 3:20PM Location: N228

Participants
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Discrimination between drug-induced parkinsonism (DIP) and idiopathic Parkinson's disease (IPD) is challenging because they may be clinically indistinguishable. Dopamine transporter imaging can help differentiate them, but it is expensive and imposes radiation on patients. We hypothesized that the nigrosome 1 is not affected in patients with DIP unlike in those with PD. The aim of this study was to investigate whether nigrosome 1 imaging at 3T can help differentiate PD from DIP.

**METHOD AND MATERIALS**

We enrolled 20 patients with DIP (16 female; mean age, 74) who showed normal activity on 18F-FP-CIT PET (CIT PET), 29 patients with IPD (10 female; mean age, 71; HandY stage ≤ 2) who showed abnormality on CIT PET, and 18 healthy subjects (10 female; mean age, 66). All participants underwent 3D multi-echo gradient-recalled echo imaging (number of echoes, 6) covering the midbrain parallel to the plane from the posterior commissure and top of the pons (spatial resolution, 0.5 × 0.5 × 1 mm). Two independent reviewers assessed nigrosome 1 on three slices: an upper slice at the lower tip of red nucleus, and two successive lower slices by comparing the signal intensity of the central portion of the nigrosome 1 with that of the white matter lateral to decussation of the superior cerebellar peduncles. Relative hypointensity in either side of nigrosome 1 was considered abnormal. Interobserver observer agreement, diagnostic sensitivity, specificity, and accuracy were analyzed.

**RESULTS**

Inter-rater agreement was excellent (κ = 0.821). All 29 patients with IPD and three of 18 healthy subjects were rated as abnormal on nigrosome 1 MRI (sensitivity, 100%; specificity, 83.3%; accuracy, 93.6%; positive predictive value [PPV], 100%; negative predictive value [NPV], 100% between the patients with IPD and healthy subjects). Three of 20 patients with DIP were considered abnormal on nigrosome 1 MRI (sensitivity, 100%; specificity, 85%; accuracy, 93.9%; PPV, 90.6%; NPV, 100% between the patients with IPD and DIP). Abnormality on MRI was significantly more frequent in patients with IPD (P < 0.0001).

**CONCLUSION**

Nigrosome 1 imaging at 3T can differentiate IPD from DIP with accuracy of 93.9%.

**CLINICAL RELEVANCE/APPLICATION**

High diagnostic accuracy and perfect NPV of nigrosome imaging at 3T between patients with IPD and DIP can help manage them properly and may reduce dependence on dopamine transporter imaging.

**SSE17-03 The Pattern of Iron Deposition in the Progression of Parkinson’s Disease by Quantitative Susceptibility Mapping**

**Participants**

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Min Xian, HangZhou, China (Abstract Co-Author) Nothing to Disclose
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Wei Luo, Hangzhou, China (Abstract Co-Author) Nothing to Disclose
Minmin Zhang, MD, PhD, Hangzhou, China (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

The influence of iron on the pathophysiological progression of Parkinson's disease (PD) and the pattern of iron accumulation in the subregions of substantia nigra (SN) were unclear. In the present cross-section study, we aimed to clarify the potential pattern of iron deposition in the subcortical nuclei, especially in the SN, among the controls and PD subgroups, thus the possible underlying iron-related pathogenesis of PD.

**METHOD AND MATERIALS**

Forty-eight PD patients (H-Y stage <= 2.5, n=16, belonged to mild subgroup; H-Y stage >= 3, n=32, belonged to severe subgroup), and 47 gender-, age-, duration- matched healthy controls were included in our study. All subjects participated in the 3D-enhanced T2 star weighted angiography (ESWAN) scanning. The phase images of ESWAN data were processed to generate quantitative susceptibility mapping (QSM). Then, we measured the iron content within the ROIs and the relevant clinical assessments of these patients.

**RESULTS**

After controlling for age as a covariant (Bonferroni corrected), QSM values within the medSNc and latSNc increased significantly in both PD subgroups compared with controls respectively (both p<0.01), while QSM values within medSNr (p<0.01) and latSNr (p<0.05) only increased in the severe subgroup of PD. More interestingly, medSNc had higher iron content in the severe group of PD than the mild one (p<0.05), while that could not observe in the latSNc. Further, in the severe subgroup iron content within medSNr (p<0.01) and latSNr (p<0.05) elevated greatly compared with the mild subgroup.

**CONCLUSION**

Due to the limitation of present study, which recruited symptomatic patients, we didn't observe the presymptomatic or early changes in the latSNc between 2 PD subgroups. After all, we had investigated the dynamic pattern of iron deposition in the SN during the progression of PD, which was perfectly consistent with the work of Feamley JM ( Brain 1991 ). As the disease proceeding, the iron deposition accumulated first in the latSNc ( Martin W.R. et al., 2008 ), and then involved the medSNc, finally reached the medSNr and latSNr.

**CLINICAL RELEVANCE/APPLICATION**

Firstly, present work would help understand the possible pathogenesis of PD indirectly; secondly, the pattern of iron deposition would indicate the imaging biomarker of early diagnosis of PD.

**SSE17-04 Participants**
**Resting State Functional Connectivity in Parkinson’s Patients with Implanted Deep Brain Stimulation Electrodes**

Monday, Nov. 30 3:30PM - 3:40PM Location: N228

Subhendra N. Sarkar, PhD, RT, Boston, MA (Presenter) Nothing to Disclose  
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Rafael Rujas, MD, Chestnut Hill, MA (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

rs-fcMRI, if performed within MR safety limits, could help evaluate electrode placement and the effects of DBS on brain connectivity for Parkinson's patients. However, fMRI traditionally requires high speed and high field MRI violating RF and gradient safety for DBS (1).  

**METHOD AND MATERIALS**

10 PD patients with DBS electrodes were imaged within MR safety limits (SAR < 0.1 W/kg, dB/dT < 20 mT/S, B0 = 1.5T) by single-shot EPI (TR/TE/Voxel/# brain volumes = 3-4s/50ms/4x4x5mm3/interleaved/100-120 volumes/scan time 6 min). 5 PD patients prior to DBS implantation were imaged at high SAR (> 0.8 W/kg, 3T) by a single-shot EPI (TR/TE/Voxel/whole brain volumes = 2s/30ms/3.4x3.4x3.4mm3/interleaved/100-140 volumes/scan time 3-4 min/2-3 runs). Motion corrected, normalized images were co-registered with 3D MPRAGE using SPM. Several resting state networks were computed (default mode/DMN, executive control/ECN and sensory motor/SMN) using common seed regions and CONN rs-fMRI processing algorithm(2). The networks for low and high SAR groups were averaged and objectively compared by two independent readers.  

**RESULTS**

The group average network images at low SAR were similar to those imaged pre-DBS at high SAR. The spatial correlation coefficients between the high and low SAR for each network were: DMN 0.70, ECN 0.64 and SMN 0.64, supporting the maps similarities. Zhang et al (3) have shown that PD patients with Tremor show increased centrality in rs networks in frontal, parietal and occipital lobes that are supported by our results although low SAR maps were weaker perhaps due to the susceptibility from electrodes. Anticorrelations among networks were also preserved at low SAR even after using global regressors that are quite acceptable (4).  

**CONCLUSION**

High quality rs fc-MRI images can be safely obtained at 1.5T at about 10% of routine SAR at high fields. Abnormal brain connectivity may be used to modulate DBS settings. Resting state fc-MRI is promising toward understanding and manipulating the stimulation effects on brain cognition and motor control in refractory PD. Reference (1) Kahan et al Brain Feb 2014; (2) Whitfield-Gabrieli et al Neuroimage 2011; (3) Zhang et al Front. Aging Neurosci 2015; (4) Chai et al Neuroimage 2012

**CLINICAL RELEVANCE/APPLICATION**

High quality resting state fc images can be obtained for DBS patients within MR safety margin, with device programming and understanding stimulation effects on brain connectivity in refractory PD.

**SSE17-05**

**Chemical Exchange Saturation Transfer Signal of the Substantia Nigra as Imaging Biomarker for Assessing Progression of Parkinson’s Disease**

Monday, Nov. 30 3:40PM - 3:50PM Location: N228

Participants  
Chunmei Li, MD, Beijing, China (Presenter) Nothing to Disclose  
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Min Chen, MD, PhD, Beijing, China (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To evaluate chemical-exchange-saturation-transfer (CEST) signal of the substantia nigra (SN) in Parkinson's disease (PD) patients, as well as their relationship to clinical progression.

**METHOD AND MATERIALS**

CEST MR imaging of 26 normal controls and 61 PD patients [18 early stage (disease duration ≤ 1 year), 19 mid stage (disease duration 2~5 years) and 24 late stage (disease duration ≥ 6 years)] were acquired on a Philips 3 Tesla MRI system. Magnetization transfer spectra with 31 different frequency offsets (-6 to 6 ppm) were acquired at the slice of the SN. The FLAIR image was used as the anatomical reference to draw regions of interest. MTRasym(3.5ppm) and MTRtotal values of the SN were measured. Clinical measures were obtained for PD patients, such as the Hoehn and Yahr (HandY) scale, and the unified Parkinson’s disease rating scale (UPDRS), etc. One-way ANOVA was used to compare the CEST signal differences between normal controls and PD patients of all stages. Correlation analysis was made for the CEST signal of SN and clinical progression.

**RESULTS**

Compared to normal controls, the MTRasym(3.5ppm) and MTRtotal values of the SN were significantly lower in PD patients of all stages. Both the MTRasym(3.5ppm) and MTRtotal values of the SN strongly associated with HandY scale, UPDRS, UPDRS-3 and disease duration.

**CONCLUSION**

CEST signal of the SN has the potential to serve as imaging biomarker for assessing progression of PD.
CEST signal of the SN has the potential to serve as imaging biomarker for assessing progression of PD.

**CLINICAL RELEVANCE/APPLICATION**

CEST signal could provide information additional to conventional MR imaging and potentially serve as imaging biomarker in the progression assessment of PD.

**SSE17-06  Multivariate Pattern Analysis of Paroxysmal Kinesigenic Dyskinesia Using Diffusion Tensor Imaging**

Monday, Nov. 30 3:50PM - 4:00PM Location: N228

Participants
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Du Lei, Chengdu, China (Abstract Co-Author) Nothing to Disclose
Xueling Suo, Chengdu, China (Abstract Co-Author) Nothing to Disclose
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Qiyong Gong, Chengdu, China (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Paroxysmal kinesigenic dyskinesia (PKD) is a rare movement disorder. Available researches using diffusion tensor imaging (DTI) have shown that PKD is accompanied by abnormalities in white matter (WM). However, results of those publications were based on average differences between groups, which permitted little use in clinical practice. Multivariate pattern analysis (MVPA) approach is a promising analytical technique which allows the classification of individual observations into distinct classes. Thus, in this study, we aimed to (i) apply MVPA approach known as Support Vector Machine (SVM) for investigating whether fractional anisotropy (FA) of WM can be used to discriminate between patients with PKD and healthy control subjects (HCS) at the level of the individual; (ii) explore which WM regions contributed to such discrimination.

**METHOD AND MATERIALS**

DTI data were acquired from 48 PKD patients and 48 demographically matched HCS using a 3T MRI system. Differences in FA values of WM were used to discriminate between PKD patients and HCS using leave-one-out cross-validation with SVM based on Probid software (http://www.brainmap.co.uk/probid.htm), and to find a spatially distributed pattern of regions with maximal classification weights. We also drew a receiver operating characteristic (ROC) curve to help evaluate the performance of the classifier.

**RESULTS**

SVM applied to FA images correctly identified PKD patients with a sensitivity of 91.67% and a specificity of 87.50% resulting in a statistically significant accuracy of 89.58% (P <0.001). This discrimination was based on a distributed network including anterior thalamic radiation temporoparietal junction, inferior fronto-occipital fasciculus, inferior longitudinal fasciculus, corpus callosum, and cingulum.

**CONCLUSION**

The present study demonstrates subtle and spatially distributed WM abnormalities in individuals with PKD, indicating neuroanatomical basis for the involvement of the basal ganglia-thalamocortical pathway in PKD, and provides preliminary support for the suggestion that SVM approach could be used to aid the identification of individuals with PKD in clinical practice.

**CLINICAL RELEVANCE/APPLICATION**

The current study illustrated that the application of SVM to FA images could allow accurate discrimination between PKD patients and HCS, which indicated its potential diagnostic value in helping detecting this disease.
Neuroradiology (Stroke and Recovery)
Monday, Nov. 30 3:00PM - 4:00PM Location: N229

Participants
David J. Mikulis, MD, Toronto, ON (Moderator) Stockholder, Thornhill Research Inc; Research Grant, General Electric Company; Pina C. Sanelli, MD, Manhasset, NY (Moderator) Nothing to Disclose

SSE18-01 Magnitude of Predictive Error When Employing ASPECTS Methodology for Core and Penumbra Estimation Towards Diagnosis and Prognostication in Acute Ischemic Stroke: A Paradigm Challenge of Imaging-Based Approaches to Therapy Selection
Monday, Nov. 30 3:00PM - 3:10PM Location: N229

Participants
Meredith Bowen, BA, Atlanta, GA (Presenter) Nothing to Disclose
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Deqiang Qiu, PhD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
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Fadi Nahab, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

PURPOSE
Emerging treatment strategies in acute ischemic stroke (AIS) propose CTP-derived therapy selection paradigms; however, speed and availability of non-contrast CT may compel fast, qualitative approaches to risk stratification using ASPECTS. The superiority of rigorous automated approaches has been recently reported, although the magnitude of potential error in estimating core and putatively at-risk volumes using qualitative approaches remains unknown. We proposed the analysis of prediction error towards core and penumbral volumes using qualitative approaches, hypothesizing broad ranges across potential values, with greatest vulnerability to error using NCCT ASPECTS

METHOD AND MATERIALS
54 patients (36 female, 71 years +/-16) with anterior circulation AIS imaged with NCCT and CTP were evaluated. Perfusion analysis (time ~2.5 min) was performed in an operator independent environment (RAPID). Estimated core infarct volume was calculated by relative CBF. At-risk volume was calculated at Tmax>6s. NCCT and CTP ASPECTS were determined by two independent evaluators. Linear regression models were fitted with each of the volume variables as outcomes and qualitative scores as covariates. F-statistics of ANOVA were performed.

RESULTS
Demographics included median NIHSS=16 (IQR 15), mean time to imaging=233min (IQR 252). Mean (sd) volumes for rCBF core for NCCT-ASPECTS scores 8-10 were 27(31.6), 11.2(17.8), 4.7(7.8), respectively (p<0.001), while at-risk volumes at Tmax>6s were 68.3(30.9), 56.4(55.4), 44.2(42.1) (p=0.36). For CBV-ASPECTS scores 7-10, rCBF volumes were 12.2(23), 5.1(9.4), 0(0), 0(0) (p=0.004), while at-risk volumes, Tmax>6s were 42.2(28.7), 44.3(34.6), 17.1(26.7), 47.1(56.1) (p=0.04). For CBF-ASPECTS scores 7-10, rCBF volumes were 17.6(30.5), 5(10), 0(0), 3.2(4.5) (p=0.05), while at-risk volumes, Tmax>6s were 40.4(20.8), 44.5(40), 17.1(26.7), 15.7(12.7) (p=0.07).

CONCLUSION
ASPECTS is widely reported as a quick approach to risk stratification and treatment selection in AIS, but tissue changes may lag hypoperfusion and irreversible injury. While not practical as an estimation of at-risk tissue, the present study further challenges the feasibility of such approaches as predictors of irreversible core at presentation.

CLINICAL RELEVANCE/APPLICATION
Qualitative methods are prone to wide ranges of core and at-risk tissue volume for any one appearance in AIS; fast, comprehensive image triage may be advisable for therapy choice, risk stratification.

SSE18-02 Detection of Small Vessel Occlusions Using a Wavelet-based CT Angiography Reconstructed from CT Perfusion Data in Acute Ischemic Stroke
Monday, Nov. 30 3:10PM - 3:20PM Location: N229

Participants
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Maximilian F. Reiser, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Kolja M. Thierfelder, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Birgit B. Ertl-Wagner, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose
To evaluate a newly developed wavelet-based CTA (waveCTA) reconstructed from whole-brain CT perfusion (WB-CTP) data in stroke patients in which conventional single-phase CTA (spCTA) failed to demonstrate a vessel occlusion.

METHOD AND MATERIALS

Out of a retrospective cohort of 658 consecutive patients who had undergone multiparametric CT due to suspected stroke, we included all patients with the following inclusion criteria: (1) CT perfusion deficit as assessed by CBF, (2) no evidence of occlusion in spCTA, and (3) acute ischemic non-watershed infarction as confirmed by follow-up MRI or CT within 72hrs. waveCTA images were calculated from whole-brain CT perfusion data after initial rigid-body motion correction using the wavelet transform (Paul wavelet, order 1) of each pixel attenuation time course, from which the angiographic signal intensity was extracted as the maximum of the wavelet power spectrum. waveCTA was analyzed by two blinded and experienced readers with respect to presence and location of vessel occlusions and detail visibility of vessels in comparison to spCTA.

RESULTS

Sixty-three patients (9.6%, mean age 74.8 yrs, range 34-89) fulfilled the inclusion criteria. waveCTA reconstruction was successful in all patients. Overall, in 31 (49.2%) of these patients with negative spCTA, an occlusion could be identified using waveCTA. In the subgroup of 48 MCA infarctions, 24 occlusions (50.0%) were detected by waveCTA, mainly located on the M2- (12) and M3-level (10). A subgroup of ACA and PCA infarctions with 6 patients each demonstrated occlusions using waveCTA in 3 cases each. Detail visibility of small vessels (M2-4 level) was rated significantly higher for waveCTA vs. spCTA (4.5 vs. 2.8; p < 0.001).

CONCLUSION

Wavelet-based CT angiography reconstructed from CT perfusion data allows the detection of small vessel occlusions that are missed by spCTA in around 50% of the cases.

CLINICAL RELEVANCE/APPLICATION

waveCTA is a promising new angiographic reconstruction technique of WB-CTP data that improves the sensitivity in the detection of small-vessel occlusions. Further studies on the prognostic value of these occlusions may contribute to clinical decision making in acute ischemic stroke.

SSE18-04  Comparing Different Imaging Strategies in Acute Ischemic Stroke

Participants
Omar N. Kallas, MD, New York, NY (Presenter) Nothing to Disclose
Jana Ivanidze, MD, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE

To examine the influence of radiation dose reduction on image quality and sensitivity of Volume Perfusion CT (VPCT) maps regarding the detection of ischemic brain lesions.

METHOD AND MATERIALS

VPCT data of 20 patients with suspected ischemic stroke acquired at 80 kV and 180 mAs were included. Using realistic reduced-dose simulation, low-dose VPCT datasets with 144 mAs, 108 mAs, 72 mAs and 36 mAs (80%, 60%, 40% and 20% of the original levels) were generated, resulting in a total of 100 datasets. Perfusion maps were created and signal-to-noise-ratio (SNR) measurements were performed. Qualitative analyses were conducted by two blinded readers, who also assessed the presence/absence of ischemic lesions and scored CBV and CBF maps using a modified ASPECTS-score.

RESULTS

SNR of all low-dose datasets were significantly lower than those of the original datasets (p<.05). All datasets down to 72 mAs (40%) yielded sufficient image quality and high sensitivity with excellent inter-observer-agreements, whereas 36 mAs datasets (20%) yielded poor image quality in 15% of the cases with lower sensitivity and inter-observer-agreements (Figure)).

CONCLUSION

Low-dose VPCT using decreased tube currents down to 72 mAs (40% of original radiation dose) produces sufficient perfusion maps for the detection of ischemic brain lesions.

CLINICAL RELEVANCE/APPLICATION

The application of LD-CTP is associated with lower patient radiation exposure while maintaining high diagnostic accuracy for the detection of ischemic brain lesions.
CONCLUSION

The purpose of our study was to compare two different imaging strategies in acute ischemic stroke: using Noncontrast CT (NCCT) versus CT Angiography and Perfusion (CTAP) as the first imaging modality after patient presentation. Our hypothesis is that using CTAP as the first imaging modality may correlate with better outcomes compared to NCCT depending on patient characteristics of age, NIHSS, and time from symptom onset to presentation.

METHOD AND MATERIALS

In this institutional review board-approved retrospective study, 373 patients with acute ischemic stroke who presented within a one year period at two large institutions were enrolled in this study. Inclusion criteria included presentation within 8 hours of stroke symptom onset, and no evidence of hemorrhage on initial imaging study. Patients were divided into two groups: those who received NCCT and those who received CTAP as their first imaging study. Patients were subsequently stratified based on treatment strategy (no treatment, Intravenous tPA (IVTAP) treatment, and endovascular therapy), and sub-stratified based on age, NIHSS, and time from symptom onset to presentation. Outcomes of mRS scores were compared between groups to determine the best imaging strategy based on patient characteristics.

RESULTS

Among the patients who were eventually treated with IVTAP, patients who received CTAP as their first imaging study had significantly lower mRS scores compared to those who received NCCT first (p < 0.001). This difference in mRS scores was seen in the subgroup of patients greater than 70 years old, with NIHSS greater than 5, and who presented within 4.5 hours of symptom onset. There was no significant difference in outcomes between the two imaging strategies in patients who did not receive treatment at all, and those who only received endovascular therapy.

CONCLUSION

In those patients who were eventually treated with IVTAP, significantly better outcomes were observed in patients who underwent CTAP as their first imaging study compared to those who received NCCT first (the current imaging standard). In patients greater than 70 years of age, with NIHSS greater than 5, and presenting within 4.5 hours of symptoms onset, CTAP may better inform physicians as to subsequent treatment strategy.

CLINICAL RELEVANCE/APPLICATION

Imaging strategies for ischemic stroke patients should be individualized based on patient characteristics of age, NIHSS and time from symptom onset to presentation.

SSE18-05 Dynamic Grey Matter Changes during Motor Recovery after Pontine Infarction: A Voxel-based Morphometry Study

Participants

Peipei Wang, Beijing, China (Abstract Co-Author) Nothing to Disclose
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Jie Lu, MD, PhD, Beijing, China (Presenter) Nothing to Disclose
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PURPOSE

To investigate the neural mechanisms of motor recovery after pontine infract, we explored changes of grey matter within motor cortex by voxel-based morphometry (VBM) analysis method and calculated the correlations between the thickness of grey matter of each voxel and clinical scores.

METHOD AND MATERIALS

Fifteen stroke patients with unilateral infraction of pontine area were scanned and neurologically assessed 5 times after the stroke (within 3~7 days, at 2 weeks, 1 month, 3 months, and 6 months after stroke onset). All patients underwent MPRAGE scans on a Siemens Magnetom Trio 3.0T scanner. Fifteen age-sex with left and right handed matched healthy participants were also examined with the same protocol. The gray matter volume changes after infarction were assessed using VBM and motor deficits were evaluated with Fugl-Meyer Motor Scale (FMMS) score at the same time. The correlation between gray matter changes, infarction volumes and FMMS scores were respectively analyzed.

RESULTS

The FMMS significantly increased progressively from the seventh day to the sixth month after infarction (P<0.05). In pontine group, GMV were increased in putamen, pallidus, frontal gyrus, temporal gyrus, inferior parietal lobe, and occipital gyrus, which mostly located in the contralateral. And GMV were decreased in frontal gyrus, postcentral gyrus, precuneus, caudate culmen, and uvula. The results of group analysis showed that there was no significant change in normal control group between different time point. While, in stroke group the GMV showed increase in ipsilateral thalamus and putamen after 7 days compared to 3 months and 6 months. Comparison between two groups at each time point, we found that the volume of contralateral inferior parietal lobe increased continually, however, ipsilateral precuneus showed decrease of GMV during the study period. The changes of GMV in the contralateral putamen and pallidus were positive correlated with the changes in the FMMS of stroke patients(r=0.287, p=0.012); Changes in ipsilateral postcentral was negative correlated with changes in FMMS(r=-0.24, p=0.000).

CONCLUSION
The existence of gray matter volume increased, and spontaneous with motor recovery in patients with pontine infarction is closely related to brain plasticity.

**CLINICAL RELEVANCE/APPLICATION**

Our findings provide imaging evidences that reveal the motor function recovery mechanisms after cerebral infarction.

**SSE18-06 A Correlation Study between Diffusivity of Ischemic White Matter Fiber Tract and Neuro-functional Recovery in Patients with Acute Stroke by Using DTI Technique**

Monday, Nov. 30 3:50PM - 4:00PM Location: N229

Participants
Shuohui Yang, MD, Shanghai, China (Presenter) Nothing to Disclose
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Jiang Lin, MD, PhD, Shanghai, China (Abstract Co-Author) Nothing to Disclose
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Qiong Zhu, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Songhua Zhan, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To evaluate the correlation between diffusivity of ischemic white matter fiber tract and neuro-functional recovery in acute stroke patients by using DTI, and try to predict motor outcome of these patients.

**METHOD AND MATERIALS**

Forty unilateral cerebral ischemic patients with motor dysfunction underwent MRI and DTI study within 3 days after the onset of illness. MRI scans were done 1, 2 and 3 month after treatment. Fractional anisotropy (FA) and apparent diffusion coefficient (ADC) maps were obtained. With the reference of DW images, regions of interest (ROIs) were selected on the ischemic white matter fiber tract, and the control ROIs were selected on the contra-lateral homonymous tract. The ratios of FA and ADC (rFA and rADC) within these ROIs and infarction volume (IV) were calculated. The relationship between DTI parameters with IV and national institute of health stroke scale (NIHSS) scores were assessed. According to motricity index (MI), a total of 32 stroke follow-up patients after one year were divided into no motor deficit group and motor deficit group; DTI parameters were used to predict the motor outcome.

**RESULTS**

Significant differences were found regarding rFA, rADC and IV of ischemic white matter fiber tract among the onset, 1, 2 and 3 month of acute stroke patients (F = 13.84, P = 0.00, F = 64.57, P = 0.00 and F = 37.41, P = 0.00). There was significantly negative correlation between rFA and NIHSS scores at the onset and 1 month (r = -0.59, t = -4.59, P = 0.00, r = -0.34, t = -2.27, P = 0.02) and between rADC and NIHSS at the onset (r = -0.44, t = -3.04, P = 0.00). There was significantly positive correlation between rADC and NIHSS scores (r = 0.28, t = 1.83, P = 0.04, r = 0.39, t = 2.69, P = 0.00, r = 0.63, t =4.99, P = 0.00) and between IV and NIHSS (r = 0.4, t = 2.73, P = 0.01, r = 0.44, t = 3.05, P = 0.00, r = 0.32, t = 2.13, P = 0.04) at 1, 2, and 3 month from the onset. There was significant correlation between the rADC of 3 month and MI of 32 stroke patients after one year (t = 2.75, P = 0.01) with AUC of ROC being 0.905.

**CONCLUSION**

There could be a significant correlation between the change of diffusivity of the ischemic white matter and the neuro-functional recovery in acute stroke patients by analyzing DTI metrics. rADC at 3 month after onset may be used to predict the motor outcome.

**CLINICAL RELEVANCE/APPLICATION**

ADC values of DTI at 3 month after onset of stroke patients may be used to predict the motor outcome.
**SSE19**

**Neuroradiology (Epilepsy)**

Monday, Nov. 30 3:00PM - 4:00PM Location: N230

NR CT MR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants

Steven M. Stufflebeam, MD, Charlestown, MA (Moderator) Nothing to Disclose
Roland R. Lee, MD, San Diego, CA (Moderator) Nothing to Disclose

Sub-Events

**SSE19-01** A Novel Electrocorticography Grid Using Conductive Nanoparticles in a Polymer Thick Film on an Organic Substrate Improves CT and MR Imaging

Monday, Nov. 30 3:00PM - 3:10PM Location: N230

Participants

Emad Ahmadi, MD, Boston, MA (Presenter) Nothing to Disclose
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Laleh Daftaribesheli, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Qiang Gu, PhD, Jefferson, AZ (Abstract Co-Author) Nothing to Disclose
Reza Atefi, PhD, Charlestown, MA (Abstract Co-Author) Nothing to Disclose
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Emad N. Eskandar, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Michael H. Lev, MD, Boston, MA (Abstract Co-Author) Research support, General Electric Company Stockholder, General Electric Company
Alexandra J. Golby, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Conventional electrocorticography (ECoG) grids produce extensive metal artifacts at CT and MR imaging. This study compares CT and MR artifacts from conventional ECoG grids with those from a grid developed by deposition of conductive nanoparticles in polymer thick film on an organic substrate (PTFOS).

**METHOD AND MATERIALS**

We compared the induced artifacts between the newly developed PTFOS grid and the conventional ECoG grids at CT and MR imaging. All imaging was performed on a cadaveric human head specimen. We then asked two neuroradiologists to score the quality of CT and MR images in the cases of the head sample with no grid, with conventional grids, and with PTFOS grids. The functioning of the PTFOS for cortical recording and stimulation was tested in mice. We used electron microscopy to study the microstructural changes of PTFOS after long-term implantation in mice. We also studied changes in electrical properties of the PTFOS after long-term submersion in a saline bath.

**RESULTS**

The PTFOS grid produced no appreciable artifacts in CT and MR images, and the image quality reported by neuroradiologists was significantly higher for the PTFOS compared to conventional grids (P<0.05). Cortical recording and stimulation was successfully done in mice using PTFOS. PTFOS pieces showed no appreciable microstructural changes after long-term implantation in mice. After long-term submersion in the saline bath, the impedance of the PTFOS traces did not change (P>0.05) and remained within the range of 150-300Ω which is favorable for cortical recording and stimulation.

**CONCLUSION**

PTFOS grids are an attractive alternative to conventional grids as they show no appreciable artifacts at CT and MR imaging, and remain stable after long-term in-vivo implantation.

**CLINICAL RELEVANCE/APPLICATION**

Diagnosis of surgical complications of electrocorticography grids implantation is largely dependent on CT and MR imaging. The newly developed PTFOS grid demonstrated excellent image quality both at CT and MR imaging, which can facilitate diagnosis of post-operative complications.

**SSE19-02** A Novel Electrocorticography Grid Using Conductive Nanoparticles in a Polymer Thick Film on an Organic Substrate Causesless MRI Heating Compared to Conventional Grids

Monday, Nov. 30 3:10PM - 3:20PM Location: N230

Participants

Emad Ahmadi, MD, Boston, MA (Presenter) Nothing to Disclose
Reza Atefi, PhD, Charlestown, MA (Abstract Co-Author) Nothing to Disclose
Martin Y. Villeneuve, PhD, Charlestown, MA (Abstract Co-Author) Nothing to Disclose
Michael H. Lev, MD, Boston, MA (Abstract Co-Author) Research support, General Electric Company Stockholder, General Electric Company
Alexandra J. Golby, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Rajiv Gupta, PhD, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Giorgio Bonmassar, PhD, Charlestown, MA (Abstract Co-Author) Nothing to Disclose
CONVENTIONAL ELECTROCORTICOGRAPHY (ECoG) GRIDS MIGHT CAUSE SIGNIFICANT HEATING DURING MR IMAGING. THIS STUDY COMPARES MRI HEATING, AT A 3T SCANNER, CAUSED BY A CONVENTIONAL ECoG GRID WITH THAT CAUSED BY A GRID DEVELOPED BY DEPOSITION OF CONDUCTIVE NANOPARTICLES IN POLYMER THICK FILM ON AN ORGANIC SUBSTRATE (PTFOS).

A 64-CONTACT ELECTROCORTICOGRAPHY GRID WAS DEVELOPED IN A PTFOS CONSTRUCT VIA DEPOSITION OF SILVER AND CARBON NANOPARTICLES ON DENATURIZED COLLAGEN. WE PLACED THE DEVELOPED PTFOS GRID OVER A HEAD PHANTOM AND MEASURED THE TEMPERATURE CHANGES AROUND THE GRID DURING 30 MINUTES OF MRI AT A 3T SCANNER. THE PHANTOM HAD MRI HEATING PROPERTIES SIMILAR TO HUMAN TISSUES. TEMPERATURE WAS MEASURED USING EIGHT OPTICAL SENSORS PLACED WITHIN THE PHANTOM. FOR COMPARISON PURPOSES, WE ALSO STUDIED TEMPERATURE CHANGES DURING MR IMAGING IN THE CASES OF THE HEAD PHANTOM WITH NO GRID AND WITH A CONVENTIONAL PLATINUM GRID.


CONCLUSION

CONVENTIONAL PLATINUM GRIDS MIGHT CAUSE CONSIDERABLE HEATING DURING MR IMAGING, WHILE THE NEWLY DEVELOPED PTFOS GRID CAUSES MINIMAL, IF ANY, HEATING DURING MR IMAGING.

CLINICAL RELEVANCE/APPLICATION

DIAGNOSIS OF SURGICAL COMPLICATIONS OF ELECTROCORTICOGRAPHY GRIDS IMPLANTATION IS LARGELY DEPENDENT ON MR IMAGING. OUR RESULTS RAISE THE CONCERN THAT CONVENTIONAL ELECTROCORTICOGRAPHY GRIDS MIGHT NOT BE SAFE FOR MR IMAGING AT THE FIELD STRENGTH OF 3T, BECAUSE THEY MIGHT CAUSE CONSIDERABLE MRI HEATING. ON THE OTHER HAND, THE NEWLY DEVELOPED PTFOS GRID SHOWED FAVORABLE MRI HEATING PROFILE AT THE FIELD STRENGTH OF 3T.

PURPOSE

CONVENTIONAL ELECTROCORTICOGRAPHY (ECoG) GRIDS MIGHT CAUSE SIGNIFICANT HEATING DURING MR IMAGING. THIS STUDY COMPARES MRI HEATING, AT A 3T SCANNER, CAUSED BY A CONVENTIONAL ECoG GRID WITH THAT CAUSED BY A GRID DEVELOPED BY DEPOSITION OF CONDUCTIVE NANOPARTICLES IN POLYMER THICK FILM ON AN ORGANIC SUBSTRATE (PTFOS).

A 64-CONTACT ELECTROCORTICOGRAPHY GRID WAS DEVELOPED IN A PTFOS CONSTRUCT VIA DEPOSITION OF SILVER AND CARBON NANOPARTICLES ON DENATURIZED COLLAGEN. WE PLACED THE DEVELOPED PTFOS GRID OVER A HEAD PHANTOM AND MEASURED THE TEMPERATURE CHANGES AROUND THE GRID DURING 30 MINUTES OF MRI AT A 3T SCANNER. THE PHANTOM HAD MRI HEATING PROPERTIES SIMILAR TO HUMAN TISSUES. TEMPERATURE WAS MEASURED USING EIGHT OPTICAL SENSORS PLACED WITHIN THE PHANTOM. FOR COMPARISON PURPOSES, WE ALSO STUDIED TEMPERATURE CHANGES DURING MR IMAGING IN THE CASES OF THE HEAD PHANTOM WITH NO GRID AND WITH A CONVENTIONAL PLATINUM GRID.


CONCLUSION

CONVENTIONAL PLATINUM GRIDS MIGHT CAUSE CONSIDERABLE HEATING DURING MR IMAGING, WHILE THE NEWLY DEVELOPED PTFOS GRID CAUSES MINIMAL, IF ANY, HEATING DURING MR IMAGING.

CLINICAL RELEVANCE/APPLICATION

DIAGNOSIS OF SURGICAL COMPLICATIONS OF ELECTROCORTICOGRAPHY GRIDS IMPLANTATION IS LARGELY DEPENDENT ON MR IMAGING. OUR RESULTS RAISE THE CONCERN THAT CONVENTIONAL ELECTROCORTICOGRAPHY GRIDS MIGHT NOT BE SAFE FOR MR IMAGING AT THE FIELD STRENGTH OF 3T, BECAUSE THEY MIGHT CAUSE CONSIDERABLE MRI HEATING. ON THE OTHER HAND, THE NEWLY DEVELOPED PTFOS GRID SHOWED FAVORABLE MRI HEATING PROFILE AT THE FIELD STRENGTH OF 3T.

PURPOSE

ATYPICAL LANGUAGE REPRESENTATIONS ARE FREQUENTLY SEEN IN LEFT HEMISPHERIC TEMPORAL LOBE EPILEPSY (ITLE) PATIENTS. fMRI BASED LANGUAGE CONNECTOME ANALYSIS ALLOWS TO STUDY NEURONAL NETWORKS, LINKED TO LANGUAGE FUNCTION. THE AIM OF THIS STUDY WAS TO VISUALIZE THE (RE-) ORGANIZATION OF THE LANGUAGE CONNECTOME (LC) IN A COHORT OF ITLE PATIENTS.

METHOD AND MATERIALS

THE FUNCTIONAL LC WAS CALCULATED ON THE BASIS OF FUNCTIONAL MRI DATA (3 Tesla, TE=35ms, TR=3000ms, SLICE THICKNESS: 4mm, 32 SLICES, 96x96 MATRIX, 2.4x2.4x4MM, 100 DYNAMICS, VERB GENERATION TASK, FREESURFER, FSL). THE LC OF 8 PATIENTS WITH NON LESIONAL ITLE (MEDIAN AGE 35) AND 12 ITLE PATIENTS WITH HIPPOCAMPAL SCLEROSIS (HS) (MEDIAN AGE 42) WERE COMPARED TO A REFERENCE LC BASED ON 13 HEALTHY CONTROLS (MEDIAN AGE 38). VARIATIONS IN THE FUNCTIONAL CONNECTOME ANALYSIS WERE QUANTIFIED USING THE NETWORK-BASED STATISTICS (NBS) APPROACH.

RESULTS

THE LANGUAGE CONNECTOME OF NON LESIONAL ITLE PATIENTS AND HS PATIENTS SHOWED A SIGNIFICANTLY INCREASED INTERHEMISPHERIC CONNECTIVITY (P<0.001), COMPARED TO HEALTHY CONTROLS (FIGURE). A STRONGER IPSILATERAL CONNECTIVITY OF THE DEFAULT MODE NETWORK WAS FOUND IN CONTROLS. NON LESIONAL ITLE AND HS PATIENTS SHOWED AN INCREASED NODE DEGREE IN THE BROCA REGION.

CONCLUSION

THE TASK-BASED LANGUAGE CONNECTOME OF ITLE PATIENTS SHOWS WIDESPREAD ALTERATIONS (FIGURE). RECRUITMENT OF INTERHEMISPHERIC CONNECTIONS MAY BE RELATED TO FUNCTIONAL LANGUAGE NETWORK REORGANIZATION DUE TO STRUCTURAL ALTERATIONS OF THE LEFT TEMPORAL LOBE AND/OR SEIZURE ACTIVITY.

CLINICAL RELEVANCE/APPLICATION

TASK-BASED NBS ANALYSIS OFFERS A NEW PERSPECTIVE IN UNDERSTANDING THE LESION INDUCED REORGANIZATION OF LANGUAGE FUNCTION IN THE HUMAN BRAIN. THESE RESULTS WILL IMPACT THE PREOPERATIVE EVALUATION OF INDIVIDUAL ITLE PATIENTS AND MAY REDUCE THE INCIDENCE OF POSTOPERATIVE LANGUAGE DEFICITS.

PURPOSE

ATYPICAL LANGUAGE REPRESENTATIONS ARE FREQUENTLY SEEN IN LEFT HEMISPHERIC TEMPORAL LOBE EPILEPSY (ITLE) PATIENTS. fMRI BASED LANGUAGE CONNECTOME ANALYSIS ALLOWS TO STUDY NEURONAL NETWORKS, LINKED TO LANGUAGE FUNCTION. THE AIM OF THIS STUDY WAS TO VISUALIZE THE (RE-) ORGANIZATION OF THE LANGUAGE CONNECTOME (LC) IN A COHORT OF ITLE PATIENTS.

METHOD AND MATERIALS

THE FUNCTIONAL LC WAS CALCULATED ON THE BASIS OF FUNCTIONAL MRI DATA (3 Tesla, TE=35ms, TR=3000ms, SLICE THICKNESS: 4mm, 32 SLICES, 96x96 MATRIX, 2.4x2.4x4MM, 100 DYNAMICS, VERB GENERATION TASK, FREESURFER, FSL). THE LC OF 8 PATIENTS WITH NON LESIONAL ITLE (MEDIAN AGE 35) AND 12 ITLE PATIENTS WITH HIPPOCAMPAL SCLEROSIS (HS) (MEDIAN AGE 42) WERE COMPARED TO A REFERENCE LC BASED ON 13 HEALTHY CONTROLS (MEDIAN AGE 38). VARIATIONS IN THE FUNCTIONAL CONNECTOME ANALYSIS WERE QUANTIFIED USING THE NETWORK-BASED STATISTICS (NBS) APPROACH.

RESULTS

THE LANGUAGE CONNECTOME OF NON LESIONAL ITLE PATIENTS AND HS PATIENTS SHOWED A SIGNIFICANTLY INCREASED INTERHEMISPHERIC CONNECTIVITY (P<0.001), COMPARED TO HEALTHY CONTROLS (FIGURE). A STRONGER IPSILATERAL CONNECTIVITY OF THE DEFAULT MODE NETWORK WAS FOUND IN CONTROLS. NON LESIONAL ITLE AND HS PATIENTS SHOWED AN INCREASED NODE DEGREE IN THE BROCA REGION.

CONCLUSION

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CLINICAL RELEVANCE/APPLICATION

TASK-BASED NBS ANALYSIS OFFERS A NEW PERSPECTIVE IN UNDERSTANDING THE LESION INDUCED REORGANIZATION OF LANGUAGE FUNCTION IN THE HUMAN BRAIN. THESE RESULTS WILL IMPACT THE PREOPERATIVE EVALUATION OF INDIVIDUAL ITLE PATIENTS AND MAY REDUCE THE INCIDENCE OF POSTOPERATIVE LANGUAGE DEFICITS.

PURPOSE

ATYPICAL LANGUAGE REPRESENTATIONS ARE FREQUENTLY SEEN IN LEFT HEMISPHERIC TEMPORAL LOBE EPILEPSY (ITLE) PATIENTS. fMRI BASED LANGUAGE CONNECTOME ANALYSIS ALLOWS TO STUDY NEURONAL NETWORKS, LINKED TO LANGUAGE FUNCTION. THE AIM OF THIS STUDY WAS TO VISUALIZE THE (RE-) ORGANIZATION OF THE LANGUAGE CONNECTOME (LC) IN A COHORT OF ITLE PATIENTS.

METHOD AND MATERIALS

THE FUNCTIONAL LC WAS CALCULATED ON THE BASIS OF FUNCTIONAL MRI DATA (3 Tesla, TE=35ms, TR=3000ms, SLICE THICKNESS: 4mm, 32 SLICES, 96x96 MATRIX, 2.4x2.4x4MM, 100 DYNAMICS, VERB GENERATION TASK, FREESURFER, FSL). THE LC OF 8 PATIENTS WITH NON LESIONAL ITLE (MEDIAN AGE 35) AND 12 ITLE PATIENTS WITH HIPPOCAMPAL SCLEROSIS (HS) (MEDIAN AGE 42) WERE COMPARED TO A REFERENCE LC BASED ON 13 HEALTHY CONTROLS (MEDIAN AGE 38). VARIATIONS IN THE FUNCTIONAL CONNECTOME ANALYSIS WERE QUANTIFIED USING THE NETWORK-BASED STATISTICS (NBS) APPROACH.

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THE LANGUAGE CONNECTOME OF NON LESIONAL ITLE PATIENTS AND HS PATIENTS SHOWED A SIGNIFICANTLY INCREASED INTERHEMISPHERIC CONNECTIVITY (P<0.001), COMPARED TO HEALTHY CONTROLS (FIGURE). A STRONGER IPSILATERAL CONNECTIVITY OF THE DEFAULT MODE NETWORK WAS FOUND IN CONTROLS. NON LESIONAL ITLE AND HS PATIENTS SHOWED AN INCREASED NODE DEGREE IN THE BROCA REGION.

CONCLUSION

THE TASK-BASED LANGUAGE CONNECTOME OF ITLE PATIENTS SHOWS WIDESPREAD ALTERATIONS (FIGURE). RECRUITMENT OF INTERHEMISPHERIC CONNECTIONS MAY BE RELATED TO FUNCTIONAL LANGUAGE NETWORK REORGANIZATION DUE TO STRUCTURAL ALTERATIONS OF THE LEFT TEMPORAL LOBE AND/OR SEIZURE ACTIVITY.

CLINICAL RELEVANCE/APPLICATION

TASK-BASED NBS ANALYSIS OFFERS A NEW PERSPECTIVE IN UNDERSTANDING THE LESION INDUCED REORGANIZATION OF LANGUAGE FUNCTION IN THE HUMAN BRAIN. THESE RESULTS WILL IMPACT THE PREOPERATIVE EVALUATION OF INDIVIDUAL ITLE PATIENTS AND MAY REDUCE THE INCIDENCE OF POSTOPERATIVE LANGUAGE DEFICITS.
To evaluate ultra high field MR-microscopy for the discrimination of sclerotic and non-sclerotic hippocampi (HC) in patients with mesial temporal lobe epilepsy (mTLE).

**METHOD AND MATERIALS**

Resected HC of 11 patients diagnosed with mTLE were scanned on a preclinical 7T MRI (ClinScan, Bruker). Morphologic images (T2w, resolution: 42x42x300 µm) were acquired. Diffusion tensor imaging was performed and voxel based maps of T1-, T2- and T2*-times were calculated for each HC. On morphologic images, the pyramid cell layer (PCL) was segmented on 10 consecutive slices. The segmentation mask was transferred to the respective parameter maps. Depending on the neuropathologic diagnosis, HC were classified sclerotic (n=9) or non-sclerotic (n=2). The parameters PCL volume, T1-, T2- and T2*-times, apparent diffusion coefficient (ADC), fractional anisotropy (FA) and trace of the diffusion tensor (TW) were inserted into a multiparametric analysis and parameter-probability curves were adjusted using GNU R's logistic response model.

**RESULTS**

On morphologic images, a narrowing of the PCL for the sclerotic as compared to the non-sclerotic HC is discernible (Fig. 1a). The median parameter values were determined in the PCL for sclerotic/non-sclerotic HC including PCL volume (8/11 mm³), T1 time (736/1094 ms), T2 time (85/129 ms), T2* time (42/41 ms), ADC (593/228 µm²/s), FA (0.495/0.476 a.u.), TW (495/384 mm²/s). As a result of the multiparametric analysis, T1 time is the most significant predictor of sclerosis (p=0.026), followed by T2 time (p=0.072) and PCL volume (p=0.097). The respective parameter-probability curves are shown in Fig. 1b. HC with T1 times below 750 ms have a probability higher than 90 % of being sclerotic.

**CONCLUSION**

Ultra high field MR-microscopy revealed distinct characteristics in morphology and significantly different T1 times in the PCL of sclerotic and non-sclerotic HC. Time-adapted imaging protocols might be translated for clinical application on ultra high field systems.
PURPOSE
MRI-guided stereotactic laser ablation is currently being used for amygdalohippocampotomy in mesial temporal lobe epilepsy (MTLE). The technique aims to eliminate seizures while minimizing adverse cognitive effects of open resection procedures. The purpose of this study is to establish pre- and postprocedural MRI findings that predict seizure freedom outcome with laser amygdalohippocampotomy.

METHOD AND MATERIALS
This retrospective study included 24 patients with diagnosis of MTLE who were treated with amygdalohippocampotomy and for which 12-month seizure freedom outcome data was available. Two neuroradiologists experienced in epilepsy imaging evaluated the MRI exams. On baseline exams, T2 signal intensity and volume of mesial temporal lobe regions were rated utilizing coronal oblique images. On periprocedural exams, extent of ablation of each region was rated utilizing postcontrast coronal oblique 3D T1 MPRAGE images. The patients were followed-up at 12 months after ablation and classified according to the Engel scale as seizure free / almost free or not improved. MRI findings were correlated with seizure freedom outcome by employing Fisher's exact test and Chi-square test.

RESULTS
16 patients fulfilled imaging criteria for mesial temporal sclerosis (MTS). Among these patients, 10/16 (62.5%) were seizure free 12 months after ablation. Three out of 8 patients without MRI diagnosis of MTS were free of seizures arising from the side of ablation at follow-up, while 5 of them were not improved. Among patients with MTS diagnosis, there was a significant correlation between the extent of amygdala ablation - in addition to the hippocampus - and favorable seizure freedom outcome (p= 0.032). 9/11 patients with 50% or greater ablation of the amygdala were seizure free after 12 months, compared to 1/5 patients in which the amygdala was less than 50% ablated.

CONCLUSION
MRI diagnosis of MTS predicts improved seizure freedom outcomes in patients treated with laser amygdalohippocampotomy. In these patients, our data suggests that seizure freedom outcome is improved by greater extent of ablation of the amygdala, in addition of the hippocampus. Larger sample sizes are required to better predict outcome in non-MTS patients.

CLINICAL RELEVANCE/APPLICATION
Precise knowledge of the extent and location of the ablation zone is crucial to predict seizure freedom and cognitive effects of stereotactic laser amygdalohippocampotomy in MTLE.
**SSE20-02**  
**Post-treatment Diffusion Tensor Imaging to Evaluate Response to Total Body Hypothermia in Neonates with Hypoxic-ischemic Encephalopathy**  
Monday, Nov. 30 3:10PM - 3:20PM Location: S102AB

**Participants**  
Laura Scarcioilla, MD, Massafra, Italy (Presenter) Nothing to Disclose  
Carlo Cosimo Quattrocchi, MD, PhD, Rome, Italy (Abstract Co-Author) Nothing to Disclose  
Thomas Joseph Re, Boston, MA (Abstract Co-Author) Nothing to Disclose  
Lorenzo Figa Talamanca, Rome, Italy (Abstract Co-Author) Nothing to Disclose  
Antonio Napolitano, Rome, Italy (Abstract Co-Author) Nothing to Disclose  
Giuseppe Calbi, Rome, Italy (Abstract Co-Author) Nothing to Disclose  
Bruno Bernardi, MD, Bologna, Italy (Abstract Co-Author) Nothing to Disclose  
Bruno Beomonte Zobel, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose  
Daniela Longo, Rome, Italy (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

to test the efficacy of ADC and FA for the evaluation of treatment response in newborns with moderate and severe hypoxic-ischemic encephalopathy (HIE) treated with total-body hypothermia.

**METHOD AND MATERIALS**

27 newborns with clinical criteria of moderate-severe HIE (17 treated with total body therapeutic hypothermia, 10 nontreated) and 10 healthy neonates were studied with MR imaging and DTI. Ten treated neonates and healthy neonates underwent a follow-up brain MRI and DTI at 6 months of life. All data were acquired on a 3-T Skyra (Siemens, Erlagen, Germany). Conventional MRI imaging included: axial T1 TSE (slice thickness = 2 mm, TR=550 ms, TE 6,7 ms, matrix size = 416x512), sagittal T1 TIRM (slice thickness = 3 mm, TR=2690 ms, TE 8,5 ms, matrix size = 256x256), axial and coronal T2 TSE (slice thickness = 2 mm, TR=10320 ms, TE 122 ms, matrix size= 348x384). DTI acquisition was performed by a single-shot echo-planar sequence, one volume not diffusion-weighted (b0), and bipolar diffusion gradients (b = 800 s/mm²) applied in 30 directions. On ADC and FA maps, basal ganglia and thalamus ROIs were designed. Preprocessing of the raw DTI data was performed using FSL software. Diffusion toolkit along with TrackVis (trackvis.org) were used to reconstruct and visualize tractography pathways respectively.

**RESULTS**

Conventional MR imaging was normal in 11 (65%) treated neonates and in 3 (30%) nontreated neonates. All treated neonates presented lower FA values in all tracks, in BG and in Thalamus ROI (p<0.01) comparing to healthy newborns but higher FA values (p<10-5) comparing to nontreated neonates. ADC values were higher in BG and in all white matter fibers (p<10-4) comparing to nontreated neonates. At 6 months follow-up MR, the treated neonates FA and ADC values were closer to normal.

**CONCLUSION**

FA and ADC may more accurately reflect true microstructure characteristics of brain immediately after therapeutic hypothermia and at 6-months follow-up than does conventional MRI. DTI data for nontreated neonates at 6 months would be required to confirm our results.

**CLINICAL RELEVANCE/APPLICATION**

As DTI metrics reflect a different aspect of brain microstructure than conventional MRI, they may provide a more accurate tool for diagnosing and following neonates with poor neurodevelopment due to HIE.

**SSE20-03**  
**Increased Gray Matter Volume of Emotional Circuits in Children without Direct Parental Care**  
Monday, Nov. 30 3:20PM - 3:30PM Location: S102AB

**Participants**  
Yuan Xiao, Chengdu, China (Presenter) Nothing to Disclose  
Lili Yang, Wenzhou, China (Abstract Co-Author) Nothing to Disclose  
Zhihan Yan, Wenzhou, China (Abstract Co-Author) Nothing to Disclose  
Yuchuan Fu, Wenzhou, China (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Increased gray matter volume of emotional circuits in children without direct parental care.
**Purpose**

With the economic boom, hundreds of millions of laborers are migrating away from their children to pursue a better job. This international parental migration has resulted in millions of left-behind children (LBC) and has raised widespread concern. However, it is still unclear where and how the brain is affected in these children who lack parental care. Therefore, we aimed to explore the gray matter volume alteration in LBC in relative to those with parental care.

**Method and Materials**

This study was IRB approved and written informed consent was obtained from guardians. Thirty-eight LBC (age=9.6±1.8yrs, 21boys) and 30 comparison children (age=10.0±1.95yrs, 19boys) were included and performed a 3.0T MR scan. The LBC is defined as children who living with the absence of both of their biological parents for a period over six months. Image preprocessing and statistical analyses were performed with optimized voxel-based morphometry in SPM8. IQ of all participants was measured to quantify cognitive function.

**Results**

Compared to controls, LBC showed significantly greater gray matter volume in bilateral fusiform gyri, bilateral parahippocampus, right superior parietal lobe, right thalamus, right superior occipital gyrus, left cuneus, right superior temporal gyrus, right superior medial frontal gyrus, left postcentral gyrus, left middle occipital gyrus and left putamen (p<0.05, FDR corrected). The mean value of IQ scores in LBC was not significantly different from that in controls. Furthermore, gray matter volume in bilateral parahippocampus, gyrus in LBC was negatively correlated with IQ score (p>0.05).

**Conclusion**

This study provided the first empirical evidence of larger gray matter volumes, especially in emotional circuits in LBC than children living with their parents, suggesting the parental care affects the brain development. Since the larger gray matter volume may reflect insufficient pruning and mature of brain, the negative correlation between the gray matter volume and IQ scores suggest that growing without parental care may delay the development of brain.

**Clinical Relevance/Application**

To our knowledge, this study provides the first empirical evidence of larger gray matter volumes in emotional circuits in LBC, suggesting that parental care affects brain development. From a public health perspective, the study highlighted the importance of parental care in children and indicated early intervention and stimulation are needed to LBC.

**SSE20-04 Age-dependent Signal Density of Diffusion Kurtosis Imaging (DKI) of Healthy Volunteers’ Brains at Left-right Hemispheric Level Analyses**

*Monday, Nov. 30 3:30PM - 3:40PM Location: S102AB*

**Participants**

Mamiko Koshiba, PhD, Iruma-gun, Japan (Presenter) Nothing to Disclose
Takako Aoki, PhD, Iruma-Gun, Japan (Abstract Co-Author) Nothing to Disclose
Hayato Sakurai, MD, Moroyama, Japan (Abstract Co-Author) Nothing to Disclose
Tsuyoshi Sasaki, RT, Moroyama, Japan (Abstract Co-Author) Nothing to Disclose
Tomokazu Araki, RT, Moroyama, Japan (Abstract Co-Author) Nothing to Disclose
Hiroko Kakei, Moroyama, Japan (Abstract Co-Author) Nothing to Disclose
Naomi Hotta, Moroyama, Japan (Abstract Co-Author) Nothing to Disclose
Yuuki Minamikawa, Moroyama, Japan (Abstract Co-Author) Nothing to Disclose
Mamoru Nitsu, MD, Saitama, Japan (Abstract Co-Author) Nothing to Disclose
Tetsuya Kunikata, Iruma-Gun, Japan (Abstract Co-Author) Nothing to Disclose
Hideo Yamamoto, Iruma-Gun, Japan (Abstract Co-Author) Nothing to Disclose

**Background**

For approaches to DKI application in neuropsychiatry without any risky sedation, the lower resolution data of an infant’s smaller brain raise a question whether 122significantly useful or not. As the preliminary evaluation, we are attempting to examine macroscopic DKI quantitative analyses in the data of our own medical staff volunteers if the linear regression would be visualized as previously reported age-dependency (2014).

**Discussion**

In the scatter diagrams with DKI signal density as a dependent variable and age as an explanatory variable, age-dependent increasing of DKI density was generally revealed repeatedly in both left and right hemispheres in the 2nd to 4th slices (e.g. square correlation coefficient (R2) = 0.52) but not in either cerebellums (R2 = 0.069) or eye balls (R2 = 0.023) imaged in the 1st slice.

**Conclusion**

DKI hemispheric density quantification in adult was preliminarily confirmed as a practical simple approach to diagnose neuronal development. This macroscopic comprehension using DKI is expected possibly contributable to Neuropsychiatry by MRI without sedation under lower resolution.

**SSE20-05 Repeatability of Graph-Theoretical Metrics Derived from Resting-State fMRI in Pediatric Patients with Epilepsy**

*Monday, Nov. 30 3:40PM - 3:50PM Location: S102AB*

**Participants**

Michael J. Paldino, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Wei Zhang, PhD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Zhi David Chu, PhD, Houston, TX (Presenter) Nothing to Disclose
PURPOSE

To measure the test-retest repeatability of metrics that quantify network architecture in the brain derived from resting-state fMRI in a cohort of pediatric epilepsy patients.

METHOD AND MATERIALS

This IRB approved study identified patients with: 1. epilepsy; 2. brain MRI at 3 Tesla; 3. two identical resting state fMRI acquisitions performed in the same examination. Resting-state time series were co-registered to a T1-weighted structural image. Network nodes were defined by subdivision of whole brain gray matter into 400 (coarse parcellation) or 800 (fine parcellation) volumes of interest. The strength of an edge (connection) between two nodes was defined as the absolute value of the correlation between their BOLD time series. For each weighted connection matrix, correlation coefficients were thresholded over a range of values (0.7 to 0.98). The following topological properties were calculated for each graph: clustering coefficient, transitivity, modularity, characteristic path length, smallworldness, and global efficiency. A potential difference between observations was assessed using the Wilcoxon signed-rank test. For each parameter, we calculated: 1. Mean coefficient of variation (CoV). 2. Pearson Coefficient; 3. ICC; 4. Repeatability coefficient; 5. Ninety-five percent confidence limits (95%CL) for change.

RESULTS

12 patients were included (4-21 yrs). There was no significant difference between observations for any metric. Maximal test-retest estimates for each metric are presented in Table 1. ICC for modularity, transitivity and clustering was consistent across thresholds (Fig 1). By contrast, ICC for characteristic path length, smallworldness and global efficiency peaked over a narrow range of threshold. Modularity, path length and smallworldness were the most repeatable measures.

CONCLUSION

These findings demonstrate the test-retest repeatability of network metrics in a cohort of pediatric epilepsy patients. Change in an individual patient greater than the repeatability coefficient or 95%CL for change is unlikely to be related to intrinsic variability of the method.

CLINICAL RELEVANCE/APPLICATION

NA

SSE20-06 Identifying Medicated-naïve Boys with ADHD using Cortical Thickness via a Multivariate Pattern Analysis

Monday, Nov. 30 3:50PM - 4:00PM Location: S102AB

Participants
Qi Liu, Chengdu, China (Presenter) Nothing to Disclose
Lizhou Chen, Chengdu, China (Abstract Co-Author) Nothing to Disclose
Ming Zhou, Chengdu, China (Abstract Co-Author) Nothing to Disclose
Xinyu Hu, Chengdu, China (Abstract Co-Author) Nothing to Disclose
Ying Chen, Chengdu, China (Abstract Co-Author) Nothing to Disclose
Lanting Guo, Chengdu, China (Abstract Co-Author) Nothing to Disclose
Qiyong Gong, Chengdu, China (Abstract Co-Author) Nothing to Disclose
Xiaoqi Huang, MD, Chengdu, China (Abstract Co-Author) Nothing to Disclose

PURPOSE

Despite previous studies have reported structural and functional deficits in Attention-deficit/hyperactivity disorder (ADHD) children, it’s still a challenge to translate the neuroanatomic abnormalities to clinical practice. Studies focus on adults with ADHD had shown the potential clinical value of support vector machine (SVM) in distinguishing patients with ADHD from healthy controls individually, but no study has explored its usage in unmedicated children with ADHD. As ADHD has a higher prevalence in males, our study sought to use cortical thickness (CT) to distinguish the medicated-naïve school-age ADHD boys from healthy controls via SVM.

METHOD AND MATERIALS

Forty drug-naïve ADHD boys (mean age: 10.1) and 40 healthy controls (mean age: 10.2) were recruited. The T1-weighted images were obtained by 3T MRI with SPGR sequence. The whole-brain analysis between two groups was performed via the Qdec surface-based group analysis tool in Freesurfer for CT with age as covariate (corrected by FDR p<0.05). We used PROBID software to investigate the diagnosis potential of CT of each hemisphere separately based on SVM using leave-one-out cross-validation approach. Then we examined their combined discriminative power for both hemisphere (p<0.001). We also drew Receiver Operating Characteristic (ROC) curves to assess the diagnosis accuracy power.

RESULTS

Compared to healthy group, ADHD boys showed significant reduction in cortical thickness of bilateral orbitofrontal, insula and lingual, right anterior and posterior cingulate, prefrontal, temporal and parietal cortex (Figure A), and left CT demonstrated obviously more significance in classification (sensitivity 80%, specificity 85%, accuracy 82.5%, P<0.001, ROC area 0.841) (Figure B). The combined CT of both hemispheres didn’t provide better result than left CT alone.

CONCLUSION

Our study demonstrated deficits in cortical thickness provides best solution for classification of medicated-naïve ADHD boys with healthy controls. The fact that left hemisphere is more useful in classification showed the lateralization in brain neural pathology of ADHD.

CLINICAL RELEVANCE/APPLICATION

Classification approach based on cortical thickness may be a useful technique to distinguish the ADHD individuals from healthy controls.
Molecular Imaging Symposium: Case-based MI

Monday, Nov. 30 3:30PM - 5:00PM Location: S405AB

CA NR VA MI RO

AMTRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
FDA

Discussions may include off-label uses.

Participants
Vikas Kundra, MD, PhD, Houston, TX (Moderator) License agreement, Introgen Therapeutics, Inc
Jeffrey T. Yap, PhD, Salt Lake City, UT (Moderator) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify molecular imaging. 2) Comprehend the basis of aspects of molecular imaging. 3) Describe molecular imaging performed in a radiology setting.

ABSTRACT
This course will describe molecular imaging, identify the mechanisms of some aspects of molecular imaging, and give examples of molecular imaging in oncology. Cases will include those from current practice. Mechanisms and scientific basis of examples will be discussed. Sample applications will be discussed and illustrated. Translational examples, including those that have good potential for clinical application, will be used to illustrate interesting aspects of molecular imaging in oncology.

Sub-Events

MSMI24A Oncology

Participants
Vikas Kundra, MD, PhD, Houston, TX (Presenter) License agreement, Introgen Therapeutics, Inc

LEARNING OBJECTIVES
View learning objectives under main course title.

MSMI24B Neurology

Participants
Rathan M. Subramaniam, MD, PhD, Baltimore, MD, (rsubram4@jhmi.edu) (Presenter) Travel support, Koninklijke Philips NV

LEARNING OBJECTIVES
View learning objectives under main course title.

MSMI24C Cardiology

Participants
Robert J. Gropler, MD, Saint Louis, MO (Presenter) Advisory Board, Bracco Group Advisory Board, GlaxoSmithKline plc Advisory Board, Pfizer Inc Advisory Board, Bayer AG Research Grant, GlaxoSmithKline plc Research Grant, Pfizer Inc Research Grant, Clinical Data, Inc Research Grant, Lantheus Medical Imaging, Inc

LEARNING OBJECTIVES
View learning objectives under main course title.

MSMI24D Vascular Inflammation

Participants
Chun Yuan, PhD, Seattle, WA (Presenter) Research Grant, Koninklijke Philips NV; Consultant, Koninklijke Philips NV; 

LEARNING OBJECTIVES
View learning objectives under main course title.

MSMI24E Instrumentation

Participants
Jeffrey T. Yap, PhD, Salt Lake City, UT (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.
LEARNING OBJECTIVES

1) Review the pertinent anatomy of the upper aerodigestive tract. 2) Discuss the spread patterns of various head and neck tumors. 3) Illustrate the importance of multimodality imaging for tumor contouring.

ABSTRACT

This e-contouring session will be given by a head and neck radiologist and radiation oncologist. This session will review the pertinent anatomy of the upper aerodigestive tract, discuss the spread patterns of various head and neck tumor and illustrate the importance of multimodality imaging for tumor contouring.
Participants
Thiru A. Sudarshan, DMRD, FRCR, Dundee, United Kingdom (Presenter) Nothing to Disclose
Avinash K. Kanodia, MD, Perth, United Kingdom (Abstract Co-Author) Nothing to Disclose
Jonathan Weir-McCall, MBChB, FRCR, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose
Anu Kamalasanan, MBBS, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose
Bangalore Anil Kumar, MD, FRCR, Slough, United Kingdom (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1.) Review the diagnosis of a specific condition by using either a single-modality or multimodality approach. 2.) Identify state-of-the-art imaging and methods of treatment for various pathologic conditions. 3.) Assess new research on applications of various imaging and therapeutic modalities.
SPDL30

RSNA Diagnosis Live™: 'Tic Tac D'Oh' - Test Your Diagnostic Skills at the Crack of Dawn

Tuesday, Dec. 1 7:15AM - 8:15AM Location: E451B

[CA GI HN MK NR]

AMA PRA Category 1 Credit™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Adam E. Flanders, MD, Penn Valley, PA (Presenter) Nothing to Disclose
Christopher G. Roth, MD, Philadelphia, PA (Presenter) Nothing to Disclose
Sandeep P. Deshmukh, MD, Philadelphia, PA, (sandeep.deshmukh@jefferson.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) The participant will be introduced to a series of radiology case studies via an interactive team game approach designed to encourage "active" consumption of educational content. 2) The participant will be able to use their mobile wireless device (tablet, phone, laptop) to electronically respond to various imaging case challenges; participants will be able to monitor their individual and team performance in real time. 3) The attendee will receive a personalized self-assessment report via email that will review the case material presented during the session, along with individual and team performance. This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.
Case-based Review of Nuclear Medicine: PET/CT Workshop-Head and Neck Cancers (In Conjunction with SNMMI) (An Interactive Session)

Tuesday, Dec. 1 8:30AM - 10:00AM Location: S406A

Participants
Janis P. O'Malley, MD, Birmingham, AL (Director) Nothing to Disclose
Jonathan E. McConathy, MD, PhD, Saint Louis, MO (Presenter) Research Consultant, Eli Lilly and Company; Research Consultant, Blue Earth Diagnostics Ltd; Research Consultant, Siemens AG; Research support, GlaxoSmithKline plc

LEARNING OBJECTIVES

1) Participants will use FDG-PET/CT more effectively in their clinical practice through better understanding of the anatomy, clinical scenarios, and differential diagnoses relevant to the diagnostic imaging of head and neck cancers.
LEARNING OBJECTIVES

1) Describe the imaging characteristics of gliomas. 2) Recognize substantial heterogeneity exists within these tumor types and understand the prognostic and predictive variables to allow for the selection of the appropriate therapy. 3) Explain the role of each modality including surgery, radiotherapy and chemotherapy in managing gliomas.

ABSTRACT

Significant progress has been made in the treatment of CNS tumors with an emphasis on molecular prognostic and predictive biomarkers that allow for appropriate treatment selection. The role of advanced neuro-imaging will help clinicians improve the diagnosis, treatment and response assessment for CNS tumors will be emphasized. This session highlights the need for a multi-disciplinary treatment approach.
**Participants**
Howard A. Rowley, MD, Madison, WI, (hrowley@uwhealth.org) (Moderator) Research Consultant, Bracco Group; Research Consultant, Guerbet SA; Research Consultant, General Electric Company; Consultant, F. Hoffmann-La Roche Ltd; Consultant, W.L. Gore & Associates, Inc; Consultant, Lundbeck Group; ; ; ; ;
Albert J. Yoo, MD, Newton, MA (Moderator) Research Grant, Penumbra, Inc; Research Grant, Terumo Corporation; Research Consultant, Medtronic, Inc;

**Sub-Events**

**RC305-01 Imaging for Stroke Triage: Where Do We Stand?**
Tuesday, Dec. 1 8:30AM - 8:55AM Location: N230

Participants
Max Wintermark, MD, Lausanne, Switzerland, (max.wintermark@gmail.com) (Presenter) Advisory Board, General Electric Company;

**LEARNING OBJECTIVES**

1) We will review the most common neuroimaging modalities and treatment algorithms used in the evaluation of acute stroke patients.

**ABSTRACT**

Neuroimaging has become essential in the evaluation of the acute stroke patient. CT and MRI are used to confirm the diagnosis of acute stroke, exclude stroke mimics, and triage patients for intravenous t-PA and endovascular revascularization therapies. Advanced neuroimaging techniques, including CT-angiography, MR-angiography, CT-perfusion and MR-perfusion further inform acute stroke treatment decisions and are increasingly used in the acute setting. We will review the most common neuroimaging modalities and treatment algorithms used in the evaluation of acute stroke patients.

**RC305-02 Feasibility Of Improving Detection Of Early Ischemic Infarction on Head CT Using Continuity-Based Correlative Enhancement.**
Tuesday, Dec. 1 8:55AM - 9:05AM Location: N230

Participants
Aseem Sharma, MBBS, Saint Louis, MO (Presenter) Stockholder, General Electric Company; Consultant, BioMedical Systems; Co-Founder, Correlative Enhancement, LLC
Manu S. Goyal, MD, MSc, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Michelle M. Miller-Thomas, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Rashmi Jain, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
James D. McEachern, MD, Saskatoon, SK (Abstract Co-Author) Nothing to Disclose
Charles F. Hildebolt, DDS, PhD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Recognition of early signs of brain infarction may influence patient management, but can be difficult on head CT. Using custom software (patent pending) that manipulates images based on correlation between intensities of continuous pixels, we aimed to assess the feasibility of improving the detection of brain infarction with head CT images.

**METHOD AND MATERIALS**

35 head CT images through the region of proven infarction and 20 control images across brain tissue without infarction were post-processed using a custom software (patent pending). Three readers, evaluated the baseline and enhanced images in a masked manner, and marked the location of infarction whenever suspected, while using a 5-point scale to rate their confidence for the presence of infarction. In a separate session, readers rated the comparative ease-of-recognition of signs of infarction for baseline and enhanced images on a 7-point scale, while evaluating these images simultaneously along with the follow-up imaging indicating the infarct distribution. Infarct identification data were analyzed with jackknife, alternative, free-response receiver operating characteristic (JAFROC) weighted software. Comparative ease-of-recognition was assessed using the one-sided Wilcoxon signed rank test for differences > a value of 4.

**RESULTS**

For infarct localization, JAFROC analysis revealed figure-of-merit values of 0.56 and 0.67 for baseline and enhance images respectively (p=0.03). Corresponding values for infarct localization within 6 hours of symptom onset were 0.49 and 0.63 (p = 0.04). Comparative ease-of-recognition was significantly higher than the equivalent value of 4 for all three readers (p <0.01, 0.03, <0.01), tilted favorably towards the enhanced images.

**CONCLUSION**

Continuity-based correlative enhancement improves conspicuity and accurate detection of early changes of brain infarction on non-contrasted head CT.
By improving diagnostic accuracy for detection of ischemic infarction on head CT, continuity-based correlative enhancement may help in making more informed decisions for management of stroke patients.

**Diagnostic Accuracy of Whole-brain CT Perfusion in MRI-confirmed Infratentorial Infarctions**

Participants

Kolja M. Thierfelder, MD, MSc, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Christine Bollwein, Munich, Germany (Abstract Co-Author) Nothing to Disclose

Purpose

Recently introduced whole-brain CT perfusion (WB-CTP) allows for an evaluation of the posterior fossa, but data on WB-CTP in this region is limited. Our aim was to determine the diagnostic accuracy of WB-CTP for infratentorial infarctions and to identify factors influencing the detection rate.

**Intracranial Vessel Imaging at 1.5 Tesla versus 3 Tesla versus 7 Tesla:A Comparison Trial**

Participants

Lale Umutlu, MD, Essen, Germany (Presenter) Consultant, Bayer AG
Oliver Kraff, MSc, Essen, Germany (Abstract Co-Author) Nothing to Disclose

Purpose

The increase of the magnetic field strength is associated to an increase in SNR that can be transitioned into imaging at higher spatial resolution for each field strength while preserving comparable acquisition times. All datasets were read by two radiologists utilizing a 5-point scale (5= excellent vessel delineation to 1= non-diagnostic). All TOF-MRA datasets were assessed for delineation of the intracranial arteries, subdivided into 8 segments (ICA, A1/2, M1,M2,M3,PCA, P1/2, basilar artery). SWI datasets were read for delineation of 14 different smaller and larger veins. Additionally, overall image quality, vessel sharpness, vessel to background contrast and image impairment due to artifacts was assessed. For statistical analysis, a Wilcoxon Rank Test was used.

Results

With increasing magnetic field strength, all sequences could be obtained at higher spatial resolution at comparable acquisition
times, enabling improved vessel delineation. TOF-MRA at 7T enabled a significantly better delineation particularly of small peripheral vessel segments compared to 3T and 1.5T (mean M3 TOF7T=4.3; TOF3T=3.8; TOF1.5T=2.9). 7 Tesla SWI imaging demonstrated its superiority in the highly-detailed delineation of larger and smaller veins with statistical significance to lower field strengths (p=0.03) (e.g. average mean value larger veins: SWI7T =4.5, SWI3T =3.3, SWI11.5T =2.7). Overall image quality was rated comparably high for all three field strengths (7T=4.6; 3T=4.7; 1.5T=4.7).

CONCLUSION
Our results demonstrate the benefits of an increase of magnetic field strength from 1.5T to 7T, offering improved and highly-detailed delineation of the intracranial arterial and venous vasculature.

CLINICAL RELEVANCE/APPLICATION
The excellent delineation of non-enhanced vascular structures in 7T neuro MRI may lead to a more accurate diagnosis of vascular disease, such as aneurysms or cavernomas using 7T MRI.

RC305-05 High Resolution Intracranial Vessel Wall Imaging of Atherosclerotic Plaque Characteristics: Correlation with Patient Symptoms

Tuesday, Dec. 1 9:25AM - 9:35AM Location: N230

Participants
Aaron M. Rutman, MD, Seattle, WA (Presenter) Nothing to Disclose
Chun Yuan, PhD, Seattle, WA (Abstract Co-Author) Research Grant, Koninklijke Philips NV; Consultant, Koninklijke Philips NV; ; William D. Hwang, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Daniel S. Hippe, MS, Seattle, WA (Abstract Co-Author) Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company
Niranjan Balu, PhD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Thomas S. Hatsukami, MD, Seattle, WA (Abstract Co-Author) Research Grant, Koninklijke Philips NV
David Tirschwell, MD, MSc, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Adam de Havenon, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Mahmud Mossa-Basha, MD, Seattle, WA (Abstract Co-Author) Research support, General Electric Company

PURPOSE
High resolution intracranial vessel wall imaging (VWI) has recently gained attention for its ability to evaluate and differentiate various intracranial arteriopathies, including atherosclerosis (ICAD), inflammatory vasculopathy, arterial dissection, and reversible cerebral vasoconstriction syndrome. VWI also allows for atherosclerotic plaque characterization, depicting potential vulnerable plaque features. The aim was to compare the VWI plaque characteristics between symptomatic and asymptomatic intracranial atherosclerotic lesions using a multi-contrast VWI protocol.

METHOD AND MATERIALS
Cases of ICAD imaged with VWI were collected and retrospectively analyzed from our database between the dates 12/20/12-12/5/13. The imaging protocol included T2, T1 pre and post contrast, 3D T2 SPACE VWI and TOF MRA sequences. Symptomatic plaques were those upstream from an infarct within 6 months of VWI. Lesions with symptoms greater than 6 months prior were excluded. Each plaque was assessed for presence/absence of a fibrous cap, presence of fibrous cap thinning/disruption, cap:necrotic core ratio, and remodeling ratio (total vessel area of diseased segment)/(total vessel area of reference segment). Characteristics were compared by Fisher’s exact test (fibrous cap presence, thinning/disruption) and unpaired t-test (cap:necrotic core ratio, remodeling ratio).

RESULTS
48 intracranial atherosclerotic plaques were included from 22 patients. Assessment for fibrous capsule was possible in 18/21 symptomatic and 25/27 asymptomatic plaques. 18/18 symptomatic and 11/25 asymptomatic lesions either did not have a visible fibrous cap, or had apparent disrupted luminal surface or thinning of a visible fibrous cap (p<<0.01). There was no significant difference in the cap:lipid core ratio or the remodeling ratio between symptomatic and asymptomatic lesions.

CONCLUSION
VWI allows for evaluation of ICAD characteristics which may indicate plaque vulnerability, and be associated with symptoms. These features might serve as biomarkers for assessing risk, as well as indicate culprit lesions. Our study shows a significantly increased likelihood of absent fibrous cap or fibrous cap rupture/thinning in the setting of symptoms.

CLINICAL RELEVANCE/APPLICATION
VWI of intracranial atherosclerotic plaque can demonstrate characteristics of vulnerable, symptom-associated plaque.

RC305-06 Potential Applications for Intracranial Vessel Wall Imaging

Tuesday, Dec. 1 9:35AM - 10:00AM Location: N230

Participants
David J. Mikulis, MD, Toronto, ON (Presenter) Stockholder, Thornhill Research Inc; Research Grant, General Electric Company;

LEARNING OBJECTIVES
1) Understand the issues concerning clinical implementation of intra-cranial vessel wall imaging. 2) Understand how vessel wall imaging can aid in differentiating vasculopathies that have similar angiographic appearances. 3) Understand pitfalls related to arterial wall image interpretation.

ABSTRACT
Modern high field MRI systems with increased multi-element coil design have enabled higher resolution by providing greater overall signal. This in turn has paved the way for imaging smaller parts including the walls of smaller and smaller vascular structures. For example, current technology is capable of generating 3D images with 0.4 x 0.4 x 0.4 mm isotropic voxels using 3T MRL. This has
enabled characterization of circle of Willis vessels out to secondary branches (A2,M2, and P2). Not only has analysis of vasculopathies with identical angiographic appearances been made possible thereby increasing specificity of diagnosis, it has also provided insight into disease pathophysiology. An example of this is the strong relationship found between ischemic stroke and gadolinium enhancing intra-cranial atherosclerotic plaques. The purpose of this presentation therefore is to summarize the current status of arterial wall imaging in clinical neuroradiology.

**RC305-07** **Update on Acute Stroke Intervention**

Tuesday, Dec. 1 10:20AM - 10:45AM Location: N230

Participants
Colin P. Derdeyn, MD, Saint Louis, MO, (colin-derdeyn@uiowa.edu) (Presenter) Consultant, Terumo Corporation; Consultant, Penumbra, Inc; Consultant, Silk Road Medical; Stock options, Pulse Therapeutics, Inc; ;

**LEARNING OBJECTIVES**

1) Describe the current indications for endovascular stroke intervention. 2) Describe the available mechanical devices currently used in these cases.

**ABSTRACT**

The past 12 months have seen the publication of more positive pivotal clinical trials (n = 4) for the treatment of acute ischemic stroke than the last 20 years combined (n = 6). Endovascular stroke treatment (EVT) is now proven effective for a large subgroup of patients presenting with acute ischemic stroke. We will carefully review the data from the four recently published trials of endovascular treatment (EVT) for acute ischemic stroke: MR CLEAN (Multicenter Randomized Clinical Trial of Endovascular Treatment for Acute Ischemic Stroke in the Netherlands), ESCAPE (Endovascular Treatment for Small Core and Anterior Circulation Proximal Occlusion with Emphasis on Minimizing CT to Recanalization Times), and EXTEND-IA (Extending the Time for Thrombolysis on Emergency Neurological Deficits) and SWIFT PRIME (Solitaire With the Intention For Thrombectomy as Primary Endovascular Treatment for Acute Ischemic Stroke). We will examine the implications of these trials for current practice and future studies. In particular, we will focus on procedural details such as patient selection, devices, adjunctive therapies, treatment time windows and performance metrics.

**Active Handout:** Colin P. Derdeyn


**RC305-08** **Carotid Intraplaque Hemorrhage is Associated with Accelerated Progression in Patients with Acute Ischemic Stroke: A Prospective Multicenter-Study on Carotid Plaque Imaging in Patients with Acute Stroke**

Tuesday, Dec. 1 10:45AM - 10:55AM Location: N230

Participants
Andreas Schindler, MD, Munich, Germany (Presenter) Nothing to Disclose
Anna Bauer-Karpinska, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Tilmann Obenhuber, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Florian Schwarz, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Clemens C. Cyran, MD, Munich, Germany (Abstract Co-Author) Research Grant, Bayer AG Research Grant, Novartis AG Speakers Bureau, Bayer AG
Tobias Saam, MD, Munich, Germany (Abstract Co-Author) Research Grant, Diamed Medizintechnik GmbH; Research Grant, Pfizer Inc
Andreas D. Helck, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Andreas Harloff, Freiburg, Germany (Abstract Co-Author) Speaker, Boehringer Ingelheim GmbH Speaker, Bayer AG
Holger Poppert, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Martin Dichgans, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To prospectively evaluate whether carotid plaque hemorrhage - as detected by high-resolution carotid plaque MRI - is associated with an accelerated progression rate of atherosclerosis.

**METHOD AND MATERIALS**

58 consecutive patients (76.3±9.8 years; 45 male) with acute ischemic stroke in the anterior circulation and non-stenosing carotid plaque in any carotid artery were included in the ongoing multi-center trial (which is also registered on ClinicalTrials.gov). Patients underwent MRI of both carotid arteries at baseline and at 12 months. Carotid plaques were characterized by the American Heart Association (AHA) classification system and plaque burden as well as components such as the lipid-rich/necrotic core, calcifications, and hemorrhage were identified and quantified. Annualized changes for each item were analyzed for both arteries combined on a patient basis for the whole cohort, as well as depending on the status of intra plaque hemorrhage (IPH) at baseline (IPH+ vs. IPH-). Unpaired t-test and one-sample t-test vs. 0 were performed.

**RESULTS**

A total of 14 patients had complicated AHA-LT6 plaques with IPH at baseline; no new IPH was detected at follow-up. During follow-up a total of four re-events occurred (all IPH+ at baseline). For all patients no significant changes in plaque burden or component size were measurable after one year, with a non-significant increase of mean wall area of 2.3%/year. IPH+ vs. IPH- subjects had a significantly higher progression of the normalized wall index (3.5% vs. 0.5%; p<0.05), and an accelerated progression of mean wall area (7.3% vs. 0.8%; p=n.s. for IPH+ vs. IPH-; P=0.037 for IPH+ vs. 0). No significant quantitative changes for all plaque components were measurable, although mean necrotic core area increased from 6.2 to 7.1 mm² in IPH+ patients (+16%) and remained unchanged in IPH- patients.

**CONCLUSION**

Intraplaque hemorrhage is associated with an accelerated atherosclerotic plaque progression rate in patients with acute ischemic stroke.

**CLINICAL RELEVANCE/APPLICATION**
This multi-center study provides further evidence that IPH is a good marker of plaque vulnerability; further studies are needed to test if patients with IPH could profit from more intensive therapy.

**RC305-09 Dual-Energy Head CT Can Accurately Distinguish Intraparenchymal Hemorrhage from Calcification in Emergency Department Patients**

Participants
Laleh Daftaribesheli, MD, Boston, MA (Presenter) Nothing to Disclose
Ranilang Hu, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Joseph Y. Young, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Markus Y. Wu, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Michael H. Lev, MD, Boston, MA (Abstract Co-Author) Research support, General Electric Company Stockholder, General Electric Company
Rajiv Gupta, PhD, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Stuart R. Pomerantz, MD, Boston, MA (Abstract Co-Author) Research Grant, General Electric Company

**PURPOSE**

Conventional head CT and MRI with gradient-echo susceptibility scanning are limited in their ability to distinguish hemorrhage from calcification, a critical distinction in the selection of stroke patients for IV-thrombolytic and endovascular therapies. Dual energy CT (DECT) scanning, however, may be able to better discriminate calcium from hemorrhage based on the differing proportions of X-ray attenuation of these materials at different scanning energies. The purpose of this study is to evaluate the ability of DECT for differentiation of calcification from acute hemorrhage.

**METHOD AND MATERIALS**

In this IRB approved study, all unenhanced DECT head exams performed in our emergency department in November and December 2014 were retrospectively reviewed. Patients with at least one focus of intra-parenchymal hyperdensity were included and material decomposition images were post-processed. Virtual non-calcium and calcium overlay images were reviewed for the presence of calcification versus hemorrhage. Relevant prior and follow-up imaging and clinical data were used to determine the reference standard.

**RESULTS**

Of 399 DECT head exams, 83 (21%) contained at least one intraparenchymal hyperdensity on the corresponding simulated single energy CT (SECT) image; 64/83 (77%) with reference standard proof of diagnosis were included. Mean age was 67 years; 39/64 (61%) were male. 68 distinct intraparenchymal hyperdense lesions were identified, of which 41/68 (60%) were calcification and 27/68 (40%) were hemorrhage. Sensitivity, specificity and accuracy of DECT for the detection of hemorrhage were 96% (CI 81-99%), 100% (CI 91-100%) and 99% (CI 90-100%), respectively. Seven of 27 (26%) of hemorrhages were incorrectly classified by SECT alone, compared to 1/27 (4%) for DECT.

**CONCLUSION**

DECT post-processed images can distinguish intraparenchymal hemorrhage from calcification rapidly and with very high accuracy in emergency department patients. Conventional gradient-echo MRI and CT scanning are unable to make this distinction accurately. This may have important implications for patient care, most notably in excluding stroke patients with intracranial hemorrhage from IV-thrombolytic and endovascular stroke therapies.

**CLINICAL RELEVANCE/APPLICATION**

Ability of DECT for differentiation of calcification from hemorrhage has important implications for patient care, most notably in excluding stroke patients with hemorrhage from IV-thrombolytic.

**RC305-10 Favorable Outcomes Following Endovascular Treatment in Anterior Circulation Stroke Patients Defined Prospectively Using MRI and Clinical Criteria**

Participants
Ramon G. Gonzalez, MD, PhD, Boston, MA (Presenter) Nothing to Disclose
Thabele M. Leslie-Mawzi, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Pamela W. Schaefer, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Michael H. Lev, MD, Boston, MA (Abstract Co-Author) Research support, General Electric Company Stockholder, General Electric Company
Natalia Rost, Boston, MA (Abstract Co-Author) Nothing to Disclose
Lee Schwamm, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Joshua A. Hirsch, MD, Boston, MA (Abstract Co-Author) Shareholder, Intratech Medical Ltd

**PURPOSE**

To evaluate the clinical efficacy of major anterior circulation stroke thrombectomy in patients prospectively classified by specific MRI and clinical criteria.

**METHOD AND MATERIALS**

72 patients with MCA or terminal ICA occlusion by CTA, followed by core infarct volume determination by MRI, underwent thrombectomy after meeting institutional criteria. D WI lesion volume <70mL, age <80, stroke onset to procedure initiation <6 hours and baseline mRS ≤1. Thirty two were prospectively classified as Uncertain to Benefit (UTB) if one or more of the clinical criteria were not met or if the DWI lesion was 70-100 mL. Outcomes were based on 90-day modified Rankin score (mRS). Favorable outcomes were defined as 90 day mRS of 0, 1 or 2.

**RESULTS**

72 patients underwent thrombectomy (19 were excluded with favorable outcomes for CTA and MRI). Of 53 patients who were not excluded, 40 patients were prospectively classified as Likely to Benefit (LTB) using the following institutional criteria: DWI lesion volume <70mL, age <80, stroke onset to procedure initiation <6 hours and baseline mRS ≤1. Thirty two were prospectively classified as Uncertain to Benefit (UTB) if one or more of the clinical criteria were not met or if the DWI lesion was 70-100 mL. Outcomes were based on 90-day modified Rankin score (mRS). Favorable outcomes were defined as 90 day mRS of 0, 1 or 2.

40 patients were prospectively classified as Likely to Benefit (LTB) using the following institutional criteria: DWI lesion volume <70mL, age <80, stroke onset to procedure initiation <6 hours and baseline mRS ≤1.
Reperfusion (mTICI 2b or 3) and prospective categorization as LTB were strongly associated with favorable outcomes (p<0.001 and p<0.005, respectively). Successful reperfusion had a significant positive impact on the distribution of mRS scores of the LTB cohort (p<0.0001). Intervention resulted in successful reperfusion in 68% of the LTB patients and 75% of UTB patients (not significant). Favorable outcomes were obtained in 53% and 25% of LTB and UTB patients that were treated, respectively (p= 0.016; Fisher exact test). In considering the effect of successful intervention, favorable outcomes were observed in 74% of LTB patients that had successful reperfusion compared to 33% of successfully reperfused UTB patients (p=0.004; Fisher exact test).

CONCLUSION

Patients prospectively classified as Likely to Benefit based on MRI and clinical criteria have a high likelihood of favorable outcome after thrombectomy, particularly if reperfusion is successful.

CLINICAL RELEVANCE/APPLICATION

This work demonstrates how to achieve high levels of favorable outcomes in severe ischemic stroke patients by using imaging for selection of appropriate patients for endovascular therapy.

RC305-11  Body Temperature Fluctuations Modulate Infarct Expansion, Penumbral Rescue, and Clinical Outcome in Acute Ischemic Stroke Following Successful Endovascular Reperfusion: Impact of Subclinical Temperature Changes on Ischemic Progression

Tuesday, Dec. 1 11:25AM - 11:35AM Location: N230

Participants

Seena Dehkarghani, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Meredith Bowen, BA, Atlanta, GA (Presenter) Nothing to Disclose
Diogo C. Haussen, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Michael Frankel, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Adam B. Prater, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Andrey Lima, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Tyler Gleason, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Raul G. Negueira, MD, Boston, MA (Abstract Co-Author) Consultant, Stryker Corporation Consultant, Medtronic, Inc Consultant, CoAxia, Inc

PURPOSE

The exquisite temperature sensitivity of neuronal substrate has been thoroughly expounded in past studies. The effect of systemic temperature changes on stroke progression, and its impact upon the fate of at-risk tissues remains unknown. We undertook the analysis of temperature fluctuations and their interaction with rescue of penumbral tissues in a cohort of successfully revascularized acute stroke patients, hypothesizing greater relative infarct expansion as a function of sub-clinical systemic temperature changes.

METHOD AND MATERIALS

129 patients with acute stroke presenting within 12 hours were culled from our prospective registry. CT perfusion was obtained, with perfusion analysis undertaken in a user- and vendor-independent processing environment (RAPID). Automated lesion segmentation and thresholding of CTP data produced core, penumbral, and mismatch volumes. Final infarct volumes (FIV) were measured from DWI, and relative infarct growth (FIV-core/mismatch) computed. Systemic temperatures were recovered from medical records for the duration of hospitalization (up to q15 minutes), with minima, maxima, and ranges collected. All patients underwent successful endovascular reperfusion (mTICI IIb/III). Kendall's tau correlation was prescribed to assess the association between temperature change from baseline and both relative infarct growth (RIG) and favorable clinical outcome (FCO) as 90d mRS<=2.

RESULTS

59 men and 70 women (age 63±14 yrs) with acute stroke (NIHSS median[IQR]=19[9]; time to groin puncture median[IQR]=330[301]) were examined. All patients exhibited an occlusive lesion of the anterior circulation (ICA/MCA) with successful reperfusion (mTICI III/III). Median core (rCBF), penumbral (Tmax), and FIV (median[IQR]) were 9.6cc[25], 131cc[125], and 21cc[37], respectively. Mean temperature minima=35.1°C and maxima=37.9°C. Correlational analysis demonstrated significant associations between temperature fluctuation from baseline and both RIG (P=0.01) and FCO (P<0.001).

CONCLUSION

The impact of sub-clinical temperature changes had not previously been reported as a driving factor in penumbral rescue, however the present findings suggest that neuronal fate may be affected by even minor temperature changes.

CLINICAL RELEVANCE/APPLICATION

Sub-clinical temperature dysregulation may potentiate neuronal injury following acute ischemic stroke, compelling further investigation into the mechanistic relationship.

RC305-12  Impact of the Implementation of Thrombectomy with Stent Retrievers on the Frequency of Hemicraniectomy in Patients with Acute Ischemic Stroke

Tuesday, Dec. 1 11:25AM - 11:35AM Location: N230

Participants

Peter Sporns, MD, Munster, Germany (Presenter) Nothing to Disclose
Jens Minnerup, Munster, Germany (Abstract Co-Author) Nothing to Disclose
Tarek Zoubi, Munster, Germany (Abstract Co-Author) Nothing to Disclose
Uta Hanning, MD, Munster, Germany (Abstract Co-Author) Nothing to Disclose
Walter L. Heindel, MD, Munster, Germany (Abstract Co-Author) Nothing to Disclose
Wolfram Schwindt, MD, Munster, Germany (Abstract Co-Author) Nothing to Disclose
Thomas Niederstadt, MD, Munster, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE

Tuesday, Dec. 1 11:15AM - 11:25AM Location: N230

Participants

Seena Dehkarghani, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Meredith Bowen, BA, Atlanta, GA (Presenter) Nothing to Disclose
Diogo C. Haussen, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Michael Frankel, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Adam B. Prater, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Andrey Lima, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Tyler Gleason, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Raul G. Negueira, MD, Boston, MA (Abstract Co-Author) Consultant, Stryker Corporation Consultant, Medtronic, Inc Consultant, CoAxia, Inc

PURPOSE

The exquisite temperature sensitivity of neuronal substrate has been thoroughly expounded in past studies. The effect of systemic temperature changes on stroke progression, and its impact upon the fate of at-risk tissues remains unknown. We undertook the analysis of temperature fluctuations and their interaction with rescue of penumbral tissues in a cohort of successfully revascularized acute stroke patients, hypothesizing greater relative infarct expansion as a function of sub-clinical systemic temperature changes.
The increasing use of endovascular treatments has led to higher recanalization rates and better clinical outcomes compared to intravenous thrombolysis alone. Stent retrievers represent the latest development for recanalization of large vessel occlusions. Decompressive hemicraniectomy has proved beneficial in patients suffering from rising intracranial pressure after malignant stroke. We investigated the effect of the implementation of stent retriever treatment on the frequency of hemicraniectomy as a surrogate marker for infarct size and thus for poor neurological outcome.

METHOD AND MATERIALS

Patients with acute ischemic stroke were retrospectively studied. We compared the frequency of hemicraniectomy following proximal artery occlusion of the internal carotid artery and middle cerebral artery main stem in the years before (2009 and 2010) and after (2012 and 2013) introducing stent retrievers.

RESULTS

Overall, 497 patients with proximal arterial occlusion were included in the study. Of 253 patients admitted in the years 2009 and 2010 44 (17.4 %) and of 244 patients admitted in 2012 and 2013 20 (8.2 %) received a hemicraniectomy. This decrease in the proportion of hemicraniectomies was statistically significant (p<0.01).

CONCLUSION

The findings in this study illustrate a significantly reduced rate of hemicraniectomies in patients with proximal artery occlusions after implementation of thrombectomy with stent retriever. Hereby we could show a significant reduction of malignant infarctions after thrombectomy with stent retriever.

CLINICAL RELEVANCE/APPLICATION

Stent retriever is a safe and effective device and improves clinical outcome.

RC305-13  Hallmarks of Pediatric Ischemic Stroke

Tuesday, Dec. 1 11:35AM - 12:00PM Location: N230

Participants

Arastoo Vossough, MD, PhD, Philadelphia, PA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Define the epidemiological features and risk profiles of stroke in different pediatric patient populations. 2) Classify the types of pediatric stroke and features of vasculopathies leading to stroke. 3) Identify major mimickers of pediatric arterial ischemic stroke. 4) Specify current approved treatment options available for pediatric stroke 5) Identify recent and ongoing clinical trials in pediatric stroke.
Contemporary Thyroid and Parathyroid Imaging: The Incidental Thyroid Nodule Through 4DCT

Tuesday, Dec. 1 8:30AM - 10:00AM Location: N227

Participants

Sub-Events

RC306A  Managing the Incidental Thyroid Nodule

Participants
Jenny K. Hoang, MBBS, Durham, NC, (jennykh@gmail.com) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Describe the recommendations for workup an incidental thyroid nodule detected on imaging. 2) Examine the implications and costs of workup of incidental thyroid nodules.

ABSTRACT

Facts about incidental thyroid nodules on imaging
Majority of thyroid nodules detected incidentally do not have suspicious clinical history or imaging findings to differentiate a malignant from benign nodule. Incidental thyroid nodules are common whereas thyroid cancer is uncommon. Only 1.6% of patients with one or more thyroid nodules will actually have thyroid cancer [1]. Health care costs of workup of incidental thyroid nodules add up. Other costs to consider are patient anxiety, time lost, and potential complications of diagnostic lobectomy. Facts about incidental thyroid cancers
Small thyroid cancers are typically indolent and most patients die with rather than of thyroid cancer. The observed incidence of thyroid cancer is increasing exponentially and has doubled in the last decade [2]. Mortality has not changed significantly despite this trend which raises concern that the apparent increase in incidence is due to overdiagnosis of subclinical thyroid cancers. How should we be reporting thyroid nodules on imaging? In 2015 the American College of Radiology published a white paper on the management of Incidental Thyroid Nodules [3].

References:

RC306B  Imaging Thyroid Cancer

Participants
Ashley H. Aiken, MD, Atlanta, GA, (ashley.aiken@emoryhealthcare.org) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Discuss the American Thyroid Association (ATA) recommendations for preoperative imaging evaluation of thyroid cancer. 2) Recognize the indications for cross-sectional imaging in the pre-operative evaluation of thyroid cancer. 3) Use pre-operative cross-sectional imaging to accurately stage the primary tumor and regional lymph nodes.

ABSTRACT

Differentiated thyroid cancer (DTC), including papillary and follicular subtypes, is the most common (90%) primary thyroid malignancy. The remaining 10% of thyroid cancers include medullary, anaplastic and lymphoma. The American Thyroid association (ATA) guidelines currently recommend ultrasound (US) as the preoperative study for uncomplicated thyroid cancer. Cross-sectional imaging adds important anatomical information and should be recommended for cases with clinical evidence of invasive disease (vocal cord palsy, fixed mass, dysphagia, or respiratory symptoms), large size or mediastinal extent not well seen on US or rapid enlargement. Cross-sectional imaging is also recommended by the ATA when there is US or clinical evidence of bulky LAD or US expertise is not available. When interpreting a CT or MRI for preoperative evaluation, the radiologist should assess the primary tumor for extrathyroidal extension. The critical structures to assess for local invasion include the infrahyoid strap muscles (T3), larynx, trachea, or esophagus (T4a), recurrent laryngeal nerve (T4a), carotid encasement (T4b) and prevertebral fascia (T4b). The second role of imaging is to assess for regional nodal disease. It is important for the radiologist to recognize that lateral neck dissections are NOT part of routine management and identification of nodal disease in the lateral neck will alter the surgical plan. Radiologists should pay close attention to the typical drainage pathways including the central neck (level VI), lateral neck (levels III, IV), superior mediastinum (VII) and retropharyngeal nodes. Nodal metastases in papillary thyroid cancer may be characteristically cystic or calcified on CT or hyperintense on T1 weighted MRI. However, metastatic nodes may also be small and reactive appearing, so that clustered nodes in the paratracheal and mediastinal locations should increase suspicion. PET/CT may play a role in dedifferentiated tumors that no longer concentrate iodine, especially for surveillance in patients with elevated thyroglobulin but negative 131I WBS.

Active Handout: Ashley Hawk Aiken

RC306C  Parathyroid Imaging

Participants
Deborah R. Shatzkes, MD, New York, NY, (shatzkes@hotmail.com) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Key anatomic features of both normal and variant parathyroid anatomy. 2) The imaging modalities available for the work-up of primary hyperparathyroidism and their relative pros and cons. 3) The surgical techniques that have driven the development of contemporary parathyroid imaging.

**ABSTRACT**

The advent of minimally invasive parathyroid surgery (MIPS) has driven the development of improved localization techniques for parathyroid adenoma. The most successful imaging techniques are those that combine excellent anatomic detail with functional information that will help differentiate parathyroid adenoma from other nodules in the region. Ultrasound remains a very useful modality, because of its availability, cost and absent ionizing radiation. Radionuclide scanning, typically utilizing Tc99m Sestamibi, adds more specific functional information, and when combined with CT, good anatomic detail. Recently, there has been increasing interest in parathyroid CT, also known as 4DCT. This is essentially a CTA study whereby the characteristic hyperperfusion of parathyroid adenomas allows them to be differentiated from lymph nodes and exophytic thyroid nodules. There remains considerable controversy regarding technical details of 4DCT, particularly the number of phases required. The associated ionizing radiation remains a significant concern. Often, a combination of two imaging modalities is performed in order to increase reliability. The high incidence of ectopic parathyroid glands, the position of the glands at the root of the neck, the proximity to often multinodular thyroid tissue and what appears to be a rising incidence of multi glandular disease are challenges that relate to all imaging modalities.
LEARNING OBJECTIVES

1) Discuss the potential roles and limitations of PET imaging for amyloid and tau protein in evaluating patients with dementia. 2) Describe anatomic and functional MRI techniques for evaluating Alzheimer's disease. 3) Understand the clinical challenges of diagnosing and managing patients with dementia.

Participants

**RC311A PET Imaging, Tracers**

Terence Z. Wong, MD, PhD, Chapel Hill, NC (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**RC311B MRI and fMRI**

Jeffrey R. Petrella, MD, Durham, NC (Presenter) Advisory Board, Johnson & Johnson Speakers Bureau, Quintiles Inc Advisory Board, Piramal Enterprises Limited

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**RC311C Clinical Examples**

P. M. Doraiswamy, MD, Durham, NC (Presenter) Research Consultant, Bristol-Myers Squibb Company Research Consultant, Eli Lilly and Company Research Consultant, Neuronetrix, Inc Research Consultant, Medivation, Inc Research Grant, Bristol-Myers Squibb Company Research Grant, Eli Lilly and Company Research Grant, Neuronetrix, Inc Research Grant, Mediation, Inc Stockholder, Sonexa Therapeutics, Inc Stockholder, Clarimedix, Inc Speaker, Forest Medical, LLC

**LEARNING OBJECTIVES**

View learning objectives under main course title.
Interactive Quiz Cases in Neuro-oncologic Imaging (An Interactive Session)

Tuesday, Dec. 1 8:30AM - 10:00AM Location: E352

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50

Participants

LEARNING OBJECTIVES

Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

Sub-Events

RC318A Spine

Participants
James C. Anderson, MD, Portland, OR (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Review imaging of tumors of the spine. 2) Identify aspects of spinal tumors that affect staging, treatment and management. 3) Highlight roles of various imaging modalities.

ABSTRACT

Review imaging of tumors of the spine Review aspects of spinal tumors that affect staging, treatment and management. Review roles of various imaging modalities.

RC318B Head and Neck/ENT

Participants
Suresh K. Mukherji, MD, Northville, MI (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Review common head and neck tumors. 2) Identify pertinent imaging findings that show how imaging affects staging. 3) Highlight specific imaging findings that will affect staging, treatment and management.

ABSTRACT

Review common tumors of the head and neck. Review imaging findings in head and neck malignancies that specifically change staging. Review the value of imaging in directly affecting management and treatment.

RC318C Brain

Participants
Megan K. Strother, MD, Nashville, TN (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify basic anatomic, pathologic, and physiologic principles as they apply to neuro-oncologic imaging of the brain.

ABSTRACT

Five interactive neuro-oncologic cases will be presented in an interactive format. Participants will review basic knowledge and skills that are relevant to the clinical practice of neuroradiology, while evaluating the results of the latest research in neuro-oncologic imaging.
Confluence of Diagnostic Radiology and Radiation Oncology in Management of Pediatric Malignancies

Tuesday, Dec. 1 8:30AM - 10:00AM Location: S403A

Participants
Stephanie A. Terezakis, MD, Baltimore, MD (Moderator) Speaker, Elekta AB

Sub-Events

RC320A Supratentorial CNS Tumors

Participants
Stephanie M. Perkins, MD, Saint Louis, MO (Presenter) Nothing to Disclose
Tina Y. Poussaint, MD, Boston, MA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify the common supratentorial brain tumors of childhood. 2) Evaluate the imaging features of supratentorial brain tumors.

ABSTRACT
The most common type of solid tumor among children is the pediatric brain tumor, which is the second most frequent childhood malignancy after leukemia, and the leading cause of death from solid tumors in this population. Among children aged 0-19, the incidence rate for all primary brain and central nervous system tumors was roughly 5.3 per 100,000, with approximately 4350 cases of new cases of childhood primary malignant and non-malignant CNS tumors were expected to be diagnosed each year in the United States in 2013. Supratentorial tumors are most common in the first 2-3 years of life and in children older than 10 years, supratentorial and infratentorial are of equal frequency. This lecture will focus on the standard and advanced MR imaging features of the common supratentorial tumors of childhood affecting the cerebral hemispheres, suprasellar/sellar regions and pineal regions.

RC320B Infratentorial Central Nervous System Tumors

Participants
David B. Mansur, MD, Cleveland, OH (Presenter) Nothing to Disclose
Thierry Huisman, MD, Baltimore, MD, (thuisma1@jhmi.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify the types of diagnostic imaging most useful in the management of infratentorial CNS tumors. 2) Describe how proper diagnostic imaging aids in target delineation, staging, and treatment planning in posterior fossa CNS radiotherapy. 3) Define how conventional and advanced neuroimaging may characterize and differentiate brain neoplasms from treatment-related imaging findings following radiotherapy.

ABSTRACT
The radiotherapeutic management of infratentorial CNS tumors requires close collaboration between neuroradiology and radiation oncology. This process begins with accurate initial tumor description and delineation in the pre-operative setting. Detection of drop metastases is another critical role for neuroimaging which can be done either preoperatively or post operatively. Post-operative imaging is essential to assist with determining extent of resection as well as defining radiotherapy treatment volumes. Finally, neuroimaging after radiotherapy can aid in determining benign radiation therapy changes from recurrent or progressive tumor.

RC320C Pediatric Sarcomas: MR Imaging

Participants
Oren Cahlon, Princeton, NJ (Presenter) Investor, ProCure Treatment Centers, Inc
Laura M. Fayad, MD, Baltimore, MD (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Examine the roles MRI plays in the evaluation of pediatric sarcomas. 2) Assess the utility of various imaging sequences for the initial assessment and post-treatment follow-up of sarcomas. 3) Apply anatomic, functional and metabolic techniques for the identification of tumor extent and character.

ABSTRACT
MRI plays a critical role in the assessment of pediatric musculoskeletal tumors, both osseous and soft tissue masses. Although such neoplasms may initially be evaluated on other modalities, such as sonography or radiography, the most salient role for MRI is in determining the extent of disease. MRI sequences also offer information for tumor detection, characterization, the assessment of treatment response and the distinction of post-operative scar from recurrence. With conventional MRI, excellent anatomic detail is obtained, but with the advent of non-contrast chemical shift imaging, diffusion weighted imaging and MR spectroscopy, functional and metabolic features of a neoplasm can be evaluated noninvasively. In this presentation, a comprehensive MRI approach to assessing pediatric musculoskeletal tumors will be reviewed, focusing on the roles of anatomic, functional and metabolic MRI sequences.
Molecular Imaging Mini-Course: Clinical Applications of Molecular Imaging - Neuro

Tuesday, Dec. 1 8:30AM - 10:00AM Location: N226

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Sub-Events

RC323A Oncology Applications

Participants
Hyunsuk Shim, PhD, Atlanta, GA, (hshim@emory.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) To learn about the potential of combining an advanced MR spectroscopic imaging with standard MR images to reduce the recurrence rate in glioblastomas.

ABSTRACT

Radiation therapy (RT) is as good as the images that guide RT planning. RT based on conventional MRIs may not fully target tumor extent in glioblastomas (GBM), which may, in part, account for high recurrence rates (60-70 percent at 6 months). Magnetic resonance spectroscopic imaging (MRSI), a molecular imaging modality that quantifies endogenous metabolite levels without relying on perfusion, leakage and diffusion of injected material, may better define extent of actively proliferating tumor. In addition, advances in this technology now permit acquisition of full-brain high-resolution 3D MRSIs in 12-14 minutes. We correlated state-of-the-art MRSI metabolite maps with tissue histopathology to validate further its use for identifying tumor that may not be fully imaged by conventional MRI sequences and provide support for its adjunctive use in tumor contouring for RT planning. Integration of histologically-verified, whole brain 3D MRSI into RT planning is feasible and may considerably modify target volumes. Thus, RT planning for GBMs may be augmented by MRSI potentially leading to reduced recurrence rates.

RC323B Functional Applications

Participants
Satoshi Minoshima, MD, PhD, Salt Lake City, UT (Presenter) Royalties, General Electric Company; Consultant, Hamamatsu Photonics KK; Research Grant, Hitachi, Ltd; Research Grant, Nihon Medi-Physics Co, Ltd; Research Grant, Astellas Group; Research Grant, Seattle Genetics, Inc;
Among these, 67 patients developed brain metastasis and 126 patients did not. A univariate analysis of factors for patients with NSCLC to develop brain metastasis. Materials/Methods: MOSAIQ databases were queried for patients that received radiotherapy treatment at the institution. Details of patients that received radiotherapy to the brain were collected for further data collection using the EPIC database. Pathology records of these patients were examined for presence of certain biomarkers (TTF-1, CK7, CK20, Synaptophysin, p63, and CK 5/6) and histology (adenocarcinoma or SCLC, with neuroendocrine differentiation). Radiological reports were examined for tumor site(s), tumor size information, nodal involvement, and number of nodules present. Information on age, sex, and tumor stage were also collected. Results: A total of 193 patients were identified and included in this analysis. Among these, 67 patients developed brain metastasis and 126 patients did not. A univariate analysis of effective treatment with Prophylactic Cranial Irradiation (PCI) to minimize the risk of metastasis. We sought to identify predictive factors for patients with NSCLC to develop brain metastasis. Materials/Methods: MOSAIQ databases were queried for patients that received radiotherapy treatment at the institution. Details of patients that received radiotherapy to the brain were collected for further data collection using the EPIC database. Pathology records of these patients were examined for presence of certain biomarkers (TTF-1, CK7, CK20, Synaptophysin, p63, and CK 5/6) and histology (adenocarcinoma or SCLC, with neuroendocrine differentiation). Radiological reports were examined for tumor site(s), tumor size information, nodal involvement, and number of nodules present. Information on age, sex, and tumor stage were also collected. Results: A total of 193 patients were identified and included in this analysis. Among these, 67 patients developed brain metastasis and 126 patients did not. A univariate analysis of
data determined that tumor stages 3 and 4 (pA multivariable logistic regression model of data determined higher stage (stages 3 or 4: p=0.004, Adjusted OR=3.612) and tumor size (Above 3 cm: pAdditionally, the presence of CK7 and Synaptophysin showed a trend and non-significant increased risk of brain metastasis (OR=2.22 and 2.90, p=0.06 and 0.40, respectively).Conclusion: Identifying the presence of predictive characteristics in NSCLC patients can help patient survival through the administration of prophylactic cranial irradiation. In this study, we showed that NSCLC of stages 3 or 4, with tumors greater than 3 cm in at least one dimension, or more than two nodes or nodules involved are predictive of brain metastasis. Presence of CK7 may also be a reliable predictor of brain metastasis. This evidence can be helpful to doctors in evaluating whether or not patients should receive PCI.

MSRO35-04 Roles of Tumor Size and Histology in Outcomes Following Resection and Stereotactic Radiosurgery for Brain Metastases

Tuesday, Dec. 1 11:00AM - 11:10AM Location: S103CD

Awards
Trainee Research Prize - Medical Student

Participants
Chase Escott, Lebanon, NH (Presenter) Nothing to Disclose
Linton T. Evans, MD, Lebanon, NH (Abstract Co-Author) Nothing to Disclose
Zhongze Li, Lebanon, NH (Abstract Co-Author) Nothing to Disclose
Nathan Simmons, MD, Lebanon, NH (Abstract Co-Author) Nothing to Disclose
David W. Roberts, MD, Lebanon, NH (Abstract Co-Author) Scientific Advisory Board, Carthera AB; Scientific Advisory Board, IMRIS Inc; Scientific Advisory Board, Radiosurgery, Inc; Medical Advisory Board, Medtronic, Inc; Research support, Medtronic, Inc; Equipment support, Carl Zeiss AG; Research support, Carl Zeiss AG; Andrew Zureick, BA, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Alan C. Hartford, MD, PhD, Lebanon, NH (Abstract Co-Author) Nothing to Disclose

PURPOSE
Stereotactic radiosurgery (SRS) following resection of a brain metastasis improves disease control at the surgical site. Our prior published work demonstrated a relationship between size of the resected tumor and risk of local recurrence (LR). In this analysis we expanded our database to examine the role of tumor histology among factors that may predict recurrence and overall survival (OS).

METHOD AND MATERIALS
We retrospectively reviewed all patients treated through Jan 2013 who underwent SRS to the surgical bed, deferring whole brain radiation therapy (WBRT). Multiple factors - including histology, tumor size, planning target volume (PTV), dose, meningeal contact (SUP), development of leptomeningeal disease (LMD), gross total resection (GTR), number of metastases (MET#), and the RTOG's histology-specific Graded Prognostic Assessment (GPA) - were analyzed for time to local recurrence at the tumor bed (LR), to distant recurrence within the brain (DR), to intracranial recurrence (ICR), to salvage WBRT, and for OS.

RESULTS
122 lesions in 118 patients were treated with resection and SRS between February 2002 and January 2013. With median follow-up 18.3 months, local control rates at the resection cavity were 91.2% at 1-year, 83.4% at 2-years. Overall survival (OS) rates at 1-year and 2-years were 51.2% and 24.4%, respectively. On univariate analysis tumors > 3.0 cm, compared to smaller tumors, had a marginally significant higher risk of local recurrence (p=0.067) and a significantly higher rate of WBRT (66.2% versus 35.6% at 2-years, p<.05). Multivariate Cox regressions showed pre-op size to be significant for risk of LR in patients with non-lung tumors (p<.05), but not significant for patients with NSCLC metastases. In multivariate analysis of the entire dataset, only GPA was significantly associated (p<.0001) with OS, while size, PTV, GTR, histology, SUP, dose, LMD, and MET# were not -- arguing for successful salvage of recurrences.

CONCLUSION
SRS without WBRT is efficacious in controlling disease recurrence following resection of brain metastases. This study supports tumor size and histology as important factors prognostic for disease control in this group of patients.

CLINICAL RELEVANCE/APPLICATION
Pre-operative tumor size and tumor histology are important prognostic factors for efficacy of stereotactic radiosurgery following resection for brain metastases.

MSRO35-05 Gamma Knife Radiosurgery for Intracranial Grade 2 Meningiomas

Tuesday, Dec. 1 11:10AM - 11:20AM Location: S103CD

Participants
Tamer Refaat Abdelrahman, MD, PhD, Chicago, IL (Presenter) Nothing to Disclose
Michelle S. Gentile, MD, PhD, Cambridge, MA (Abstract Co-Author) Nothing to Disclose
Onh Bloch I, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Maryanne Marymont, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
James P. Chandler, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
John A. Kalapurakal, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Irene Helenowksi, Chicago, IL (Abstract Co-Author) Nothing to Disclose

PURPOSE
There has been few reports addressing the treatment outcomes of Gamma knife radiosurgery (GKRS) for grade 2 meningiomas. This study aims to report clinical outcomes after GKRS for intracranial grade 2 meningiomas.

METHOD AND MATERIALS
In this IRB approved study, we reviewed the records of all patients with histopathologically confirmed meningiomas treated with GKRS between 1998 and 2014. The median GKRS dose was 15 Gy (range 11-20) prescribed to the 50% isodose line.
RESULTS

A total of 209 meningiomas were treated consecutively and postoperatively with GKRS; of them 96 were histopathologically confirmed grade 2 meningiomas and were included in this study. Median age was 61 years, 57.3% were females and 42.7% were males. Tumor sites included anterior (11.5%), middle (11.5%), and posterior (18.7%) cranial fossae, convexity (32.3%), parasagittal (12.5%), temporal (10.4%), and others (3.1%). Mean tumor size was 3.3 cm³ (median 2.2 cm³). Among 41 (48.8%) symptomatic patients, most common symptoms were headache (21.9%), visual impairment (14.6%), hearing deficit (5.2%) and motor deficits (9.4%). After a mean follow up of 40 months (range 3 - 174), the local control rate was 70 % of all treated meningiomas. The median time to recurrence was 89 months (range 47 - 168 months). Of symptomatic patients, 54%, 39%, and 7% reported improved, stable, or worse initial symptoms, respectively. The 3, and 5-year actuarial local control rates were 69.9%, and 55.6%, respectively. The 3, and 5-years overall survival were 80.7%, and 65.6%, respectively. Multivariate analysis including tumor size, site, status (residual versus recurrent), dose, age, sex, race, previous irradiation, previous surgery, time since surgery, will be represented during the meeting in order to identify most contributing factors for local failure and provide recommendations for optimal treatment. The most common acute toxicities after GKRS were headache (1.1%), sensory loss (1.1%), visual impairment (1.1%), and dementia (3.4%). Chronic toxicities included, headache (1.1%), and visual impairment (2.2%). There were no radiation necrosis or second malignant tumors noted in our series.

CONCLUSION

This report, one of the largest GKRS series for grade 2 meningiomas, demonstrates that GKRS is a safe and effective treatment modality for grade 2 meningiomas with durable tumor control and minimal toxicity.

CLINICAL RELEVANCE/APPLICATION

GKRS is a safe and effective treatment modality for grade 2 meningiomas patients.

MSR035-07 Stereotactic Radiosurgery for Treatment of Brain Metastases from Colorectal Cancer: A Single-Institution Experience

Tuesday, Dec. 1 11:30AM - 11:40AM Location: S103CD

Participants

Michael A. Cummings, MD, MS, Rochester, NY (Presenter) Nothing to Disclose
Kevin Walter, Rochester, NY (Abstract Co-Author) Nothing to Disclose
Kenneth Usuki, Rochester, NY (Abstract Co-Author) Nothing to Disclose
Paul G. Okunieff, MD, Rochester, NY (Abstract Co-Author) Nothing to Disclose
Alan W. Katz, MD, Rochester, NY (Abstract Co-Author) Nothing to Disclose
Michael T. Milano, MD, PhD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): To review outcomes of patients with colorectal adenocarcinoma who underwent stereotactic radiosurgery for brain metastases Materials/Methods: A retrospective review of patients with biopsy proven colorectal adenocarcinoma treated with stereotactic radiosurgery for brain metastases from 2001-2013 was conducted under an IRB approved protocol. End points were radiologic response, neurologic symptom response, overall survival, and treatment related complications. Radiographic response to treatment was defined as stable or shrinking lesion size (accounting for expect post-radiation changes) on follow-up imaging, which was MRI in all except 1 patient. Neurologic symptom response was defined as improved or stable deficits on follow up exam with decreasing steroid dosage and no interval novel-to-patient systemic therapy Results: Twenty-three patients received single fraction SRS using either a frame based (2002-2010) or frameless (2011-2013) technique. Mean follow up was 5.4 months (range 1 to 13) which was dictated by overall survival. A total of 46 lesions were treated. The mean lesion size on MRI was 17 mm in greatest dimension (range 2 – 35 mm) with mean PTV size of 3.4 cm³ (0.02 to 14.94 cm³). The median number of lesions treated in a single course was 2 (range 1 to 5). Median prescribed dose to isocenter was 16.5 Gy (12.5 to 20) with median minimal PTV dose of 14 Gy (10 to 19.6). Eight lesions were recurrent after previous resection. Six lesions were treated with SRS and then required retreatment with SRS. Eleven patients had previous WBRT with median dose of 30 Gy. Radiographically 72% of lesions were stable or decreasing in size using last available assessment with mean interval of 4.1 months (1 to 19.2). Mean overall survival was 6 months. Two patients died within 1 month of treatment from causes other than disease (MI, MVA). Sixteen courses of treatment coincided with presentation of neurologic symptoms, with previous WBRT in 14. Seven of these sixteen patients had improvement in their presenting deficit, first noted on assessment at median interval of 2 months after SRS (range 1.3 to 6 mos).

Two patients remained steroid dependent, both on substantially decreased doses. None of the patients with neurologic response had recurrence of their presenting neurologic symptom prior to death. No patients required hospitalization for adverse effects of treatment. Two patients proceeded to resection post SRS for progressive lesion. Two patients who did not have WBRT had progression of CNS disease outside the treatment volumes. Conclusion: Stereotactic radiosurgery was well tolerated with excellent radiographic response and no major reported adverse events. In this review 44% of patients with neurologic symptoms prior to SRS had clinical improvement with length and time course not attributable to steroid therapy.

MSR035-08 Long-term Follow-up of Intensive Chemotherapy Followed by Reduced Dose and Field Irradiation for Intracranial Germ Cell Tumors

Tuesday, Dec. 1 11:40AM - 11:50AM Location: S103CD

Participants

Akihori Takada, MD, Tsu, Japan (Presenter) Nothing to Disclose
Noriko Ii, MD, PhD, Tsu, Japan (Abstract Co-Author) Nothing to Disclose
Toshio Matsubara, MD, PhD, Tsu, Japan (Abstract Co-Author) Nothing to Disclose
Yoshihiro Komada, MD, PhD, Tsu, Japan (Abstract Co-Author) Nothing to Disclose
Hajime Sakuma, MD, Tsu, Japan (Abstract Co-Author) Departmental Research Grant, Siemens AG; Departmental Research Grant, Koninklijke Philips NV; Departmental Research Grant, Bayer AG; Departmental Research Grant, Guerbet SA; Departmental Research Grant, DAICHI SANKYO Group; Departmental Research Grant, FUJIFILM Holdings Corporation; Departmental Research Grant, Nihon Medi-Physics Co, Ltd
Yoshito Nomoto, Tsu, Japan (Abstract Co-Author) Nothing to Disclose
Hidemi Toyoda, MD,PhD, Tsu, Japan (Abstract Co-Author) Nothing to Disclose
Takao Deguchi, MD,PhD, Tsu, Japan (Abstract Co-Author) Nothing to Disclose
Yutaka Toyomasu, MD, Tsu, Japan (Abstract Co-Author) Nothing to Disclose
ABSTRACT

Purpose/Objective(s): The purpose of this study is to report the treatment outcomes of intensive chemotherapy followed by reduced dose and field irradiation for the treatment of intracranial germ cell tumors (GCTs). Materials/Methods: 22 patients (18 males and 4 females) with intracranial GCTs were treated at our facility between 1991 and 2012. They were classified into three groups based on serological and histological findings. Five patients (23%) with pure germinoma were treated with conventional-dose chemotherapy (ifosfamide-cisplatin-etoposide) followed by 24 Gy ventricular field irradiation as good prognosis group, and 14 patients (64%) germinoma with syncytiotrophoblastic giant cells and 3 patients (14%) with nongerminomatous GCTs were treated with high-dose chemotherapy (HDC) with stem-cell support followed by 24-50.4 Gy reduced field irradiation as intermediate and poor prognosis group, respectively. The median age was 14 years and primary sites were at pineal region for 11 (50%) patients, suprasellar region for 4 (18%) patients and others for 7 (32%) patients. Disseminated tumors were present in 4 patients. Ten patients (45%) were diagnosed with hydrocephalus before treatment. Four patients who relapsed after initial chemotherapy were included in this study.

Materials/Methods: 345 microscopically confirmed cases of sacral chordoma were identified between 1974 and 2011 from the Surveillance, Epidemiology, and End Results (SEER) program of the National Cancer Institute. Incidence and survival rates were adjusted for age. Cases were divided into three cohorts by calendar year, 1974-1989, 1990-1999, and 2000-2011, as well as into two groups by age less than or equal to 65 versus greater than 65 to investigate trends over time and by age via Chi-square analysis. Kaplan-Meier analyses were performed to determine effects of treatment on survival.

RESULTS

Results: Median age at diagnosis was 64. The age-adjusted incidence rate of sacral chordomas was .03 per 100,000. 5-year relative survival for the entire cohort was 60%. Overall survival correlated significantly with treatment modality, with 44% surviving at 5 years with no treatment, 52% with radiation alone, 82% surgery alone, and 78% surgery and radiation (p = .03). Trends of Radiation, Surgery, and Survival by Time.1974-1989(N=68)1990-1999(N=78)2000-2011(N=193)P-valuePatients Receiving Radiation73%40%33%.03Patients Receiving Surgery65%74%70%.555-Year Overall Survival (%)63%59%63%.91Treatments were not mutually exclusive. 2Calculated from 94 cases between 2000-2006 with median follow-up 84 months.

CONCLUSION

Conclusion: Surgery remains an important component in the treatment of sacral chordomas in current practice. Fewer patients were treated with radiation more recently despite advances in photon and proton beam radiation. Overall survival remains unchanged. Additional analyses of margin status, radiation modality, and local control in current practice are warranted.

ABSTRACT

Purpose: Sacral chordomas represent approximately a third of all chordomas, a rare neoplasm of notochordal remnants. Current NCCN guidelines recommend surgical resection with or without adjuvant radiotherapy, or definitive radiation for unresectable cases. Recent advances in radiation for chordomas include conformal photon and proton beam radiation. We investigated the incidence, treatment, and survival outcomes for sacral chordomas to observe any trends in response to improvements in surgical and radiation techniques over a near 40 year time period.

METHOD AND MATERIALS

Materials/Methods: 345 microscopically confirmed cases of sacral chordoma were identified between 1974 and 2011 from the Surveillance, Epidemiology, and End Results (SEER) program of the National Cancer Institute. Incidence and survival rates were adjusted for age. Cases were divided into three cohorts by calendar year, 1974-1989, 1990-1999, and 2000-2011, as well as into two groups by age less than or equal to 65 versus greater than 65 to investigate trends over time and by age via Chi-square analysis. Kaplan-Meier analyses were performed to determine effects of treatment on survival.

RESULTS

Results: Median age at diagnosis was 64. The age-adjusted incidence rate of sacral chordomas was .03 per 100,000. 5-year relative survival for the entire cohort was 60%. Overall survival correlated significantly with treatment modality, with 44% surviving at 5 years with no treatment, 52% with radiation alone, 82% surgery alone, and 78% surgery and radiation (p = .03). Trends of Radiation, Surgery, and Survival by Time.1974-1989(N=68)1990-1999(N=78)2000-2011(N=193)P-valuePatients Receiving Radiation73%40%33%.03Patients Receiving Surgery65%74%70%.555-Year Overall Survival (%)63%59%63%.91Treatments were not mutually exclusive. 2Calculated from 94 cases between 2000-2006 with median follow-up 84 months.

CONCLUSION

Conclusion: Surgery remains an important component in the treatment of sacral chordomas in current practice. Fewer patients were treated with radiation more recently despite advances in photon and proton beam radiation. Overall survival remains unchanged. Additional analyses of margin status, radiation modality, and local control in current practice are warranted.
Clinical Applications of 3D Printing

Tuesday, Dec. 1 10:30AM - 12:00PM Location: S501ABC

CA NR ED IN

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Shi-Joon Yoo, MD, Toronto, ON (Moderator) Owner, 3D HOPE Medical; CEO, IMIB-CHD;
Vincent B. Ho, MD, MBA, Bethesda, MD (Moderator) In-kind support, General Electric Company

Sub-Events

RCC32A Role of 3D Printing in Congenital Heart Disease

Participants
Shi-Joon Yoo, MD, Toronto, ON (Presenter) Owner, 3D HOPE Medical; CEO, IMIB-CHD;

LEARNING OBJECTIVES
1) Understand 3D printing process for heart models. 2) Know how 3D printing helps pediatric cardiac surgery, with case examples. 3) Know the future directions of 3D printing for cardiac surgery.

ABSTRACT
Using rapid prototyping or 3D printing, physical replicas of the hearts can be provided to surgeons before their surgical decision and procedure. The replicas fill the gap between the imagination from the medical images and the reality. By having the replicas in hands, the surgeons can make optimum surgical decision and simulate the intended procedures on the replica prior to the procedure. This allows precise surgical procedures with reduced procedure and anesthesia time. In cases in the grey zone for biventricular versus univentricular repair, the replicas are of tremendous help in a binary decision. The presentation will include a few clinical cases where 3D printing played a crucial role in surgical decision making.

RCC32B 3D Surgical Planning Using Printed Models: The Surgeon’s Perspective

Participants
Edward J. Caterson, MD, PhD, Boston, MA (Presenter) Nothing to Disclose

RCC32C 3D Surgical and Treatment Planning Using Printed Models

Participants
Frederik L. Giesel, MD, MBA, Heidelberg, Germany (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) History of 3D-Printing. 2) Imaging modalities and post-processing procedures to provide data surrogates for 3D-printing. 3) Concept of 3D-printing for improved clinical services. 4) Limitations and challenges of 3D-printing in surgical planning.

ABSTRACT
This presentation outlines the impact of 3D-printing in the imaging environment. Applications in the medical field are reviewed and growing clinical applications are discussed. Starting with an overview of current 3D-printing technologies including fused deposition modelling (FDM), selective laser sintering (SLS), and stereolithography (SLA) common techniques for generating 3D object models based on medical imaging are illustrated. Typically, imaging source data from different modalities are post-processed using dedicated algorithms and software in order to generate triangle mesh surface data. These surface data are usually exported to STL-files that are commonly understood by current 3D printing machines. 3D-printed objects are most often made from plastic, such as ABS, PA, or PLA, but metal or other material is even possible. Finally the presentation will demonstrate how 3D-printed objects are valuable for treatment planning, treatment procedures in several clinical subspecialties, intra-operative surgical navigation, or for prosthesis production. However, medical applications of 3D-printing are still in a very early phase but the growing awareness in the medical and non-medical field nowadays support the promising utilization and development in the very near future.

RCC32D Validation of Coronary Contrast Gradients Using 3D Coronary Phantoms

Participants
Dimitris Mitsouras, PhD, Boston, MA (Presenter) Research Grant, Toshiba Corporation; Speakers Bureau, Toshiba Corporation

LEARNING OBJECTIVES
1) Learn about which 3D printing technologies can produce physiological compliant vascular phantoms. 2) Recognize those in vivo imaging techniques that can be translated into vascular models that can be 3D printed. 3) Be able to describe the steps required in developing an in silico plus in vitro experiment to explain an imaging finding. 4) Be able to explain the reason for the coronary contrast enhancement gradient seen in standard coronary CT angiography.

ABSTRACT
3D-printed cardiovascular models are poised to become a disruptive force in the development of novel functional CT and MR imaging techniques. With 3D printing, patient-specific models can be produced for physiologically accurate - with respect to both pathophysiology and underlying physics - validation studies that are not otherwise feasible due to e.g., radiation burden, scan time,
and cost. Multiple 3D printing technologies are key for such applications, particularly regarding vascular compliance and incorporation of hard materials for e.g., calcifications. Similarly, multiple imaging techniques such as rotational DSA, CT and MRI can be used to produce such models. A particularly important application is validation of in silico computational fluid dynamics (CFD) simulations that have been used to advance our understanding of cardiovascular disease and imaging methods developed to diagnose it in the last two decades. A given patient-specific model simulated with CFD can now concurrently be realized for identical in vitro flow experiments to validate conclusions drawn from the numerical model. Two examples are the coronary Transluminal Attenuation Gradient (TAG) and simulated fractional flow reserve (FFR) being developed for the non-invasive detection of significant coronary artery disease from standard CT angiography. We will showcase in vitro CTA experiments to elucidate the intra-luminal kinetics of iodinated contrast that give rise to TAG as an example of the steps from in vivo image acquisition, to lumen segmentation and preparation for 3D printing, and in vitro experimentation. Just as numerical 3D modeling has been a disruptive application of computational fluid dynamics methods with the potential to bridge the gap between understanding anatomy and function, 3D printing is poised to be a disruptive application of in vivo imaging and additive manufacturing to advance our understanding of pathophysiology, and new imaging techniques and devices.

RCC32E Blood Flow in the Thoracic Aorta Elucidated with 3D Models

Participants
Michael Markl, PhD, Chicago, IL (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Describe the use of 3D models of the aorta for the in-vitro simulation of aortic hemodynamics. 2) Explain the potential of in-vitro 4D flow MRI for the modeling and systematic analysis of the influence of common aortic pathologies on local and global 3D flow patterns in the aorta.

ABSTRACT
Flow sensitive MRI offers the ability to assess anatomy as well as flow characteristics in healthy and pathological blood vessels and is therefore an attractive tool for the diagnosis of vascular diseases. However, in-vivo studies do not allow the prediction of hemodynamic changes due to vascular modifications. Realistic vascular in-vitro 3D phantoms in combination with MRI flow measurements allow to model different vascular deformations and evaluate their effect on blood flow dynamics. This presentation will provide a review of the methods for the in-vitro simulation of aortic 3D blood flow with realistic boundary conditions and review previously reported application for the simulation of common aortic pathologies and their impact on aortic hemodynamics.
**SSG12**

**Neuroradiology (The Aging Brain and Neurodegenerative Disease)**

Tuesday, Dec. 1 10:30AM - 12:00PM Location: N226

NR MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

**Participants**
Jeffrey R. Petrella, MD, Durham, NC (Moderator) Advisory Board, Johnson & Johnson Speakers Bureau, Quintiles Inc Advisory Board, Piramal Enterprises Limited
Mykol Larvie, MD, PhD, Boston, MA (Moderator) Nothing to Disclose

**Sub-Events**

**SSG12-01  Tract-specific Degeneration of White Matter Microstructure is Related to Worse Cognitive Performance**

Tuesday, Dec. 1 10:30AM - 10:40AM Location: N226

Participants
Lotte G. Cremers, MD, Rotterdam, Netherlands (Presenter) Nothing to Disclose
Marius De Groot, PhD, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Gabriel P. Krestin, MD, PhD, Rotterdam, Netherlands (Abstract Co-Author) Consultant, General Electric Company; Research Grant, General Electric Company; Research Grant, Bayer AG; Research Grant, Siemens AG; Speakers Bureau, Siemens AG
Aad Van Der Lugt, MD, PhD, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Meike W. Vernooij, MD, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Mohammad A. Ikram, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Organization of white matter microstructure has been related to cognition. Yet, it remains unclear whether it is a brain-wide loss or localized loss of microstructure that leads to worse cognition. We investigated the role of tract-specific white matter microstructural organization in global cognitive function and specific cognitive domains.

**METHOD AND MATERIALS**

In 4516 non-demented middle-aged and elderly (mean age 63.8 ±11.1 years, 55.4% female) we obtained diffusion magnetic resonance imaging parameters (fractional anisotropy (FA) and mean diffusivity (MD)) in 25 white matter tracts using probabilistic tractography. In general, lower values of FA and higher values of MD are reflecting loss of white matter microstructural organization. With a cognitive test battery we assessed memory, information processing speed, executive function, and motor speed. We studied the association of tract-specific white matter microstructural organization and cognition using multivariable linear regression models, adjusting for macrostructural pathology, cardiovascular risk factors and APOE-ε4 allele carrierhip.

**RESULTS**

Loss of tract-specific white matter microstructure in all tracts, except for the brain stem tracts, was associated with worse global cognition. Lower FA in the association and callosal tracts and higher MD in the projection and association tracts most strongly related to poorer cognition. Loss of white matter microstructure associated with worse information processing speed, executive functioning, and motor speed, but not with memory.

**CONCLUSION**

Loss of white matter microstructure mainly in projection, association and callosal tracts is related to worse cognition, especially to worse information processing speed, executive function and motor speed, but not to memory.

**CLINICAL RELEVANCE/APPLICATION**

Tract-specific microstructural changes may aid in identifying early biomarkers to predict which persons will suffer from neurodegenerative diseases.

**SSG12-02  Stripe Sign of Precentral Gyri in Amyotrophic Lateral Sclerosis: A Novel Finding on Phase Difference Enhanced Images-initial Results**

Tuesday, Dec. 1 10:40AM - 10:50AM Location: N226

Participants
Shingo Kakeda, MD, Kitakyushu, Japan (Presenter) Nothing to Disclose
Tetsuya Yoneda, PhD, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose
Mari Miyata, MD, Kitakyushu, Japan (Abstract Co-Author) Nothing to Disclose
Keita Watanabe, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Satoru Ide, Kitakyushu, Japan (Abstract Co-Author) Nothing to Disclose
Yukunori Korogi, MD, PhD, Kitakyushu, Japan (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Recently, we have developed new phase-weighted MR imaging, "Phase Difference Enhanced Imaging (PADRE)", in which phase difference between objective and surrounding tissue is selected in order to enhance the contrast of objective tissue. We compared the precentral gyr (PG) of patients with amyotrophic lateral sclerosis (ALS) and healthy subjects on PADRE images to determine whether the visualization of changes makes it possible to discriminate between ALS patients and healthy subjects on an individual
METHOD AND MATERIALS
At first, with a nonblinded manner, two radiologists reviewed the normal and ALS appearances of the PG on PADRE images, and deviations from the normal PG appearance were recorded. Next, the observer performance study based on the PG abnormalities on PADRE image was performed by two reviewers, and both diagnostic accuracy and inter-observer agreement for the diagnosis of ALS on PADRE images were calculated.

RESULTS
At the nonblinded evaluations, the two radiologists consensually defined the PG as abnormal when the following finding was present; a low signal intensity layer was seen in the middle gray matter in the PG. By the low signal intensity layer, we found that the four-layer organization could be characterized in the PG (Figure). The observer performance study demonstrated that the sensitivity, specificity, and accuracy of PG abnormalities on PADRE images for discriminating ALS patients from healthy subjects were 100% for reviewer 1 and 90%, 100%, and 96% for reviewer 2. The k values for inter-observer agreement were excellent (k = 0.932).

CONCLUSION
We propose the term "stripe sign" to describe the characteristically abnormal appearance (four-layer organization) of the PG in the ALS patients. Based on novel PADRE finding on the PG it was possible to discriminate between ALS patients and healthy subjects. The PADRE finding in ALS patients may reflect pathologic changes due to the degeneration of upper motor neurons.

CLINICAL RELEVANCE/APPLICATION
PADRE in ALS patients showed a stripe sign on precentral gyr, which may be the useful finding for diagnosis of ALS on an individual basis.

SSG12-03  Systolic Cerebrospinal Fluid Flow Distinguishes Patients with Normal Pressure Hydrocephalus from Age-Matched Controls

Participants
Sophia Mueller, MD, Munich, Germany (Presenter) Nothing to Disclose
Sarah Lause, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Andreas Pomschar, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Roman Schniepp, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Sang H. Lee, MS, Miami, FL (Abstract Co-Author) Nothing to Disclose
Klaus Jahn, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Birgit B. Ertl-Wagner, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE
Patients with idiopathic normal pressure hydrocephalus (iNPH) suffer from a potentially treatable cause of dementia, and therefore benefit from fast and precise diagnosis. However, MR-based imaging signs are often ambiguous, and obscured by concomitant age-related changes such as generalized atrophy and microangiopathy. The aim of this study was to find an MR-based flow measure that can help discriminate iNPH patients from age-matched controls.

METHOD AND MATERIALS
10 patients with NPH (mean age=74.4, STD=6.2, 8 female), 18 age-matched healthy control subjects (mean age=71.1, STD=5.2, 11 female), and 14 young control subjects (mean age=21.6, STD=1.7, 8 female) were studied using a 3.0 T MR scanner (Siemens Healthcare, Erlangen, Germany). Cine phase-contrast images of blood and CSF flow to and from the cranium were used to quantify systolic CSF flow rate and arterial blood flow rates.

RESULTS
Maximal systolic CSF flow rate was significantly decreased in iNPH patients as compared to age-matched healthy controls (p<0.01). Maximal systolic arterial blood flow, however, did not differ significantly between patients and their age-matched controls (p>0.05). Both maximal arterial blood flow and CSF flow were reduced in healthy adult subjects and iNPH patients as compared to the young control group (p<0.0001 respectively).

CONCLUSION
While both vascular and CSF flow rates showed age-related decline, only reduction of CSF flow exceeded age-related changes in iNPH patients.

CLINICAL RELEVANCE/APPLICATION
Reduced systolic CSF flow rates are a robust and easily obtainable MR-based measure that may support the diagnosis of iNPH.

SSG12-04  Enlarged Perivascular Spaces on MRI - Pathological or Normal Finding in Cognitive Impairment?

Participants
Sara Shams, Stockholm, Sweden (Presenter) Nothing to Disclose
Juha Martola, Espoo, Finland (Abstract Co-Author) Nothing to Disclose
Andreas Charidimou, Boston, MA (Abstract Co-Author) Nothing to Disclose
Mykol Larvie, MD, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Tobias Granberg, Stockholm, Sweden (Abstract Co-Author) Nothing to Disclose
Mana Shams, Stockholm, Sweden (Abstract Co-Author) Nothing to Disclose
Yngve Forslin, Stockholm, Sweden (Abstract Co-Author) Nothing to Disclose
Enlarged perivascular spaces (EPVS) are seen as a normal finding in the brain. However, increased amounts of EPVS have shown associations with high age and impaired cognitive function, and are thought to be a marker of cerebral small vessel disease. In this study we sought to investigate EPVS in a continuum of cognitive impairment, and the associations with clinical and radiological parameters.

**METHOD AND MATERIALS**

989 patients undergoing memory investigation (mean age 63 ±10) were recruited and scanned on 1.5T MRI scanners. Routine clinical cerebrospinal fluid (CSF) biomarkers, amyloid B42 (AB42), total-tau (T-tau), tau phosphorylated at threonine 18 (P-tau), and CSF/ serum albumin ratios were analyzed in 761 patients. Rating of EPVS was made on T2-weighted sequences according to the EPVS rating scale. Associations between EPVS and clinical and radiological parameters were analyzed with multivariate linear and logistic regression models, controlling for appropriate variables.

**RESULTS**

Increasing number of EPVS had increased odds ratio for white matter hyperintensities (WMH) (OR: 3.7, 95CI: 2.5-5.4), cerebral microbleeds (OR: 2.3, 95CI: 1.6-3.3) and lacunar infarctions (OR: 3.2, 95CI: 2.2-4.8). Odds ratios for EPVS further increased with high age (OR: 2.5, 95CI:1.8-3.9), mild cognitive impairment (OR:1.1, 95CI: 1.0-1.1), and vascular dementia (OR:2.5, 95CI: 1.1-5.8), but not in Alzheimer's disease. No association between low cognition, measured by the MMSE test, and increased EPVS was seen. AB42 levels decreased with increasing EPVS (Beta: -0.131, P<0.01). T-tau (Beta: 0.10, P<0.01) and P-tau (Beta: 0.08, P<0.05) levels increased with increasing EPVS. No difference was seen in CSF/serum albumin ratios.

**CONCLUSION**

Our results suggest that increased EPVS may be a marker of cerebral small vessel disease, and associated with cognitive impairment. Increased EPVS with vascular dementia, but not with Alzheimer's disease suggests that EPVS may be more associated with vascular disease caused by hypertensive arteriopathy.

**CLINICAL RELEVANCE/APPLICATION**

Increased enlarged perivascular spaces may be a marker of cerebral small vessel disease, and associated with cognitive impairment.
**SSG12-06 Fluid Dynamics Study of CSF in Idiopathic Normal Pressure Hydrocephalus**

**Tuesday, Dec. 1 11:20AM - 11:30AM Location: N226**

**Participants**
Lekang Yin, Shanghai, China (Presenter) Nothing to Disclose
Yan Mei Yang, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Xiaozhu Hao, Shanghai, China (Abstract Co-Author) Nothing to Disclose

**Purpose**
To study the difference of CSF fluid dynamics at the aqueduct between idiopathic normal pressure hydrocephalus (iNPH) patients and normal elderly.

**Method and Materials**
A total of 15 iNPH patients (iNPH group) and 20 healthy volunteers as normal control (NC group) were included in this study. The flow data of CSF through the aqueduct were collected with phase-contrast cine method in 3T MR unit (MR PC-cine). The CSF fluid dynamics parameters including peak cranio-caudal velocity, peak caudo-cranial velocity, net flow volume, stroke volume, minute flow volume, as well as the direction of net flow were measured and compared statistically between the two groups.

**Results**
The flow curve of iNPH group was similar to the NC, both presented a sinusoidal flow pattern and caused a net flow per cardiac cycle. All fluid dynamics parameters except for peak cranio-caudal velocity (iNPH vs NC: 6.50±1.63 vs 5.76±1.32, P=0.20) were significantly increased in patients with iNPH. The net flow of 13 iNPH patients (13/15) were in the caudo-cranial direction, while 15 volunteers (15/20) were in the opposite direction, which was statistically significant differences (P =0.002).

**Conclusion**
iNPH patients present a hyperdynamic flow with increased velocity and volume during a cardiac cycle. The degree of rising in caudo-cranial direction exceeds that in cranio-caudal direction. The resulting reversal of net flow direction may play a key role in the occurrence of hydrocephalus in iNPH patients.

**Clinical Relevance/Application**
This finding about the reversal of net flow direction in iNPH patients helps to understanding the development of the disease.

**SSG12-07 Quantitative Susceptibility Mapping of the Motor Cortex in ALS and PLS Patients: A Biomarker for Upper Motor Neuron Dysfunction**

**Tuesday, Dec. 1 11:30AM - 11:40AM Location: N226**

**Participants**
Santanu Chakraborty, FRCP, DMRD, Ottawa, ON (Presenter) Grant, Bayer AG; Grant, General Electric Company
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**Purpose**
Motor Neuron Disease is a progressive neurodegenerative disease characterized by lower- (LMN) and upper motor neuron (UMN) dysfunction in ALS (Amyotrophic Lateral Sclerosis) and mostly UMN dysfunction in PLS (Primary Lateral Sclerosis). The diagnosis is currently based on clinical assessment, electrodiagnostic studies and exclusion of other diseases. Electromyography effectively detects LMN degeneration but there is no definite technique for demonstrating UMN involvement and UMN findings on clinical examination may not occur until late in the disease course. A method that detects early UMN involvement and accurately monitors disease progression is highly desirable especially for future clinical trials and strategies for early intervention.

**Method and Materials**
Ten ALS and three PLS patients were included in the study. The QSM processing was performed with a software package developed in-house using Matlab. To evaluate the susceptibility changes, ROIs were drawn into the right (RMC) and the left motor cortex (LMC). For control, susceptibility values were calculated from ROIs in the anterior border of precentral gyrus on the right (RCT) and left (LCT). We correlated the susceptibility values between the primary motor cortex (in the hand knob area) and the anterior border of precentral gyrus with presence of UMN signs (spasticity and hyperreflexia) and also most affected side of symptoms.

**Results**
Patients with spasticity symptoms have significant higher susceptibility values in the motor cortex area than those who do not (p<0.043). In the patient group showing symptoms of spasticity the susceptibility in the control cortex area is significant lower than in the motor cortex area (p<0.001).

**Conclusion**
Our results suggest QSM could be a quantitative tool to detect changes in the UMN changes in ALS and PLS. Larger prospective studies will be needed to find the incidence, sensitivity and specificity of this sign in ALS patients and to establish its prognostic value.

**Clinical Relevance/Application**
QSM could be a quantitative tool to detect changes in the motor cortex in ALS and PLS patients as an objective marker of UMN involvement. However, larger prospective studies will be needed to find the incidence, sensitivity and specificity of this sign and its...
Our MR study using PADRE suggests that the signal in the specific cerebral cortices in AD patients is different from that in healthy subjects.

CONCLUSION
Higher for AD patients than control subjects (STG, p=0.0052; PrCn, p=0.023; Cun, p=0.002). Mean CR of the cerebral cortices other than the SFG was significantly higher for AD patients than control subjects (STG, p=0.027; PrCn, p=0.0002; Cun, p=0.013). Mean CR of the cerebral cortices other than the SFG was significantly higher for AD patients than control subjects (STG, p=0.0052; PrCn, p=0.023; Cun, p=0.002).

METHOD AND MATERIALS
A total of thirty-seven TI patients and thirty-eight age, education matched healthy elderly controls were enrolled in the present study. MR imaging were performed at a 3.0T MR scanner. Volumes of hippocampal subfields on MR images were automatically estimated using FreeSurfer software. Clinical examinations (verbal recall, recall of the complex graphics and digit span backward task) were performed for all subjects. Two sample t-test was conducted to explore differences in hippocampal subfield volumes, with intracranial volume and age as covariate variables. Partial correlation analyses were used to examine the relationship between volumes of hippocampal subfields and the memory function in patients, when controlling age, gender and years of education.

RESULTS
TI group had smaller volume in presubiculum (left, p<0.001; right, p<0.001) and subiculum (left, p=0.029; right, p=0.006) when compared with healthy control. In addition, smaller presubiculum volumes were related with poorer long delayed recall (r=0.403, p=0.020) and complex graphics recall (r=0.410, p=0.018) in TI patients. Moreover, smaller subiculum volumes were associated with poorer short delayed recall (r=0.397, p=0.022).

CONCLUSION
Our findings indicated that thalamus infarction lead to hippocampal abnormality and memory deficits. These preliminary results suggested that information might not be passed between hippocampal subfield regions and thalamus, and aberrant hippocampus could not be responsible for memory function in patients with thalamus infarction.

CLINICAL RELEVANCE/APPLICATION
To our far as we know, this is the first study exploring the pattern of volume reductions in specific hippocampal subfields in TI patients and investigating association between hippocampal subfield volume and memory function.

SSG12-09 Alzheimer's Disease: Diagnostic Potential of Phase Difference Enhanced MR Imaging at 3T

METHOD AND MATERIALS
Phase difference enhanced imaging (PADRE) technique can selectively enhanced the phase difference between the target and surrounding tissue and might visualize amyloid-related brain changes in Alzheimer's disease (AD). We aimed to determine whether it is possible to diagnose patients with AD on an individual basis using 3T MR images with PADRE.

RESULTS
For the cortices other than the SFG, the mean grade of the cerebral cortex was significantly higher for AD patients than control subjects (STG, p=0.027; PrCn, p=0.0002; Cun, p=0.013). Mean CR of the cerebral cortices other than the SFG was significantly higher for AD patients than control subjects (STG, p=0.0052; PrCn, p=0.023; Cun, p=0.002).

CONCLUSION
Our MR study using PADRE suggests that the signal in the specific cerebral cortices in AD patients is different from that in healthy subjects.
CLINICAL RELEVANCE/APPLICATION

3T MR images with PADRE may provide useful information for the diagnosis of AD.
PURPOSE

We postulated that subcortical white matter hyperintensities (WMH) without clinical symptoms might be occurring in astronauts exposed to hypobaric conditions. We previously demonstrated the presence of increased WMH burden in high altitude U-2 pilots (U2P) and altitude chamber aerospace physiology personnel (AOP) occurring in the absence of clinical symptoms.

METHOD AND MATERIALS

In our prior study evaluating WMH burden in high altitude U-2 pilots (U2P) and aerospace physiology personnel (AOP) we obtained 2-dimensional 5mm clinical MRI sequences, both T2 FSE and FLAIR. Brain exams were conducted on the two Siemens 3T magnets with either a 12-channel or 32-channel phased array head coil. The National Aeronautics and Space Administration (NASA) has previously obtained similar 3T brain MRI scans on 42 astronauts after international space station (ISS) mission completion. These scans were conducted on 3 different 3T magnets, two Siemens scanners and one Philips scanner, with 12-channel head coils. WMH burden was evaluated by 1 neuroradiologist and 1 neurologist for lesion count. Assessment of lesion volume is in progress. Nonparametric Wilcox statistics were used to compare the astronauts to our normative, advanced degree (DOC) population (n=162) data as well as our AOP group (n = 83) and U2P group (n = 105). Age range of our prior study populations was 26-50; average DOC 34.6; average AOP 36.5; and average U2P 37.7. NASA age range 35-55, average 45.

RESULTS

The average number of WMHs for U2P was 8.1; AOP 6.3; DOC 2.8; and for the NASA astronauts 9.4. Wilcox rank sum test with continuity correction data demonstrates a significant difference for WMH burden between the NASA group and DOC (p value = 0.0211). There was no significant difference between the NASA group and AOP (p = 0.4762) or U2P (p = 0.725) groups.

CONCLUSION

Astronauts demonstrate a similar WMH burden to our high altitude U2 pilots and aerospace physiology personnel, significantly higher than the normal population.

CLINICAL RELEVANCE/APPLICATION

This study suggests the potential for similar pathophysiology in astronauts as seen in personnel exposed to the hypobaric environment in military operations, which has direct relevance to future deep space operations. Understanding the association between WMHs and hypobaric exposure may provide insight into the pathophysiology of other white matter disease processes.
METHOD AND MATERIALS
Data from 5 healthy controls and 29 patients with relapsing-remitting and progressive multiple sclerosis (MS) were acquired on a Philips 3T using sagittal 3D sequences. Signal-to-noise ratio and CNR were estimate by assessing the noise between repeated acquisitions of the same scan. Various spatial resolutions ranging from 0.2 mm$^3$ to 1 mm$^3$ were tested.

RESULTS
Gray matter (GM)- white matter (WM) CNR was by 55% and 74.5% higher in FLAIR² than in FLAIR and double inversion recovery (DIR) and improved between lesions and WM by 59% and 29.6%, respectively. The figure shows a 3D T2 (A), a conventional 3D FLAIR (B), 3D FLAIR² (C) and 3D DIR of a person with relapsing-remitting MS. In agreement with the quantitative CNR measurements, lesion conspicuity and contrast between GM and WM appear improved on FLAIR². Here, FLAIR² was acquired at 0.6×0.75×1.35 mm$^3$ and reconstructed to 0.3 mm$^3$ voxels, while DIR was acquired and reconstructed to 1 mm$^3$. The 3D-nature of FLAIR² allowed the visualization of callosal and infratentorial MS lesions. Cortical and juxtacortical MS lesions were more conspicuous in FLAIR² than in the other scans.

CONCLUSION
We present a simple approach for obtaining CSF suppression with improved CNR compared to conventional FLAIR and DIR. Lesions in the entire brain are captured, including infratentorial regions, the corpus callosum and most of the cervical cord as well as cortical lesions, at high spatial resolution. With its DIR-like contrast, FLAIR² may elegantly resolve the debate whether or not to include DIR into the standard imaging protocol of MS.

CLINICAL RELEVANCE/APPLICATION
FLAIR² is very easy to acquire on most MR scanners. Apart from MS, the improved detection of WM hyperintensities will benefit research and diagnosis in Alzheimer's disease, neurotrauma, stroke and other applications. The isotropic 3D-acquisition allows for excellent image registration in serial studies, which may improve automated detection of lesions. Dedicated head-neck coils will allow to assess abnormalities in the entire cervical cord and parts of the thoracic cord.

SSG13-03 Clinical Feasibility of Synthetic MRI in Multiple Sclerosis: A Diagnostic and Volumetric Validation Study

Tuesday, Dec. 1 10:50AM - 11:00AM Location: N227

Participants
Tobias Granberg, Stockholm, Sweden (Presenter) Nothing to Disclose
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Sten Fredinsson, MD, PhD, Stockholm, Sweden (Abstract Co-Author) Speaker, Actavis, Inc; Speaker, Bayer AG; Speaker, Bogen Idec Inc; Speaker, Merck KGaA; Speaker, Novartis AG; Speaker, sanofi-aventis Group; Speaker, Teva Pharmaceutical Industries Ltd Maria Kristoffersen Wiberg, Stockholm, Sweden (Abstract Co-Author) Nothing to Disclose

PURPOSE
To implement synthetic magnetic resonance imaging (syMRI) on a new scanner type and to compare its diagnostic accuracy with conventional MRI in multiple sclerosis (MS). Secondary aims were to study the repeatability of syMRI volumetry and compare its feasibility with commonly used volumetric methods.

METHOD AND MATERIALS
This prospective study was approved by the ethical review board and written informed consent was obtained. In October 2014, 20 MS patients were consecutively recruited along with 20 healthy controls. SyMRI was implemented on a Siemens 3T scanner. Comparable conventional (11:00 minutes) and synthetic (6:50 minutes) T1, PD, T2 and FLAIR images were acquired. Diagnostic accuracy, lesion detection and artifacts were assessed by blinded neuroradiological evaluation and contrast-to-noise ratios by manual tracing. Volumetry was performed with SyMRI, Freesurfer, FSL and SPM. Ordinal data was analyzed using Wilcoxon signed ranks test and categorical data using McNemar test. Repeatability was quantified using the inter-measurement coefficient of variance (CoV).

RESULTS
Synthetic images were of good to sufficient quality, except FLAIR images that were degraded by artifacts. All participants were correctly classified as patients/controls and incidental findings were identical with both MRI techniques. There were no differences in lesion number (P = 0.78) or location (P = 0.50-0.77). SyMRI provided the fastest segmentations with the lowest CoV for brain volume (0.14%) and brain parenchymal fraction (0.14%).

CONCLUSION
SyMRI provides diagnostic T1-, PD- and T2-weighted images in MS patients and controls. Synthetic brain tissue segmentations are fast and precise quantitative biomarkers suitable for longitudinal MS studies.

CLINICAL RELEVANCE/APPLICATION
Synthetic MRI can lower the threshold of implementing radiological quantitative biomarkers into clinical practice in MS by providing fast and precise brain tissue segmentations Conventional T1, PD and T2 sequences could possibly be replaced by synthetic images with the additional benefits of being able to arbitrarily adjust the weightings post-hoc and a slight reduction in acquisition times, meanwhile providing abovementioned quantitative biomarkers.

SSG13-04 Grey/white Matter Ratio at Diagnosis, and the Risk of 10-year Multiple Sclerosis Progression

Tuesday, Dec. 1 11:00AM - 11:10AM Location: N227
Participants
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PURPOSE
Grey and white matters are both affected in multiple sclerosis (MS), but poorly correlate among each other. This is possibly due to the heterogeneous pathological substrates of the disease, with preponderance of white matter demyelinating inflammation in relapsing-remitting (RR), and of grey matter neurodegeneration in secondary progressive (SP). Aim of the study is to investigate the relationship between grey and white matter in a population of newly diagnosed RRMS subjects, with long-term MS-related outcomes.

METHOD AND MATERIALS
The present 10-year retrospective longitudinal study included 134 RRMS subjects that performed MRI at the time of diagnosis with acquisition of T1-weighted volumes for segmentation purposes. In particular, the ratio between grey and white matter was subsequently calculated. The occurrence of clinical relapses, the reaching of Expanded Disability Status Scale (EDSS) 4.0, and the SP conversion were recorded during a mean follow-up period of 10.1±1.8 years (from 7.1 to 13.2).

RESULTS
During the study period, 54 subjects (40.3%) reached EDSS 4.0, and presented reduced grey/white matter ratio, as compared to subjects not reaching EDSS 4.0 (1.270±0.156 and 1.343±0.185, respectively) (p=0.017). At the same time, 29 subjects (21.6%) converted to SP, and presented reduced grey/white matter ratio, as compared to subjects not converting to SP (1.241±0.149 and 1.334±0.179, respectively) (p=0.012). In particular, subjects with higher grey/white matter ratio at diagnosis had a 80% reduced rate of reaching EDSS 4.0 (p=0.040; hazard ratio=0.195; 95% confidence interval=0.041-0.829), and a 90% reduced rate of SP conversion, as compared to subjects with lower grey/white matter ratio (p=0.043; hazard ratio=0.105; 95% confidence interval=0.011-0.831).

CONCLUSION
The ratio of grey/white matter is a predictor of disability progression and of SP conversion in newly diagnosed RRMS subjects, suggesting that different pathological substrates are present from the early phases of MS, and highlighting the importance of appropriate MRI techniques at MS diagnosis.

CLINICAL RELEVANCE/APPLICATION
The present study evaluated for the first time the ratio between grey and white matter in MS, suggesting a novel MRI method to predict MS progression from the diagnosis.

SSG13-05 Substages of Acute Multiple Sclerosis Lesions Demonstrated on Quantitative Susceptibility Mapping and R2* from Gradient Echo MRI

Tuesday, Dec. 1 11:10AM - 11:20AM Location: N227

Participants
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PURPOSE
Multiple sclerosis (MS) lesions at early stages are highly dynamic and pathologically heterogeneous, and therefore not well delineated in standard MRI. Quantitative susceptibility mapping (QSM) and R2* may offer new insight into the rapid changes in myelin and iron content within new lesions. The goal of this study was to characterize changes in QSM and R2* at various stages of lesions gadolinium enhancement.

METHOD AND MATERIALS
This retrospective study included 43 MS patients with newly identified T2w white matter lesions that first appeared on the current T2w image compared to the former scans. All patients underwent a 3D gradient multiple echoes sequence to generate QSM and R2* maps. These new lesions were substaged according to enhancing patterns: nodular, shell and non-enhancing. Lesions susceptibilities and R2* values were quantified and compared using analysis of variance (ANOVA) among three patterns. A paired t test was used to analyze susceptibility and R2* between the enhancing rim and the non-enhancing core of shell lesions.

RESULTS
Of the total 116 new T2w WM lesions, 65 were nodular with 62 (95.4%) isointense on QSM, 17 were shell with 15 (88.23%)
Increased GABA Concentrations in Patients with Relapsing-remitting Multiple Sclerosis Demonstrated by Edited Magnetic Resonance Spectroscopy

Participants
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PURPOSE
Gamma-aminobutyric acid (GABA) is the main inhibitory neurotransmitter in the central nervous system. Previous studies have demonstrated that there is a dysfunctional GABAergic neurotransmission in animal models of multiple sclerosis (MS). Edited magnetic resonance spectroscopy (MRS), using the MEGA-PRESS sequence, is the most widely used technique for detecting GABA in the human brain. However, to date there has been a paucity of studies exploring changes in GABA concentration in patients with MS. In this study, therefore, J-difference edited MRS was used to investigate GABA concentrations in patients with relapsing-remitting MS (RRMS) and healthy controls.

METHOD AND MATERIALS
Fifteen patients with RRMS (7 males/8 females, mean age 41.7±3.6 years) and fifteen healthy controls (6 males/9 females, mean age 43.3±4.7 years) were examined on a 3T scanner and T1-weighted three-dimensional TFE images were used as a localizer. The MEGA-PRESS sequence (TR 2000 ms; TE 68 ms; 256 averages) was used to measure GABA concentrations in the posterior cingulate cortex (PCC), left dorsolateral prefrontal cortex (DLPFC) and left hippocampus (LHC). For quantification, a shorter measurement (8 averages) of the unsuppressed water signal was obtained. The MRS data were analyzed using 'Gannet' (GABA-MRS Analysis Tool) in Matlab with Gaussian curve fitting to the GABA peaks. 3 Hz exponential line broadening was applied. The ratios of the integrals of the GABA and water signals, making corrections for T1 and T2 relaxation times and partial volume effects, were used to calculate water-scaled GABA concentration in mmol/L (mM) using a formula.

RESULTS
GABA concentrations in the PCC and LHC regions were significantly lower in RRMS patients compared to healthy controls (PCC region: 0.95±0.09 mM vs. 1.06±0.13 mM, p = 0.01; LHC region: 1.04±0.20 mM vs. 1.23±0.22 mM, p = 0.02). No statistical difference in GABA concentrations in the DLPFC region was seen between groups (0.91±0.10 mM vs. 0.95±0.13 mM, p = 0.32).

CONCLUSION
These results are consistent with a hypothesis of dysfunctional GABAergic neurotransmission in the central nervous system in patients with MS, and suggest a potential treatment target for MS.

CLINICAL RELEVANCE/APPLICATION
MRS study suggests dysfunctional GABAergic neurotransmission in the central nervous system in patients with MS, as well as a potential treatment target for MS.

Temporal Assessment of Injury and Repair in Multiple Sclerosis Lesions Using Structure Tensor Analysis

Participants
Laura Chin, Edmonton, AB (Abstract Co-Author) Nothing to Disclose
Andrew Szava-Kovats, MD, Edmonton, AB (Presenter) Nothing to Disclose
Yunyan Zhang, MD, PhD, Calgary, AB (Abstract Co-Author) Nothing to Disclose

PURPOSE
Multi-focal plaques remain to be the hallmark of multiple sclerosis (MS). Subtle changes in lesion structure are ongoing but not detectable with standard measures. Here we aimed to determine how lesions evolve in brain MRI of MS patients using a new measure of tissue alignment, structure tensor analysis.

METHOD AND MATERIALS
19 untreated MS patients were scanned bimonthly for 14 months at 1.5T. All images were non-uniformity corrected and sequential images were co-registered to baseline MRI (month 0). T2 lesions were segmented with reference to other MRI contrasts and followed over time. For lesions appeared during study, we mapped their onset time to baseline for consistency. Structure tensor analysis was applied to the corrected T2 images that resulted in 2 index maps: coherency and energy, which represent tissue...
RESULTS
We identified 156 white matter lesions; 145 visible throughout the study; 15 lesions appeared post baseline and were adjusted. Overall, there is a trend to increase for lesion coherency, prominently from month 10. Lesion energy appeared stable except a remarkable decrease at month 8, as also seen in lesion coherency. These results are not affected by lesion adjustment. Lesion size tended to decrease over 14 months.

CONCLUSION
Abrupt increase in lesion coherency from month 10 suggests tissue repair including remyelination in these patients. While being a similar measure to diffusion anisotropy, structure tensor coherency has the advantage of using standard MRI, no extra scan time needed. Stable energy and lesion size may indicate lack of sensitivity of these measures. Further confirmation is warranted.

CLINICAL RELEVANCE/APPLICATION
Structure tensor coherency may become a new measure of nerve repair in MS lesions after demyelination. As it is embeddable to clinical MRI, this measure may improve routine patient care.

SSG13-08 Lack of Correlation between Neck Venous Drainage and Multiple Sclerosis

Tuesday, Dec. 1 11:40AM - 11:50AM Location: N227

Participants
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Enrico Tedeschi, MD, Napoli, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE
Presence of flow abnormalities in neck veins of Multiple Sclerosis (MS) patients is still controversial, and the best imaging technique to evaluate them is not well defined yet. Aim of this study is to evaluate, using a quantitative MRI analysis, blood flow and venous stenosis in neck vessels, and investigate if there are differences between MS patients and healthy controls (HC), along with possible correlation with clinical scores.

METHOD AND MATERIALS
A group of 61 Relapsing-Remitting MS patients (mean age 38±11 years; F/M=27/34) and 18 HC (mean age 38±13.6 years; F/M=8/10) underwent MR scan of the neck. Acquisition included a 2D dynamic Phase-Contrast sequence (TR=66.8ms; TE=5.3ms; slice thickness=3mm; 30 time points), with peripheral retrospective triggering, acquired as a single slice at two different levels (C2 and C6). Quantitative measures, obtained with a semi-automated method through a dedicated software (Signal Processing In NMR - SPIN, Detroit, USA), were: left and right internal jugular vein (IJV) flow rates, and their cross-sectional areas, total IJV flow rate, total arterial and venous blood flow rates and the corresponding arteriovenous mismatch. Clinical variables included: number of relapses, disease duration, Expanded Disability Status Scale, Annualized Relapsing Rate and Multiple Sclerosis Severity Score. All statistical analyses were performed using SPSS (SPSS Inc, 2008. V.17.0. Chicago, SPSS Inc.).

RESULTS
Only 13/61 (21.3%) MS patients, with 7/18 HC (38.9%), showed a reduction in IJV cross sectional area. An independent samples t-test between MS patients and HC showed no significant differences for any flow measure. Furthermore, no correlations were found between any MR measure and clinical variables.

CONCLUSION
Quantitative MR evaluation of blood flow in neck vessels found no difference between MS patients and HC for any of the tested flow measures, confirming that the neurovascular hypothesis of MS is, in our sample, not suitable. Also, MS patients and HC showed no difference in terms of IJV area, suggesting that IJV stenosis is not related to the disease. Further studies, with a larger HC group, need to be performed to confirm our results.

CLINICAL RELEVANCE/APPLICATION
Neck venous drainage abnormalities have been claimed to be associated with Multiple Sclerosis. Conversely, our quantitative MR analysis seems to exclude that venous patterns are related to the disease.

SSG13-09 fMRI and Multiple Sclerosis: Cognitive Function Assessment Using Verbal Fluency Paradigm

Tuesday, Dec. 1 11:50AM - 12:00PM Location: N227

Participants
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Tania M. Netto, PhD, Rio de Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Lucas Ramos, Rio de Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Lucas Faria, Rio de Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Soniza Alves-Leon, PhD, Rio de Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Multiple Sclerosis (MS) is an autoimmune disease of the Central Nervous System, characterized by chronic inflammatory demyelination of both white and grey matter pathology. Individuals with MS suffer from a range of physical, psychiatric and cognitive symptoms. Cognitive impairments have been reported in 40-60% of these patients and verbal fluency tests such as semantic and phonemic have consistently been reported as more sensitive to executive functions impairments in MS than other measures. The aim of this study was to evaluate MS patients by functional magnetic resonance imaging (fMRI) with a verbal fluency paradigm and cognitive neuropsychological scores.

**METHOD AND MATERIALS**

Nineteen patients with MS (14 women; mean age 35.47 years, SD +/- 9.01) underwent a neuropsychological assessment including: Mini Mental State Examination for exclusion criteria; Semantic and Phonemic Verbal Fluency to measure verbal initiation and inhibition, memory, phonological and semantic language; and Hayling test to evaluate verbal initiation and inhibition, search strategies, syntactic-semantic and processing speed. This was followed by one fMRI session within a period of no more than one month and no less than 1 week. All MRI studies were performed on a 3T Siemens Trio, using fMRI EPI sequences while the patients responded to a verbal fluency task. Image processing and analysis were done using BrainVoyager software using GLM.

**RESULTS**

During Whole brain analysis (qFDR<0.05) we found an increased BOLD response to verbal fluency task of Wernicke and Brocas areas and Inferior Frontal Gyrus (Broadman Area 9) in left hemisphere. In a ROI analysis, this activation had an inverse correlation ($r = -0.61$, $p<0.01$) between Hayling test scores and Wernicke area fMRI responses during Verbal Fluency task. In this situation, subjects that scored higher in Hayling test exhibited lower Wernicke responses to verbal fluency task.

**CONCLUSION**

This results revealed that those patients that had reduced processing speed to evoke words had higher scores in Hayling test and lower brain responses in Wernicke area, reflecting on executive functions difficulties in initiation and inhibition of phonological and semantic language.

**CLINICAL RELEVANCE/APPLICATION**

Cognitive impairments are important causes to functional disability on MS patients, and knowing its functional relationships in the brain can affect treatment decisions and improve patients life quality.
Correlation between US Features and Cytological Analysis in Risk Stratification of Thyroid Malignancy.
Diagnostic Accuracy of Two TIRADS in the Evaluation of 1864 Thyroid Nodules that Underwent Ultrasound-guided Fine Needle Aspiration Biopsy

Station #1

Participants
Pratik Mukherjee, MD, PhD, San Francisco, CA (Moderator) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company;

Sub-Events
NR332-SD-TUA1 Correlation between US Features and Cytological Analysis in Risk Stratification of Thyroid Malignancy. Diagnostic Accuracy of Two TIRADS in the Evaluation of 1864 Thyroid Nodules that Underwent Ultrasound-guided Fine Needle Aspiration Biopsy

RESULTS
1745 nodules (93.6%) were classified as "non-surgical" and 119 (6.4%) as "surgical". The US features significantly associated with surgical indication were: microcalcification (OR: 33.0; CI: 12.0 to 90.5; p <0.01), not circumscribed margins (OR: 22.7; CI: 8.0 to 64.1; p <0.01), the presence of halo, whether thick (OR = 16.1; CI: 4.5 to 57.5; p <0.01) or thin (OR: 8.2; CI 2.7 to 24.5; p <0.01), hypoechochogenicity (OR = 9.4, CI: 1.2 to 74.6; p = 0.03), solid composition (OR = 2.9 CI: 1.3 to 6.4; p <0.01) and taller-than-wide shape (OR = 2.9, CI: 1.7 to 5.2; p <0.01). The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy for TIRADS-A were 99.2%, 78.9%, 24.3%, 99.9% and 80.2%; and for TIRADS-B 97.5%, 66.2%, 16.4%, 99.7% and 68.2%.

CONCLUSION
Both TIRADS showed high sensitivity and NPV and can be used as a screening tool to reduce unnecessary fine needle aspiration biopsies. Sonographic predictors of surgical indication were microcalcifications, solid composition, not circumscribed margins, taller-than-wide shape, hypoechochogenicity and presence of halo.

CLINICAL RELEVANCE/APPLICATION
Selection criteria are mandatory to avoid unnecessary invasive procedures such as fine needle aspiration biopsies and eventually thyroidectomy in the growing number of patients with thyroid nodules.

Imaging Assessment and Follow-up of Post-surgical Neck with Flap Reconstruction in Malignant Head and Neck Neoplasms

Station #2

Participants
Babar Nazir, MD, FRCR, Singapore, Singapore (Presenter) Nothing to Disclose
Ngian Chye Tan, Singapore, Singapore (Abstract Co-Author) Nothing to Disclose
Shuliang Ge, Singapore, Singapore (Abstract Co-Author) Nothing to Disclose
Hiang Khoon Tan, Singapore, Singapore (Abstract Co-Author) Nothing to Disclose
Patrick Tze Hem Teo, Singapore, Singapore (Abstract Co-Author) Nothing to Disclose
James Boon Kheng Khoo, Singapore, Singapore (Abstract Co-Author) Nothing to Disclose

PURPOSE
To study the role of cross-sectional imaging in the follow-up and detection of the complications after flap reconstruction for resected malignant head and neck neoplasms.

METHOD AND MATERIALS
Authors retrospectively reviewed the cross-sectional imaging scans of 197 patients who had flap reconstruction after resection of malignant head and neck tumors. The demographic profile, clinical presentation, history of radiation therapy, type of flaps and surgical details were obtained. The flaps were assessed for temporal changes in appearance, size, density/signals, enhancement and volume of flaps. The local complications were analyzed for incidence, detection rate, location, histology, clinical pattern and imaging
The study analyzed 197 patients. Site of primary tumor was: Oral cavity and Oropharynx (70%); Nasal cavity, Paranasal sinuses and Nasopharynx (74%); Scalp, Lip, Skin and Orbits (10.5%); Thyroid and Salivary glands (7.4%); and neck lymph nodes (4.7%). The types of flaps used for reconstruction were 22.1% local flaps and 77.4% pedicled/free flaps. The pedicled/free flaps included 69 pectoralis major flaps, 14 latissimus dorsi flaps, 13 fibular flaps, 14 radial forearm flaps, 11 anterolateral thigh flaps and 13 deltopectoral flaps. Follow-up imaging scans were done with CT scan in 124, MRI scan in 61 and PET-CT scans in 5 patients. The average time to first follow-up scan was 13.1±18.0 months. Flaps showed initial increase in T2W signals and contrast enhancement, followed by atrophy and increased T1W signals. The flap complications included tumor recurrence in 16.3%, flap necrosis in 3.7%, ischemia/thrombosis in 2.1%, infection/abscess/fistula in 5.8% and others complications in 4.7% patients. Median time of the flap complications was 0.7 months while median time of tumor recurrence was 12.1 months. Majority of the tumor recurrence were at the resected bed of the primary tumor. Nodal recurrences were also common.

**CONCLUSION**

Due to complex post-operative anatomy and deep location of complications, the imaging study is imperative in the follow up of the patients with flap reconstruction after head and neck tumor resection.

**CLINICAL RELEVANCE/APPLICATION**

Cross-sectional imaging is recommended in the follow-up after flap reconstruction after neck tumors. Radiologist should be aware of temporal changes in different types of the flaps and the imaging features of the local complications.

**NR334-SD-TUA3 Combined Evaluation of Indeterminate Cervical Lymph Nodes with FDG PET/CT and Contrast-Enhanced CT to Increase the Interpretation Accuracy for Metastatic Involvement in Head and Neck Squamous Cell Carcinoma**

**Station #3**

**Participants**

Richard A. Marshall, MD, New York, NY (Presenter) Nothing to Disclose
Peter M. Som, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Lale Kostakoglu, MD, MPH, New York, NY (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To assess whether cross modality combinations of anatomical and functional imaging characteristics of cervical lymph nodes could improve diagnostic accuracy for nodal metastasis in patients with head and neck squamous cell carcinoma.

**METHOD AND MATERIALS**

A total of 131 patients with head and neck squamous cell carcinoma who had received combined FDG PET and contrast enhanced CT simultaneously were retrospectively included. FDG avid lymph nodes were evaluated with functional parameters (SUVmax, metabolic tumor volume, total lesion glycolysis) and morphological parameters (shape - round/oval, fatty hilum, long axis size, short axis size, volume, eccentricity factor) by a neuroradiologist. Since necrosis and extracapsular spread are strong, late indicators of node metastasis, nodes with these features were excluded from the analysis. Histopathology <6 weeks or serial imaging >12 months were used as reference standard. ROC curves were used to calculate optimal cut-offs for each variable, and sensitivity, specificity, likelihood ratio, and odds ratio were calculated for individual and combination functional/morphologic variables.

**RESULTS**

Malignancy was confirmed in 28 of the 114 total lymph nodes included. At the optimal cutoff of 3.9 g/mL, SUVmax performed better than all other individual functional or morphologic features, with sensitivity of 85% and specificity of 73% (p<0.001). In combined analyses, the combination of SUVmax with shape significantly improved detection of malignancy, increasing specificity for malignancy to 94% (p=0.044). Additionally, combination of SUVmax with eccentricity factor, a measure of how much a node deviates from a spherical shape, resulted in significant improvement to specificity 89% (p=0.031). SUVmax combined with short axis, long axis, and volume did not result in significant improvement. Complete results are in Table 1.

**CONCLUSION**

A combined evaluation strategy using individual PET and contrast enhanced CT characteristics in cross modality combinations, particularly SUVmax with a measure of ‘roundness’ (reader defined shape, or eccentricity factor) can improve diagnostic accuracy in the evaluation of indeterminate cervical lymph nodes for malignancy.

**CLINICAL RELEVANCE/APPLICATION**

The results of this study will support the development of a reproducible, reliable algorithm for differentiating benign from malignant cervical lymphadenopathy in patients with head and neck squamous cell carcinoma.

**Honored Educators**

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Lale Kostakoglu, MD, MPH - 2012 Honored Educator

**NR335-SD-TUA4 Metabolic Changes in the Anterior Cingulate Cortex in Alzheimer’s Disease Using 1H-MR Spectroscopy**

**Station #4**

**Participants**

Wei Chen, PhD, MD, Tianjin, China (Presenter) Nothing to Disclose
Volume Loss in Relapsing-remitting Multiple Sclerosis: Grey Matter Hypoperfusion using Voxel-based Analysis of 3D Arterial Spin-labeling Imaging with 1H-MR spectroscopy has been widely accepted to evaluate the metabolic changes in-vivo in dementia including Alzheimer's disease (AD). Studies have paid attention to the metabolic abnormalities in AD focusing on some special areas, such as the medial temporal lobe, hippocampus and posterior cingulate gyrus, etc. The anterior cingulate cortex (ACC) has been well-understood as one of the most important structures that take part in execution and confirmed to be involved with the progress of AD. However, few of these changes of metabolites in the ACC in AD using 1H-MRS.

METHOD AND MATERIALS

Twelve-four subjects diagnosed with AD (mean age= 71.3±6.93 yrs, females=12) and 11 age- and sex-matched cognitively normal subjects (CN, mean age= 67.64±5.35 yrs, females=4) were recruited in this study. Subjects were divided into 3 groups according to their MMSE scores (mild: 20≤MMSE<24; moderate: 10≤MMSE<20; severe: MMSE<10) and undergone MRI with a 3T Siemens scanner. The MR sequences included a STEAM for multiple-voxel MRS imaging and a MPRAGE for anatomic imaging. The ACC was chosen as the ROI and NAA, Cho, Cr, C2 and ratios of NAA/Cr, Cho/Cr, Cr2/Cr in ACC were exported with the Siemens's MRS data processing software. SPSS version 16.0 was used for statistics.

RESULTS

Significant decreases were found in NAA, Cr and Cr2 in the ACC in AD compared with those in the CN group. Moreover, great differences were found in NAA, Cho and Cr between the 3 groups in AD (F=7.45, F=5.97, F=4.32; p<0.05, respectively). The mean values of NAA and Cho were correlated with the cognition scores (r2=0.38, p<0.01; r2=0.22, p<0.01).

CONCLUSION

Cr has been found to be relatively stable in MRS and could evaluate the chemical changes in brain, whereas in our study, the absolute value of metabolites seemed to be more sensitive in AD than those ratios with Cr, especially NAA. The level of NAA in the ACC was significantly lower in the AD group than that in the CN group and further decreased with the cognition decline, indicating the great reduction in the number of neuron in ACC and its contribution to cognition in patients with AD. NAA in the ACC might be a potential tool to help with the diagnosis of AD and the prognosis of cognitive decline.

CLINICAL RELEVANCE/APPLICATION

NAA in the anterior cingulate cortex might be a potential tool to help with the diagnosis of AD and the prognosis of cognitive decline.

NR336-SD-TUAS

Grey Matter Hypoperfusion using Voxel-based Analysis of 3D Arterial Spin-labeling Imaging with Volume Loss in Relapsing-remitting Multiple Sclerosis

Station #5

Participants

Haiqing Li, Shanghai, China (Presenter) Nothing to Disclose
Yuxin Li, MD, PhD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Bo Yin, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Geng Daoying, Shanghai, China (Abstract Co-Author) Nothing to Disclose

PURPOSE

To detect the inflammation changes of grey matter (GM) using voxel-based morphometry (VBM) of 3D-T1WI and voxel-based analysis (VBA) of three-dimensional arterial spin-labeling imaging (3D-ASL) in patients with relapsing-remitting multiple sclerosis (RRMS)

METHOD AND MATERIALS

Thirty-six patients with RRMS and 46 the age- and sex-matched healthy controls were recruited. 3D-ASL scans and 3D-T1WI covering the whole brain were acquired with a 3.0 T magnetic resonance scanner. Spatial processing was performed with statistical parametric mapping 8 (SPM8). A second-level one-way analysis of variance analysis was performed on the preprocessed ASL data. An average whole-brain CBF for each subject was also included as group-level covariates for the perfusion data, to control for individual CBF variations. GM volume differences of the whole brain were assessed using SPM8 to make VBM comparison between two groups. The clinical disability of all patients was assessed by expanded disability status scale (EDSS). Twenty-seven out of 36 RRMS patients had a neuropsychological examination with memory and execution screening scale (MES) by a neuropsychologist.

RESULTS

In RRMS patients,VBM revealed clusters of GM atrophy in cerebellum, insula, precuneus, lingual gyrus, anterior cingulate gyrus, para-hippocampal gyrus, pre/post-central gyrus, deep GM, frontal and temporal cortex(P<0.05,FDR corrected). Significantly increased CBF was detected in left pre- and post-central gyrus in RRMS compared with controls, while decreased CBF in the lingual gyrus, anterior cingulate gyrus, left para-hippocampal gyrus, right insula, temporal, frontal, and deep GM (P<0.05,FDR corrected).

Disease duration was negatively correlated with CBF of bilateral anterior cingulate gyrus (r=-0.41) and caudate nucleus (r=-0.37).

Disease duration was also negatively correlated with the grey matter volume of left caudate (r=-0.42) and right caudate (r=-0.36).

MES score was significantly correlated with the GM volume of thalamus, caudate and insular.

CONCLUSION

The distribution of grey matter hypo-perfusion was consistent with that of GM atrophy to a great extent in RRMS patients, which indicate valuable pathologic information. Caudate nucleus maybe a specific structure be progressively involved with disease progress.
NR337-SD-TUA6  The Value of High-resolution MRI and Perfusion Weighted Imaging in the Middle Cerebral Artery Atherosclerotic Stenosis

Station #6

Participants
Shanshan Xie, BMedSc, MMed, Zhengzhou, China (Presenter) Nothing to Disclose
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Yong Zhang, DO, Zhengzhou, China (Abstract Co-Author) Nothing to Disclose
Heng Cui, Zhengzhou, China (Abstract Co-Author) Nothing to Disclose
Chengru Song, Zhengzhou, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To explore the assessment value of HRMRI and PWI in patients of TIA with unilateral MCA atherosclerotic stenosis.

METHOD AND MATERIALS
43 patients with MCA territory symptoms underwent preliminary DWI and MRA to exclude acute cerebral infarction and ascertain unilateral stenosis of MCA M1 segment. Thereafter, all the patients underwent HRMRI and PWI. We analyzed atherosclerotic plaques within the affected segment, distinguishing plaque stability and plaque AHA type, and calculated the degree of stenosis. Then we postprocessed PWI data, getting the perfusion parameters of relative cerebral blood volume (rCBV), relative cerebral blood flow (rCBF), relative mean transit time (rMTT), time to peak (TTP) in the regions of interest.

CONCLUSION
HRMRI can assess AHA sub-type and stability of atherosclerotic plaque, and stenosis rate of MCA, MTT, TTP can be found changes in early ischemic events, which are sensitive parameters to diagnose TIA.

CLINICAL RELEVANCE/APPLICATION
HRMRI united with PWI can evaluate the atherosclerotic MCAs and the hemodynamic changes in TIA patients

NR338-SD-TUA7  Gadolinium Deposition in Skin and Brain after Multiple, Extended Doses of Linear and Macrocyclic Gadolinium Chelates in Rats

Station #7

Participants
Jessica Lohrke, PhD, Berlin, Germany (Abstract Co-Author) Employee, Bayer AG
Anna-Lena Frisk, PhD, Berlin, Germany (Abstract Co-Author) Employee, Bayer AG
Thomas Frenzel, PhD, Berlin, Germany (Abstract Co-Author) Employee, Bayer AG
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Gregor Jost, PhD, Berlin, Germany (Abstract Co-Author) Employee, Bayer AG
Hubertus Pietsch, PhD, Berlin, Germany (Presenter) Employee, Bayer AG

PURPOSE
Recent retrospective evaluations of patient data have indicated an association between increased signal intensity in the dentate nucleus on unenhanced T1-weighted MR images and repeated administrations of linear chelated gadolinium-based contrast agents (GBCAs) in patients with multiple sclerosis or brain metastases. In this preclinical study, we systematically examined histopathological changes and gadolinium retention in the skin and brain of rats after multiple intravenous injections of linear and macrocyclic GBCAs at extended doses.

METHOD AND MATERIALS
Healthy, male Wistar-Han rats were randomly divided into one control and three treatment (linear GBCAs gadodiamide and gadopentetate dimeglumin and macrocyclic gadoteridol) groups (n=10). Each animal received twenty daily intravenous injections at a dose of 2.5 mmol Gd/kg body weight. Eight weeks after the last application, the animals were sacrificed and skin and brain were sampled. The brain was divided into seven sections. Histopathology and analysis of Gd tissue concentration by ICP-MS were performed.

RESULTS
As expected for the artificially high doses, 4/10 animals in the gadodiamide group and none in the gadopentetate dimeglumin and macrocyclic gadoteridol groups (n=10). Each animal received twenty daily intravenous injections at a dose of 2.5 mmol Gd/kg body weight. Eight weeks after the last application, the animals were sacrificed and skin and brain were sampled. The brain was divided into seven sections. Histopathology and analysis of Gd tissue concentration by ICP-MS were performed.

CONCLUSION
The results of this preclinical study in healthy rats with an intact blood brain barrier indicate a significantly higher retention of linear GBCAs in the brain when compared to a macrocyclic agent. However, an accumulation in the lateral cerebellar nucleus was not observed.

CLINICAL RELEVANCE/APPLICATION
Systematic preclinical studies may help to gain a better understanding of the clinical observation of high signal intensities in the dentate nucleus on unenhanced T1-weighted MR images.

NR245-ED-Rhombencephalic Lesions in Adults: From a Case-based Tutorial to Practical Diagnostic Short-lists
Awards
Certificate of Merit

Participants
Amandine Crombe, Bordeaux, France (Presenter) Nothing to Disclose
Nicolas Alberti, MD, Bordeaux, France (Abstract Co-Author) Nothing to Disclose
Jean-Christophe Ouallet, Bordeaux, France (Abstract Co-Author) Nothing to Disclose
Aurélie Ruet, Bordeaux, France (Abstract Co-Author) Nothing to Disclose
Bruno Brochet, Bordeaux, France (Abstract Co-Author) Nothing to Disclose
Vincent Dousset, MD, PhD, Bordeaux, France (Abstract Co-Author) Nothing to Disclose
Thomas Tourdias, Bordeaux, France (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Rhombencephale is affected by various diseases: infections, neoplasms, inflammation, metabolic diseases and intoxication, vascular disorders and degeneration. Our aim is to review parenchymal lesions in adults, from the most common to the most exceptional, based on quiz. All the cases were collected from our neuroimaging centre. Finally, based on clinics and MRI semiology, we proposed an original diagnostic tree and summary tables.

TABLE OF CONTENTS/OUTLINE
1) Infectious diseases* Tuberculosis / pyogenic abscess* Listerial rhombencephalitis* Progressive multifocal leucoencephalopathy
2) Neoplasms 2.1) Benign 2.2) Malignant: * Atypical Leptomeningeal carcinomatosis * Ependymoma * Lymphoma * Glioma * Metastasis
3) Vascular diseases* Stroke* Hematoma * Posterior reversible Encephalopathy syndrome * Leukoaraiosis* Cavernoma * Developmental venous anomaly * Telangiectasia * Arteriovenous malformation
4) Metabolic diseases and Intoxications* Wilson* Neuroferritinopathy* Farh disease* Lithium / Methadone intoxications* Osmotic demyelination syndrome * Gayet-Wernicke encephalopathy
5) Inflammatory diseases* Multiple Sclerosis* ADEM* Devic* Neurosarcoidosis* CLIPPERS* Bickerstaff* Behcet
6) Degeneration* Wallerian degeneration * Multiple system atrophy
Neuroradiology Tuesday Poster Discussions

Tuesday, Dec. 1 12:45PM - 1:15PM Location: NR Community, Learning Center

NR340-SD-TUB2 Registration of Images in Multiphase Computed Tomography Using a Fast Fourier Transform Based Approach for Preoperative Planning in Minimally Invasive Parathyroidectomy.

Participants
Pratik Mukherjee, MD, PhD, San Francisco, CA (Moderator) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company;

Sub-Events

PURPOSE
Minimally invasive parathyroidectomy (MIP) has replaced four-gland exploration for isolated parathyroid adenomas to minimize operative morbidity. This has created the need for improved preoperative image localization. Multiphase computed tomography (MCT) is a useful technique which combines traditional anatomical localization with qualitative arterial enhancement and venous washout in suspected lesions. Improved diagnostic accuracy of MCT is possible through quantitative analysis of lesion features such as shape, density, heterogeneity, and contrast washout. A Fast Fourier Transform (FFT) based technique was used to perform translation, rotation, and scale-invariant image registration. The aim of this study is to evaluate the feasibility of registration of arterial and venous images to facilitate quantitative measurements, hopefully leading to improved diagnostic accuracy.

METHOD AND MATERIALS
Twenty surgically confirmed cases of single adenoma primary hyperparathyroidism were chosen. Dual phase multi detector CT slices were obtained at 1 x 0.5 mm acquisition after giving a weight-based dose of IV contrast power injected at 4 cc/second through a peripheral IV. Identical scans were obtained 25 and 90 seconds after injection to obtain arterial and venous phases. An in-house software package was developed to view, manually segment, and perform co-registration on raw DICOM images transferred from our PACS system. Registration validation was based on a distance to agreement (DTA) criterion of manually identified anatomical landmarks, while a Dice similarity coefficient was used for spatial overlap accuracy of manual segmentations.

RESULTS
Registration using the FFT based technique was successful in all cases. The DTA method showed that global registration was subpixel accurate. Dice scores for lesion spatial overlap were greater than 80% for all image series.

CONCLUSION
Registration of multiphase images in MCT using an FFT-based approach is feasible with excellent reproducibility. This technique allows quantitative measurement of adenoma contrast washout, which could improve diagnostic accuracy, essential for preoperative planning in MIP.

CLINICAL RELEVANCE/APPLICATION
Minimally invasive parathyroidectomy has created the need for more accurate image-based localization. Quantitative contrast washout measurements could improve diagnostic accuracy of MCT but requires image registration, now feasible with the FFT-based algorithm.

NR341-SD-TUB3 Clinical Application of Small Surface Coil Combine with 3D-FISP-FS Sequence in Parotid MRI

Participants
Guixun Hong, MD, Guangzhou, China (Presenter) Nothing to Disclose
Zhiyun Yang, Guangzhou, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To investigate the clinical value of small surface coil combine with 3D-FISP-FS sequence in parotid gland diseases MR imaging.

METHOD AND MATERIALS
21 cases of patients with parotid gland diseases were scanned using a small surface coil combine with 3D-FISP-FS sequence and head coil combine with conventional sequences separately. With the operation findings as the gold standard, the characteristic of the parotid gland lesions, the displaying rates of intra-parotid facial nerves and parotid ducts, the status of parotid lymph nodes and their operation consistency were assessed and compared respectively.

RESULTS
Head coil and small surface coil showed no significant difference in MR imaging of parotid gland lesions. The displaying rates of facial nerves using head coil and routine sequence showed low. The displaying rates of the main trunks, the temporofacial branches, the cervicofacial branches and the branches of the latter two were 100%, 68%, 73.3%, 53.3%, and 53.3% by using a small surface coil
combine with the 3D-FISP-FS sequence. The accuracy is 100% compared with the intraoperative findings. Whether the parotid ducts were compressed or invaded by the lesions and whether the parotid lymph nodes got enlarged or had abnormal morphology were also be accurately displayed.

CONCLUSION

Small surface coil with 3D-FISP-FS sequence was superior to conventional scanning by head coil, which had a great advantage in clearly displaying the parotid facial nerves, the parotid ducts and the location relationship with the lesions.

CLINICAL RELEVANCE/APPLICATION

Micro surface coil performed better in parotid MR imaging with 3D-FISP-FS sequence than that of head coil, which can simultaneously display the trunk and branches of the intra-parotid facial nerve and parotid duct, and had more advantages in displaying the secondary branches of the facial nerve.

NR342-SD-TUB4

Quantitative Susceptibility Mapping to Reveal Multiple Sclerosis Enhancing Lesions: A Longitudinal plus Cross-sectional Study

Station #4

Participants
Yan Zhang, Wuhan, China (Presenter) Nothing to Disclose
Susan Gauthier, New York, NY (Abstract Co-Author) Nothing to Disclose
Lijie Tu, New York, NY (Abstract Co-Author) Nothing to Disclose
Ajay Gupta, MD, New York, NY (Abstract Co-Author) Research Consultant, Biomedical Systems; Research support, General Electric Company
Joseph P. Comunale JR, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Dong Zhou, New York, NY (Abstract Co-Author) Nothing to Disclose
Weiwei Chen, Wuhan, China (Abstract Co-Author) Nothing to Disclose
Carlo A. Salustri, PhD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Wenzhen Zhu, MD, PhD, Wuhan, China (Abstract Co-Author) Nothing to Disclose
Yi Wang, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE

To characterize the susceptibility change of MS lesions from enhancing to non-enhancing status and to assess the feasibility of using quantitative susceptibility mapping (QSM) to recognize active lesions without the use of gadolinium injection.

METHOD AND MATERIALS

First, we studied 20 MS patients who showed new white matter (WM) enhancing lesions on contrast-enhanced T1-weighted (T1w+C) images, and had undergone a follow up MRI scan within one year after the appearance of those lesions. A 3D gradient-echo (GRE) sequence was used to generate QSM maps, and susceptibilities of the normal appearing white matter (NAWM) in the contralateral mirror side were taken as references. A total of 35 enhancing lesions were identified and their susceptibilities were quantified and compared using generalized estimating equations (GEE) model in the baseline and follow up scans. Using the results of this longitudinal study, we then selected 127 new T2-weighted (T2w) lesions, both enhancing and non-enhancing, in a larger sample of 43 MS patients (which included the previous 20). Receiver operating characteristics (ROC) were analyzed to assess the feasibility of QSM to identify enhancing lesions.

RESULTS

The relative (affected minus normal hemispheres) susceptibilities were 3.27 ppb ± 6.79 on the baseline scan and 19.56 ppb ± 8.33 on the follow up scan (P<.01). For all the 127 new T2w lesions, the relative susceptibility provided excellent discrimination between enhancing (93) and non-enhancing (34) lesions, with the ROC analysis showing an area under the curve (AUC) of 0.956. A cutoff of 8.8 ppb provided a sensitivity of 86.6% and specificity of 94.1%.

CONCLUSION

Magnetic susceptibilities remain unchanged at the early stage of the new lesion formation but increase rapidly as the lesion transitions to nonenhancing. This study proves that QSM has the ability to clearly recognize active lesions in MS patients.

CLINICAL RELEVANCE/APPLICATION

QSM does not require special settings or equipment, as it obtains susceptibility maps from standard GRE scans. Its efficacy is not based on the use of contrast agents and thus it is especially useful in patients who do not tolerate gadolinium.

NR343-SD-TUB5

Laryngeal-Hypopharyngeal Mass Lesions: Is There a Role of Ultrasonography in Clinical Practice?

Station #5

Participants
Argha Chatterjee, MBBS, MD, Kolkata, India (Presenter) Nothing to Disclose

PURPOSE

The present study aims to evaluate the role of ultrasonography (USG) in the evaluation of the mass lesions of the larynx and hypopharynx.

METHOD AND MATERIALS

27 patients with clinically suspected laryngeal or hypopharyngeal mass lesions were included in the study. USG examination was conducted percutaneously using a 9-3 MHz linear array transducer in transverse, coronal and sagittal planes at various levels of the neck. Mass lesions were assessed for their epicentre, laryngeal-hypopharyngeal subsite involvement, laryngeal cartilage involvement and extralaryngeal spread. Vocal cord mobility was also assessed. 25 patients underwent Contrast enhanced computed tomography (CECT) of neck after the USG examination. 18 patients underwent 27 patients with laryngeal or hypopharyngeal mass lesions that are clinically suspected or detected by indirect laryngoscopy (IL) were included in the study. USG examination was...
Reduced Diffusion of the Corpus Callosum: Mechanisms, Etiologies, and Manifestations of Cytotoxic Lesions of the Corpus Callosum (CLOCC)

RESULTS

5 patients were excluded due to inadequate visualisation due to dense cartilage calcification. USG correctly identified the epicentre in 81.8% (n=22). Excellent correlation (accuracy: 81.8-100%) was achieved in predicting involvement of false and true cord, pyriform sinus, epiglottis and aryepiglottic folds as well as extra-laryngeal structures. Correlation was less (accuracy: 63.6-72.7%) in evaluating posterior commissure, post-cricoid area and posterior pharyngeal wall. Vocal cord mobility was correctly assessed in all patients. Regarding thyroid cartilage involvement, correlation with CT was achieved in 18 of 21 cases.

CONCLUSION

USG is a fast, inexpensive and fairly accurate imaging modality in evaluation of laryngeal-hypopharyngeal lesions with an ability to assess cord mobility.

CLINICAL RELEVANCE/APPLICATION

Ultrasoundography can be used as a simple office procedure to evaluate suspected lesions of larynx-hypopharynx. It is especially useful in patients who fails to co-operate for indirect laryngoscopy.

Awards

Magna Cum Laude
Identified for RadioGraphics

Participants

Jay Starkey, MD, Tokyo, Japan (Presenter) Nothing to Disclose
Nobuo Kobayashi, MD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Yuji Numaguchi, MD, PhD, Chuoku, Japan (Abstract Co-Author) Nothing to Disclose
Toshio Moritani, MD, PhD, Iowa City, IA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

CCC lesions have many etiologies. The lesions are primarily posterior lesions and have 3 patterns: small round/oval lesions, lesions extending laterally, and lesions extending anteriorly. Lesions are often more-or-less symmetric. They are often single but may be associated with other white matter lesions. Such lesions are often, but not always, reversible. Lesions can easily be mistaken for stroke, so familiarity with them is important. We aim to:1. Introduce CCC lesions2. Show typical cases

TABLE OF CONTENTS/OUTLINE

General outline: Background, schematics of mechanisms (CNS cytokinopathy and excitotoxic), 3 lesion patterns, cases as unknowns. Cases Epilepsy (drug) associated lesions.- Carbamazepine in epilepsy, 2 cases Malignancy associated lesions- Chemotherapy in breast cancer- Chemotherapy in DLBCL- Leptomeningeal glioblastomatosis in cord glioblastoma Infection associated lesions- Adult encephalitis- Pediatric rotavirus- Pediatric EB virus- HUS in E-coli enterocolitis- Bacterial staphylococcal meningitis- MalariaSubarachnoid hemorrhage associated lesions- 4 adult casesMetabolic derangement associated lesions- Osmotic myelinolysis Wernicke encephalitis/PRES associated lesions- Hepatic encephalopathy in alpha-1 antitrypsin deficiencyTrauma associated lesions- Adult case in diffuse axonal injury
BOOST: CNS Tumor Board-Case-based Review of PET/MR Imaging and Role in the Clinical Treatment Management of Brain Tumors (An Interactive Session)

Tuesday, Dec. 1 3:00PM - 4:15PM Location: S103CD

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credits: 1.50

Participants
Christina I. Tsien, MD, Saint Louis, MO (Moderator) Speaker Bureau, Merck & Co, Inc
Soonmee Cha, MD, San Francisco, CA (Presenter) Nothing to Disclose
Michael Vogelbaum, MD, Cleveland, OH (Presenter) Stockholder, Infuseon Therapeutics, Inc
Patrick Y. Wen, MD, Boston, MA (Presenter) Research support, Agios Pharmaceuticals, Inc; Research support, Angiochem Inc; Research support, AstraZeneca PLC; Research support, Exelixis, Inc; Research support, F. Hoffmann-La Roche Ltd; Research support, GlaxoSmithKline plc; Research support, Karyopharm Therapeutics, Inc; Research support, Novartis AG; Research support, sanofi-aventis Group; Research support, Regeneron Pharmaceuticals, Inc; Research support, Vascular Biogenics Ltd; Advisory Board, AbbVie Inc; Advisory Board, Cavion; Advisory Board, Cellnex Therapeutics, Inc; Advisory Board, Merck & Co, Inc; Advisory Board, F. Hoffmann-La Roche Ltd; Advisory Board, Midatech Pharma; Advisory Board, Momenta Pharmaceuticals; Advisory Board, Novartis AG; Advisory Board, NovoCure Ltd; Advisory Board, Sigma-Tau Pharmaceuticals, Inc; Advisory Board, Vascular Biogenics Ltd; Speaker, Merck & Co, Inc

LEARNING OBJECTIVES
1) Present latest advances in imaging of brain tumors with special emphasis on PET/MR Imaging. 2) Review strengths, pitfalls, and limitations of the advanced imaging methods in a case-based format. 3) Discuss key imaging methods and features to differentiate recurrent tumor and treatment effect and to identify brain tumor mimics.
Neuroradiology (Advances in Intracranial CT, MR Angiography and Perfusion)

Tuesday, Dec. 1 3:00PM - 4:00PM Location: N226

NR CT MR
AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00
FDA
Discussions may include off-label uses.

PURPOSE
CT perfusion (CTP) imaging offers great opportunities in improving patient selection for endovascular therapy of acute ischemic stroke due to its potential in differentiating ischemic penumbra from the infarct core. However, several challenges in CTP such as poor image quality and high radiation dose have severely reduced its clinical value. This work introduces a task-driven framework to optimize CTP system parameters for improved imaging performance and reduced radiation dose.

METHOD AND MATERIALS
The proposed framework quantitatively relates image quality metrics (e.g., noise power spectrum or NPS) of the final CTP functional maps with CTP system parameters such as radiation dose and post-processing filter strength. This was achieved by developing a cascaded chain model for the CTP imaging system. To address the limitation of zero-frequency metrics such as the contrast-to-noise ratio (CNR), the framework used the task-based detectability index to quantify the CTP imaging performance. Using this framework, optimization of the post-processing denoising filter was performed for different radiation dose levels, and the optimized system parameters were validated using an in vivo canine stroke model.

RESULTS
The NPS predicted by the proposed framework had excellent agreement with the experimental data (relative RMSE<2% for all CTP maps). This indicates that the “noisiness” of the CTP maps can be quantitatively related to CTP system parameters and dose levels. Compared with the CNR that favored the strongest spatial filters, the task-based detectability led to much more reasonable optimal filter selection. With these optimized protocols, numerical simulation results demonstrate a relative increase of 101% (95% CI: [23%, 179%]), 172% (95% CI: [67%, 277%]), or 256% (95% CI: [76%, 436%]) in terms of detectability index for CBV, CBF, and MTT maps, respectively. Visual inspection of the in vivo canine results agreed with the simulation results.

CONCLUSION
The task-driven framework has successfully guided the optimization of CTP imaging systems, potentially enabling a fundamental improvement in the quality and reliability of CTP-based parametric perfusion measurements.

CLINICAL RELEVANCE/APPLICATION
It is highly desirable for endovascular therapy, which has demonstrated its benefits in recently published clinical trials, to be able to reliably distinguish the penumbra from the infarct core during patient selection.
Still no consent could be agreed about imaging of Acute Ischemic Stroke (AIS) in the posterior circulation. To our knowledge there exist only two studies investigating the efficacy of Computed Tomography Perfusion (CTP) for stroke detection in the posterior circulation. A recent study proposes an increase of diagnostic accuracy by additional CTP to protocols including only computed tomography angiography (CTA) and noncontrast computed tomography (NCCT), where another blinded study recognized no significant difference in the detection of supratentorial and infratentorial stroke lesions. However patient populations were relatively small. We therefore conducted a research containing a large number of consecutive patients to evaluate the diagnostic value of CTP in acute posterior circulation stroke.

**METHOD AND MATERIALS**

We retrospectively evaluated data of consecutive ischemic stroke patients admitted between January 1st 2012 and March 31st 2015 at a tertiary care center. The inclusion criteria for this study were (1) suspected ischemic stroke of the posterior circulation as defined in the Oxfordshire classification; (2) NCCT, CTA and CTP performed on admission; and (3) CT performed <9 hours after symptom onset. For statistical analysis we used three logistic regression models: (1) NCCT, (2) NCCT + CTA-SI and (3) NCCT + CTA-SI + CTP.

**RESULTS**

198 patients with suspected posterior circulation stroke fulfilled the inclusion criteria. Admission NCCT detected 28 (19%), CTA-SI 65 (48%), and CTP 109 (80%) of the 136 patients with an infarct in the posterior circulation on follow up imaging. Model 3 (area under the curve (AUC) from the receiver operating characteristic curve (ROC-curve)=0.90; 95% CI, 0.85-0.94) predicted an infarct in the posterior circulation territory better than models 1 (AUC from ROC-curve=0.597; 95% confidence interval, 0.52-0.67) and 2 (AUC from ROC-curve =0.74; 95% confidence interval, 0.67-0.81).

**CONCLUSION**

Our findings in a large cohort of consecutive patients show that CTP detects significantly more ischemic strokes in the posterior circulation than CTA and NCCT alone.

**CLINICAL RELEVANCE/APPLICATION**

Computed Tomography Perfusion should be added to standard CT- protocols for detection of ischemic stroke in the posterior circulation.
RESULTS

1085 ROI in brain tissue were the basis of all calculations. Using the SSS AIF, ve is significantly less overestimated compared to ACI or CV AIF (p< 0.001). ROI CA peaks falsely exceed AIF peaks significantly more often in ACI or CV AIF than in SSS AIF (p<0.0001). CA peaks are significantly higher in SSS AIF (p< 0.001). For glioma, the range of Ktrans values based on SSS AIF correlates best with expected ranges. Peak CA values correlate poorly between AIF selection methods except for ACI and CV AIF (r=0.515); T1-DCE parameters differed highly depending on AIF selection method (p< 0.001).

CONCLUSION

A ROI placement in the SSS for manual AIF selection produces significantly more trustworthy results compared other selection methods in T1-DCE MRI. ROI placements in the ACI and the CV frequently underestimate the peak arterial concentration of contrast agent and consecutively distort T1-DCE parameters.

CLINICAL RELEVANCE/APPLICATION

This technical analysis study of effects of AIF selection on T1-DCE parameters is of value for all radiologists using T1-DCE MRI in the CNS concerning interpretation and validation of their results.

PURPOSE

When applying T1-DCE MRI in the CNS, the right selection technique for the arterial input function (AIF) is a disputed question. AIF selection bias is a major obstacle for clinical implementation of the method. This study is aimed to determine the AIF selection mode that allows the most coherent and robust results of T1-DCE parameters.

METHOD AND MATERIALS

76 patients with various brain lesions underwent a T1-DCE scan MRI at 3.0 T (Philips Achieva TX, 8-channel head coil): 36 axial slices, TE=1.7 ms, 2 dual flip angle series, dynamic sequence: 50 scans; 12 scans/min.; contrast agent (CA) gadobutrol (0.1 mmol/kg BW; Bayer Healthcare). T1-DCE parameters Ktrans and ve were calculated with Intellispace software (Philips Healthcare). Regions of interest (ROI) were placed in different image slices. The manual AIF was derived from a 7x7 pixel ROI. 4 classical AIF selection modes were tried: (1) a Parker model based selection (MB), manual AIF selection in (2) the terminal ACI, (3) the blood vessel closest to the lesion (CV) and (4) the superior sagittal sinus (SSS, Fig. 1). Reliability of the AIF was approximated by presence of the expected curve shape, peak CA concentration and plausibility of calculated ve (< 100%). Ktrans values resulting from all AIF selection methods were compared for consistency between cases.

RESULTS

The average #vessel obtained with ASASL-MRA (16.9±4.9, P<0.0001) was larger than that with TOF-MRA (7.2±4.5). The average CNR with ASASL-MRA (20.4±8.0, P<0.0001) was higher than that with TOF-MRA (9.2±9.2). The increment in #vessel was higher in hemispheres with severe IC stenosis (11.0±4.0, P<0.01) than those with mild stenosis (6.8±2.4). The increment in #vessel was higher in hemispheres with well-developed LMA (11.4±3.9, P<0.01) than those with mildly developed LMA (6.8±2.2).
CONCLUSION
The ASASL-MRA improved the visualization of peripheral arteries distal to the steno-occlusive site reflecting collateral flow via LMA in moyamoya disease.

CLINICAL RELEVANCE/APPLICATION
ASASL-MRA serves as a non-invasive technique to evaluate the status of branches distal to the affected main trunk representing the LMA collateral flow. The method might be useful in the planning of bypass surgery.
SSJ19

Neuroradiology/Head and Neck (ENT Oncology)

Tuesday, Dec. 1 3:00PM - 4:00PM Location: N228

HN NR MR RO US

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Ashley H. Aiken, MD, Atlanta, GA (Moderator) Nothing to Disclose
Barton F. Branstetter IV, MD, Pittsburgh, PA (Moderator) Nothing to Disclose

Sub-Events

SSJ19-01 Lymph Node Imaging Reporting and Data System for Ultrasound and Real-time Elastography of Cervical Lymph Node: A Pilot Study

Tuesday, Dec. 1 3:00PM - 3:10PM Location: N228

Participants
Kyeong Hwa Ryu, MD, Busan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Kwanghwi Lee, Busan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Ji-Hwa Ryu, Busan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jung Hee Son, MD, Busan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To analyze ultrasound (US) and real-time elastography (RTE) features of cervical lymph node and propose a structural reporting system for lymph node.

METHOD AND MATERIALS
Between 2013 and 2014, 291 consecutive patients underwent US guided biopsies and follow-up for cervical lymph nodes were enrolled in a single institution. US features were analyzed as follows; shape, margin, echogenicity, echogenic hilum, gross necrosis, calcification, matting and vascular pattern. RTE features were analyzed; elasticity score and strain ratio. By logistic regression analysis, a score for each significant factor was assigned and multiplied by the β coefficient, and then fitted probability of malignancy was calculated. The risk of malignancy of lymph node was determined, based on the number of suspicious features.

RESULTS
Imaging features to be significantly associated with malignancy were round shape, not circumscribed margin, hyperechogenicity, absence of hilum, presence of gross necrosis and calcification, peripheral/mixed vascularity, elasticity score 3 and 4, and high strain ratio (p< 0.05). The fitted probability and risk of malignancy increased, as a number of suspicious features increased. Lymph node imaging reporting and data system (LNRADS) was established using a 5-point scale; 1 (probably benign), 2 (low suspicion for malignancy), 3 (moderate suspicion for malignancy), 4 (high suspicion for malignancy), and 5 (highly suggestive for malignancy). The risk of malignancy according to LNRADS categories was as follows; 1: 3.3%, 2: 10.9%, 3: 26.7%, 4: 51.8%-74.4%, 5: 90.6%-98.8%.

CONCLUSION
LNRADS was proposed using risk stratification of cervical lymph node according to the number of suspicious US and RTE features.

CLINICAL RELEVANCE/APPLICATION
LNRADS will help to determine the optimal strategies for management of cervical lymph node.

SSJ19-02 How Can We Differentiate Follicular Nodular Lesions with Ultrasonographic Features?

Tuesday, Dec. 1 3:10PM - 3:20PM Location: N228

Participants
Sun Hye Jeong, MD, Bucheon, Korea, Republic Of (Presenter) Nothing to Disclose
Hyun-Sook Hong, MD, PhD, Bucheon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Eun Hye Lee, MD, Bucheon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Bora Lee, Bucheon-Si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
We retrospectively evaluated the ultrasonographic (US) features used to differentiate follicular nodular lesions of thyroid gland (or follicular cell-derived thyroid nodules) and tried to identify specific US features of nodular hyperplasia (NH).

METHOD AND MATERIALS
The study included 178 patients (mean age 46.6 (range 17-82) years) with surgically confirmed NH (n=100), follicular adenoma (FA) (n=56), or follicular carcinoma (FC) (n=22). Two radiologists retrospectively analyzed the US features. To determine the predictors of follicular-patterned lesions, univariate and multivariate multinomial logistic regression analyses were conducted. Receiver operating characteristic (ROC) analyses were performed to determine the effectiveness of the final model at predicting NH, FA, and FC. The inter-observer agreement was calculated.

RESULTS
Tumor diameter, margin, echotexture, cystic changes, calcification, hypoechoic rim, and vascularity were significant in the
univariate analyses. The multivariate multinomial logistic regression analyses revealed that tumor diameter (FA: p=0.002, odds ratio (OR) = 1.75, 95% confidence interval (CI) 1.22, 2.51; FC: p=0.001, OR=2.02, 95% CI 1.32, 3.10), absence of cystic changes (FA: p=0.127, OR=2.21, 95% CI 0.80, 6.13; FC: p=0.001, OR=17.74, 95% CI 4.00, 78.73), and spongiform appearance (FA: p=0.234, OR=0.31, 95% CI 0.04, 2.15; FC: p<0.001, OR=1673.46, 95% CI 671.35, 4711.38) differed significantly among the three follicular nodular lesions, with NH as a reference group. The area under the curve (AUC) for NH, FA, and FC was 0.844, 0.858, and 0.705, respectively. The sensitivity for NH, FA, and FC was 0.696, 0.868, and 0.755, respectively, and the specificity was 0.820, 0.690, and 0.580. Using this model, the diagnostic accuracy of the original data was 72.6%. The inter-observer agreement was moderate to almost perfect.

**CONCLUSION**

Tumor diameter, cystic changes and spongiform appearance differed significantly among follicular nodular lesions. Using the US criteria, there was moderate diagnostic ability for NH, FA, and FC.

**CLINICAL RELEVANCE/APPLICATION**

Tumor diameter and the presence of cystic changes differed significantly among NH, FA, and FC (or follicular nodular lesions).

**SSJ19-03** The Added Diagnostic Value of DW-MRI to Conventional Parameters in Characterization of Cervical Lymphadenopathy

**Tuesday, Dec. 1 3:20PM - 3:30PM Location: N228**

**Participants**

A M Aboelsouad, MSc, Assiut, Egypt (Presenter) Nothing to Disclose

Haisam A. Atta, MD, Assiut, Egypt (Abstract Co-Author) Nothing to Disclose

Mohamed M. Abd Ellah, MD, Innsbruck, Austria (Abstract Co-Author) Nothing to Disclose

Hisham M. Imam, MBBCH, MD, Assiut, Egypt (Abstract Co-Author) Nothing to Disclose

**Purpose**

To assess what can DW-MRI add to conventional parameters (Short axis diameter, presence or absence of hilum and presence or absence of necrosis) in prediction of malignant cervical lymphadenopathy.

**Method and Materials**

The study population included 72 patients having cervical lymphadenopathy underwent MRI with diffusion on 1.5T machine before they underwent biopsy. The cutoff short axis diameter (determined by ROC curve and Youden index), presence or absence of hilum, presence or absence of necrosis and cutoff ADC value (determined by ROC curve and Youden index) were assessed and finding their ability to predict malignant cervical lymphadenopathy each parameter alone, all parameters and comparing DW-MRI efficacy with that of conventional parameters.

**Results**

The short axis diameter achieved 72.13%,45.45 %,88%,22.73% and 68.06% sensitivity, specificity, positive predictive value, negative predictive value and accuracy respectively. Absent hilum criterion achieved 63.9%,27.3%, 83%,12% and 58.3% sensitivity, specificity, positive predictive value, negative predictive value and accuracy respectively. Present necrosis criterion achieved 21.3%,72.7%,81.3%,14.3% and 29.2% sensitivity, specificity, positive predictive value, negative predictive value and accuracy respectively. Combined conventional criteria achieved 86.9%,0%,82.8%,0% and 73.6% sensitivity, specificity, positive predictive value, negative predictive value and accuracy respectively. The DWI with its cutoff ADC achieved 80.33%,63.64%,92.45%,36.84% and 83.33% sensitivity, specificity, positive predictive value, negative predictive value and accuracy respectively. Combined conventional parameters and DWI achieved 98.4%,0%,84.5%,0% and 83.3% sensitivity, specificity, positive predictive value, negative predictive value and accuracy respectively. Absent hilum criterion achieved 63.9%,27.3%, 83%,12% and 58.3% sensitivity, specificity, positive predictive value, negative predictive value and accuracy respectively. Present necrosis criterion achieved 21.3%,72.7%,81.3%,14.3% and 29.2% sensitivity, specificity, positive predictive value, negative predictive value and accuracy respectively. Combined conventional criteria achieved 86.9%,0%,82.8%,0% and 73.6% sensitivity, specificity, positive predictive value, negative predictive value and accuracy respectively. The DWI with its cutoff ADC achieved 80.33%,63.64%,92.45%,36.84% and 83.33% sensitivity, specificity, positive predictive value, negative predictive value and accuracy respectively. Present necrosis criterion achieved 21.3%,72.7%,81.3%,14.3% and 29.2% sensitivity, specificity, positive predictive value, negative predictive value and accuracy respectively.

**Conclusion**

DWI is carrying the highest sensitivity, specificity and accuracy among all conventional parameters, each alone and nearby lower sensitivity with higher specificity and accuracy than combined conventional parameters, thus use of DWI added significant diagnostic value to the ability of conventional parameters to predict malignant cervical lymphadenopathy with no extra time consuming.

**CLINICAL RELEVANCE/APPLICATION**

DW-MRI is non invasive and non time consuming method that can predict malignancy in cervical lymphadenopathy and its addition to conventional parameters increases their sensitivity with no significant extra time consuming.

**SSJ19-04** Proposal for an MRI-based Score to Differentiate Pleomorphic Adenoma and Warthin Tumor in Patients with Benign Parotid Neoplasms

**Tuesday, Dec. 1 3:30PM - 3:40PM Location: N228**

**Participants**

Beatrice Sacconi, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose

Angelo Iannarelli, Rome, Italy (Abstract Co-Author) Nothing to Disclose

Renato Argio, Rome, Italy (Presenter) Nothing to Disclose

Marta Bottero, Rome, Italy (Abstract Co-Author) Nothing to Disclose

Emanuela Basile, Rome, Italy (Abstract Co-Author) Nothing to Disclose

Piero Cascone, Rome, Italy (Abstract Co-Author) Nothing to Disclose

Carlo Catalano, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose

Mario Bezzi, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose

**Purpose**

To evaluate the diagnostic efficacy of an MRI-based score in the differential diagnosis between parotid pleomorphic adenoma (PA) and Warthin tumor (WT).
METHOD AND MATERIALS
Twenty patients (M=10, F=10; mean age=63.5 years, range=35-87) complaining of long-standing (stable for at least 3 months) painless parotid mass underwent a 3T MR (Discovery MR750, GE); T2-weighted, DWI and T1-weighted sequences before and after contrast administration (Gadobenic acid, 0.1 ml/kg) were performed. The lesions were evaluated by three radiologists in consensus using a complex score based on three-point scales rating four different MR features (T2-signal intensity, Apparent Diffusion Coefficient values, enhancement pattern, bilateral/multiple location); total scores of ≤3 and >3 were respectively considered as suggestive of PA or WT. Final diagnosis was based on pathology reports after US-guided fine-needle-aspiration cytology (FNAC) or surgical resection.

RESULTS
Twenty-four lesions were imaged; three lesions were excluded because of MR features suggesting less common histotypes (lipoma, sialolipoma, haemangioma, all confirmed at surgery). Radiologists correctly identified 6/6 PAs and 13/13 WTs; two lesions, defined as PAs, revealed to be an oncocytoma and a granulomatous lymph node (diagnostic accuracy 90.5%).

CONCLUSION
The score allowed the differential diagnosis in all cases of PAs and WTs; an oncocytoma and a granulomatous lymph node were misdiagnosed, but the incidence of benign lesions other than PA and WT is expected to be low. These data need to be confirmed in larger patient cohorts.

CLINICAL RELEVANCE/APPLICATION
In case of benign parotid lesions, the surgical plan depends on histology. MRI can suggest tumor histology in case of uncertain cytologic diagnosis and provide information over the entire neoplasm.

SSJ19-06 Intravoxel Incoherent Motion Diffusion-weighted Magnetic Resonance Imaging for Monitoring of ZD6474 Therapy in Human Nasopharyngeal Carcinoma Xenografts

Tuesday, Dec. 1 3:50PM - 4:00PM Location: N228

Participants
Yanfen Cui, Shanghai, China (Presenter) Nothing to Disclose
Caiyuan Zhang, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Huanhuan Liu, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Dengbin Wang, Shanghai, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the diagnostic value of the combination of echo-planner diffusion-weighted MR imaging (DWI), dynamic contrast enhanced MR imaging (DCE-MRI) and conventional MR imaging in the characterization of solid neoplasms from parotid gland.

METHOD AND MATERIALS
148 subjects (101 benign and 47 malignant) involved with parotid gland tumors were recruited in the study. Prior to surgery and pathologic verification, conventional maxillofacial MR imaging, DWI with b factor of both 0 and 1000 s/mm2 and DCE-MRI were performed on each subject. Logistic regression analysis was performed to see differences of morphological MR features (margin,shape,envelope and signal intensity of masses) between benign and malignant groups. Mean ADC value was calculated from ADC map, and then ADC threshold values between benign and malignant tumors was obtained. Time-intensity curve (TIC) with parameters were obtained from DCE-MRI. Sensitivity, specificity, accuracy, and positive and negative predictive values were calculated for the combination of relative parameters.

RESULTS
Ill-defined margin,irregular shape, no envelope, ADC value lower than cut-off point of 1.12×10-3mm2/s and TIC pattern with time to peak less than 120s and low washout ratio(<30%)were the valuable parameters for predicting malignancy (P=0.005, 0.004, 0.001, <0.001, <0.001, respectively). However, no significant difference was found in signal intensity of tumors between benign and malignant lesions. A combination of ADC value and TIC pattern yielded a sensitivity, specificity and diagnostic accuracy of 91.5%, 97.0% and 95.3%, respectively. Positive and negative predictive value for distinguishing benign and malignant tumors was 93.5% and 96.1% respectively.

CONCLUSION
Conventional MR imaging combined DWI and DCE-MRI has the ability to improve the diagnostic accuracy in distinguishing between benign and malignant parotid gland tumors.

CLINICAL RELEVANCE/APPLICATION
It will be helpful for clinical diagnosis of Parotid gland tumors
PURPOSE
To investigate the value of intravoxel incoherent motion (IVIM) diffusion-weighted (DW) imaging biomarkers for monitoring the early response to ZD6474 in an experimental tumor model by quantitative assessments of tumor microcirculation parameters with histopathological validation.

METHOD AND MATERIALS
Twenty-four female BALB/c nude mice bearing human nasopharyngeal carcinoma xenografts were scanned at baseline and after 1, 3, and 7 days of treatment with ZD6474 (n = 12) or vehicle (n = 12) at a 3T magnetic resonance imager using a custom-built 8-channel receiver coil with 2.5cm inner diameter. For IVIM DW imaging, parameters including apparent diffusion coefficient (ADC), true diffusion coefficient (D), perfusion fracture (f), and blood pseudodiffusion coefficient (D*) were measured with 12 b-values ranging from 0 to 2000 s/mm². All IVIM DW imaging parameters at different time points were compared between the treated and control groups using Student’s t tests or Mann-Whitney tests. Parameters were also analyzed within the treated group by one-way analysis of variance (ANOVA). The relationships between histopathological staining for Ki-67, TUNEL, or CD31 and all IVIM parameters were evaluated by Spearman’s rank correlation.

RESULTS
The percent change of the perfusion-related parameters f and D* decreased significantly in the treated group as early as the 1-day follow-up compared with those in the control group. In contrast, the diffusion-related parameters ADC and D were significantly higher in the treated group compared with the control group beginning on day 3 (P < 0.05). The substantial decreases in f at day 1 and D* at day 3 were moderately correlated with the smaller increase in tumor size over the week-long study (r = 0.66 and 0.58, respectively; P < 0.05 for both). Moderate correlations were found between microvessel density and the perfusion-related parameters f and D* and between increased TUNEL index or decreased Ki-67 index and the diffusion-related parameters ADC and D.

CONCLUSION
IVIM DW imaging was sensitive to ZD6474-induced changes in the tumor microenvironment. In particular, the f parameter had the potential to allow early prediction of tumor response to anti-angiogenic treatment.

CLINICAL RELEVANCE/APPLICATION
IVIM DW imaging was sensitive to ZD6474-induced changes in the tumor microenvironment. In particular, the f parameter had the potential to allow early prediction of tumor response to anti-angiogenic treatment.
Participants
Chad A. Holder, MD, Atlanta, GA (Moderator) Nothing to Disclose
Adam E. Flanders, MD, Penn Valley, PA (Moderator) Nothing to Disclose

Sub-Events
SSJ20-01  Non-invasive Detection IDH1 Gene Status in Astrocytoma by DSC MRI: A Retrospective Study of 91 Lesions
Tuesday, Dec. 1 3:00PM - 3:10PM Location: N229

Participants
Wen Li Tan, MD, Shanghai, China (Presenter) Nothing to Disclose
Dao Ying Geng, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Songhua Zhan, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Ji Xiong, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Wei Yuan Huang, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Jin Song Wu, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To investigate the value of dynamic susceptibility contrast (DSC) magnetic resonance imaging (MRI) in the noninvasive evaluation of isocitrate dehydrogenase (IDH) 1 status in astrocytoma.

METHOD AND MATERIALS
We retrospectively analyzed the preoperative DSC MRI data of 91 lesions with pathologically confirmed astrocytoma. We obtained the normalized maximum ratios of relative cerebral blood volume (rCBV) of tumor parenchyma. The enrolled astrocytoma patients were divided into six groups according to the World Health Organization (WHO) classification method and IDH1 gene status. We compared the differences in the rCBV ratio of tumor parenchyma between the IDH1 gene mutant and wild-type groups of WHO grades II, III, and IV and plotted receiver operating characteristic (ROC) curves for imaging indicators showing statistically significant differences.

RESULTS
The IDH1 gene mutant and wild-type groups of WHO grades II, III, and IV astrocytoma showed statistically significant differences in the rCBV ratio. In WHO grade II astrocytoma, the area under the ROC curve value for the rCBV ratio was 0.83, and the cutoff value was 2.20; in WHO grade III astrocytoma, the area under the ROC curve value for the rCBV ratio was 0.86, and the cutoff value was 3.14; in WHO grade IV astrocytoma, the area under the ROC curve value for the rCBV ratio was 0.94, and the cutoff value was 5.63.

CONCLUSION
The rCBV ratio value provided by DSC MRI provides a new imaging method for the noninvasive evaluation of the IDH1 status in astrocytomas of various WHO grades.

CLINICAL RELEVANCE/APPLICATION
DSC MRI can noninvasively judge the IDH1 gene status of astrocytomas.

SSJ20-02  IDH Mutation Status in Human Glioma is Associated with Differential Activation of Hypoxia and Angiogenesis Related Signaling and is Non-invasively Predictable with rCBV-imaging
Tuesday, Dec. 1 3:10PM - 3:20PM Location: N229

Participants
Philipp Kickingereder, Heidelberg, Germany (Presenter) Nothing to Disclose

PURPOSE
The recent identification of isocitrate dehydrogenase (IDH) mutations in gliomas and several other cancers suggests that this pathway is involved in oncogenesis; however effector functions are complex and yet incompletely understood. To study the regulatory effects of IDH on hypoxia-inducible-factor 1-alpha (HIF1A), a driving force in hypoxia-initiated angiogenesis, we performed mRNA-expression and functional, as well as genotype/imaging phenotype correlation analysis.

METHOD AND MATERIALS
We studied differential mRNA-expression profiles from 288 samples with low-grade and anaplastic gliomas from The Cancer Genome Atlas (TCGA) of HIF1A and related downstream signaling on a single-gene and pathway level, as well as upstream biological causes and probable downstream effects between mutant and wild-type IDH tumors. Genotype/imaging phenotype correlation analysis was performed in a separate (local) dataset with relative cerebral blood volume (rCBV) MRI - an estimate of tumor angiogenesis - in 72 treatment-naive patients with low-grade and anaplastic gliomas.
We show decreased expression of HIF1A-target genes on a single-gene and pathway level, strong inhibition of upstream regulators such as HIF1A and downstream biological functions such as angiogenesis and vasculogenesis in IDH-mutant tumors. Our radiogenomic imaging approach revealed increased levels of rCBV in IDH wild-type tumors, where a one-unit increase in rCBV corresponded to a two-third decrease in the odds for an IDH-mutation and correctly predicted IDH mutation status in 87% of patients.

CONCLUSION
Together, these findings show that IDH-mutation status is associated with a distinct angiogenesis transcriptome signature which correlates with rCBV-imaging findings and highlight the potential future role of radiogenomics for noninvasive profiling of cancer genomic key events.

CLINICAL RELEVANCE/APPLICATION
IDH-mutation status in human glioma is associated with a distinct angiogenesis transcriptome signature which correlates with rCBV-imaging findings and highlight the potential future role of radiogenomics for noninvasive profiling of cancer genomic key events.

SSJ20-03 The Added Prognostic Value of ADC in Glioblastomas Treated with Temozolomide: Correlation with MGMT Promoter Methylation Status and Survival Analysis

Participants
Yoon Seong Choi, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
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Mina Park, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sung Soo Ahn, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jinna Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Seung-Koo Lee, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
The prognostic value of ADC in patients with glioblastoma treated with temozolomide, and relationship between ADC and MGMT promoter methylation status are controversial. We investigated the added prognostic value of ADC in combination with MGMT in glioblastomas treated with temozolomide, and the association between ADC and MGMT promoter methylation status, using histogram analysis.

METHOD AND MATERIALS
This retrospective study consisted of 72 consecutive patients who underwent preoperative DTI for glioblastoma, and operation followed by CCRT with temozolomide. The histogram parameters of ADC, including mean, minimum, 5th (p5), 25th (p25), 50th (p50), 75th (p75), 95th (p95) percentile and maximum values, skewness and kurtosis were calculated from entire enhancing tumors. Univariate analyses for overall survival (OS) were performed with ADC parameters according to MGMT methylation status and other clinical factors. Multivariate Cox regression was performed to build prognostic models with and without ADC parameters. The performance of each model was compared using Harrell's concordance index. In addition, the difference of ADC histogram parameters according MGMT promoter methylation status was assessed using Student t-test.

RESULTS
In univariate analysis, only lower p75 of ADC was significantly associated with worse OS in overall patients, and lower mean and p75 of ADC in patients with unmethylated MGMT. No parameters of ADC were significantly prognostic in patients with methylated MGMT. Other significant prognostic factors were age and enhancing tumor volume, as well as MGMT methylation status. In multivariate analysis, mean and p75 of ADC were independently prognostic in patients with unmethylated MGMT. The performance of prognostic models were significantly improved when mean and p75 of ADC were added to dichotomize the patients with unmethylated MGMT. Any of ADC parameters was significantly different according MGMT methylation status.

CONCLUSION
Lower ADC histogram parameters were associated with worse prognosis of glioblastomas treated with temozolomide, especially those with unmethylated MGMT. ADC histogram parameters may have the added prognostic value in combination with MGMT in patients with glioblastoma.

CLINICAL RELEVANCE/APPLICATION
Preoperative ADC histogram analysis has the added prognostic value in combination with MGMT methylation status, in patients with glioblastomas treated with temozolomide.

SSJ20-04 The Role of Advanced CT and MRI Perfusion Imaging in Differentiating Diagnosis between Gliomas Masquerading as Acute Cerebral Stroke- Eight-year Experience in a Single Institution

Participants
Xiang Liu, MD, Rochester, NY (Presenter) Nothing to Disclose
Wei Tian, MD, PhD, Rochester, NY (Abstract Co-Author) Nothing to Disclose
Sven E. Ekholm, MD, Rochester, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE
Stroke mimics could account for 3 - 13% of patients primarily diagnosed and treated as acute stroke, thrombolysis in stroke mimics is not only unnecessary and costly, but will delay a correct diagnosis/treatment and may result in complications, including hemorrhage. Gliomas could present similar clinical symptom and conventional neuroimaging finding as acute brain stroke. The purpose of this study is to evaluate the value of advanced CT and MRI perfusion imaging in such differential diagnosis.

METHOD AND MATERIALS
CT and/or MR perfusion imaging findings in 1096 cases with suspected acute stroke onset in eight years of period were reviewed.
There were 22 cases with pathology confirmed gliomas, presenting acute onset of symptoms and conventional neuroimaging findings similar as acute stroke. The ratios of relative cerebral blood volume (rCBV), relative cerebral blood flow (rCBF), and mean transit time (MTT) were evaluated and compared with these stroke patients.

RESULTS

These 22 stroke-mimicking gliomas are malignant, including 13 Anaplastic astrocytomas, WHO grade III; and 9 glioblastomas, WHO Grade IV. All these gliomas showed non-enhancement or mild enhancement in post-contrast T1WI, and increased rCBV, rCBF and MTT compared to contralateral references, (p<0.001, paired t-test). The mean rCBV, rCBF and MTT values of ischemic stroke lesions were significantly lower than contralateral hemisphere (p<0.001, paired t-test). The ischemic lesions with re-perfusion could present mixed decreased and increased perfusion within the lesions. The maximal rCBV ratio (1.83±0.57, p=0.022) and rCBF ratio (2.91±0.82, p<0.001) of gliomas were significantly higher than ischemic lesions with re-perfusion (maximal rCBV ratio 1.64±0.13, maximal rCBF ratio 1.35±0.18; mann-whitney U test)

CONCLUSION

Our study shows that the gliomas mimicking symptom and imaging of acute stroke present higher perfusion than acute cerebral ischemic lesions. Carefully interpretation of multi-parameters derived from advanced CT and MRI perfusion imaging is useful in differentiating between gliomas mimicking acute stroke lesions.

CLINICAL RELEVANCE/APPLICATION

The perfusion imaging is important and adjuvant tool for accurate diagnosis in differentiating between gliomas mimicking acute stroke lesions.

SSJ20-05  
Clinical Performance Characteristics of Multivoxel Magnetic Resonance Spectroscopy in Distinguishing Between True Progression and Pseudoprogression in a Series of Patients with High-Grade Glial Neoplasm

Tuesday, Dec. 1 3:40PM - 3:50PM Location: N229

Participants

Jason M. Johnson, MD, Houston, TX (Presenter) Nothing to Disclose
Rutvij J. Shah, MBBS, Houston, TX (Abstract Co-Author) Nothing to Disclose
Leena M. Ketonen, MD, PhD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Dawid Sc hellingerhout, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Norman E. Leeds, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Ashok J. Kumar, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Rivka R. Colen, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose

PURPOSE

Rates of psuedoprogression (PsP) following chemoradiotherapy can be as high as 30% and can present a significant clinical and diagnostic burden. Early differentiation between true progression (TP) and PsP affects management decisions particularly in the era of progressive individualized treatments. We sought to review the clinical performance characteristics of MRS in a group of high-grade glial based neoplasm presenting for differentiation of PsP from TP.

METHOD AND MATERIALS

66 patients with high-grade glial neoplasm (GBM or AA) imaged during 2014 with MRI of the brain including multivoxel MRS with TE of 144 ms were evaluated. Patients were required to have either pathology follow-up or six-months of clinical and imaging follow-up to assess for accuracy. MRS solely was assessed for choline to NAA ratio within suspicious tissue as well as relative choline within suspicious tissue to normal brain parenchyma. A threshold of 2 for Cho/NAA and of >1.5 for relative choline concentrations were used as a guideline. Prior imaging and concurrent anatomic brain sequences were not reviewed.

RESULTS

Out of the 66 cases reviewed 23 patients were removed from further analysis due to unreliable MRS data. Of the remaining 33 cases (mean age 56 years, 19 males), high-grade glial neoplasm was suspected in 16 cases and not suspected in 17 cases. 15 out of 16 cases suspicious for TP were correct. MRS not thought to be consistent with TP was correct in 16/17 cases. Sensitivity = 93.8%; Specificity = 94.1%; PPV = 93.8%; NPV= 94.1%. The majority of excluded cases were due to calvarial lipid contamination into the shim box. Modest choline elevations were seen in many voxels of suspicious tissue.

CONCLUSION

High-quality multivoxel MRS is an excellent predictor of high-grade glial neoplasm versus pseudoprogression. Rigorous choline elevation thresholds for tumor versus radiation necrosis must be applied due to the common presence of modestly elevated choline concentrations in the post-treated tissue. Relying upon choline to NAA ratios alone should be done cautiously when a comparative voxel of normal appearing brain is not available for review.

CLINICAL RELEVANCE/APPLICATION

High quality multivoxel MRS at TE of 144 can provide a high level of accuracy and additional confidence in the evaluation of the post-treatment brain for recurrent high-grade glial based neoplasm.

SSJ20-06  
Investigating Dynamic Susceptibility-weighted Contrast-enhanced (DSC) Perfusion MR Imaging in Posterior Fossa Tumors: Differences and Similarities with Supratentorial Tumors

Tuesday, Dec. 1 3:50PM - 4:00PM Location: N229

Participants

Matia Martucci, MD, Rome, Italy (Presenter) Nothing to Disclose
Simona Gaudino, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Annibale Botto, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Anna D'Angelo, Rome, Italy (Abstract Co-Author) Nothing to Disclose
PURPOSE
DSC perfusion is routinely used in brain tumor imaging, for its added value in glioma grading and tumor differentiation. However, compared to supratentorial tumors (ST), there are only few data about its reliability and its cut-off values for infratentorial tumors (IT). Thus, the aims of our study were:1-to assess the accuracy of DSC perfusion in the evaluation of IT, for glioma grading and tumor differentiation2- to evaluate differences and similarities with ST.

METHOD AND MATERIALS
This retrospective study included 114 patients (3-85 years) with a pathologically proven diagnosis of brain tumor (40 IT, 70 ST), divided in 4 groups: high grade glioma (HGG), low grade glioma (LGG), metastases (MET), primary central nervous system lymphoma (PCNSL). rCBV, mean and min PSR were calculated. For statistical analysis lesions were divided according to the location and histology. Mann-Whitney U test was used to test the differences; accuracy, sensitivity, specificity, PPV and NPV for rCBV and PSR were calculated from ROC curves.

RESULTS
For IT, rCBV had high accuracy in differentiating HGG from LGG (p<0.001) and PSR (mean and min) resulted significantly higher in PCNSL and HGG compared to MET (p<0.001), showing a good accuracy (AUC>0.9). Comparing IT with ST, some perfusion parameters resulted similar: high rCBV in HGG, high mean PSR in PCNSL, low mean PSR in MET. Main differences between ST and IT were: the optimum threshold value of rCBV (3.05 for ST, 1.89 for IT), the mean PSR significantly higher in LGG than in HGG in ST (p=0.001) and a trend of higher perfusion values in ST. Exchanging of rCBV threshold values between ST and IT decreased both sensitivity and specificity.

CONCLUSION
rCBV and PSR are helpful in grading and differentiating IT. The overall behaviour of perfusion parameters was similar between ST and IT, but some differences in rCBV and PSR were demonstrated. The difference of rCBV threshold value between ST and IT -to distinguishing HGG from LGG- might be of high clinical relevance, and in our opinion deserves consideration.

CLINICAL RELEVANCE/APPLICATION
Our study suggests that different rCBV cut-off values should be applied in IT. In fact, our results demonstrated a different optimum threshold value of rCBV for IT (1.89) compared to ST (3.05).
Preoperative Brain Tumor Imaging

Tuesday, Dec. 1 4:30PM - 6:00PM Location: N227

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Jay J. Pillai, MD, Baltimore, MD (Moderator) Medical Advisory Board, Prism Clinical Imaging, Inc; Author with royalties, Springer Science+Business Media Deutschland GmbH; Author with royalties, Reed Elsevier
Haris I. Sair, MD, Baltimore, MD (Moderator) Research support, Carestream Health, Inc

LEARNING OBJECTIVES
1) To understand, based on anatomic considerations, how to localize lesions along the brain surface. 2) To become familiar with DTI techniques, their limitations and their applications to neurosurgical planning. 3) To understand the value of BOLD fMRI in presurgical mapping of brain functional systems and appreciate the types of paradigms that are in clinical use.

ABSTRACT
State-of-the-art preoperative brain tumor imaging will be described from the standpoint of neurosurgical planning. The lectures included in this course will cover gyral and other anatomic considerations for lesion localization, as well as the role that both diffusion tensor imaging (DTI) and blood oxygen level dependent (BOLD) functional MRI (fMRI) play in the delineation of eloquent cortex and white matter tracts. The importance of both DTI and BOLD fMRI in the accurate assessment of brain functional networks will be stressed in the context of presurgical mapping. The value, as well as limitations, of each of these approaches will be discussed.

Sub-Events

Localization of Lesions Along the Brain Surface

Participants
Thomas P. Naidich, MD, New York, NY (Presenter) Nothing to Disclose

Preoperative Diffusion Tensor Imaging: Toward Improving Neurosurgical Outcomes

Participants
John L. Ulmer, MD, Milwaukee, WI, (julmer@mcw.edu) (Presenter) Stockholder, Prism Clinical Imaging, Inc Medical Advisory Board, General Electric Company

LEARNING OBJECTIVES
1) To become familiar with DTI technique, visualization strategies, and limitations, as well as to identify strategies for defining spatial relationships between lesion borders and functional brain networks in order to guide Neurosurgical decision making.

ABSTRACT
Presurgical mapping has revolutionized the neurosurgical care of brain tumor patients. Maximizing resections more safely can improve the accuracy diagnosis, optimized treatment algorithms, and most importantly, decrease the incidence of devastating postoperative deficits associated with injury to functional brain networks. Presurgical mapping in tumor and epilepsy patients is clearly a multi-parameter process, but diffusion tensor imaging (DTI) has had the most significant impact in reducing postoperative neurological complications and warrants focus. At the same time, the technique is among the available, easy to acquire, and easily translatable to clinical practice. By understanding the DTI technique, data visualization methods, effects of pathological processes, and technical limitations, and combining the DTI data with expertise in functional white matter anatomy, physicians can create patient-specific neurosurgical plans that define spatial relationships between lesion borders and functional brain networks. This, in turn, can impact surgical decision making, guide intraoperative assessments, and improve post-operative outcomes. Through case illustrations, this presentation provides strategies to translate DTI and fiber tracking, with all of their limitations, to clinical presurgical brain mapping. The presentation emphasizes the emerging and powerful clinical application of pre-surgical DTI.

Identification of Eloquent Cortex Using BOLD FMRI

Participants
Jay J. Pillai, MD, Baltimore, MD (Presenter) Medical Advisory Board, Prism Clinical Imaging, Inc; Author with royalties, Springer Science+Business Media Deutschland GmbH; Author with royalties, Reed Elsevier

LEARNING OBJECTIVES
1) Understand the value of Blood Oxygen Level Dependent functional magnetic resonance imaging (BOLD fMRI) in presurgical mapping in patients with resectable brain lesions. 2) Describe the functional systems that can be reliably activated using BOLD fMRI in the clinical setting. 3) Appreciate the types of BOLD fMRI paradigms that are typically utilized for presurgical mapping.

ABSTRACT
This lecture will provide a basic overview of Blood Oxygen Level Dependent functional magnetic resonance imaging (BOLD fMRI) and how it can be used to effectively map eloquent cortex in various functional systems. Specifically, applications of BOLD fMRI to sensorimotor mapping, vision mapping as well as mapping of the language network will be described. The value that clinical BOLD fMRI has added to current state-of-the-art presurgical planning will be emphasized. In particular, the specific value that BOLD fMRI can add to standard structural brain MRI in the setting of resectable brain lesions such as brain tumors that distort classical
functional anatomic landmarks will be discussed.
**Head and Neck College Bowl! (An Interactive Session)**

Tuesday, Dec. 1 4:30PM - 6:00PM Location: E450B

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

**Participants**

C. Douglas Phillips, MD, New York, NY (Presenter) Stockholder, MedSolutions, Inc Consultant, Guerbet SA
Richard H. Wiggins III, MD, Salt Lake City, UT (Presenter) Nothing to Disclose
Lawrence E. Ginsberg, MD, Houston, TX (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review important head and neck imaging differentials. 2) Recognize imaging appearances of common head and neck pathologies. 3) Understand important head and neck pathologies relationships to normal anatomy. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

**ABSTRACT**

A fun and light-hearted review of important head and neck imaging anatomy and pathology important differentials. This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

**Honored Educators**

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Richard H. Wiggins III, MD - 2012 Honored Educator
Emergency Neuroradiology (An Interactive Session)

Tuesday, Dec. 1 4:30PM - 6:00PM Location: E353B

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC408A Imaging of Non-traumatic Intracranial Hemorrhage

Participants
Diego B. Nunez JR, MD, MPH, New Haven, CT, (diego.nunez@yale.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Differentiate the imaging patterns of non-traumatic intracranial hemorrhage on initial presentation. 2) Recognize opportunities for providing a more precise diagnosis based on the initial CT findings. 3) Define and recommend the best additional imaging approach for appropriate patient management.

RC408B Imaging of Spine Infection

Participants
Wayne S. Kubal, MD, Tucson, AZ (Presenter) Stockholder, Stryker Corporation; Stockholder, Sarepta Therapeutics Inc; Stockholder, CVS Health Corporation

LEARNING OBJECTIVES
1) Understand how pathophysiology and anatomy determine the imaging appearance of spine infection. 2) Critically assess which imaging options offer the greatest sensitivity for both initial diagnosis and post treatment assessment of spine infection. 3) Be able to differentiate spine infection from common mimics most notably degenerative disease.

RC408C Imaging of Cervical Spine Trauma

Participants
Stuart E. Mirvis, MD, Baltimore, MD (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Recognize circumstances in which MRI is indicated for blunt cervical spine trauma. 2) Be familiar with the spectrum of radiologic findings associated with atlanto-occipital dissociation injuries. 3) Understand similarity in appearance and methods to distinguish stable from unstable hyperflexion injuries. 4) Know association of cervical spine injury patterns with vertebral artery injury.

ABSTRACT

Honored Educators

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Stuart E. Mirvis, MD - 2015 Honored Educator
Ultrasound Elastography

Tuesday, Dec. 1 4:30PM - 6:00PM Location: S406B

GI GU HN NR US

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

LEARNING OBJECTIVES

1) Explain the difference between strain and shear wave elastography. 2) Understand the techniques to be able to perform thyroid ultrasound elastography. 3) Apply ultrasound elastography into routine clinical practice of thyroid nodules.

ABSTRACT

Thyroid nodules are very common and work-up of these nodules remains challenging. Fine needle aspiration has been the method of choice for diagnosing suspicious lesions with a sensitivity of 54%-90% and specificity of 60-96% for detection of malignant lesions. Malignant thyroid lesions are statistically stiffer than benign lesions. Ultrasound elastography can assess the stiffness of thyroid lesions. Several studies have been performed evaluating strain and shear wave elastography to characterize thyroid nodules. Strain elastography is qualitative while shear wave elastography is quantitative. These studies suggest that ultrasound elastography may improve sensitivity and specificity of characterizing thyroid lesions over B-mode imaging alone. There is a learning curve for performing adequate thyroid ultrasound elastography. Both cystic lesions and calcified lesions are difficult to evaluate with elastography. There is some overlap of stiffness values between benign and malignant thyroid nodules and elastography should not eliminate biopsy of suspicious lesions based on B-mode imaging. Stiff lesions on elastography should increase the suspicion for malignancy. This presentation will discuss the differences between strain and shear wave elastography, discuss technique and pitfalls in performing the examination, review the literature, and discuss published guidelines.

Participants

Nicolas Grenier, MD, Bordeaux CEDEX, France, (nicolas.grenier@chu-bordeaux.fr) (Presenter) Advisory Board, Supersonic Imagine; Travel support, Guerbet SA

LEARNING OBJECTIVES

1) To become familiar with the advantages and limits of the different elastography technologies applied to kidney. 2) To understand the factors affecting reliability and reproducibility of elasticity measurement within the kidney. 3) To learn about the intrarenal changes responsible for elasticity changes. 4) To learn about the clinical impact of elasticity measurement in renal parenchymal diseases. 5) To learn about the clinical impact of elasticity measurement in renal tumors.

ABSTRACT

Ultrasound elastography is a new imaging technique under development that provides information about renal stiffness. Kidney elasticity quantification with ultrasound should be better performed with a quantitative technique, based on shear wave velocity measurements (ARFI or SSI methods). Kidney stiffness changes can be affected by mechanical factors such as external pressure induced by the probe and intrarenal characteristics such as tissue anisotropy, which is high in renal medulla, vascularization, which is high within the cortex, and hydronephrosis. Chronic kidney disease (CKD) incidence and prevalence are increasing in Western countries, due particularly to diabetes mellitus and hypertension-related nephropathies. During progression of such renal parenchymal diseases, cellular density may increase, mainly during acute inflammatory phases, and the interstitial matrix may be invaded by fibrosis. All components of these tissue changes may induce an increase of renal elasticity which is not specifically related to fibrosis. Tubular, glomerular, interstitial and vascular changes may also be responsible for an increase of stiffness. This is why, further studies are now necessary before to understand the real impact of elastography measurement in clinical nephrology. Considering characterization of renal tumors with elastography, clinical experience is still limited. Preliminary results show that benign tumors seem to have lower values of elasticity than malignant ones, but, here too, more experience is also necessary.

Participants

Paul S. Sidhu, MRCP, FRCR, London, United Kingdom, (paulsidhu@nhs.net) (Presenter) Speaker, Bracco Group; Speaker, General Electric Company

LEARNING OBJECTIVES

1) To understand the concept of liver fibrosis grading and the implications for healthcare management. 2) To review the basis for the assessment of liver fibrosis using elastography, with emphasis on the different techniques. 3) To understand the differences in the techniques and the variability in measurement assessment. 4) To achieve an overview of the need and position of this technique in clinical care.
ABSTRACT

Liver fibrosis and cirrhosis from many causes is an important cause of long term morbidity and mortality. Most cases are a consequence of chronic viral disease (Hepatitis B and C) with alcoholic liver disease an important aetiological factor. The degree of liver fibrosis, and the presence of established cirrhosis confer different management strategies, with imaging playing an important role in the non-invasive assessment of patients with chronic liver disease. Fibrosis grading traditionally performed using the Metavir or Ishak scoring system is essentially a histological grading system. Ultimately the possibility to avoid a liver biopsy is the aim, if a non-invasive technique can stage the grade of fibrosis, establishing correct patient management. Liver ultrasound elastography is a developing technique that offers this possibility, with varying methods of assessment ranging from strain methods and shear wave methods. These techniques will be explained, the status of the current standing of the techniques will be summarised, and the level of technology offered by different machines will be reviewed. An overall summary of the current status and the implications for clinical practice will be discussed.
**Image-guided Stereotactic Body Radiotherapy (SBRT) for Spinal Metastases - Spinal Imaging, Target Delineation and Post-SBRT Response Evaluation**

Tuesday, Dec. 1 4:30PM - 6:00PM Location: S102C

**Overview of SBRT for Spinal Metastases**

Participants
Simon S. Lo, MD, Cleveland, OH (Simon.Lo@UHhospitals.org) (Moderator) Research support, Elekta AB;

**LEARNING OBJECTIVES**
1) To understand the basics of stereotactic body radiotherapy (SBRT) for spinal metastasis. 2) To know the basics of diagnostic imaging for spinal metastasis. 3) To learn the principles and methods of target delineation for SBRT for spinal metastasis. 4) To know the principles and methods of response evaluation after SBRT for spinal metastasis.

**ABSTRACT**
Stereotactic body radiotherapy (SBRT) has become an important treatment modality for spinal metastases in various settings. To facilitate safe and effective delivery of SBRT for spinal metastases, proper pre-SBRT evaluation including appropriate diagnostic imaging, and proper target delineation and contouring of organs-at-risk are necessary. The gold standard for post-SBRT response evaluation for spinal metastases is not well-defined and this is an emerging area of research interest. This refresher course will provide an overview of the spinal SBRT process, diagnostic imaging for spinal metastasis, target delineation for SBRT for spinal metastases, and post-SBRT response evaluation for spinal metastases.

**Sub-Events**

**RC420A**  
**Overview of SBRT for Spinal Metastases**

Participants
Simon S. Lo, MD, Cleveland, OH (Presenter) Research support, Elekta AB;

**LEARNING OBJECTIVES**
1) To know the indications for stereotactic body radiotherapy (SBRT) for spinal metastasis. 2) To know the technical aspects of SBRT for spinal metastasis. 3) To know the expected outcomes of SBRT for spinal metastasis. 4) To know the potential toxicities of SBRT for spinal metastasis.

**ABSTRACT**
This subsection will provide an overview of the indications, technical aspects, expected outcomes, and toxicities of stereotactic body radiotherapy (SBRT) for spinal metastasis.

**RC420B**  
**Pre-SBRT Imaging of Spinal Metastases**

Participants
Pejman Jabehdar Maralani, MD, FRCPC, Toronto, ON, (pejman.maralani@utoronto.ca) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
1) To understand the role of different imaging modalities in diagnosis of spinal metastasis. 2) To understand relevant imaging characteristics of spinal metastasis.

**ABSTRACT**
This section will provide an overview of multiple imaging modalities used for diagnosis and treatment planning of spinal metastasis.

**Active Handout:**Pejman Jabehdar Maralani

**RC420C**  
**Target Delineation of Spinal Metastases**

Participants
Kristin J. Redmond, MD, MPH, Baltimore, MD (Presenter) Research support, Elekta AB

**LEARNING OBJECTIVES**
1) To understand target and normal tissue delineation for patients receiving SBRT for malignant spinal metastases.

**ABSTRACT**
The purpose of this section will be to review principles involved with target and normal tissue delineation in patients being treated with SBRT for malignant spinal metastasis. This will include review of both current consensus guidelines as well as areas of controversy.

**Active Handout:**Kristin Janson Redmond
Participants
Arjun Sahgal, Toronto, ON, (arjun.sahgal@sunnybrook.ca) (Presenter) Speaker, Medtronic, Inc; Speaker, Elekta AB; Medical Advisory Board, Varian Medical Systems, Inc; Speaker, Accuray Incorporated; Research Grant, Elekta AB

LEARNING OBJECTIVES
1) To understand the challenges of post-spine SBRT response assessment. 2) To understand the current state of response criteria consensus.

ABSTRACT
The aim of this presentation is to highlight the challenges of post spine SBRT response assessment, and current consensus work to standardize imaging and evaluation.
Nerve Ultrasound Based on a Regional Approach: Elbow to Hand (Hands-on)

Tuesday, Dec. 1 4:30PM - 6:00PM Location: E264

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Carlo Martinoli, MD, Genova, Italy, (carlo.martinoli@unige.it) (Moderator) Nothing to Disclose
J. Antonio Bouffard, MD, Detroit, MI (Presenter) Nothing to Disclose
Catherine J. Brandon, MD, Ann Arbor, MI (Presenter) Stock options, VuCOMP, Inc
Mary M. Chiavaras, MD, PhD, Ancaster, ON (Presenter) Nothing to Disclose
Joseph G. Craig, MD, Detroit, MI (Presenter) Nothing to Disclose
Michael A. Dipietro, MD, Ann Arbor, MI (Presenter) Nothing to Disclose
David P. Fessell, MD, Ann Arbor, MI (Presenter) Nothing to Disclose
Ghiyath Habra, MD, Royal oak, MI (Presenter) Nothing to Disclose
Marnix T. van Holsbeeck, MD, Detroit, MI, (marnix@rad.hfh.edu) (Presenter) Consultant, General Electric Company Consultant, Koninklijke Philips NV Stockholder, Koninklijke Philips NV Stockholder, General Electric Company Grant, Siemens AG Grant, General Electric Company
Rachel B. Hulen, MD, Novi, MI (Presenter) Nothing to Disclose
Marina Kislyakova, MD, Moscow, Russia, (mki@mi.ki.ru) (Presenter) Nothing to Disclose
Joseph H. Introcaso, MD, Neenah, WI (Presenter) Nothing to Disclose
Jon A. Jacobson, MD, Ann Arbor, MI (Presenter) Consultant, BioClinica, Inc; Royalties, Reed Elsevier; ;
Kenneth S. Lee, MD, Madison, WI (Presenter) Research Consultant, SuperSonic Imagine; Consultant, Echometrix, LLC; Royalties, Reed Elsevier
Humberto G. Rosas, MD, Madison, WI (Presenter) Nothing to Disclose
Matthieu Rutten, MD, Hertogenbosch, Netherlands (Presenter) Nothing to Disclose
Courtney E. Scher, DO, Detroit, MI (Presenter) Nothing to Disclose
Alberto S. Tagliafico, MD, Genova, Italy (Presenter) Nothing to Disclose
Ximena L. Wortsman, MD, Santiago, Chile, (xworts@yahoo.com) (Presenter) Nothing to Disclose
Andrea Klauser, MD, Innsbruck, Austria (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Familiarize course participants with the ultrasound appearance of nerves and the scanning techniques used to image them in the distal upper extremity.
2) Emphasize the ultrasound anatomy of the median, ulnar, radial nerves and their divisional branches at the most common sites of entrapments, including the carpal tunnel and the cubital tunnel.
3) Learn the technique to image some minor nerves in their course throughout the distal upper extremity, such as the the lateral and the medial antebrachial cutaneous.
4) Outline the range of clinical conditions where ultrasound is appropriate as the primary imaging modality for nerve assessment.

ABSTRACT

In recent years, ultrasound of the musculoskeletal and peripheral nervous systems is becoming an increasingly imaging tool with an expanding evidence base to support its use. However, the operator dependent nature and level of technical expertise required to perform an adequate ultrasound assessment means that appropriate training is required. For this purpose, the present course will demonstrate the basic principles of musculoskeletal ultrasound with a special focus on nerves of the distal upper extremity (elbow to hand). The standardized techniques of performing an adequate ultrasound study of the median, ulnar, radial and their divisional branches, lateral cutaneous of the forearm and medial cutaneous of the arm and the forearm will be illustrated. The hands-on workshops will provide the opportunity to interactively discuss the role of ultrasound in this field with expert instructors. Participants will be encouraged to directly scan model patients. A careful ultrasound approach with thorough understanding of soft-tissue planes and extensive familiarity with anatomy are prerequisites for obtaining reliable information regarding the affected structure and the site and nature of the disease process affecting it.

Honored Educators

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Jon A. Jacobson, MD - 2012 Honored Educator
LEARNING OBJECTIVES

1) Define normal anatomy in the CNS. 2) Define and contour the GTV/CTV for Glioma. 3) Define and contour the GTV/CTV for CNS tumors.

ABSTRACT

The safe and successful treatment of brain tumors is depending upon accurately and reliability being able to identify normal CNS anatomy, and regions of gross tumor and regions at risk. This course will teach participants to identify normal anatomy and define the GTV and CTV for brain tumors.
Participants
Thiru A. Sudarshan, DMRD, FRCR, Dundee, United Kingdom (Presenter) Nothing to Disclose
Avinash K. Kanodia, MD, Perth, United Kingdom (Abstract Co-Author) Nothing to Disclose
Jonathan Weir-McCall, MBCh, FRCR, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose
Anu Kamalasanan, MBBS, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose
Bangalore Anil Kumar, MD, FRCR, Slough, United Kingdom (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1.) Review the diagnosis of a specific condition by using either a single-modality or multimodality approach. 2.) Identify state-of-the-art imaging and methods of treatment for various pathologic conditions. 3.) Assess new research on applications of various imaging and therapeutic modalities.
LEARNING OBJECTIVES
1) To be familiar with traumatic brain injury demographics and classification schemes. 2) Be able to apply appropriateness criteria for head trauma imaging in children and adults. 3) Identify key imaging patterns and pitfalls in the evaluation of brain and neurovascular trauma.

ABSTRACT
This lecture on CNS Trauma and Neurovascular Injury is divided into 4 parts: Part 1 will briefly review traumatic brain injury (TBI) demographics and the most common TBI classification schemes; Part 2 will discuss the current imaging approach to acute TBI in clinical practice. Part 3 will illustrate the imaging manifestations of the different injuries located in the extra-axial space (e.g., scalp and skull injury; epidural, subdural, subarachnoid and intraventricular collections), and the intra-axial space (e.g., dysautoregulation, contusion, hematoma, penetrating TBI, axonal injury, fat emboli). Part 4 will review traumatic neurovascular injuries and fracture patterns correlated with high risk of vascular injury.

LEARNING OBJECTIVES
1) To know the modalities (CT/MRI) and protocols for non-traumatic neurological emergencies. 2) To know and diagnose the main non-traumatic neurological vascular and non-vascular emergencies. 3) To be aware of the pitfalls and limitations of clinical presentation and imaging findings in non-traumatic neurological emergencies.

ABSTRACT
Neurological emergencies are often associated with high morbidity and mortality, and thus require prompt diagnostic and therapeutic action. Non-traumatic emergencies may however have a subacute onset, and radiological signs may be subtle, which can lead to delay in diagnosis and treatment. Since clinical features are often nonspecific, the radiologist may be the first to point the clinician in the direction of the correct diagnosis. It is therefore of great importance that the radiologist is aware of and familiar with the various imaging findings, on both computed tomography (CT) and magnetic resonance imaging (MRI), of non-traumatic neurological emergencies. These include vascular, infectious and inflammatory diseases. Commonly encountered emergencies are ischaemic and haemorrhage stroke, venous thrombosis, arterial dissection, abscess, acute disseminated encephalomyelitis (ADEM), and encephalitis. Radiological findings in rarer diseases may mimic those in the more commonly occurring diseases, but need to be correctly interpreted as therapeutic strategies and prognosis may be entirely different. Such entities include for instance posterior reversible encephalopathy syndrome (PRES), reversible cerebral vasoconstriction syndrome, Susac's syndrome, and status epilepticus. Furthermore, initial findings of (impending) complications of brain disease, such as hydrocephalus and herniation of brain structures, may be subtle, while early recognition allows for prompt and adequate intervention. Finally, diagnostic and therapeutic interventions performed in an emergency setting may interfere with the diagnosis and interpretation of clinical and imaging findings. Associated limitations and pitfalls therefore need to be recognised to avoid false negative or false positive diagnosis respectively.

LEARNING OBJECTIVES
1) To review traumatic brain injury (TBI) and non-traumatic neurological emergencies. 2) To describe imaging manifestations of TBI and non-traumatic neurological emergencies. 3) To understand the clinical implications of radiological imaging findings in TBI and
non-traumatic neurological emergencies. 4) To know the state-of-the-art radiological imaging options for the assessment of acute TBI and non-traumatic neurological emergencies.

ABSTRACT

This interactive case discussion builds on the two previous lectures in this session, on traumatic and non-traumatic neurological emergencies respectively. Both lecturers will take the audience through several clinical cases, highlighting and emphasizing important issues from their lectures, such that the previously presented theory is placed in a clinical context. Preferably, the participants will have attended the two prior lectures, to optimally benefit from and participate in this interactive case discussion.
PURPOSE
Clinical care and outcome in Glioblastoma (GBM) remains challenging due to the tumor's invasive growth. To establish personalized treatment options in GBM, discovery of genetic mechanisms essential for the tumor's invasion is needed. We have previously described radiogenomic approaches to diagnose gene networks non-invasively by analyzing genomic data from TCGA. The purpose of the current research is to identify a genetic network that drives GBM invasion and can be targeted specifically.

METHOD AND MATERIALS
Using Kaplan-Meier statistics, the data of the two independent databases TCGA and REMBRANDT were used to validate the genetic network's impact on clinical outcome. The genes' status was assessed in a panel of human glioma stem cells (GSCs) and conventional proneural, classical and mesenchymal GBM cell lines using RT-PCR. Differentiation potential (Tuj1+ve, S100A+ve, and GFAP+ve), self-renewal (limiting dilution assays), invasion (Boyden chamber) and proliferation (BrdU) were assessed. Gain (lentiviral vectors) and loss (SMARTchoice Inducible shRNA) of function experiments were performed. Orthotopic xenograft models (nude mice) were used to characterize the genes impact in vivo. Potential FDA approved therapeutics were identified using connectivity map.

RESULTS
Texture analysis based on radiogenomics significantly predicted the genes responsible for invasion of GBM in a non-invasive manner. Invasion in both, in vitro and in vivo was significantly decreased upon downregulation of this gene network. Transcriptome microarray analysis showed that an upregulation of the described genes results in class switching from proneural to mesenchymal subtypes. Cmap derived therapeutics could significantly inhibit the gene network's activity and hence invasion.

CONCLUSION
The described genes could be essential drivers of molecular subtypes and invasion in GBM. The therapeutics defined with cmap offer a targeted therapy to address these key features of GBM pathogenesis. Noninvasive radiogenomics-based identification of tumor subgroups and potential treatment approaches can significantly contribute to personalized therapy.

CLINICAL RELEVANCE/APPLICATION
The described gene network seems to be key for GBM pathogenesis. Noninvasive, radiogenomics-based subgroup identification and specific novel treatment approaches can significantly contribute to personalized GBM therapy.
recently-described, aggressive subtype of LGG that is characterized by an absence of all three of these genetic alterations. The absence of IDH1/2 mutation or 1p19q deletion have been identified improve their characterization is with molecular biomarkers: P53, IDH 1/2, and 1p19q. These objective markers correlate with low-grade gliomas (LGGs) are a heterogeneous group of tumors with distinct clinical behavior and prognosis. One strategy to

PURPOSE

To investigate relationships between imaging phenotype and genetic classification of LGGs in the TCGA/TCIA database, we analyzed semi-quantitative MR features and IDH/1p19q classifications.

METHOD AND MATERIALS

Pre-operative MRIs of 72 TCGA/TCIA LGGs were reviewed by 3 neuroradiologists blinded to molecular status, using the VASARI LGG feature-set (standardized set of 26 MRI features). Data were compiled across 3 readers to define a single measure per sample. Clinical and molecular classifications were obtained from the LGG-AWG marker paper (TCGA Research Network.NEJM;2015, in press). Associations with histology, WHO grade and molecular type were assessed by Fisher’s exact test (categorical features) and ANOVA/t-test (continuous features).

RESULTS

Of 70 tumors with IDH/1p19q classification, 16 were IDHmut-codel, 34 were IDHmut-non-codel, and 19 were IDHwt. IDHmut-codel tumors were preferentially centered in the frontal lobes (75%, FET p=0.026). IDHmut-non-codel tumors tended to arise in frontal (41%) and temporal lobes (41%), while IDHwt tumors did not show preference. Nonenhancing tumor margins were more well-defined for IDHmut LGGs (56% and 76%) were well-defined (32%, FET p=0.027). 66% of LGGs had an enhancing region, but this was not associated with molecular class (FET p=0.286), although enhancement was more likely in grade III than grade II (FET, p=0.043). 23% of these grade II/III tumors had MRI evidence of necrosis, with presence equally likely in any of the 3 molecular classes (FET p=0.931); however, 5/16 (31%) of LGGs with necrosis on MRI were grade II. IDHwt tumors tended to be smaller than IDHmut tumors (23.0 cm2 vs 39.7cm2, respectively, for maximal area, t-test p<0.001). Further differences were found in T1/FLAIR ratio (FET p=0.030), T2/FLAIR signal crossing the midline (FET p=0.007), and presence of hemorrhage (FET p=0.009), cysts (FET p=0.006), or satellites (FET p=0.030).

CONCLUSION

Review showed differential MR features between LGG molecular classes. IDHwt LGGs had association with aggressive features (e.g., small dimension with poorly-defined non-contrast-enhanced borders). Lack of association with necrosis or presence of an enhancing region suggests that the IDHwt class is not simply underdiagnosed GBM. An investigation of imaging profiles that align with molecular type or define further subclasses is underway.

CLINICAL RELEVANCE/APPLICATION

Differential MR features exist between LGG molecular classes.

HONORED EDUCATORS

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Daniel L. Rubin, MD, MS - 2012 Honored Educator
Daniel L. Rubin, MD, MS - 2013 Honored Educator

RC505-05 The Triple-Negative Low-Grade Glioma: MR Imaging Correlates of Aggressive Molecular Phenotype

Wednesday, Dec. 2 9:25AM - 9:35AM Location: E451A

Participants

Javier Villanueva Meyer, MD, San Francisco, CA (Presenter) Nothing to Disclose
Byung Se Choi, MD, Seongnam-Si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Matthew Wood, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Tarik Tihan, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Soonmee Cha, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose

PURPOSE

Low-grade gliomas (LGGs) are a heterogeneous group of tumors with distinct clinical behavior and prognosis. One strategy to improve their characterization is with molecular biomarkers: P53, IDH 1/2, and 1p19q. These objective markers correlate with histologic classification and clinical outcomes. Specifically, the absence of IDH1/2 mutation or 1p19q deletion have been identified as indicative of a poor prognosis. The purpose of our study was to determine MR imaging parameters that can discriminate a, recently-described, aggressive subtype of LGG that is characterized by an absence of all three of these genetic alterations.
A retrospective review of our medical records from 2010 to 2014 yielded 105 cases of pathologically-confirmed LGG that had molecular testing for P53 mutation, IDH1/2 mutation, and 1p/19q deletion. The MR imaging characteristics including tumor location, volume, infiltration pattern, cortical involvement, hemorrhage, contrast-enhancement, and quantitative diffusion and perfusion were assessed. Additionally, clinical data of patient treatment, disease course, and survival was collected.

RESULTS

There were 24 diffuse astrocytomas (23%), 36 oligoastrocytomas (34%) and 45 oligodendrogliomas (43%). P53 mutation was found in 21 (20%), IDH1/2 mutation was found in 70 (67%), and 1p19q deletion was found in 45 (43%). Thirteen cases (12%) did not have any of these genetic alterations. Triple-negative tumors showed a lower incidence of cortical involvement (p<0.05) and lower mean and minimum apparent diffusion coefficient (ADC) values (1.25 vs 1.45x10^-3 mm^2/s; 0.89 vs 1.09x10^-3 mm^2/s, p<0.01). Multiple logistic regression analysis showed low ADC value as an independent predictor of triple-negative LGG. With a cut-off of 1.0x10^-3 mm^2/s, ADC value provides a 73% sensitivity and a 72% specificity with an odds ratio of 7.0 (p<0.01). In cases with available clinical follow-up, triple-negative LGGs were found to have disease progression within 2 years in 50% compared to 16% in the non-triple-negative cohort.

CONCLUSION

Triple-negative LGGs are a clinically and biologically aggressive phenotype that exhibit lower mean ADC values and lack of cortical involvement on MR imaging.

CLINICAL RELEVANCE/APPLICATION

MR imaging features can be used alongside molecular biomarkers to assess the aggressiveness and prognosis of LGGs and subsequently may provide a means of guiding management as patient-tailored therapy.

PURPOSE

Based on T1 shortening on noncontrast MR, recent studies have suggested that small amounts of gadolinium(Gd) may accumulate in brain even in patients with normal renal function. Recently McDonald confirmed Gd deposition in postmortem human brain tissue. To date, studies have shown Gd brain deposition only with Group 1 linear agents. The purpose of this study was to determine whether Gd is deposited in brain among patients receiving more stable macrocyclic agents using postmortem tissue analysis with inductively coupled plasma mass spectrometry (ICP-MS).

METHOD AND MATERIALS

This study was approved by the IRB. Brain tissue was collected at autopsy from decedents with available medical records that document past history of MRS with or without GBCA exposure. Decedents with no prior MRI or only nonGd MRI served as controls. Tissue samples were collected from white matter, putamen, globus pallidus, caudate nucleus, pons and dentate nucleus and analyzed for Gd using ICP-MS. Bone tissue from rib was also analyzed as a reference tissue in each case. Results were correlated with types of agent received, cumulative dose, time since dosing and clinical and laboratory data.

RESULTS

Among 21 cases obtained to date, 15 cases with normal renal function received 1 or more GBCA exposures and 6 cases had no exposure. ICP-MS showed measurable amounts of Gd deposition (range 0.003-3.54ng/mg) in all 15 cases receiving GBCA.A subset of these ,4 cases received only a macrocyclic GBCA(1 Gadavist ; 3 ProHance) with doses ranging from 10 to 126 ml and Gd was also detected in all macrocyclic cases (0.006-0.188 ng/mg). Gd in brain was detected after only a single dose and deposition was shown among all brain regions sampled. Gd deposition in rib was also positive in all 15 cases and showed significantly higher levels than brain in each case. By comparison there was no detectable Gd in any control cases.

CONCLUSION

Gd deposition occurs in normal brain tissue in patients with normal renal function with a past history of GBCA exposure even in those receiving only macrocyclic agents. The clinical significance remains undetermined and we are pursuing further investigation.

Handout: Nozomu Murata


RC505-07 Post-therapy Brain Tumors: Imaging Pitfalls and Strategy

Participants
A Multiparametric Voxel-level Model for Prediction of Cellularity in Glioblastoma

**PURPOSE**

To create a robust multiparametric model for prediction of cellular density in glioblastoma (GBM) using voxel-by-voxel analysis of T1W-postcontrast, FLAIR and ADC intensity values calibrated to biopsy-proven histopathologic data.

**METHOD AND MATERIALS**

As part of an IRB-approved protocol, MR-localized biopsies of GBM patients were obtained from both contrast-enhancing tumor (CE) and nonenhancing (nCE) peritumoral edema using Brainlab referenced to T1W-postcontrast images. Total cell counts were obtained after H&E slide preparation scanned at 400x magnification. FLAIR and ADC data were interpolated and coregistered to the reference T1W volume using affine transformation and a mutual information cost function. For each biopsy site, corresponding mean intensity was obtained on T1W-postcontrast, FLAIR and ADC sequences. Univariate linear regression was used to determine correlation between cell count and intensity for each MR sequence. Two multivariate linear regression models, one each for CE and nCE regions, were used to combine data from each MR sequence into a robust model for tumor cellularity.

**RESULTS**

A total of 58 biopsy sites were obtained. Overall, cellularity demonstrated moderate linear correlation with T1W-postcontrast ($r = 0.76$), FLAIR ($r = 0.62$) and ADC ($r = 0.64$, within nCE region only). Multiple linear regression combining all three variables yielded a model highly predictive of cellularity, both within the nCE ($r = 0.93$) and CE ($r = 0.76$) region. Within the nCE region, the model weighted ADC ($p = 0.0072$) and FLAIR ($p = 0.058$) more significantly than T1W ($p = 0.83$), as determined by analysis of variance (ANOVA). Within the CE region, T1W ($p < 0.001$) and FLAIR ($p = 0.12$) were weighted more significantly than ADC ($p = 0.21$).

**CONCLUSION**

A multiparametric model combining T1W-postcontrast, FLAIR and ADC values strongly predicts cell counts in GBM, notably with correlation >90% in the nCE region. By applying this model at each voxel within the tumor volume, a noninvasive map of cellular density can be generated.

**CLINICAL RELEVANCE/APPLICATION**

Cellularity maps of the peritumoral region in GBM localize tumor microinvasion and may be used as a tool to guide extended surgical resection or biopsy and to assess infiltrative tumor burden.

**RC505-11**  **Receiver Operating Characteristic (ROC) and Logistic Fit Analysis for Detecting Brain Tumor Based on OEF Measurements Obtain by PET and MR**

**Wednesday, Dec. 2 11:15AM - 11:25AM Location: E451A**

Participants

Parinaz Massoumzadeh, PhD, Saint Louis, MO (Presenter) Nothing to Disclose
Jonathan E. McConathy, MD, PhD, Saint Louis, MO (Abstract Co-Author) Research Consultant, Eli Lilly and Company; Research Consultant, Blue Earth Diagnostics Ltd; Research Consultant, Siemens AG; Research support, GlaxoSmithKline plc
Andrei Vlassenko, MD, PhD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Yi Su, PhD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Hongyu An, DSc, Chapel Hill, NC (Abstract Co-Author) Nothing to Disclose
Charles F. Hildebolt, DDS, PhD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Daniel S. Marcus, PhD, Saint Louis, MO (Abstract Co-Author) Owner, Radiologics, Inc
Keith M. Rich, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Tamme S. Benzinger, MD, Saint Louis, MO (Abstract Co-Author) Research Grant, Eli Lilly and Company; Investigator, Eli Lilly and Company; Investigator, F. Hoffmann-La Roche Ltd;

**PURPOSE**

To determine the optimal balance of sensitivity and specificity in detecting brain tumors using OEF. To quantitatively assess the OEF changes using ROC and logistic fit analysis.
Receive operating characteristic (ROC) curve and logistic fit analysis for detecting brain tumors using cerebral oxygen extraction fraction (OEF) measurement obtained by [15]O positron emission tomography (PET) and oxygen sensitive magnetic resonance (MR) imaging.

METHOD AND MATERIALS

30 participants (20 with brain tumors) were recruited. MRI included standard clinical sequences plus OEF-MRI; a two-dimensional multi-echo gradient spin echo sequence. Concurrent with the MR acquisition, subjects with brain tumors underwent PET scanning, which included 2 sets of 3 scans with serial inhalation of air with 40-75 mCi [15]O labeled carbon monoxide, 40-75 mCi [15]O labeled oxygen, and injection of 25-50 mCi [15]O labeled water. MR and PET data were post-processed off line and registered to the anatomic T1 pre- and post-contrast images. Regions of interest were drawn based upon contrast-enhancing tumor areas, contra-lateral normal white matter (NWM), and normal gray matter (NGM). Ratios of OEF were obtained for lesions compared to normal tissue. Statistical analyses, including Bland-Altman plot, ROC, and logistic fit, were performed.

RESULTS

Bivariate analyses results are: between rOEF-PET measurements of all selected regions R=0.92 and P <0.0001, and tumor type R=0.68 and P<0.0001; and similarly between rOEF-MR and rOEF-PET all selected regions R=0.3 and P <0.0413, and tumor type R=0.39 and P<0.173. Based on Bland-Altman analysis both MR and PET methods of obtaining OEF are in agreement (the measurements lie within range ±1.96xSD). However, the coefficient obtain for rOEF-MR covers much larger range which may not be not be clinically acceptable. Area under ROC curve (AUC) has much higher value for PET (0.95) than MR (0.58).

CONCLUSION

Both MR and [15]O PET can measure OEF in brain tumors and in peritumoral edema. Variable OEF measurements in tumor and edema may be implication for tumor grade and prognosis. BOLD MR fails in regions with signal loss on SWI or T2*. Area under ROC Curve (AUC) has much higher value for PET (0.95) than MR (0.58). Based on logistic fit probability of distinguishing tumor with PET is much higher than MR.

CLINICAL RELEVANCE/APPLICATION

Both MR and PET techniques have tremendous potential and may offer new insights into the underlying physiology of brain tumors and their response to therapy without requiring radiation or injected contrast. BOLD MR fails in regions with signal loss on SWI or T2*.

RC505-12 What Does the Black Box Tell us? Risk and Benefit of Ferumoxytol as an MRI Contrast Agent

Wednesday, Dec. 2 11:25AM - 11:35AM Location: E451A

Participants
Csanad G. Varallyay, MD, PhD, Portland, OR (Presenter) Nothing to Disclose
Rochelle Fu, Portland, OR (Abstract Co-Author) Nothing to Disclose
Joao Prola Netto, MD, Portland, OR (Abstract Co-Author) Nothing to Disclose
Edward Neuwelt, MD, Portland, OR (Abstract Co-Author) Nothing to Disclose

PURPOSE

Ferumoxytol, an ultrasmall iron oxide nanoparticle (USPIO) has been marketed as Feraheme® for iron replacement therapy in patients with chronic kidney disease. Due to its magnetic properties, and long plasma half-life, ferumoxytol uniquely allows MR imaging of the intravascular space early after injection, which is beneficial for high-resolution blood volume mapping of brain lesions. Delayed (24h) ferumoxytol enhancement may help in differential diagnosis. As of March 30, 2015, the FDA added a boxed warning to Feraheme® package insert, which strengthens existing warnings regarding potential fatal and serious hypersensitivity reactions including anaphylaxis, even in patients who received Feraheme® previously. It emphasizes the importance of trained personnel, monitoring at least 30 min post injection to properly treat hypersensitivity reactions.

METHOD AND MATERIALS

Our institution has been actively doing imaging research with ferumoxytol for over 10 years. In this study we evaluated early adverse events (occurring within 1 day), potentially related to ferumoxytol administration hypersensitivity, and qualitatively compared it with published data.

RESULTS

At the time writing this abstract we have analyzed a total of 553 ferumoxytol infusions in 298 patients and have not recorded any severe (grade 3, 4 or 5) hypersensitivity reactions occurring within 1 day. Early grade 1 and 2 reactions, were present, such as nausea/vomiting (5.1%), hypertension (3.3%), pruritus (1.3%). In published data, the frequency of severe hypersensitivity of Feraheme® was equivalent to ionic iodinated contrast media, and about 10x higher than gadolinium MR contrast agents and nonionic iodinated contrast agents.

CONCLUSION

Our results suggest less frequent severe hypersensitivity reactions compared to published data, and it may be due to the difference in patient population. A detailed toxicity evaluation of our data is in progress. The intended purpose of change in labeling by the addition of the boxed warning is to strengthen the warnings in the label and to mitigate the risk of serious hypersensitivity reactions including anaphylaxis in order to enhance patient safety.

CLINICAL RELEVANCE/APPLICATION

Ferumoxytol remains safe for MRI in the vast majority of patients, with a very small risk of serious adverse event, and personnel should be prepared to treat such reactions if they were to occur.

RC505-13 Moving Towards Quantitative Brain Tumor Imaging

Wednesday, Dec. 2 11:35AM - 12:00PM Location: E451A

Participants
Thomas L. Chenevert, PhD, Ann Arbor, MI (Presenter) Consultant, Koninklijke Philips NV
**Sinonasal and Orbital Imaging**

**Participants**

**Sub-Events**

**RC506A**  
**Sinonasal Inflammatory Disease**

Participants  
Rebecca S. Cornelius, MD, Cincinnati, OH (Presenter) Stockholder, Gilead Sciences, Inc; Stockholder, HCP, Inc; Stockholder, CVS Health Corporation; Stockholder, 3M Company; Spouse, Stockholder, Gilead Sciences, Inc; Spouse, Stockholder, HCP, Inc; Spouse, Stockholder, CVS Health Corporation; Spouse, Stockholder, 3M Company; Spouse, Stockholder, Celgene Corporation; Spouse, Stockholder, E. I. du Pont de Nemours & Company

**LEARNING OBJECTIVES**

1) Recognize imaging findings in chronic rhinosinusitis. 2) Recognize imaging findings of orbital and intracranial complications of sinonasal inflammatory disease. 3) Differentiate between types of fungal sinus disease.

**Active Handout:** Rebecca Sue Cornelius  

**RC506B**  
**Sinonasal Tumors**

Participants  
Ilona M. Schmalfuss, MD, Gainesville, FL (schmai@radiology.ufl.edu) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe differentiating imaging features between the different sinonasal tumors. 2) Discuss extension patterns of sinonasal malignancies. 3) Outline critical areas of involvement that impact treatment of sinonasal tumors.

**RC506C**  
**Orbital Differential Diagnosis**

Participants  
Michelle A. Michel, MD, Milwaukee, WI (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Recommend optimal imaging modality for evaluating diverse pathology of orbit. 2) Discuss approach to orbital lesion diagnosis based upon patterns of disease, patient demographics, and presenting symptoms. 3) Recognize orbital pathologies occurring in key differential diagnoses.

**ABSTRACT**

Sinonasal Inflammatory DiseaseRhinosinusitis is one of the most commonly diagnosed diseases in the United States, affecting >16% of the US population annually. There are acute, subacute and chronic forms defined by duration. Imaging is indicated in patients with chronic disease. Complications of rhinosinusitis include spread into adjacent superficial tissues, orbital extension and intracranial extension. Types of sinusitis will be defined, characteristics of chronic disease and fungal disease discussed and imaging examples of complications reviewed.Sinonasal TumorsSinonasal tumors (benign and malignant) present with non-specific symptoms such as nasal obstruction or drainage, leading to work up with CT. Associated facial, oral, ocular, or central nervous system symptoms should raise the concern for an advanced, often malignant tumor and evaluated with MRI. Distinguishing imaging features will be presented for the different sinonasal tumors to facilitate the correct diagnosis, prevent complications, determine the extent of the tumor, and provide accurate staging for optimal treatment planning purposes and improved patient prognosis.Orbital Differential DiagnosisOrbital pathology is diverse and lesions can appear similar on imaging. There are differential diagnoses (DDx) to understand that aid in making an accurate diagnosis. Clinical information should also be correlated with imaging findings. The DDx's that will be discussed include: intraocular lesions, ocular calcification, optic nerve/sheath complex lesions, intraconal lesions, extraconal lesions, extraocular muscle enlargement, infiltrative lesions, and lacrimal gland lesions. Although there are a large number of pathologies that can affect the orbit, knowledge of these key differential diagnoses, patterns of disease, and clinical features can be very helpful to the imager in distinguishing these lesions.

**Active Handout:** Michelle A. Michel  
**RC522**

**Personalized Medicine: Head and Neck**

Wednesday, Dec. 2 8:30AM - 10:00AM Location: S102D

**Participants**
Kristy K. Brock, PhD, Ann Arbor, MI (Moderator) License agreement, RaySearch Laboratories AB;

**ABSTRACT**

**Sub-Events**

**RC522A IGRT and Anatomical Adaptation**

Participants
Emilie Soisson, PhD, Montreal, QC (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe the evolution of adaptive radiotherapy and relevant technological advances as they pertain to head and neck radiotherapy. 2) Understand the clinical rational for of plan adaptation in the head and neck patient population. 3) Describe possible routes to clinical implementation. 4) Discuss risks associated with adaptive planning workflows and appropriate quality assurance.

**ABSTRACT**

This session will focus on the practical implementation of adaptive radiotherapy for head and neck cancer. Although the concept of adaptive radiation therapy (ART) has been around for more than two decades, routine plan adaptation has not become standard practice in the management of head and neck cancer despite huge technological advances in imaging, image registration software, and dose calculation speed. The remaining challenges in implementing ART for head and neck cancer in 2015 as well as an update of the demonstrated clinical need will be discussed. Features of successful adaptive radiotherapy implementations will be highlighted as well as a summary of useful clinical tools and required quality assurance.

**RC522B Functional Targeting and Adaptation**

Participants
Robert Jeraj, Madison, WI (Presenter) Founder, AIQ Services

**LEARNING OBJECTIVES**

1) To learn about appropriate anatomical and imaging modalities for selection and delineation of target volumes in HN. 2) To learn about biologically conformal approaches (dose painting) in HN. 3) To learn about quantitative imaging requirements for RT in HN.

**ABSTRACT**

Anatomical and molecular imaging is used to tailor radiation treatment by enabling proper selection and delineation of target volumes and organs, which in turn lead to dose prescriptions that take into account the underlying tumor biology. Dose modulation to different parts of target volume may also be used to match variable tumor radiosensitivity (so-called biologically conformal radiotherapy or dose-painting). For accurate implementation of targeted and adaptive IMRT, tools and procedures, such as accurate image acquisition and reconstruction, automatic segmentation of target volumes and organs at risk, non-rigid image and dose registration, and dose summation methods, need to be developed and properly validated.
Case-based Review of Pediatric Radiology (An Interactive Session)

Wednesday, Dec. 2 10:30AM - 12:00PM Location: S405A

NR  NM  ER  PD

AMa PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Sudha A. Anupindi, MD, Philadelphia, PA (Director) Nothing to Disclose

LEARNING OBJECTIVES
1) To apply a systematic approach in the evaluation of pediatric diseases. 2) To identify essential imaging features of various pediatric congenital, musculoskeletal, abdominal and neurological diseases using a multimodality approach. 3) To understand and develop best imaging practice for various pediatric diseases.

ABSTRACT
To apply a systematic approach in the evaluation of pediatric diseases To identify essential imaging features of various pediatric congenital, musculoskeletal, abdominal and neurological diseases using a multimodality approach To understand and develop best imaging practice for various pediatric diseases

Sub-Events

MSCP42A  Pediatric Brain Abnormalities

Participants
Manohar M. Shroff, MD, Toronto, ON, (manohar.shroff@sickkids.ca) (Presenter) Consultant, Guerbet SA; Consultant, Magellan Health, Inc

LEARNING OBJECTIVES
View learning objectives under main course title.

MSCP42B  Pediatric Sport Injuries

Participants
Kirsten Ecklund, MD, Boston, MA, (kirsten.ecklund@childrens.harvard.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

MSCP42C  Pediatric Nuclear Medicine Cases

Participants
Ruth Lim, MD, Boston, MA (Presenter) Consultant, Alexion Pharmaceuticals, Inc; Officer, New England PET Imaging System

LEARNING OBJECTIVES
View learning objectives under main course title.
PURPOSE
Numerous neuroimaging studies have reported impaired white matter (WM) integrity in patients with major depressive disorder (MDD). However, due to inclusion of medicated patients, it is difficult to conclude whether the alterations observed in previous meta-analyses of diffusion tensor imaging studies were related to the disease itself. The present study was to provide a quantitative voxel-wise meta-analysis of WM alterations in medication-free MDD patients excluding interference from medication effects.

METHOD AND MATERIALS
A systematic search was conducted for the relevant studies. Anisotropic Effect Size version of Signed Differential Mapping (AES-SDM) was applied to analyse the WM alterations between medication-free MDD patients and healthy controls. Two subgroup analyses were separately conducted in medication wash-out patients and medication-naive patients. DTIquery software was used for fibre tracking.

RESULTS
15 primary studies comprising 434 MDD subjects (251 female; mean age 34 years) matched with 429 healthy controls (233 female; mean age 33 years) were included. Both the pooled meta-analysis and the subgroup meta-analysis in medication wash-out patients showed robustly fractional anisotropy (FA) reductions in the WM of the right cerebellum hemispheric lobule (CHL), the body of the corpus callosum (CC), and the bilateral superior longitudinal fasciculus III (SLF III), while FA reductions in the genu of the CC and the right anterior thalamic projections were only seen in medication-naive patients. Fibre tracking showed that the main tracts involved the right cerebellar tracts (CT), the body of the CC and the bilateral SLF III and arcuate network.

CONCLUSION
By excluding the confounding influences of medication status, the present study revealed the WM abnormalities in brain regions of MDD involved in cognition, memory function and emotional processing. These findings may contribute to a better understanding of the underlying neuropathology of MDD and be conducive to target selection for the non-drug therapy that the current era of psychosurgery utilizes as therapies for depression, such as electroconvulsive therapy, deep brain stimulation, and transcranial magnetic stimulation.

CLINICAL RELEVANCE/APPLICATION
By excluding the confounding influences of medication status, the disease-related brain regions of white matter abnormalities of MDD can be conducive to target selection for the non-drug therapy.
PURPOSE
Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by deficits in social interaction, communication, and stereotyped or repetitive behaviors. White matter (WM) abnormalities have long been suspected in ASD, but the available evidences have been inconsistent. We conducted the first multimodal meta-analysis of WM volume (WMV) and fractional anisotropy (FA) studies to elucidate the most robust WM abnormalities in ASD.

METHOD AND MATERIALS
PubMed, ISI Web of Science, PsycINFO, Cochrane Library, and EMBASE databases were searched between 1994 and 2014 for all voxel-wise studies comparing WMV or FA between patients with ASD and healthy control subjects (HCS). Manual searches were also conducted and authors were contacted soliciting additional data. Coordinates were extracted from clusters of significant WMV and FA difference between ASD patients and HCS. Anisotropic effect size signed differential mapping (AES-SDM) was used to examine regions of WMV and FA alterations in ASD patients compared to HCS separately. Furthermore, peak WMV and FA data were combined using novel multimodal meta-analytic methods implemented in AES-SDM. Meta-regression methods were also used to explore potential effects of clinical profiles.

RESULTS
27 studies (providing 29 datasets: 20 WMV and 9 FA) were included comprising 544 adult and pediatric patients with ASD and 544 matched HCS. Patients with ASD showed widespread WM abnormalities including cerebellum, external capsule, cingulum and prefrontal WM, but findings were particularly robust in the crossing between the genu and anterior body of corpus callosum (CC), which showed both decreased WMV and decreased FA (Fig. A-C). Meta-regression showed the age was negatively correlated with WMV in the left cerebellum while the percentage of male patients was negatively correlated with FA in the body of CC (Fig. D and E).

CONCLUSION
This study gave a thorough profile for the WM abnormalities in ASD and provided evidence that inter-hemisphere was the most convergent circuitry affected in ASD. Meta-regression results perhaps revealed the structural underpinning of age and gender differences in epidemiological and clinical aspects of ASD.

CLINICAL RELEVANCE/APPLICATION
This study confirmed inter-hemisphere was the most convergent circuitry affected in ASD and suggested that structural underpinning of age and gender differences in epidemiological and clinical aspects of ASD.

SSK13-03 Disorganization of White Matter Microstructure in Attention-Deficit/Hyperactivity Disorder: A Tract-Based Spatial Meta-analysis

Wednesday, Dec. 2 10:50AM - 11:00AM Location: N226

Participants
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PURPOSE
White matter (WM) abnormalities have been conceived as important substrates of Attention-deficit/hyperactivity disorder (ADHD), but the available studies involving diffusion tensor imaging (DTI) with tract-based spatial statistics (TBSS) analysis yielded variable findings. We conducted the first tract-based spatial meta-analysis contrasting ADHD patients with healthy control subjects (HCS) to clarify the consistent changes of regional fractional anisotropy (FA) underpinning this disorder.

METHOD AND MATERIALS
Systematic and comprehensive searches of the PubMed, ISI Web of Science, PsycINFO, Medline, Cochrane Library, and EMBASE databases were performed for TBSS studies published between 1994 and 2014 together with 'in press' articles. The reference lists of identified articles and review articles were also manually scrutinized to obtain additional papers. Coordinates were extracted from clusters of significant FA difference between ADHD and HCS. Anisotropic effect size signed differential mapping (AES-SDM) was used to examine regions of FA alterations in ADHD patients relative to HCS. DTIquery software was applied to help locate the fascicles involved in each region. Besides, meta-regression methods were used to explore potential effects of clinical profiles.

RESULTS
A total of 9 TBSS studies (including 11 datasets) were enrolled, comprising 363 ADHD patients and 293 HCS. ADHD patients showed significant FA reductions in the right sagittal stratum and splenium of corpus callosum (CC) compared with HCS (Fig. A and C). Fibers passed through these clusters included the inferior fronto-occipital fasciculus, the inferior longitudinal fasciculus, and the splenium of CC (Fig. D). Sensitivity analysis and subgroups analyses further confirmed these findings. Meta-regression showed that the age was positively correlated with the FA in the splenium of CC (Fig. B).

CONCLUSION
Our findings confirmed the most convergent WM abnormalities in ADHD and suggested that the posterior brain networks of WM tracts may be affected in ADHD, with the potential of disconnection of the gray matter regions they connect. Furthermore, the disruption in splenium of CC may be a key target in the neurodevelopment of ADHD.

CLINICAL RELEVANCE/APPLICATION
Through meta-analysis using signed differential mapping (SDM), our study suggested that the disorganized white matter microstructure of posterior brain network may be a target underpinning ADHD pathophysiology.

SSK13-04 Altered Intranetwork and Internetwork Functional Connectivities in Type 2 Diabetes Mellitus with and
without Cognitive Impairment

Wednesday, Dec. 2 11:00AM - 11:10AM Location: N226

Participants
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Yong Liu, Beijing, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To analyze the alteration of intranetwork and internetwork functional connectivities using resting-state functional MRI (rsfMRI) with type 2 diabetes mellitus (T2DM) progression.

METHOD AND MATERIALS
Nineteen T2DM patients with normal cognition (DMCN), 19 T2DM patients with cognitive impairment (DMCI), 19 healthy controls (HC) were evaluated by 3 T MR scanner. Altered functional connectivities derived from 36 prior well defined brain regions of interest (ROIs) of 5 important resting-state network (RSN) systems [default mode network (DMN), dorsal attention network (DAN), control network (CON), salience network (SAL), sensorimotor network (SMN)] were investigated at 3 levels (integrity, network, connectivity pairs) by one-way ANOVA.

RESULTS
At integrity level, decreased connectivity strength of bilateral posterior cerebellum (pCBLM) were found across DMCN and DMCI (P < 0.05), right insula (rIns) only in DMCI. At network level, impaired intranetwork in DMN and CON were found in DMCI while not in DMCN (P < 0.05), and no impaired internetwork in the 5 RSNs was found among the 3 groups. At connectivity level, significant differences of fifty connectivity pairs were found among HC, DMCN, DMCI (P < 0.05), the top three altered connectivity pairs were left anterior prefrontal cortex versus left superior parietal (laPFC-lSP), right anterior cingulate cortex versus right ventral anterior cingulate cortex (rACC-rvACC), right insula versus right primary visual (rIns-rV1) (P < 0.005). Functional connectivity strength of specific brain architectures in T2DM at 3 levels were found associated with HbA1c, duration, MMSE and MoCA (P < 0.05).

CONCLUSION
These altered profiles of intranetwork and internetwork indicated intergroup differences and cognitive impairment of DMCI, might be the potential biomarkers applied to predict the progression, evaluate the impairment of cognition, understand the pathophysiology further for T2DM.

Clinical Relevance/Application
These findings might be the potential biomarkers applied to predict T2DM progression, evaluate recognition impairment, and understand T2DM pathophysiology further.

SSK13-05
Prequit Right NAcc-VTA Functional Connectivity as a Marker of Smoking Cessation Outcomes

Wednesday, Dec. 2 11:10AM - 11:20AM Location: N226

Participants
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PURPOSE
Chronic smoking hijacks nicotine-dependent individuals’ reward circuit, causing structural and functional alteration. However, the relationship between reward circuit and smoking cessation outcomes remains unclear. In the present study, we analyze the association between resting-state functional connectivity (rsFC) in reward circuit and subsequent smoking cessation outcomes (point prevalence abstinence at 4 weeks).

METHOD AND MATERIALS
Functional magnetic resonance images from 53 smokers and 41 healthy controls were acquired using a 3.0T MRI scanner prior to quitting. After 12-week treatment, smokers were divided into relapers (n=30) and abstainers (n=23). We then analyzed ROI-wise rsFC within reward circuit by setting 11 seeds (including VTA, bilateral NAcc, amygdala, hippocampus, mediodorsal thalamus and rostral anterior cingulate cortex).

RESULTS
The rsFC between right NAcc and VTA, right NAcc and right amygdala were significantly different in the three groups (p=0.014; p=0.026). While only right NAcc-VTA coupling differentiated relapers from abstainers (higher in relapers than abstainers, p=0.026). In addition, the strength of interhemispheric connectivity between NAcc (r²=0.255, p=0.004) and hippocampus (r²=0.256, p=0.004) were positively correlated with nicotine dependence severity (FTND) in relapers.

CONCLUSION
These results suggest that right NAcc-amygdala coupling reflects smoking status, while enhanced right NAcc-VTA coupling, core projection implicated in rewarding, is a promising marker of relapse vulnerability. The findings also show that relapse-vulnerable smokers can be detected before quit attempts, which may optimize clinical intervention and improve smoking cessation outcomes.

Clinical Relevance/Application
These findings might be the potential biomarkers applied to predict smoking status, evaluate recognition impairment, and understand smoking pathophysiology further.
Our study brings light to the neural mechanisms underlying smoking cessation. Prequit neuroimage data can help to identify relapse risk, which leads to personalized clinical strategies.

SSK13-06 Describing of Obsessive-compulsive Disorder in Seven Dimensions Using Multivariate Pattern Analysis Based on Gray Matter Anatomy

Wednesday, Dec. 2 11:20AM - 11:30AM Location: N226

Participants
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PURPOSE
Obsessive-compulsive disorder (OCD) is one of the most common disabling psychiatric disorders. Although previous magnetic resonance imaging (MRI) studies have already revealed abnormalities of cortical folding patterns (ie. cortical thickness, surface area) in OCD patients, how these abnormalities can be translated to clinical application is still a challenging task. Multivariate pattern analysis (MVPA) approach is a promising analytical technique which allows the classification of individual observations into distinct groups and bears the advantage of individualized judgement in the future. Thus, in current study, we aimed to apply one of the MVPA approach known as Support Vector Machine (SVM) to distinguish OCD patients from healthy control subjects (HCS) based on multidimensional surface features of gray matter anatomy.

METHOD AND MATERIALS
High-resolution T1-weighted volumetric 3D MR images were acquired for 33 drug-naive OCD patients and 33 matched HCS using a 3.0 T MRI system. Structural images were preprocessed with the FreeSurfer software to accurately and rapidly generate a set of seven morphometric parameters including volumetric and geometric features at each spatial location on the entire cortical surface (Fig A). Then all these parametric maps were used to discriminate OCD patients from HCS based on leave-one-out cross-validation approach with SVM using Probid software. We also drew a receiver operating characteristic (ROC) curve to help evaluate the performance of each parameter.

RESULTS
Classification accuracies, sensitivity and specificity for SVM classifier of combined left and right morphometric parameters are shown in Fig A. Among all parameters, the cortical thickness provided highest and above chance prediction accuracies for OCD patients (accuracy=75.76%, P<0.001) (Fig A and Fig B).

CONCLUSION
The current study illustrated that among all cortical features, cortical thickness showed the highest accuracy in classifying OCD patients from HCS, which indicated its potential diagnostic value in helping detecting OCD.

CLINICAL RELEVANCE/APPLICATION
The present study provides preliminary support for the suggestion that application of SVM to cortical thickness maps could be used to aid the identification of individuals with OCD in clinical practice.

SSK13-07 Phase II Clinical Trial: Efficacy of Methylene Blue in Human Cognitive and fMRI Measures

Wednesday, Dec. 2 11:30AM - 11:40AM Location: N226

Participants
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PURPOSE
Methylene blue (MB) is a FDA grandfathered drug used in clinics for more than 100 years. MB acts in the mitochondria to sustain or enhance ATP energy production. MB has been shown efficacious in animal models of ischemic stroke, traumatic brain injury, and Alzheimer’s disease (AD). A phase II clinical trial showed that daily oral MB (RemberTM) slowed the progression of AD compared to placebo. We have also found that low-dose MB increases brain glucose uptake, oxygen consumption, and evoked responses in the rat brain. Our goal was to use functional MRI (fMRI) to assess the efficacy of MB on cognitive and physiologic measures in the human brain.

METHOD AND MATERIALS
Double-blind, placebo-controlled, randomized clinical trial (NCT01836094) of 28 healthy young volunteers using delayed matching to sample (DMTS), psychomotor vigilance task (PVT), and visual-motor tasks (VMT) modeled using e-PRIME 2.0. Interventions: USP grade methylene blue (n=15) and placebo (n=13) administered orally at 280 mg once. All subject data were acquired in the same...
scanner (Siemens TIM Trio 3.0 Tesla; 32 channel head coil). fMRI and regression analysis were conducted using SPM 8.0 (UCL) and FSL (FMRIB). Correlation analysis was performed using MarsBar and SPSS 22 (IBM), and CBF analysis was conducted using the ASLtbx (UPenn).

RESULTS
Mean age was 29-30 years, 65% of subjects were female, and mean education was 17.5 years for both groups. No difference in cerebrovascular reactivity in both groups using CO2 challenge. Paired t-test analysis demonstrated that MB increased fMRI BOLD activity in midbrain, cerebellum, medial pallidum, prefrontal, parietal and occipital cortex (cluster-wise pFWE<0.05) during the encoding and maintenance phases of the DMTS memory task. MB subjects had a 7% increase in the number of correct responses during the DMTS task (p<0.01). MB subjects also had a significant decrease in mean CBF in the posterior cingulate and inferior parietal cortex during the VMT (cluster-wise pFWE <0.05).

CONCLUSION
MB has a robust effect enhancing visuospatial working memory and its underlying encoding and maintenance neural networks. MB is also associated with greater suppression of the default mode network during the VMT.

CLINICAL RELEVANCE/APPLICATION
As the first fMRI neuroimaging study of MB in healthy humans, our objective was to understand the effect of MB on working memory, vigilance and task-evoked BOLD and cerebral blood flow (CBF).

SSK13-08 Bayesian Analysis of fMRI Data: Application in Autism

Wednesday, Dec. 2 11:40AM - 11:50AM Location: N226

Participants
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Edward H. Herskovits, MD, Baltimore, MD (Abstract Co-Author) Consultant, BioClinica, Inc; Shareholder, RadDx, Inc;

PURPOSE
The goal of this study was to establish an automated and reliable platform for whole-brain analysis of resting state fMR (rsfMR) images using Bayesian data mining. We further investigated the software's feasibility in differentiating the subjects with autism spectrum disorder (ASD) from typically developing controls (TC), based on individual fMRIs.

METHOD AND MATERIALS
An in house developed resting state functional connectivity (rsFC) analysis environment is used to analyze rsfMR images. The analysis environment performs four tasks: image preprocessing, variable selection, Bayesian analysis, and model aggregation. After standard preprocessing and eliminating motion artifacts, the algorithm generates voxel-based rsFC maps for each atlas-based seed region. Investigators can use any structural or functional atlases of their choice. Next, by employing a Bayesian Network data-mining approach the rsFC maps and group membership variable C (e.g., TC vs. ASD) are used as inputs for pattern extraction. The outputs are group of voxels strongly predictive of group membership, presented as potential neuroimaging biomarkers of the clinical condition under analysis. In the last step, the algorithm aggregates all significant connectivity patterns across all seeds and performs the final classification. The algorithm was tested on 116 subjects (ASD=54; mean age 11.29 ± 2.66 years, 6 females) and (TC=62, mean age 12.16 ± 3.02 years, 14 females) from NYU publically available data set.

RESULTS
We used 90 AAL atlas structures as seed regions. 26 connectivity models, from 14 seeds, were found to be highly predictive of ASD with accuracies ranging from 78% to 71%. Six out of those 14 seeds were in frontal lobe. When used all connectivity models, we could classify subjects with 90.5% accuracy. Detected circuits were strongly associated with various indices of clinical severity and accurately reflected the known anatomic distribution of affected regions described in ASD.

CONCLUSION
Compared with conventional methods that focus on group differences, we identified differences in brain connectivity patterns at an individual level and accurately classified subjects in a highly heterogeneous condition such as ASD.

CLINICAL RELEVANCE/APPLICATION
Provides physicians with an automated connectivity analysis environment, and facilitates understanding and subsequently management of highly complex and socially important conditions such as ASD.

SSK13-09 Voxelwise Meta-Analysis of Resting-state Brain Activity Abnormalities in Patients with Major Depressive Disorder

Wednesday, Dec. 2 11:50AM - 12:00PM Location: N226

Participants
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PURPOSE
Resting-state brain activity abnormalities have long been suspected in major depressive disorder (MDD) but the available evidence has been inconsistent. Moreover, to our knowledge, there has been no meta-analysis utilized existent human neuroimaging literature to provide insights into the functional abnormalities in MDD at resting-state. To address this lack we conducted the first
meta-analysis of low-frequency fluctuation (ALFF) and fractional ALFF (fALFF) studies in MDD to help clarify the resting-state functional abnormalities underpinning this condition.

METHOD AND MATERIALS
A systematic search was conducted for ALFF and fALFF studies in MDD. A voxel-wise meta-analysis using the anisotropic effect-size Signed Differential Mapping (AES-SDM) method was conducted on ALFF/fALFF studies. Meta-regression was used to explore the effects of demographics and clinical characteristics.

RESULTS
A total of 8 ALFF and 4 fALFF studies comprising 345 MDD subjects (142/203 male/female; mean age 34 years) matched with 329 healthy controls (149/180 male/female; mean age 33 years) met the inclusion criteria. The pooled meta-analysis of the ALFF and fALFF studies on MDD patients showed significantly increased brain activities in the bilateral anterior cingulate cortex (ACC) extending to medial frontal gyrus and the left insula, and decreased brain activities in the right superior temporal gyrus, the left middle occipital gyrus, the left cerebellum and the right lingual gyrus relative to healthy controls (see Fig.1A). Meta-regression analyses indicated that the illness duration and the symptom severity of MDD patients were positively associated with brain activity in the left anterior cingulated cortex (LACC) and right medial superior frontal gyrus, respectively (RMSFG) (see Fig. 1B).

CONCLUSION
Meta-analysis revealed a pattern of neural abnormalities in MDD, characterized by functional brain abnormalities in brain regions involved in cognition, emotional processing and self-referential processes. These findings may contribute to a better understanding of the underlying pathophysiology as well as better characterization of the functional neural correlates of depressive symptoms.

CLINICAL RELEVANCE/APPLICATION
This study revealed resting-state brain activity abnormalities in major depressive disorder patients and could provide biomarkers for diagnosis and treatment evaluation.
SSK14
Neuroradiology/Head and Neck (Head and Neck Tumors)
Wednesday, Dec. 2 10:30AM - 12:00PM Location: N229

Application of Diffusion-weighted Imaging and Dynamic Contrast-enhanced MRI in Differentiating Nasopharyngeal Carcinoma and Nasopharyngeal Lymphoma

Participants
Suresh K. Mukherji, MD, Northville, MI (Moderator) Nothing to Disclose
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Sub-Events
SSK14-01 Application of Diffusion-weighted Imaging and Dynamic Contrast-enhanced MRI in Differentiating Nasopharyngeal Carcinoma and Nasopharyngeal Lymphoma

Participants
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Yong Zhang, DO, Zhengzhou, China (Abstract Co-Author) Nothing to Disclose
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Mengtian Sun, Zheng-Zhou, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the utility of dynamic contrast-enhanced MRI and diffusion weighted imaging (DWI) in the differentiation of nasopharyngeal carcinoma (NPC) and nasopharyngeal lymphoma (NPL).

METHOD AND MATERIALS
Forty-two patients with pathologically confirmed NPC and 27 patients with NPL were recruited and underwent conventional MRI and dynamic contrast-enhanced MRI. The MR signals, time signal-intensity curves (TIC) types, time to peak (TTP), enhancement peak (EP), maximum contrast enhancement ratio (MCER), mean apparent diffusion coefficient (ADC) value, and relative apparent diffusion coefficient (rADC) value of all the subjects were calculated and analyzed, thereafter, inter-group comparison was performed. The threshold values of ADC and rADC for differentiating NPC from NPL were determined using a receiver operating characteristic curve (ROC) analysis.

RESULTS
For NPC group, 32 cases (76.19%) demonstrated obvious heterogeneous enhancement. The mean TTP, EP, MCER and WR were (48.29±12.20)s, 1475.38±77.76, (136.89±24.41)% and 16.81±8.36, respectively. For NPL group, 24 cases (88.89%) demonstrated obvious homogeneous enhancement. The mean TTP, EP, MCER and WR were (63.21±14.29)s, 1161.82±64.04, (113.47±28.52)% and 7.39±6.21, respectively. The ADC value and rADC value were (842.34±94.66)×10^{-6} mm^2·s^{-1} and 0.74±0.08 in NPC, whereas (652.15±83.47)×10^{-6} mm^2·s^{-1} and 0.56±0.08 in NPL. The differences of TTP, EP, MCER, WR, ADC, rADC between NPC and NPL were statistically significant (P<0.05). The TTP of NPC was lower than that of NPL, whereas the opposite for the remaining parameters. The best differentiate threshold value of ADC and rADC were 736.5×10^{-6}mm^2·s^{-1}, 634.0×10^{-6}mm^2·s^{-1}, respectively. While the areas under the ROC curve (AUC), sensitivity, specificity and Youden index of ADC and rADC were 0.943, 0.909, 0.852, 0.761, and 0.951, 0.955, 0.892, 0.77, respectively. rADC value was slightly superior to ADC value in differentiating NPC from NPL.

CONCLUSION
DWI and Dynamic contrast-enhanced MRI are effective in differentiating NPC from NPL.

CLINICAL RELEVANCE/APPLICATION
Dynamic contrast-enhanced MRI and DWI can be applied in the differential diagnosis of NPC from NPL.

SSK14-02 Finding the Primary: Detection of Cervical CUP Based on Integrated PET/MRI versus MRI Alone

Participants
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PURPOSE
To evaluate and compare the diagnostic potential of 18F-FDG PET/MRI to MRI alone for detection of a potential primary cancer in patients suspect for cervical CUP (cancer of unknown primary).

METHOD AND MATERIALS
A total of 21 patients with suspected cervical CUP underwent a simultaneous 18F-FDG PET/MRI examination (Biograph mMR, Siemens). The scan protocol comprised: 1) T1 TSE, 2) T2 TSE, 3) DWI, 4) T1 fs post-contrast VIBE and 5) T1 fs TSE imaging after the application of 0.05 mmol/kg bw Gadoteric acid (Dotarem, Guerbet). The corresponding datasets (PET/MRI and MRI alone) were read separately by two radiologists for detection and identification of potential primary cancer lesions (2 point ordinal scale), lesion conspicuity as well as diagnostic confidence (3 point ordinal scale). All available data (histology, prior examinations, PET/MRI, follow-up examinations) served as standard of reference. Mean values were compared using Wilcoxon rank sum test.

RESULTS
Cervical primary cancer was present in 13 of 21 patients. 18F-FDG PET/MRI enabled correct identification of all 13 (100%), while MRI alone allowed for detection of 9/13 malignancies (69.4%). Lesion conspicuity and diagnostic confidence were rated significantly higher for 18F-FDG PET/MRI compared to MRI alone datasets (e.g. diagnostic confidence: PET/MRI:2.7±0.3; MRI alone 1.8±0.5; p<0.05).

CONCLUSION
PET/MRI was shown to be superior towards MRI alone for detection of cervical CUP, offering a significantly higher diagnostic confidence in the discrimination of malignant lesions.

CLINICAL RELEVANCE/APPLICATION
Based on the significantly improved detection of malignant lesions while maintaining equal acquisitions times to MRI alone, integrated PET/MRI can be considered a highly valuable tool for assessment of cervical CUP.

SSK14-03 Post-treatment Change versus Recurrence of Squamous Cell Carcinoma in the Head and Neck: Histogram Analysis of the Area under the Curves Ratio from Dynamic Contrast-enhanced T1-weighted Perfusion MRI

Wednesday, Dec. 2 10:50AM - 11:00AM Location: N229

Participants
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PURPOSE
To evaluate the predictive value of the histogram parameters of AUCR (initial and final area under the time signal-intensity curves ratio) derived from dynamic contrast-enhanced perfusion MR imaging (DCE MRI) for differentiation of tumor recurrence from post-treatment change of in patients with squamous cell carcinoma in the head and neck (HNSCC).

METHOD AND MATERIALS
Forty-six patients after definitive treatment for HNSCC with contrast-enhancing lesions at the primary sites on follow-up MRI were assessed using conventional and DCE MRI. We calculated and correlated the time signal-intensity curve parameters (initial and final area under the time signal-intensity curves, the maximum signal-intensity from time of arrival to time to peak (Emax), the time at Emax (Tmax), initial slope of signal-intensity increase) and the cumulative histogram parameters of AUCR (AUCR50, AUCR75, AUCR90 and AUCR95) with the final pathologic or clinical diagnosis. The best predictor for differentiation of tumor recurrence from post-treatment change was determined by receiver operating characteristic curve analyses. We assessed the added value of AUCR histogram parameters to inconclusive results of conventional MRI alone after blinded review of conventional MR images by a neuroradiologist.

RESULTS
46 patients were subsequently classified as having tumor recurrence (n=17) or post-treatment change (n=29). Tumor recurrence group showed significantly shorter Tmax and significantly higher AUCR50, AUCR75 and AUCR90 compared to those of post-treatment change group (P < 0.05). AUCR90 was the best predictor for tumor recurrence (Az = 0.77; 95% CI, 0.64-0.91) with the estimated cut-off of 1.02. When AUCR90 was added on inconclusive results of conventional MRI alone, 17.6 % of recurrent tumors were more detected without significant difference in the diagnostic specificity.

CONCLUSION
Tumor recurrence of HNSCC can be differentiated from post-treatment change by using the histogram parameters of AUCR. The added value of AUCR histogram analysis is 17.6 % of more detection of recurrent tumors without compromise of diagnostic specificity.

CLINICAL RELEVANCE/APPLICATION
Our study signifies that recurrent HNSCC can be differentiated from post-treatment change by using the histogram parameters of AUCR. The added value of AUCR90 on inconclusive results of conventional MRI alone is 17 % more detection of tumor recurrence without compromise of diagnostic specificity.

SSK14-04 Gaussian and non-Gaussian Diffusion MRI of the Head and Neck: The Effect of the Choice of B Values

Wednesday, Dec. 2 11:00AM - 11:10AM Location: N229

Participants
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Akira Yamamoto, MD, PhD, Kyoto, Japan (Abstract Co-Author) Nothing to Disclose
**DIFFERENTIATION OF MALIGNANT AND BENIGN SOLID NODULES OF THE THYROID GLAND ON UNENHANCED COMPUTED TOMOGRAPHY**

**Wednesday, Dec. 211:10AM - 11:20AM Location: N229**

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**Morimasa Kitamura, MD, PhD, Kyoto, Japan** (Abstract Co-Author) Nothing to Disclose  
**Kaori Togashi, MD, PhD, Kyoto, Japan** (Research Grant, Bayer AG Research Grant, DAIICHI SANKYO Group Research Grant, Eisai Co, Ltd Research Grant, FUJIFILM Holdings Corporation Research Grant, Nihon Medi-Physics Co, Ltd Research Grant, Shimadzu Corporation Research Grant, Toshiba Corporation Research Grant, Covidien AG**

**PURPOSE**

Diffusion MRI has been widely used for the diagnosis and monitoring of head and neck lesions. Non-Gaussian diffusion parameters (e.g., mean diffusion, ADCo, and kurtosis, K) have the potential to provide important information on tissue microstructure beyond ADC. The aim of this study was to investigate the value of quantitative diffusion assessment in the diagnosis of head and neck lesions.

**METHOD AND MATERIALS**

This IRB approved prospective study included 46 (27 malignant/19 benign) patients suspected of head and neck tumors between June 2014 and February 2015. Head and neck MRI was performed using a 3-T system equipped with a dedicated 16-channel head and neck coil. A read-out segmented EPI (RS-EPI) sequence combined with GRAPPA parallel acquisition and 2D-navigator-based reacquisition was used with 9 b values of 0, 75, 150, 300, 600, 1000, 1400, 1800, 2200 sec/mm2. Parametric maps of Gaussian and non-Gaussian diffusion parameters (K, ADCo and ADC) were generated by fitting the diffusion MRI signal using variable combinations of b values.

**RESULTS**

The performance (AUC) of ADC0-1400 (ADC derived from b values of 0 and 1400) (0.802) was higher than ADC0-600 or ADC0-1000 (0.753, 0.748) and ADC150-1400 (0.768). AUC of ADC0-1400 was significantly higher than that of ADC150-1000 (0.727, P<0.05). K or ADCo (0.71, 0.685, using all b values) didn’t significantly change depending on the choice of b values, and gave the different information than ADC on their parametric maps.

**CONCLUSION**

The choice of b values could significantly affect the diagnostic performance of ADCs in head and neck lesions. Non-Gaussian diffusion parameters showed stable results regardless of the choice of b values, and their parametric maps have the potential to provide new information on tumor characteristics in addition to ADC.

**CLINICAL RELEVANCE/APPLICATION**

Non-Gaussian diffusion parameters beyond ADC give the stable results regardless of the choice of b values in head and neck lesions, easier to make comparison between facilities.

**References**

- Mahfouz, Ahmed-Emad, MD, Doha, Qatar (Presenter) Nothing to Disclose  
- Sherif, Hanan, MD, Doha, Qatar (Abstract Co-Author) Nothing to Disclose  
- Sayedin, Ahmed, MBBCh, Doha, Qatar (Abstract Co-Author) Nothing to Disclose

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**PURPOSE**

The natural iodine content of benign thyroid nodules may be higher than that of malignant nodules. The purpose of this study is to assess the value of unenhanced computed tomography (CT) in differentiation of malignant and benign solid nodules of the thyroid gland based on this hypothesis.

**METHOD AND MATERIALS**

80 patients with solid thyroid nodules, initially seen on ultrasonography have been examined by an identical protocol of unenhanced and contrast-enhanced CT, including 48 patients with pathologically-proven thyroid carcinoma and 32 patients with pathologically-proven nodular goiter. The attenuation value of the lesions on unenhanced CT has been measured. Statistical analysis has been done by the Student’s t- test and the Chi-square test.

**RESULTS**

The attenuation value of malignant nodules on unenhanced CT has been 34±11 HU, while the attenuation value of benign nodules has been 56±21 HU. The difference has been statistically significant (p< 0.001). When the cut-off value for diagnosis of malignancy is ≤50 HU, the sensitivity, specificity, positive predictive value, negative predictive value, and accuracy for the diagnosis of malignancy have been 89.6%, 68.8%, 81.1%, 81.5%, and 81.3% respectively compared to 72.9%, 71.9%, 79.5%, 63.9%, and 72.5% at a cut-off value of ≤40 HU and 93.8%, 53.1%, 75.0%, 85.0%, and 77.5% at a cut-off value of ≤55 HU respectively.

**CONCLUSION**

Malignant thyroid nodules have a statistically-significant lower attenuation value than benign nodules on unenhanced CT. Attenuation value ≤50 HU has an accuracy of 81.5% for diagnosis of thyroid carcinoma.

**CLINICAL RELEVANCE/APPLICATION**

Unenhanced CT of the thyroid gland may be useful in differentiation of benign and malignant nodules of the thyroid and needs to be included as part of the protocol of CT of the thyroid gland.
Pre-operative imaging plays an important role in staging advanced oral cavity cancer (OCC) treated with surgical resection followed by chemoradiation. Extrinsic tongue muscle invasion (ETMI) was added as a T4a classification in the 3rd edition of AJCC. The purpose of this prospective study was to examine the accuracy of preoperative contrast enhanced CT (CECT) and surgical assessment of ETMI using pathologic evaluation as the gold standard.

METHOD AND MATERIALS
This IRB approved prospective study recruited 34 consecutive patients with primary OCC between August 2014 and February 2015. Inclusion criteria were untreated primary OCC, available pre-operative CECT and surgical resection with pathological gross examination. Two neuroradiologists blindly reviewed the images for ETMI using the following scale: yes (Y), probably yes (PY), no (N), and probably no (PN). Three Head and Neck surgeons assessed for ETMI intra-operatively using the scale: Y, N or indeterminate. A single pathologist reviewed all gross examination notes for ETMI.

RESULTS
Twenty-five of the 34 patients met inclusion criteria. Six patients had pathologically proven ETMI. For statistical analysis, a radiologic score of yes/probably yes was scored as a yes and no/probably no as a no. Sensitivity (SN), specificity (SP), positive predictive value (PPV) and negative predictive value (NPV) for Radiologist 1 and 2 were: 83%, 84%, 62.5%, and 94%, and 100%, 84%, 67%, 67%, respectively. Two intra-operative cases rated indeterminate by the surgeons were considered a no, leading to an overall intraoperative assessment SN, SP, PPV, and NPV of: 80%, 100%, 100%, 95%.

CONCLUSION
Although this preliminary study suggests that imaging findings on CECT may have a higher SN but lower SP than surgical observation, both radiographic and surgical determination of ETMI had equivocal cases. This highlights the importance of systematic assessment of the gross specimen to facilitate accurate pathologic ETMI to minimize unnecessary upstaging. Ongoing investigation with specific pathologic focus on ETMI would be needed to confirm the reproducibility of pathologic staging and follow up of clinical outcomes to determine the clinical significance.

CLINICAL RELEVANCE/APPLICATION
Radiographic ETMI should be verified with pathological findings and interdisciplinary communication between pathologists, surgeons, and radiologists to minimize unnecessary upstaging.

SSK14-07 Short-Term Effects of Concurrent Radiochemotherapy on Hypopharyngeal and Laryngeal Squamous Cell Carcinoma: Evaluated with Dual-Energy CT Quantitative Parameters

Participants
Liang Yang, Beijing, China (Presenter) Nothing to Disclose
Dehong Luo, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose
Yanfeng Zhao, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose
Li Lin, Beijing, China (Abstract Co-Author) Nothing to Disclose
Meng Lin, Beijing, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the value of dual-energy spectral computed tomography(CT) quantitative parameters in predicting short-term effects of concurrent radiochemotherapy on hypopharyngeal and laryngeal squamous cell carcinoma(SCC), and provide valuable evidence for early judging the response of the tumor to therapy in clinical pratice.

METHOD AND MATERIALS
This study was approved by the ethics committee and all patients provided written informed consent. Spectral parameters of 34 patients with laryngeal and hypopharyngeal SCC who underwent dual-energy spectral CT(GE Discovery CT 750 HD) scan with spectral mode before therapy were analyzed retrospectively, all cases were proven by pathological findings. Spectral parameters contained IC-L (iodine concentration of lesion), WC-L (water concentration of lesion) and λHU (slope of spectral HU curve), which were obtained by analyzing pretherapy CT scan datas with GS1 Volume Viewer software in AW4.6 workstation. The following scans were taken at the 4th week after concurrent radiochemotherapy ended. By therapeutic effects, all patients were divided into treatment-sensitivity group (28 cases) and reatment-resistant group (6 cases). Parameters between two groups were compared, and the diagnosis experiment was evaluated.

RESULTS
Mean IC-L and λHU in treatment-sensitivity group were 16.80±4.61 mg/cm³, 2.28±0.63 respectively, while the two parameters were 23.84±5.04 mg/cm³, 3.23±0.68 in the other group. IC-L and λHU were significantly different between two groups (P<0.05).
However, WC-L was showing no significant difference (P>0.05). Receiver operating characteristic (ROC) analysis of IC-L and λHU in prediction of treatment-sensitivity showed: AUC (the area under curve) of IC-L was 0.81, larger than the AUC of λHU (AUC=0.79). With IC-L≤18.43 mg/cm³ as diagnosis threshold in prediction of treatment-sensitivity, the sensitivity, specificity, positive predictive value, negative predictive and Youden's index value were 72.73%, 83.33%, 88.89%, 62.50%, 0.56 respectively.

CONCLUSION
IC-L could be helpful in the prediction short-term effects of concurrent radiochemotherapy on hypopharyngeal and laryngeal squamous cell carcinoma.

CLINICAL RELEVANCE/APPLICATION
Dual-energy spectral CT has a potential value in clinical treatment options of hypopharyngeal and laryngeal SCC.

SSK14-08 Role of Magnetic Resonance Imaging in Thyroid Nodules; Evaluation of the Magnetic Resonance Spectroscopy and Diffusion Weighted in Differentiating Benign from Malignant Thyroid Nodules

Wednesday, Dec. 2 11:40AM - 11:50AM Location: N229

Participants
Pratiksha Yadav, Pune, India (Presenter) Nothing to Disclose

PURPOSE
To evaluate the diagnostic benefits of MRI in evaluation of thyroid lesion To evaluate the role of DWI WITH ADC mapping To evaluate the characteristic pattern of MR spectroscopy in various benign and malignant pathologies of thyroid

METHOD AND MATERIALS
This is prospective study carried out in 39 patients with already known thyroid nodules diagnosed on ultrasonography. All studies were done on 1.5 T Siemens Magnetom machine. Precontrast T1WI sagittal, axial, STIR, T2WI coronal and axial, post contrast fat saturated axial T1WI were taken. DWI with ADC mapping, single voxel MR spectroscopy were also done. Findings of MRI correlate with the final diagnosis on histopathological examination

RESULTS
Study was done on 39 cases. There were 19 cases of multinodular goiter, 5 cases of adenomas, 6 cases of thyroiditis and 9 cases of malignant lesion. The mean ADC value of the thyroid malignant lesion was significantly lower than the mean ADC value of thyroid benign lesions. High Choline peak was observed in the malignant lesions. Sensitivity of combined DWI, ADC mapping and MRS show sensitivity of 98.9% sensitivity to detect the malignant lesion with specificity of 93.4%

CONCLUSION
Thyroid lesions routine imaging could not differentiate malignant lesion from benign lesion. Diffusion weighted imaging with ADC mapping and Magnetic resonance Spectroscopy are good noninvasive investigation to diagnose malignancy.

CLINICAL RELEVANCE/APPLICATION
MRI evaluation of thyroid lesions combined with DWI & MRS are a good noninvasive test to diagnose the malignant lesion. It is useful to see the extent of the tumor, involvement of the surrounding structures, retrosternal extension and lymph nodal involvement.

SSK14-09 Prediction Study on Energy Spectrum Parameters in Larynx and Hypopharyngeal Squamous Cell Carcinoma with Different Pathological Grades

Wednesday, Dec. 2 11:50AM - 12:00PM Location: N229

Participants
Liang Yang, Beijing, China (Presenter) Nothing to Disclose
Dehong Luo, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose
Yanfeng Zhao, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose
Lin Li, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose
Meng Lin, Beijing, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To discuss the effect of energy spectrum parameters in sDECT (single-source dual-energy spectral CT) on evaluating larynx and hypopharyngeal squamous cell carcinoma (SCC) with different pathological grades.

METHOD AND MATERIALS
Retrospective analysis was carried out in 60 patients with confirmed pathological diagnosis of larynx and hypopharyngeal SCC from January to August in 2014. They were all scanned by sDECT (Discovery CT 750 HD) before treatment. After scanning, all data was analyzed with GSI Volume Viewer software of GE AW4.6 workstation. IC-L (iodine concentration of lesion), WC-L (water concentration of lesion), s-SHC (slope of spectral Hu curve), CT value in 70Kev monoergic image, IC-C (iodine concentration of carotid sinus), WC-C (water concentration of carotid sinus), sIC (standardized IC) and sWC (standardized WC). According to cell differentiation, all the patients were divided into low differentiated group and mid-high differentiated group. Parameters between two groups were compared, and the diagnosis experiment was evaluated.

RESULTS
Mean IC-L, s-SHC and sIC in low differentiated group were 15.61 mg/cm³±5.06mg/cm³, 2.68±1.04 and 20.29±7.40mg/cm³ respectively, while the three parameters were 20.29±7.40mg/cm³, 2.68±1.04 and 20.29±7.40mg/cm³ in the other group. All three parameters were significantly different between two groups (P<0.05). However, WC-L, CT value and sWC were showing no significant difference (P>0.05). ROC (receiver operating characteristic) analysis of IC-L, s-SHC, and sIC in prediction of low differentiated larynx and hypopharyngeal SCC showed: AUC (the area under curve) of sIC was 0.79, larger than the AUC of IC-L and s-SHC. AUC difference between s-SHC and sIC was significant (P<0.05), while it was not significant between IC-L and sIC (P>0.05). With sIC>5 as diagnosis threshold in prediction of low differentiated SCC, the sensitivity, specificity, positive predictive...
value and negative predictive value were 84.21%, 75.61%, 61.5% and 91.2% respectively.

CONCLUSION
sIC could be helpful in the prediction of larynx and hypopharyngeal SCC with different pathological grades.

CLINICAL RELEVANCE/APPLICATION
sDECT maybe a potential method for judging the differentiation of pathological grade of Larynx and Hypopharyngeal SCC
MR Imaging Feature Analysis of Common Genetic Alterations in Primary Glioblastoma

PURPOSE
To determine MRI texture features of common genetic alterations in glioblastoma

METHOD AND MATERIALS
Twenty-three primary glioblastomas with genetic testing and preoperative MRI were included. We applied in-house developed software that computed and correlated volumetric enhancing and nonenhancing texture features with individual mutations. A support vector machine classifier extracted non-linear models to distinguish the presence or absence of individual mutations following feature selection using lasso regression. Classifiers with high accuracy (>80%) were selected for correlation. From 225 features computed from T1WI, FLAIR and contrast T1WI, the top 14 different features were selected including edge morphology-based entropy and contrast (capturing local heterogeneity in a structure) and energy (capturing similarity between pixels in a structure). From 341 genetic tests included in MSK-IMPACT, 6 common genetic alterations were selected: PTEN, TP53, EGFR, CDKN2A, CDKN2B, and TERT

RESULTS
Patients with and without the expression of CDKN2A and with and without the expression of PTEN showed good separation in 3D graphs using various texture imaging features. For the PTEN mutation, the selected features and p-values were: (feature=29, p=0.02; 193, 0.89; 225, 0.68). For the CDKN2A mutation, the selected features and p-values were: (89, 0.01; 90, 0.01). For the CDKN2B mutation, the selected features and p-values were: (89, 0.01; 34, 0.03). For the EGFR and TERT mutation, the selected features and p-values were: (83, <0.05) and (122, <0.05), respectively. Individual features may not be significantly different from the two groups as combinations of features are employed for classification

CONCLUSION
Texture analysis of MR imaging features can provide useful information and help establish a new framework for the radiogenomic characterization of glioblastoma in the era of precision medicine

CLINICAL RELEVANCE/APPLICATION
Novel imaging feature analysis may predict genetic mutation status in glioblastoma.

Spectral Parameters Analysis of Pathologic Differentiation of Laryngeal and Hypopharyngeal Squamous Cell Carcinoma

PURPOSE
To discuss the value of parameters with single-source dual-energy spectral CT(sDECT) in evaluating the differentiation of laryngeal and hypopharyngeal squamous cell carcinoma.

METHOD AND MATERIALS
Spectral parameters of 60 patients with laryngeal and hypopharyngeal squamous cell carcinoma who underwent sDECT at Discovery
Clinical Relevance/Application

The spectral parameters of IC and sIC has potential value to predict the pathological grade of laryngeal and hypopharyngeal carcinoma.

NR348-SD-WEA6

Differentiation of Malignant and Benign Solid Nodules of the Thyroid Gland on Unenhanced Computed Tomography

Participants
Ahmed-Emad Mahfouz, MD, Doha, Qatar (Presenter) Nothing to Disclose
Hanan Sherif, MD, Doha, Qatar (Abstract Co-Author) Nothing to Disclose
Ahmed Sayedin, MBBCh, Doha, Qatar (Abstract Co-Author) Nothing to Disclose

Purpose

The natural iodine content of benign thyroid nodules may be higher than that of malignant nodules. The purpose of this study is to assess the value of unenhanced computed tomography (CT) in differentiation of malignant and benign solid nodules of the thyroid gland based on this hypothesis.

Method and Materials

80 patients with solid thyroid nodules, initially seen on ultrasonography have been examined by an identical protocol of unenhanced and contrast-enhanced CT, including 48 patients with pathologically-proven thyroid carcinoma and 32 patients with pathologically-proven nodular goiter. The attenuation value of the lesions on unenhanced CT has been measured. Statistical analysis has been done by the Student’s t-test and the Chi-square test.

Results

The attenuation value of malignant nodules on unenhanced CT has been 34±11 HU, while the attenuation value of benign nodules has been 56±21 HU. The difference has been statistically significant (p<0.001). When the cut-off value for diagnosis of malignancy is ≤50 HU, the sensitivity, specificity, positive predictive value, negative predictive value, and accuracy for the diagnosis of malignancy have been 89.6%, 68.8%, 81.1%, 81.5%, and 81.3% respectively compared to 72.9%, 71.9%, 79.5%, 63.9%, and 72.5% at a cut-off value of ≤40 HU and 93.8%, 53.1%, 75.0%, 85.0%, and 77.5% at a cut-off value of ≤55 HU respectively.

Conclusion

Malignant thyroid nodules have a statistically significant lower attenuation value than benign nodules on unenhanced CT. Attenuation value ≤50 HU has an accuracy of 81.5% for diagnosis of thyroid carcinoma.

CLINICAL RELEVANCE/APPLICATION

Unenhanced CT of the thyroid gland may be useful in differentiation of benign and malignant nodules of the thyroid and needs therefore to be included as part of the protocol of CT of the thyroid gland.

NR349-SD-WEA6

Coiling with Balloon Remodeling Technique Followed by Deployment of Self-expandable Stents for Intracranial Aneurysms: Safety, Efficacy and Stability

Participants
Aglae Velasco Gonzalez, MD, Muenster, Germany (Presenter) Nothing to Disclose
Michael A. Stauder, Essen, Germany (Abstract Co-Author) Nothing to Disclose
Shoma Berkemeyer, Muenster, Germany (Abstract Co-Author) Nothing to Disclose
Boris Buerke, MD, Muenster, Germany (Abstract Co-Author) Nothing to Disclose
Rene Chapot, MD, PhD, Essen, Germany (Abstract Co-Author) Nothing to Disclose

Purpose

To analyze the safety and efficacy of balloon assisted coiling (BAC) technique followed by stent deployment in the parent artery for endovascular treatment of intracranial aneurysms and assess the stability of the treatment during follow up.

Method and Materials

A retrospective data collection and analysis of 80 aneurysms treated by coiling with balloon remodeling technique followed by deployment of self-expandable stents were performed. Location and dimension of aneurysms, procedure technique including type of coils deployed, balloons and stents used, and complications were collected. Angiographic results after treatment and during follow up were analyzed by two independent reviewers and categorized as stable, further thrombosis and recanalization. Neurological symptoms and clinical outcome were retrospectively rated and correlated for each patient with the post procedural MRI.

Results

The median diameter of the treated aneurysms was 8.5 mm. Coiling was performed with a combination of barecoils and hydrocoils in
53.7% (n=43) and barecoils alone in 41.2% (n=33) of cases. After BAC, a single placement of a self-expandable stent was performed in all cases except in one with two stents. Major permanent deficits occurred in 3 out of 80 treatments (3.75%). A complete and near complete initial occlusion was achieved in 67.5% and 21.25%, respectively. At a mean of 14 months follow up the rates of stability and further thrombosis reached 83.75% and the recanalization 10% (n=8), of which 6.25% (n=5) were retreated. Aneurysms treated with hydrocoils and barecoils had significantly less rates of recanalization compared with those treated with barecoils alone (4.6% Vs 21.21%; p<0.05).

CONCLUSION

Our results demonstrate the safety and feasibility of the stent placement after BAC, which provides high rates of successful initial occlusion and this leads to a reduction of retreatments.

CLINICAL RELEVANCE/APPLICATION

Stent placement after BAC, which provides high rates of successful initial occlusion and leads to a reduction of retreatments, is feasible and safe.

NR350-SD- WEAW7 CT Perfusion Mismatch in Acute Stroke Imaging: What Does It Tell Us about Time from Symptom-onset?

Station #7

Participants
Wieland H. Sommer, MD, Munich, Germany (Presenter) Founder, QMedify GmbH
Kolja M. Thierfelder, MD, MSc, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Sebastian E. Beyer, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Birgit B. Ertl-Wagner, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Louisa von Baumgarten, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Maximilian F. Reiser, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE

The purpose of the current study was to determine a possible dependency of the initial mismatch size between cerebral blood flow (CBF) and cerebral blood volume (CBV) from time after symptom onset, leptomeningeal collateralization and occlusion localization in acute middle cerebral artery (MCA) infarctions.

METHOD AND MATERIALS

Out of an existing cohort of 992 consecutive patients receiving multiparametric CT-scans including whole-brain CTP due to suspected stroke we included patients who had 1) a witnessed time of symptom onset, 2) an infarction of the MCA territory as documented by follow up imaging, 3) an initial CBF volume of > 10 ml. CBF- and CBV-lesion size, collateralization grade, and the site of occlusion were determined.

RESULTS

103 patients were included. Univariate analysis showed that time from symptom (168 +/- 91,2 min) onset did not correlate with relative or absolute mismatch volumes (p=0.458 and p=0.921). Higher collateralization gradings were associated with small absolute mismatch volumes (p=0.004 and p<0.001). Internal carotid artery (ICA) occlusions were associated with large absolute mismatch volumes (p=0.004). Multivariate analysis confirmed that ICA occlusion was associated with large absolute mismatch volumes (p=0.005) and high collateral grade was associated with small absolute mismatch volumes (p=0.017).

CONCLUSION

There is no significant correlation between initial CTP mismatch and time after symptom onset. Predictors of mismatch size include the extent of the collaterals and a proximal location of the occlusion.

NR261-ED- WEAW8 Imaging and Radiologic Nomenclature of the Degenerative Spine

Station #8

Participants
Sergiy Kushchayev, MD, Darby, PA (Presenter) Nothing to Disclose
Karl H. Schuleri, MD, Darby, PA (Abstract Co-Author) Nothing to Disclose
Michael L. Brooks, MD, JD, Lansdowne, PA (Abstract Co-Author) Nothing to Disclose
Oleg Teytelboyd, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Provide a comprehensive review of spinal degenerative changes. Review radiologic nomenclature used for degenerative spinal changes. Provide practical tips for improving clarity and consistency of radiology report.

TABLE OF CONTENTS/OUTLINE

Spinal anatomy and imaging of the normal spinal. Definition and pathophysiology of the degenerative process. Imaging, classification, and nomenclature of the degenerative disc disease, spondylosis, end-plate changes, facet joint degeneration, degenerative spinal canal stenosis, instability and degenerative spondylolisthesis. Controversies in describing degenerative disease of the spine.
**Neuroradiology Wednesday Poster Discussions**

**Wednesday, Dec. 2 12:45PM - 1:15PM Location: NR Community, Learning Center**

**NR351-SD-WEB1**

**High Dose Stereotactic Radiotherapy for Patients with Sarcoma Spine Metastases: Assessment of Treatment Response using T1-Weighted DCE-MRI**  
Station #1

**Participants**
Pratik Mukherjee, MD, PhD, San Francisco, CA (Moderator) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company;

**Sub-Events**

**PURPOSE**
To assess response to SRT in patients with sarcoma spine metastases using T1-weighted DCE-MRI.

**METHOD AND MATERIALS**
Twelve metastatic sarcoma lesions to the spine from 9 consecutive patients were included in this study. Patients were treated with high dose SRT and underwent DCE-MRI scans both before and after radiotherapy. Changes in perfusion parameters, Ktrans, Vp and a multi-parametric MRI (mpMRI) score from all perfusion parameters were calculated. Additionally, tumor size was measured and a graded response impression (“worsening of disease”, “no change”, or “improvement”) assessed by two board certified neuroradiologists with 19 and 15 years of experience. Measurements were then correlated to local control. Coefficient of determination (R2) was used to document correlation, and 2-tailed t-tests at a significance level of P<0.05 were used to assess differences.

**RESULTS**
Quantitative DCE-MRI parameters, Vp mean, Ktrans mean, Vp max, and Ktrans max, were notably reduced post-SRT as compared to pre-SBRT (58.7%, 63.2%, 59.0%, and 55.2%; p=0.006, 0.02, 0.001, and 0.005, respectively). Bi-dimensional tumor measurements showed an increase in size across the cohort (reader 1, 2.2%; reader 2, 6.4%), and 50%, 25%, and 25% of the treated lesions demonstrated features of “worsening of disease”, “no change”, or “improvement” by both readers graded impressions, respectively. There was good inter-reader reliability for both size and subjective disease response scores (R2 = 0.84). The mpMRI score had 100% accuracy in predicting local control at time of last follow-up.

**CONCLUSION**
We demonstrate that post-SRT assessment using only size and subjective impressions of neuroradiologists can be insufficient to determine disease progression or remission, and that a combination of DCE-MRI perfusion parameters provides excellent correlation to local control.

**CLINICAL RELEVANCE/APPLICATION**
Adding DCE perfusion maps to standard MRI can aid in improving diagnostic accuracy and may significantly impact patient care outcomes.

**NR352-SD-WEB2**

**Correlation between Facet Joint Asymmetry and Lumbar Disc Degenerative Disease**  
Station #2

**Participants**
Pokhraj P. Suthar, MBBS, MD, Baroda, India (Presenter) Nothing to Disclose  
Narrotam A. Patel I, MD, DMRD, Vadodara, India (Abstract Co-Author) Nothing to Disclose  
Kewal A. Mistry, MBBS, Kangra, India (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
The purpose of our study was primarily to investigate the correlation between facet joint asymmetry and lumbar disc degenerative disease.

**METHOD AND MATERIALS**
MRI of the lumbar spine of 200 subjects aged less than 80 years were examined. 110 cases thought to have degenerative disc disease ranging from minimal to severe disc degeneration and/or hemiation with no history of spinal surgery or spinal abnormality...
such as spina bifida, scoliosis or spondylololithisis. The remaining 90 subjects underwent MRI spine for a variety of back pain related reasons and had normal appearing intervertebral discs were control group. All subjects were imaged on a 1.5T MRI machine. Sagittal T1, T2 and axial T2 weighted images of the lower three lumbar spine disc space levels were used to assess the facet joint tropism. Facet lines passing through the joint space and parallel to the articular surface of each zygoapophyseal joint at the same level were drawn using electronic calipers/lines. Facet tropism was assessed by measuring the distance between the reference line (which passes through the spinous process, intersecting the intervertebral disc) and the crossing point between the two facet lines at the same vertebral level. For the purposes of this study, this distance is referred to as the Facet Tropism Length (FTL).

RESULTS
The mean FTL in the normal group was 1.90 mm, 1.72 mm, and 2.40 mm at L3/L4, L4/L5 and L5/S1 respectively, compared with 2.22 mm, 2.78 mm and 3.10 mm in the Degenerative Disc Disease. The statistical analysis revealed a significant correlation between facet joint asymmetry and lumbar disc degenerative disease at L4/L5, L5/S1 and L3/L4 levels.

CONCLUSION
Statistically significant relationship between facet joint asymmetry and disc degenerative disease at L4/L5, L5/S1 and L3/L4 levels. This association may well represent an element in the biomechanical evaluation and understanding of the etiology of premature lumbar spine disc degeneration.

CLINICAL RELEVANCE/APPLICATION
Facet Tropism Length is equal to Facetal Angle in detecting facetral tropism and is recommended in the evaluation of lumbar disc degenerative disease.

NR353-SD- WEB3  Age-Related Variation in the Atlanto-Dental Interval: Redefining Normal Reference Values

Participants
Vincent R. Spano, MD, BMedSc, Toronto, ON (Presenter) Nothing to Disclose
Eitan Barbalat, MD, Toronto, ON (Abstract Co-Author) Nothing to Disclose
Sean P. Symons, MPH, MD, Toronto, ON (Abstract Co-Author) Nothing to Disclose

PURPOSE
Widening of the atlanto-dental interval (ADI) is a well-established indicator of potential cervical spine pathology, however the standard reference value of 3mm does not account for age-related changes in the cervical spine. The purpose of this study was to assess the relationship between the ADI and patient age to re-evaluate normal reference values, and we hypothesized that variability in ADI may suggest currently accepted reference ranges should be tailored according to age.

METHOD AND MATERIALS
A retrospective analysis of the ADI measurement in 800 multidetector computed tomography (MDCT) scans of the cervical spine at a tertiary care facility was performed. Studies were conducted for all indications excluding trauma or post-surgical evaluation. Patients were equally grouped by decade into eight age ranges from 21-30 to 91-100, with 100 patients in each group. The midsagittal and axial measurements of the ADI were obtained and averaged for each patient. The mean ± SD for each age category was calculated and statistical significance between groups was determined using the student’s two-tailed t-test.

RESULTS
The mean ADI measurements were 1.63 ± 0.38 mm, 1.60 ± 0.35 mm, 1.47 ± 0.35 mm, 1.42 ± 0.39 mm, 1.30 ± 0.45 mm, 0.91 ± 0.49 mm, 0.70 ± 0.52 mm, and 0.67 ± 0.52 mm in the eight designated age groups from 21-30 to 91-100, respectively. The range of ADI measurements among all patients was 0.0 to 3.4 mm. Statistically significant differences in mean ADI were found between younger and older patient groups, most evident between patients aged 21-30 and 91-100 with a p value of <0.01.

CONCLUSION
Our data suggests that a more conservative reference value for the ADI should be considered in all patients assessed with MDCT of the cervical spine. In addition, the significant decline in ADI as patients age implies that age-specific reference values may be beneficial in the assessment of traumatic cervical spine injury.

CLINICAL RELEVANCE/APPLICATION
Widely used reference values for the atlanto-dental interval overestimate normal values on CT, and age-specific references may improve detection of cervical spine pathology in patients of varying age.

NR354-SD-WEB4  Abnormal Functional Connectivity of Seed-based Networks in Patients with Generalized Anxiety Disorder

Participants
Ming Zhou, Chengdu, China (Presenter) Nothing to Disclose
Xinyu Hu, Chengdu, China (Abstract Co-Author) Nothing to Disclose
Lizhou Chen, Chengdu, China (Abstract Co-Author) Nothing to Disclose
Qi Liu, Chengdu, China (Abstract Co-Author) Nothing to Disclose
Qiyong Gong, Chengdu, China (Abstract Co-Author) Nothing to Disclose
Xiaoi Huang, MD, Chengdu, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
Patients with generalized anxiety disorder (GAD) suffer the symptoms of psychological distress including excessive and uncontrollable anxiety. It has been reported that GAD patients exhibited abnormal network functions involving amygdala and thalamus. Functional connectivity (FC) is efficient approach to reveal the activity of brain networks. The aim of the present study is to detect the abnormalities of GAD patients using a seed-based approach.
NR355-SD-WEBS

Role of Magnetic Resonance Imaging in Thyroid Nodules; Evaluation of the Magnetic Resonance Spectroscopy and Diffusion Weighted in Differentiating Benign from Malignant Thyroid Nodules

Station #5

Participants
Pratiksha Yadav, Pune, India (Presenter) Nothing to Disclose

PURPOSE
To evaluate the diagnostic benefits of MRI in evaluation of thyroid lesionTo evaluate the role of DWI WITH ADC mappingTo evaluate the characteristic pattern of MR spectroscopy in various benign and malignant pathologies of thyroid

METHOD AND MATERIALS
This is prospective study carried out in 39 patients with already known thyroid nodules diagnosed on ultrasonography. All studies were done on 1.5 T Siemens Magnetom machine. Precontrast T1WI saggital, axial, STIR, T2WI coronal and axial, post contrast fat saturated axial T1WI were taken. DWI with ADC mapping, single voxel MR spectroscopy were also done. Findings of MRI correlate with the final diagnosis on histopathological examination

RESULTS
Study was done on 39 cases. There were 19 cases of multinodular goiter, 5 cases of adenomas, 6 cases of thyroiditis and 9 cases of malignant lesion. The mean ADC value of the thyroid malignant lesion was significantly lower than the mean ADC value of thyroid benign lesions. High Choline peak was observed in the malignant lesions. Sensitivity of combined DW, ADC mapping and MRS show sensitivity of 98.9% sensitivity to detect the malignant lesion with specificity of 93.4%

CONCLUSION
Thyroid lesions routine imaging could not differentiate malignant lesion from benign lesion. Diffusion weighted imaging with ADC mapping and Magnetic resonance Spectroscopy are good noninvasive investigation to diagnose malignancy.

CLINICAL RELEVANCE/APPLICATION
MRI evaluation of thyroid lesions combined with DWI & MRS are a good noninvasive test to diagnose the malignant lesion. It is useful to see the extent of the tumor, involvement of the surrounding structures, retrosternal extension and lymph nodal involvement.

NR357-SD-WEBS

Virtual Non-Contrast Post-Processed Images from Dual Energy CTA Datasets are Highly Accurate for the Detection of Intracranial Hemorrhage in Acute Stroke Patients

Station #6

Participants
Joseph Y. Young, MD, Boston, MA (Presenter) Nothing to Disclose
Laleh Daftaribesheli, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Markus Y. Wu, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Stuart R. Pomeraetz, MD, Boston, MA (Abstract Co-Author) Research Grant, General Electric Company
Rajiv Gupta, PhD, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Michael H. Lev, MD, Boston, MA (Abstract Co-Author) Research support, General Electric Company Stockholder, General Electric Company

PURPOSE
CTA studies are routinely acquired in the workup of acute stroke patients. Post-contrast images acquired with dual energy (DE) can be post-processed to generate virtual non-contrast (VNC) images, potentially forgoing the need to acquire a separate non-contrast CT (NCCT) study. We assessed the accuracy of VNC images for intracranial hemorrhage detection compared to NCCT images.

METHOD AND MATERIALS
We retrospectively analyzed the head and neck CTA exams from 19 acute stroke patients in our Emergency Department. NCCT with 3-mm reconstructed slices was concurrently acquired. DE-CTA source images were post-processed to generate 3-mm VNC images. Dual-energy CTA studies may potentially expedite stroke workup and reduce radiation by forgoing a separately acquired NCCT exam, however further optimization of post-processing parameters should be performed.

RESULTS
We studied 19 patients, 14 with intracranial hemorrhage. The VNC images were 100% sensitive and specific for detecting any intracranial hemorrhage in a given patient. There were a total of 76 potential compartments for hemorrhage (4 per patient), with NCCT detecting 25 and VNC images detecting 28 incidences of hemorrhage. The VNC images were 100% sensitive, 94% specific, and 96% accurate for localizing hemorrhage to the correct anatomic compartment. The VNC images overcalled the presence of 3 possible small hemorrhages, 2 subarachnoid and 1 intra-ventricular. Subjective image quality of the VNC images was inferior to that of the NCCT images, with 12/19 “slightly worse” and 7/19 “significantly worse”.

CONCLUSION
VNC images post-processed from DE-CTA datasets are highly accurate for the detection of intracranial hemorrhage. However, the quality of the VNC images is inferior to that of NCCT, which may limit reader confidence for subtle bleeds. If VNC images are to substitute for an independently acquired NCCT exam, further optimization of post-processing parameters should be performed.

CLINICAL RELEVANCE/APPLICATION
Dual-energy CTA studies may potentially expedite stroke workup and reduce radiation by forgoing a separately acquired NCCT exam, however further optimization of VNC image quality would be of value.

NR356-SD-WEB7 Bidirectional Changed Default Mode Network Functional Connectivity One Month after Liver Transplantation

Participants
Yue Cheng, Tianjin, China (Presenter) Nothing to Disclose
Wen Shen, Tianjin, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To investigate the short-term functional connectivity (FC) changes of default mode network (DMN) after Liver transplantation (LT) by using seed-based functional connectivity analysis of resting-state functional MRI (rs-fMRI) and to correlate these DMN connectivity changes with neuropsychological test results and clinical biomarkers.

METHOD AND MATERIALS
Eighteen cirrhotic patients as transplant candidates and 20 healthy control were included in this study. All the patients underwent rs-fMRI examination before and one month after LT. Seed-based functional connectivity analysis was used to isolate the DMN. The posterior cingulate cortex (PCC) and medial prefrontal cortex (MPFC) were chosen as seed regions for the DMN map. The intensity values in each spatial map were converted to z values, which indirectly provided a measurement of FC in the DMN. Maps of the DMN were compared among the groups. Pearson correlation analysis was performed to explore the relationship between the changes of FC with that of clinical indexes and neuropsychological test scores pre- and post-LT.

RESULTS
Post-LT patients showed decreased FC in the PCC, left inferior parietal cortex (IPC), and right lateral temporal cortex (LTC) and increased FC in MPFC compared with before LT. Compared to healthy controls, both pre- and post-LT patients showed widely decreased FC in DMN, including the PCC, MPFC, bilateral IPC and bilateral LTC. The change of FC in the MPFC was positively correlated with change of digit symbol test (DST) scores (P< 0.05).

CONCLUSION
This study found that the impaired DMN FC before LT displayed a bidirectional change one month after LT. There were further reduced FC in the PCC, right IPC and left LTC, and increased FC in the MPFC. The results of our study indicate that LT can partially improve the brain function, while dynamic disruptions and brain reorganization will continue even after LT.

CLINICAL RELEVANCE/APPLICATION
Very limited studies have focused on the underlying neuro-pathophysiology of cognitive abnormalities in cirrhotic patients with LT. It is important to recognize these changes that occur after LT to develop better therapeutic targets for cirrhosis-related cognitive defects.

NR001-EB-WEB Conductive Hearing Loss: An Algorithmic Approach Based on Clinical History and Pathology Divided into Anatomical Compartments

Participants
Stephen Herrmann, MD, Galveston, TX (Presenter) Nothing to Disclose
Rami Eidaya, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Jason R. Ross, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Omar S. Eissa, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Tomas E. Uribe, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Jax H. Pham, DO, Galveston, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Discuss physiology, incidence and the most common causes of conductive hearing loss.
2. Present common and rare etiologies of conductive hearing loss including including traumatic, infectious, neoplastic, congenital, vascular and osseous pathology. Clinical
history and imaging clues will be provided to help residents make the most accurate diagnosis. 3. Demonstrate anatomical compartments in which pathology can be seen using cartoons based on external auditory canal, middle and inner ear compartment pathology. 4. Provide an algorithmic approach based on clinical history and anatomical compartments to help residents establish a generalized approach to conductive hearing loss.

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Introduction: Conductive hearing loss epidemiology, anatomy and physiology Clinical history and anatomical compartment algorithm External Auditory Canal pathology Middle Ear Compartment pathology Inner Ear compartment pathology Conclusion
Emergency Radiology (Neurologic Emergencies)
Wednesday, Dec. 2 3:00PM - 4:00PM Location: S403B

Participants
Clint W. Sliker, MD, Ellicott City, MD (Moderator) Nothing to Disclose
Savvas Nicolaou, MD, Vancouver, BC (Moderator) Institutional research agreement, Siemens AG

Sub-Events

SSM07-01 Utility of Repeat Head CT in Mild Traumatic Brain Injury (mTBI) Patients Presenting with Small Isolated Falcine or Tentorial Subdural Hematoma (SDH)

Participants
Kavi K. Devulapalli, MD, MPH, San Francisco, CA (Presenter) Nothing to Disclose
Alisa D. Gean, MD, San Francisco, CA (Abstract Co-Author) Medical Advisory Board, Samsung Electronics Co Ltd Speakers Bureau, Educational Symposium International Stockholder, Global Indemnity plc
Jared A. Narvid, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
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Bhavya Rehani, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
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David McCoy, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Alina Uzelac, MD, Mill Valley, CA (Abstract Co-Author) Nothing to Disclose
Jason F. Talbott, MD, PhD, San Francisco, CA (Abstract Co-Author) Data Safety Monitoring Board, StemCells, Inc

PURPOSE
In cases of mTBI with acute intracranial hemorrhage, serial head CT (hCT) scans to evaluate stability are routinely performed, even in cases of isolated small hemorrhages which are not easily accessible for surgical decompression. This practice has not been validated, and repeat exams frequently necessitate increased emergency room stay times, ICU monitoring, and additional exposure to ionizing radiation. The goal of this study is to evaluate clinical and imaging features of isolated falcine and tentorial SDH at presentation and short term follow-up.

METHOD AND MATERIALS
A retrospective analysis of all patients presenting to our Level 1 trauma center from January 2013 through March 2015 undergoing initial and short-term follow-up hCT with initial findings positive for isolated SDH along the falx and/or tentorium was performed. Patients with penetrating trauma, other sites of intracranial hemorrhage, brain contusion, or depressed skull fractures were excluded. Clinical information including gender, age and history of anticoagulation was obtained through review of electronic medical records.

RESULTS
90 patients met inclusion criteria (55 males; 35 females; average age 57.8 years). 63% of SDHs were falcine, 32% tentorial and 5% mixed. On average, isolated falcotentorial SDHs were small (mean thickness = 2.7mm; range 2-8mm), without significant mass effect, and decreased in size on follow-up hCT with an average follow-up time of 8.4 hours. Increase in SDH size was seen in 3 patients (3%) with average increase in SDH thickness of 3.3-mm. No new intracranial hemorrhages were seen on follow-up hCT. 2 of 3 patients with increase in SDH were anti-coagulated (average INR = 3.8) and the remaining patient had a depressed platelet count. In total, nine patients (10%) were anti-coagulated at presentation with mean INR=3.2 (range 2.1-4.9).

CONCLUSION
Isolated falcine and tentorial SDHs in mild TBI are small and rarely increase in size on short term followup hCT. Present data suggest repeat hCT in mTBI patients with isolated falcine or tentorial SDH who are not anti-coagulated is unnecessary for assessing stability of hemorrhage. In anti-coagulated patients and patients with low platelet counts, follow-up imaging is advisable.

CLINICAL RELEVANCE/APPLICATION
Isolated parafalcine and paratentorial SDH are common findings after trauma and often necessitate repeat imaging. This project may help guide clinical decision making with regards to repeat imaging.

Awards
Trainee Research Prize - Fellow

Participants
Daddy Mata Mbemba, MD, PhD, Sendai, Japan (Presenter) Nothing to Disclose
Shunji Mugikura, MD, PhD, Sendai, Japan (Abstract Co-Author) Nothing to Disclose
Atsuhiro Nakagawa, Sendai, Japan (Abstract Co-Author) Nothing to Disclose
Takaki Murata, MD, Sendai, Japan (Abstract Co-Author) Nothing to Disclose
Yasuko Tatewaki, MD, Sendai, Japan (Abstract Co-Author) Nothing to Disclose
The presence of intraventricular hemorrhage (IVH) on initial CT (iCT) has been recently reported to predict diffuse axonal injury (DAI) located in the corpus callosum or brain stem (severe DAI) on subsequent MRI. We aimed to test the hypothesis that midline (interhemispheric and perimesencephalic) subarachnoid hemorrhages (SAH) commonly associated with IVH on iCT could have a similar clinical value in predicting severe DAI.

METHOD AND MATERIALS

Consecutive 270 head trauma patients who underwent iCT within 24 hours and MRI within 30 days were included. First, as potential CT predictors of DAI, we used the following 6 CT items included in Marshall or Rotterdam CT scores: status of basal cistern, status of midline shift, epidural hematoma, IVH, SAH, and volume of hemorrhagic mass. Next, SAH were searched at cerebral cortices, sylvian fissures, sylvian vallecula, cerebellar folia, interhemispheric fissure, and perimesencephalic cisterns and a 7-grade (0 to 6, 0 means no SAH) SAH severity score based on these locations was assigned to each patient. Based on MRI results, patients were divided in two groups of DAI positive and DAI negative, and were assigned a following DAI staging reported to be prognostic of functional outcome, stage 3 being the worst: stage 0: no DAI, 1: DAI in the lobar white matter or cerebellum, 2: DAI in the corpus callosum with or without stage 1 lesions, and 3: DAI in the brain stem with or without stages 1 or 2 lesions.

RESULTS

77 (28.5%) of 270 patients had DAI. Of the 6 CT items, IVH and SAH were independently associated with DAI (both P<0.05). Of the locations, the interhemispheric and perimesencephalic SAH were the independent predictors of DAI (both P<0.05). SAH score and DAI staging showed significant positive correlation (P<0.0001). SAH score in DAI stage 3 or stage 2 was significantly higher than that of DAI stage 0 (both, P<0.0001). No statistical significant difference was noted in SAH score between DAI stages 0 and 1. The presence of midline SAH on iCT had sensitivity of 60.7%, specificity of 81.8%, PPV of 43.6% and NPV of 90% in predicting severe DAI.

CONCLUSION

Midline SAH on iCT are makers of DAI, specifically severe DAI. Using them as markers could greatly reduce unnecessary MRI in head trauma patients.
CLINICAL RELEVANCE/APPLICATION

Head CT is commonly performed after blunt trauma. Results from this study may help to guide clinical decision making regarding imaging in a subset of patients taking anti-coagulant or prescription anti-platelet medication.

SSM07-04  High-pitch Paranasal Sinus CT in Drunken Emergency Room Patients after Assault - Initial Results on Image Quality and Dose with Third-generation Dual-source CT

Wednesday, Dec. 2 3:30PM - 4:00PM Location: S403B

Participants
Claudia Freiliesen, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose
Patricia Dewes, MD, Frankfurt, Germany (Presenter) Nothing to Disclose
Boris Schulz, MD, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Jan-Erik Scholtz, MD, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose
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Thomas J. Vogl, MD, PhD, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose
Ralf W. Bauer, MD, Frankfurt, Germany (Abstract Co-Author) Research Consultant, Siemens AG Speakers Bureau, Siemens AG

PURPOSE
Image quality benefits from high-pitch scanning in agitated patients by freezing patient motion. We compared image quality and exposure parameters in patients with suspected maxillofacial fractures on second- and third-generation dual-source CT (DSCT)

METHOD AND MATERIALS
4 groups with 30 patients each were compared according CTDIvol, DLP, acquisition time and subjective image quality. The first group was examined on a second-generation DSCT (Flash, Siemens) with fixed 120 kV/50 mAs, pitch 3.0. The other three groups were examined on a third-generation DSCT (Force, Siemens): group 1 with fixed 120 kV/50 mAs and pitch 2.2; group 3 and 4 with fixed 120kV and automated exposure control (AEC) with 50 ref.mAs and pitch factors of 2.2 and 3.0, respectively. Images in groups 2-4 were reconstructed with iterative reconstruction (ADMIRE), in group 1 with FBP

RESULTS
Median CTDIvol (2.76 vs. 2.66 vs. 0.66 vs. 0.69 mGy) and DLP (58 vs. 41 vs. 13 vs. 14 mGycm) were significant lower in group 3 and 4 scanned on the third-generation DSCT with AEC (-76%/ -75% and -75%/74%; p < 0.0001) without significant difference among each other. Subjective image quality was rated best in group 2 followed by group 3, both with a pitch factor of 2.2 (average scores: 1.87/1.70 vs. 1.40/1.30 vs. 1.63/1.50 vs. 2.43/2.27). Due to strong high-pitch artefacts the subjective image quality of group 4 was inferior to all other groups. Median acquisition time was significantly faster using third-generation DSCT (450 ms vs. 300 ms vs. 380 ms vs. 270 ms; p < 0.05).

CONCLUSION
Third-generation DSCT yields faster acquisition times and substantial radiation dose reduction using AEC. A pitch of 2.2 should be preferred since high-pitch artefacts are reduced. Although AEC was used, subjective image quality remains stable and reliable with iterative reconstruction

CLINICAL RELEVANCE/APPLICATION
Faster CT examination of agitated patients with suspected maxillofacial trauma with reduced radiation exposure and reliable image quality.

SSM07-06  Dual Energy in Noncontrast Head CT: Differentiation of Calcification from Acute Hemorrhage

Wednesday, Dec. 2 3:50PM - 4:00PM Location: S403B

Participants
Christopher A. Potter, MD, Boston, MA (Presenter) Nothing to Disclose
Andrew Primak, PhD, Malvern, PA (Abstract Co-Author) Employee, Siemens AG
Aaron D. Sodickson, MD, PhD, Wayland, MA (Abstract Co-Author) Research Grant, Siemens AG; Consultant, Bracco Group

PURPOSE
To evaluate whether a novel DECT postprocessing application that separates calcification from hemorrhage can reliably differentiate these materials in non-contrast head CT foci in an indeterminate Hounsfield Unit (HU) range.

METHOD AND MATERIALS
DECT acquisitions of noncontrast head CTs were performed in the Emergency Department on a 128x2 slice dual-energy scanner (Siemens FLASH, Forchheim Germany). All scans containing foci of intracranial calcification or hemorrhage of 50-85 HU were included. Foci were designated as calcium or hemorrhage based on typical morphology or confirmatory imaging. DECT acquisitions used tube voltages 100/Sn140 kVp and tube current modulation (CareDose4D) using reference mAs 300/300. Source images from each tube were reconstructed as 0.75 x 0.5 mm slices and used for postprocessing on thin-client server (Syngo via, version VA30). The Brain Hemorrhage 3-material decomposition application designed to differentiate iodine from hemorrhage was modified by changing the iodine dual energy ratio to the calcium ratio of 1.44. Dual energy regions of interest (ROI) were placed to measure HU and standard deviation (std) in the mixed high/low kVp image, and the corresponding virtual non-calcium (VNCa) and calcium-map (Ca) images. CTDIvol and DLP values were recorded.

RESULTS
10 foci each of calcification and hemorrhage were analyzed. Foci could not be differentiated based on mixed-image HUs (unpaired t-test p=0.24), with mean +/- std (range) of 63 +/- 7 (55-73) HU for hemorrhage and 68 +/- 12 (52-84) for calcification. VNCa and Ca images demonstrated excellent separation of hemorrhagic from calcified foci (both p<0.0001). Calculated HU due to calcium content was 4 +/- 10 (7-26) HU in hemorrhages and 48 +/- 15 (28-72) in calcific foci. VNCa content was 58 +/- 12 (44-80) HU in hemorrhages and 20 +/- 7 (10-28) in calcific foci. A VNCa threshold value of greater than 35 HU correctly attributed all hemorrhage and calcium cases. X-ray tube output mean +/- std (range) values were CTDIvol 48 +/- 4 (40-54) mGy and DLP 842
CONCLUSION

DECT can reliably differentiate intracranial calcification from hemorrhage in a proof-of-principle cohort of indeterminate HU value foci where densities typically overlap.

CLINICAL RELEVANCE/APPLICATION

DECT shows promise in differentiating foci of hemorrhage from calcification in ranges where HU values overlap, which may be beneficial when HU values alone are not definitive.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Aaron D. Sodickson, MD, PhD - 2014 Honored Educator
Recurrences May Occur More than Ten Years after Endovascular Treatment of Intracranial Aneurysms: A Prospective Cohort Study, a Systematic Review and Meta-Analysis

Participants
Colin P. Derdeyn, MD, Saint Louis, MO (Moderator) Consultant, Terumo Corporation; Consultant, Penumbra, Inc; Consultant, Silk Road Medical; Stock options, Pulse Therapeutics, Inc; ;
Albert J. Yoo, MD, Newton, MA (Moderator) Research Grant, Penumbra, Inc; Research Grant, Terumo Corporation; Research Consultant, Medtronic, Inc;

Sub-Events
SSM17-01 Recurrences May Occur More than Ten Years after Endovascular Treatment of Intracranial Aneurysms: A Prospective Cohort Study, a Systematic Review and Meta-Analysis

PURPOSE
Our aim was to assess the 10-year efficacy of endovascular treatment (EVT) of intracranial aneurysm (IA) in terms of recurrence, assessed on long-term MR angiography (LT-MRA), and bleeding and de novo aneurysm formation. We also aimed to identify potential risk factors of aneurysm recurrence, including IA occlusion on 3-to 5-year MRA (MT-MRA), through a prospective study and a systematic review of the literature.

METHOD AND MATERIALS
We prospectively performed clinical examination and 3T MRA 10-years after EVT of IA in a single institution. Individual informed consent was obtained. In addition, the literature was searched using PubMed, EMBASE, and Cochrane databases to identify studies reporting bleeding and/or aneurysm recurrence rate in patients followed beyond 10-years after EVT. Univariate and multivariate subgroup analyses were performed to identify risk factors (MT-MRA results, aneurysm characteristics, retreatment within 5 years).

RESULTS
In the prospective study, among 129 aneurysms followed >10 years, 16 (12.4%) demonstrated sac recanalization between MT- and LT-MRA. Neck remnant on MT-MRA (Relative risk [RR]: 4.16, 99%Confident interval [99%CI]: 2.12-8.14) and retreatment within five years (RR: 4.67, 99%CI, 1.55-14.03) were risk factors for late recurrence. In the systematic review (15 cohorts, 2773 patients, 2902 aneurysms), bleeding rate, recurrent aneurysm, and de novo lesion were, respectively 0.7% (99%CI, 0.2-2.7%, I2: 0%), 11.4% (99%CI, 7.0-18.0%, I2: 21.6%), and 4.1% (99%CI, 1.7-9.4%, I2: 54.1%). Incomplete initial treatment (RR: 7.08, 99%CI, 1.24-40.37, I2: 82.6%) and aneurysm size > 10 mm (RR: 4.37, 99%CI, 1.83-10.44, I2: 0%) were risk factors for late recurrence.

CONCLUSION
EVT of IA is effective in preventing long-term bleeding, but may be followed by recurrences in a significant proportion of cases, a finding that may justify following selected patients for ≥10 years, i.e. in patients with Raymond grade 2 classification on 3- to 5-year MRA or when aneurysm >10 mm.

CLINICAL RELEVANCE/APPLICATION
Long-term (> 10 years) MRA follow-up may be needed in patients with aneurysms larger than 10 mm, or in the case of grade 2 aneurysms at the end of standard midterm follow-up. De novo aneurysms may occur between 5 and 10 years after treatment in one in 25 patients.

Does Recurrence Effect the Clinical Outcome after Endovascular Coiling of Ruptured Intracranial Aneurysms? – A Ten Year Retrospective Study

Participants
Robert K. Moreland, MD, Ottawa, ON (Presenter) Nothing to Disclose
Marlise P. dos Santos MSc, MD, Ottawa, ON (Abstract Co-Author) Nothing to Disclose
Rafael Glikstein, Ottawa, ON (Abstract Co-Author) Nothing to Disclose

PURPOSE
To identify the factors associated with clinical outcome of coiling of ruptured intracranial aneurysms (RIA).
METHOD AND MATERIALS

Retrospective review of all patients with RIA treated with endovascular coil embolization at a active single centre between 2002-2013. Cases of flow-related (AVM, DAVF related) aneurysms, flow-diversion and parent artery occlusion were excluded. We identified patient, periprocedural, procedural and aneurysm characteristics associated with pre-discharge and long-term clinical outcomes. The flow diverter was successfully deployed in 305 patients (mean age of 55.3 years) met criteria, including 216 (70.8%) females. The mean follow-up was 34.2 months. Preoperatively, 176 patients had an mRS of 0-2, and 129 had an mRS of 3-5. Complete near-complete occlusion was observed in 425/813% of the RIA, and body residual in 60/19.7%. At discharge, 11 patients (3.61%) had a clinically worse mRS, 59 (19.34%) improved, and 231 (77.05%) were unchanged. Our perioperative mortality (≤30 days) was 13.8% (42). Perioperative complications occurred in 18.4% of the cases. Preoperative vasospasm occurred in 44.9% of the cases. Target maximum aneurysm size (≤7, >7) and aneurysm width (≤7, >7) had a significant effect on end clinical outcomes, while neck width (≤4, >4) and dome/neck ratio (≤1.2, >2) did not. Recurrence occurred 109 times (35.73%) after coilings, of which 49 (36.70%) underwent retreatment; the recoiling did not impact the clinical outcome. Mean time until retreatment was 15.7 months. Recurrence post discharge was not associated with a worsening of clinical disability (HR 1.417 CI 95% 0.722-2.779). There were four rebleeds occurring on average 30.5 months post procedure.

CONCLUSION

In our practice from 2002-2013 the safety of coil embolization of RIA was comparable to the available literature. Reoccurrence and baseline occlusion status did not influence clinical outcomes. The maximum aneurysm size and width impacted long term clinical results, while the neck size and dome/neck ratio did not.

CLINICAL RELEVANCE/APPLICATION

Reoccurrence post ruptured aneurysm repair with endovascular coil does not significantly impact end patient clinical outcome.

SSM17-03 Single Center Cerebral Aneurysm Treatment with FRED and PED Flow Diverters; Initial Experience, Techniques and Comparative Outcomes

Wednesday, Dec. 2 3:20PM - 3:30PM Location: N227

Participants

Soheil Sabet, MD, Istanbul, Turkey (Presenter) Nothing to Disclose
Nurten Andac, MD, Istanbul, Turkey (Abstract Co-Author) Nothing to Disclose
Hacer Bal, MD, Istanbul, Turkey (Abstract Co-Author) Nothing to Disclose
Feyyaz Baltacioglu, Istanbul, Turkey (Abstract Co-Author) Nothing to Disclose
Gazanfer Ekinci, Istanbul, Turkey (Abstract Co-Author) Nothing to Disclose

PURPOSE

This retrospective study of the initial institutional experience provides insight into technical challenges, clinical and radiographic outcomes, and complication rates during deployment and after the use of FRED (FRED™, TUSTIN, CA.- MicroVention, Inc.) and PED (PED™, ev3; Plymouth, Minnesota) flow-diverting stents for cerebral aneurysms.

METHOD AND MATERIALS

Informed consent was obtained from all patients. We implanted 91 flow diversion devices, including 51 PED and 46 FRED with or without adjunctive intraneurysmal embolization for treatment of a total of 95 aneurysms between February 2012-April 2015 in our institution (Forty FRED devices to treat 46 aneurysms in 35 cases and 51 Pipeline devices to treat 49 aneurysms in 36 cases.). All patients underwent angioplasty and stent placement. Angiographic follow-up examinations were carried out in 90 patients (Thirty of PED and 20 of FRED cases.). Median clinical follow up period was 1.33 year (1.81 year in PED and 0.85 year in FRED group).

RESULTS

The flow diverter was successfully deployed in 87 of 91 stents (95.6%). The complete or near-complete occlusion rate was 70% in PED and 95% in FRED cases who had angiographic follow ups. Postprocedural aneurysm hemorrhage and consequent subarachnoid bleeding occurred in 1 patients from PED group due to stent migration. Total mortality rate during study period was 0%. We experienced failure of PED expansion in two patients whereas only one early deployment of stent within normal segment of ICA occurred in FRED group. We also encountered acute stent thrombosis within one hour of FRED deployment in one case. The stent was recanalized by deployment of a Solitaire AB (eV3™, Irvine, CA, USA) stent and intraarterial Tirofiban infusion. During angiographic follow ups 1 case of each group showed evidence of asymptomatic in-stent stenosis.

CONCLUSION

Flow-diverting stents play an important role in the treatment of intracranial aneurysms. Considering our experience, easier delivery and implantation, retrievability owing to its different design and higher aneurysmal occlusion rate in FRED makes it more advantageous in treatment of cerebral aneurysms when compared with PED. The relative efficacy and morbidity of these treatment methods must be considered in the context of available alternate interventions.

CLINICAL RELEVANCE/APPLICATION

FRED flow diverter may be more advantageous in treatment of cerebral aneurysms when compared with PED.
The aim of this study was to determine the predictive value of three different dynamic CT angiography (dynCTA) parameters - occlusion length, collateralization extent, and time delay to maximum enhancement - for latest generation stent-retriever thrombectomy recanalization outcome in patients with acute ischemic stroke.

METHOD AND MATERIALS
In this IRB-approved study, subjects were selected from an initial cohort of 2059 consecutive patients who had undergone multiparametric CT including whole-brain CT perfusion (WB-CTP). We included all patients with (a) a complete occlusion of the M1-segment of the MCA or the carotid T and (b) subsequent intraarterial stent-retriever thrombectomy. dynCTA was reconstructed from WB-CTP raw datasets. Technical outcome of thrombectomy was scored using the modified Thrombolysis in Cerebral Infarction (mTICI) scale. Logistic regression analyses were performed to determine independent predictors of a favorable outcome (mTICI=3).

RESULTS
A total of 69 patients (mean age 68±14yrs, 46% male) were included for statistical analysis. mTICI scores after recanalization were as follows: mTICI=0: 5 patients, mTICI=1: 3 patients, mTICI=2a: 6 patients, mTICI=2b: 24; mTICI=3: 31 patients. In the regression analysis, a short occlusion length was an independent predictor of favorable technical outcome (OR: 0.41, p < 0.05). Both collateralization grade (OR: 1.00, p > 0.05) and time delay to peak enhancement (OR: 0.90, p > 0.05) failed to predict a favorable outcome.

CONCLUSION
A shorter occlusion length as assessed by dynCTA is associated with a better recanalization success, while collateralization grade and time delay of maximum enhancement distal to the occlusion failed to predict thrombectomy outcome.

CLINICAL RELEVANCE/APPLICATION
Large vessel occlusion length as determined by dynamic CT angiography is an independent predictor for the technical outcome of stent-retriever thrombectomy in patients with acute ischemic stroke and may be considered as a possible decision-making parameter for patient selection.

SSM17-05 Should Informed Radiation Consent Exist for Neurovascular Interventional Radiology Procedures? The Patient Perspective

Participants
Rebecca Zener, MD, London, ON (Presenter) Nothing to Disclose
Peter B. Johnson, MBBS, Kingston 7, Jamaica (Abstract Co-Author) Nothing to Disclose
Amol Mujoomdar, MD, London, ON (Abstract Co-Author) Speaker, Cook Group Incorporated; Speaker, Medtronic, Inc
Sachin Pandey, MD, Dedham, MA (Abstract Co-Author) Nothing to Disclose

PURPOSE
Radiation exposure is inherent in neurovascular interventional radiology (IR). A potential exposure of 1 mSv has been suggested as a cutoff for provision of risk information, as it corresponds to a 1 in 10000 increased cancer risk. Informed consent requires disclosure of rare yet potentially significant risks, yet patient and non-radiologist physician knowledge of these risks is lacking. Neurovascular IR patient perception and knowledge of these risks remains unknown. The purpose of this study is to explore neurovascular IR patient perception of cancer-related radiation risk exposure and whether radiation consent is warranted.

METHOD AND MATERIALS
A multiple-choice survey was administered to 42 adult patients undergoing a non-emergent neurovascular IR procedure at a tertiary care centre. 67% of patients had previously undergone a neurovascular IR procedure. Statistical analysis of with Fisher Exact test was performed based on patient past neurovascular IR history (p<0.05).

RESULTS
Almost all subjects (90%) wanted to be informed if the radiation-related increased cancer risk was 1 in 100. Most (82%) wanted to be informed if the risk was moderate, 1 in 1000, or low, 1 in 10000 (70%). Only half of the patients were aware that they were exposed to radiation during their procedure, irrespective of previous neurovascular IR history. The majority (74%) believed that the ordering physician should be responsible for informing patients about radiation exposure. Most (85%) believed radiation consent should include radiation-related cancer risks, and that both verbal and written radiation consent should be obtained (74%). No significant difference was present based on past neurovascular IR history (p>0.05).

CONCLUSION
Neurovascular IR patient awareness of radiation exposure is suboptimal. Based on this survey, most patients want to discuss cancer-related radiation risks with the ordering physician in order to make informed decisions. This is potentially concerning as non-radiologist ordering physicians may not be as knowledgeable on radiation-related cancer risks. Neurointerventional radiologists should consider obtaining informed consent for procedures with anticipated doses of 1 mSv or greater.

CLINICAL RELEVANCE/APPLICATION
Neurovascular IR patients want to discuss cancer-related radiation exposure risk prior to undergoing an intervention in order to help them make an informed decision.

SSM17-06 Successful Revascularization after Mechanical Thrombectomy with Stent Retrievers: Comparison
PURPOSE
The catheter system for mechanical thrombectomy (MT) with stent retrievers (SR) could be an important factor when it comes to successful and more rapid recanalization procedures. Multicenter retrospective data collection and comparative analysis were employed to assess the efficacy of intra-arterial mechanical thrombectomies carried out using the Balloon Guide Catheter (BGC) and the non-Balloon Guide Catheter (NBGC).

METHOD AND MATERIALS
170 consecutive patients with MCA or carotid terminus occlusions treated by SR with the BGC (N=90) or NBGC (N=80) at three stroke centers were analyzed retrospectively. Data on procedure duration, number of passes, initial and final angiographic findings were collected. The degree of vessel occlusion initially and post-intervention was defined as the Thrombolysis in Cerebral Infarction (mTICI) score. Successful revascularization was defined as a final mTICI score >=2b achieved upon conclusion of the procedure after <=3 passes. Adjuvant therapy was defined as intra-arterial thrombolysis, intracranial angioplasty, or stenting performed after a failed MT.

RESULTS
Successful recanalization (mTICI grade 3 or 2b accomplished within <=3 passes) was achieved with the BGC in 80 out of 90 thrombectomies (88.8%), significantly different from the successful recanalization rates achieved using the NBGC (67%; p<0.001). The one-pass-thrombectomy rate with BGC was significantly higher than for NBGC (62.2% vs. 35%; p<0.001). The mean number of passes for a complete recanalization (mTICI3 or 2b) was 1.5±0.8 in the BGC group and 2.0±1.1 in the NBGC group. Recanalization procedure duration for a TICI3 or 2b was significantly shorter using the BGC (24.5±15.2 min) than the NBGC (53.2 ± 37.8 min; p<=0.05). Intra-arterial thrombolysis, intracranial angioplasty, and stent placement after a failed MT were performed in 6.6% and 12.5% of the BGC and NBGC patients (BGC vs NBGC, p<=0.90).

CONCLUSION
The efficacy of mechanical thrombectomy with stent retrievers in acute ischemic stroke in the anterior circulation in terms of angiographic results and procedure duration was improved when performed in combination with BGC.

CLINICAL RELEVANCE/APPLICATION
Efficacy of mechanical thrombectomy with stent retrievers in acute ischemic stroke is improved when performed in combination with Balloon Guide Catheter.
Altered Brain Neural Activity in Sellar-Tumor Patients: A Resting-State fMRI Study

PURPOSE
The purpose of the current study was to explore how brain neural activity changes with visual deprivation in patients with sellar tumors by measuring the pattern of low-frequency fluctuation (0.1~0.01 Hz) of the BOLD signal.

METHOD AND MATERIALS
21 patients with sellar tumors and 21 sex-matched healthy volunteers participated in this study. The resting-state fMRI data were processed using the SPM8 MATLAB toolbox and DPARSF. The spontaneous brain neural activity was measured by calculating the amplitude of low-frequency fluctuations (ALFF), regional homogeneity (ReHo) and functional connectivity (FC) of BOLD signals. A two-sample t-test was performed to investigate the difference between the groups, thereafter computing the correlation coefficient between the patterns obtained from rs-fMRI of some regions and the tumor size, as expressed by its left-right radius.

RESULTS
The results of the group analysis showed that, compared to normal control subjects, patients with sellar tumors exhibited significantly decreased ALFF in the bilateral cuneus, left lingual gyrus and the right supplementary motor area (SMA). ALFF in bilateral lentiform nucleus has significantly increased (Fig.1). The sellar tumors showed decreased ReHo value in the bilateral cuneus, but increased ReHo value in the precuneus, the left insular, and left lentiform nucleus. The ReHo values in precuneus and insula are significantly correlated with the tumor radius in left-right direction (Fig.2).

CONCLUSION
The results of this study suggest that the function of the area response for high-level cognition function in visual network is less stable than primary visual cortex in the patient with sellar tumors. The decreased brain activity in the precuneus and other brain areas might reflect a maladjustment behavior caused by visual deprivation. The increased brain activity in the lenticular nucleus and insula might be related to a compensatory phenomenon. The results provide useful information for us to better understand how brain functional network change under the influence of visual deprivation.

CLINICAL RELEVANCE/APPLICATION
The value of the functional patterns in these areas could potentially be used for evaluating the recovery prognosis of visual function in the patients with sellar tumor.

Changes of Brain Motor Functional Connectivity of Ischemic Stroke Patients in the Resting State after rTMS Treatments

PURPOSE
The study aimed to 1) investigate the resting-state functional connectivity (rsFC) changes of the ipsilesional primary motor cortex (M1) with the brain after acute stroke; 2) investigate the difference of rsFC of the ipsilesional M1 in stroke patients before and after high frequency repetitive Transcranial Magnetic Stimulation (rTMS) treatments.

METHOD AND MATERIALS
Nineteen patients with unilateral ischemic stroke and fourteen age- and gender-matched healthy volunteers were recruited. Five of...
the patients achieved the rTMS treatment. Pearson correlation analysis between the time course of M1 and that of every voxel within the whole brain was performed for maps of correlation coefficients, which were Fisher's z-transformed and called as z-functional connectivity (z-FC) maps. Two sample t-tests were conducted to compare the z-FC maps between the patients and volunteers, and paired t-tests carried out between pre- and post-treatment groups. The Ethics Committee of hospital approved the study. All participants obtained written consent.

RESULTS

1) Compared with volunteers, the patients demonstrated decreased rsFC with the ipsilesional M1 and contralesional cerebellum, ipsilesional precentral gyrus, supplementary motor area (SMA) and precuneus. 2) The pre-treatment group showed higher rsFC of ipsilesional M1 with ipsilesional inferior temporal gyrus, while decreased ones with contralesional M1 and SMA. However, the post-treatment group showed higher rsFC of ipsilesional M1 with ipsilesional middle temporal gyrus, contralesional inferior temporal gyrus, middle frontal gyrus and precuneus, while decreased ones with the ipsilesional premotor cortex, M1, contralesional paracentral lobe and M1. Higher rsFC was found in the ipsilesional M1 and contralesional frontal medial gyrus in the post-treatment groups. 3) The National Institutes of Health Stroke Scale (NIHSS) of the post-treatment group decreased (p<0.05) compared to pre-treatment group, while the Fugl-Meyer Assessment (FMA) and Barthel Index (BI) increased (p<0.05).

CONCLUSION

The areas mentioned above may play an crucial role in acute stroke and the rTMS may facilitate motor recovery in stroke patients.

CLINICAL RELEVANCE/APPLICATION

High frequency repetitive transcranial magnetic stimulation elicits cortical excitation. We localized it on the ipsilesional primary motor cortex to facilitate the motor recovery in stroke patients.

SSM18-04 The Similar Aberrant Spontaneous Brain Activity Related to Cognitive Impairment in Subcortical Stroke Patients: Using Two different Resting-state fMRI Analysis Methods

Wednesday, Dec. 2 3:30PM - 3:40PM Location: N226

Participants
Cheng-Yu Peng, Nanjing, China (Presenter) Nothing to Disclose
Ying Cui, Nanjing, China (Abstract Co-Author) Nothing to Disclose
Yun Jiao, PhD, Nanjing, China (Abstract Co-Author) Nothing to Disclose
Shenghong Ju, MD, PhD, Nanjing, China (Abstract Co-Author) Nothing to Disclose
Gao-Jun Teng, MD, Nanjing, China (Abstract Co-Author) Nothing to Disclose

PURPOSE

This study combined using two resting-state functional magnetic resonance imaging (rs-fMRI) analysis methods to investigate regional homogeneity (ReHo) and the amplitude of low frequency fluctuation (ALFF) changes in subcortical stroke patients and whether these changes were correlated with impaired cognitive performance.

METHOD AND MATERIALS

Subcortical stroke patients (n=30) and age-, sex-, and education-matched healthy controls subjects (n=30) underwent multimodality MRI examinations to calculate the ReHo and ALFF within the scope of the whole brain not limited in the DMN. In the process of data processing, the stroke patients were divided into two groups (the left- and right-sided lesion groups) by flipping the brain imaging, then, the two group results were compared with the controls respectively. Scores from neuropsychological tests were also obtained and compared between the two groups. The potential relationships between ALFF and ReHo values and cognitive performance were evaluated via partial correlation analysis.

RESULTS

The patients exhibited significant deficiencies in some cognitive domains (all P < 0.05). Compared with healthy controls, patients with stroke had significantly increased ALFF and ReHo values in the left inferior parietal lobule (IPL) consistently (Fig. 1). Moreover, the partial correlation results indicated that the ALFF values of the left IPL were positively correlated with the Digit Span Forwards Test scores (r = 0.427; P = 0.026) in the subcortical stroke patients.

CONCLUSION

The abnormalities of spontaneous brain activity reflected by ALFF and ReHo measurements in post-stroke patients may provide insights into the neurobiological consequences such as cognitive impairment no matter which side the lesions located in.

SSM18-05 Leveraging Microstructural White Matter Changes to Guide Investigation of Resting-state Functional Network Connectivity

Wednesday, Dec. 2 3:40PM - 3:50PM Location: N226

Participants
Susan Sotardi, MD, MS, Bronx, NY (Presenter) Nothing to Disclose
Roman Fleysher, PhD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Namhee Kim, PhD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Michael Stockman, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Craig A. Branch, PhD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Jeremy Smith, PhD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
David Gutman, MD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Michael L. Lipton, MD, PhD, Bronx, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE
Prior research has examined the relationship of diffusion measures of structural white matter integrity to cognitive outcomes. Additionally, resting-state functional connectivity (rs-FC) is correlated with behavioral outcomes. These parallel approaches have revealed important observations regarding the role of connectivity in brain disorders. However, the methodology is inherently limited by the essentially separate nature of structural and functional arms. We propose a method that uses abnormal structural integrity to guide investigation of rs-FC in a cohort of patients with mild traumatic brain injury (mTBI).

**METHOD AND MATERIALS**

23 mTBI patients who presented to the emergency department within 48 hours of injury and 43 normal controls were recruited with IRB approval and gave informed consent. DTI and resting fMRI were performed at 3T. All individual FA maps were matched to the brain volume of a healthy volunteer for group analysis. A voxelwise t-test comparing mTBI and control subjects was used to identify regions of abnormally low FA. Regions of low FA were used as seeds for tractography with the entire cortex serving as the termination point. Gray matter regions thus reached then served as seed ROI for voxelwise analysis of rs-FC.

**RESULTS**

Multiple regions which showed low FA in mTBI subjects were identified. Using a region in the external capsule, tractography was used to delineate fiber tracts, (Figure1). The intersection of the fiber tract and frontal gray matter, which included the frontal eye field region, served as the seed for rs-FC analysis. Voxel-wise comparison of the correlation maps from the mTBI and control groups identified gray matter clusters where connectivity in mTBI subjects was stronger than in controls (Figure2).

**CONCLUSION**

Our results demonstrate a new approach to resting state fMRI analysis where diffusion tractography based on abnormal structural connectivity findings, is used to delineate cortical regions of interest for assessment of functional connectivity. The proposed method avoids the use of a priori seed ROI in rs-FC analysis to more directly interrogate the functional consequences of white matter injury.

**CLINICAL RELEVANCE/APPLICATION**

Our results demonstrate a new approach to resting state fMRI analysis where diffusion tractography, based on abnormal structural connectivity findings, is used to delineate cortical regions of interest for assessment of functional connectivity. The proposed method avoids the use of a priori seed ROI in rs-FC analysis to more directly interrogate the functional consequences of white matter injury. The proposed method avoids the use of a priori seed ROI in rs-FC analysis to more directly interrogate the functional consequences of white matter injury.
Comparison of Iodinated Contrast Staining and Hyperacute Hemorrhage on MRI: Phantom Study

**PURPOSE**

To evaluate the effect of diluted iodinated contrast agents with normal saline or blood on the magnetic resonance (MR) imaging, especially on T1 weighted image (T1WI), T2 weighted image (T2WI) and gradient echo image (GRE) for distinguishing contrast staining from hyperacute hemorrhage which could occur after intraarterial thrombolysis in the patient with acute stroke.

**METHOD AND MATERIALS**

On a 3.0T MRI, T1WI, T2WI, and GRE images were scanned using the phantom with diluted five different kinds of non-ionic iodinated contrast agents with different concentration (0, 0.1, 0.4, 0.6, 1.2, 2, 2.4 M I mole/L). The contrast agents are diluted with normal saline or venous blood (which was sampled within 6 hours). We compared SI of the phantom visually, and quantitatively calculated T1- and T2-relaxation times.

**RESULTS**

Iodinated contrast agents showed T1 and T2 shortening effect. With increase in concentration of contrast agents, the effect of T1 and T2 shortening became more prominent. T2 shortening effect of the iodinated contrast agents was much weaker than that of the product of venous blood. Whereas diluted iodinated contrast agents with normal saline showed intermediate SI on GRE image, blood with/without iodinated contrast agents showed dark SI on GRE image. FIG Comparison of SI among the physiologic saline, undiluted iodinated contrast agent, diluted iodinated contrast agent with saline, contrast agent diluted with blood and undiluted blood itself on T2WI, T1WI and GRE image. Contrast agent mixed with blood or blood itself could be distinguished from diluted iodinated contrast agents at T2WI and GRE image.

**CONCLUSION**

By obtaining T2WI and GRE images, clinicians may be able to discriminate iodinated contrast staining from hyperacute hemorrhage in stroke patients receiving intraarterial thrombolysis.

**CLINICAL RELEVANCE/APPLICATION**

By obtaining T2WI and GRE images, clinicians may be able to discriminate iodinated contrast staining from hyperacute hemorrhage in stroke patients after intraarterial thrombolysis.

Digital Subtraction Angiogram for Perimesencephalic Subarachnoid Hemorrhage: Is Once Enough? A Retrospective Study, Systematic Review and Meta-analysis

**PURPOSE**

Non-aneurysmal subarachnoid hemorrhage (NASAH) accounts for 15% of subarachnoid hemorrhage (SAH) cases. A subset of NASAH patients with perimesencephalic hemorrhage distribution (PM-NASAH) has a relatively benign clinical course. Identifying these patients on initial imaging can prevent exposure to the risks of multiple conventional angiograms. Previous studies demonstrating adequacy of a single initial digital subtraction angiogram (DSA) have been suggestive, but underpowered.

**METHOD AND MATERIALS**

Our institutional retrospective study included consecutive patients from 01/2000-12/2013 with noncontrast head CT within 48 hours positive for SAH, negative initial DSA and followup DSA within 10 days. 252 subjects were identified. Head CT images were reviewed and strictly classified per criteria of van Gijn. 131 subjects with PM-NASAH were identified. DSA reports and images were
reviewed. The medical record was reviewed, including condition at last follow up. Systematic review and meta-analysis using MEDLINE and electronic databases from database inception through 11/01/2014 identified studies documenting workup of patients with NASAH. Inclusion criteria were (a) consecutive patients, (b) head CT within 72h, (c) categorization of PM-NASAH as per Gijn et al, (d) initial negative DSA, (e) follow up DSA within 10 days. Exclusion criteria included cohort of less than 25 subjects. Data from 6 included studies were pooled. Methodology was assessed using the MOOSE guidelines for observational meta-analyses.

RESULTS

131 subjects from our institutional study were pooled with 298 subjects from 6 included studies. No aneurysm was seen on follow up DSA at our institution. 3 aneurysms were reported in the included studies. 2 of the 3 were reported in studies with cases that preceded current DSA technique. Diagnostic yield of subsequent DSA following initial negative DSA was 0.7% (95% CI, 0.1-1.4%), similar or less than the rate of DSA complication, reported from 0.3% to 2.6%.

CONCLUSION

In patients with SAH that strictly adheres to the PM-NASAH pattern, a single DSA essentially excludes a causative aneurysm. Subsequent DSA examinations are very unlikely to benefit and expose patients to unnecessary risk.

CLINICAL RELEVANCE/APPLICATION

Complications from SAH and hemorrhage recurrence in patients with PM-NASAH are rare. Reducing additive risk of multiple DSA examinations is essential in the preventing complications in a benign disease course.

SSM19-03 Dynamics of Cerebral Perfusion Deficits after Subarachnoid Hemorrhage - Predictive Value of an Early Incidence

Participants

Christian Rubbert, MD, Dusseldorf, Germany (Presenter) Nothing to Disclose
Rebecca May, MD, Dusseldorf, Germany (Abstract Co-Author) Nothing to Disclose
Bernd Turowski, Duesseldorf, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE

Delayed cerebral ischemia (DCI) is the major contributor to reduced functional outcome after subarachnoid hemorrhage (SAH). Although the pathogenesis of DCI is not fully understood, limitations in microcirculation appear to be one of the main drivers. CT perfusion (CTP) imaging can indirectly measure microcirculation and is increasingly used in treatment decisions. Early changes in perfusion might be able to predict the risk for critical changes in perfusion after SAH and allow for further risk stratification. To this end, the value of early CTP imaging is retrospectively analyzed.

METHOD AND MATERIALS

Between 1/2006 and 6/2010 351 patients with an aneurysmal SAH underwent CTP imaging. According to local guidelines, CTP imaging is acquired within 1 day after aneurysm treatment (range 0-2d after SAH), 6-8d and 9-11d after SAH or when there is clinical suspicion for deterioration in brain perfusion. Inclusion criteria were 1) at least one early CTP exam <72h after SAH and 2) at least 3 CTP exams in total. 813 CTP exams of 166 patients (4.9±1.8 exams/patient, aged 53.2±12.4, 65.1% female) were analyzed. Purpose-built software was used to automatically generate perfusion parameter maps, define a 1 cm wide circular ROI along the cortex and compute a running average over 10° every 2° for each parameter. The mean transit time (MTT) was evaluated. Critical changes in perfusion were defined as a mean MTT >=4.1s in a hemisphere according to prior work. Receiver-Operator Characteristic analysis was performed to identify the MTT cutoff with the highest sensitivity and specificity in early CTP imaging to predict critical changes in perfusion in follow-up CTP imaging.

RESULTS

The optimal MTT cutoff was 3.58s (AUC 0.65). 88 of 166 patients (53%) had an early MTT >=3.58s. Critical changes in follow-up CTP imaging were observed in 67 of 166 patients (40.4%) and could be predicted with a sensitivity of 67.2% and specificity of 56.6%.

CONCLUSION

Critical changes in brain perfusion in follow-up CTP imaging can, to some degree, be predicted by early CTP imaging <72h after SAH. Further research is needed to improve the prediction model and include data on functional outcome. Given the potential disabilities due to DCI, a cutoff with a higher sensitivity and lower specificity may be of greater clinical value.

CLINICAL RELEVANCE/APPLICATION

Early CTP imaging might be used in the decision to escalate neuromonitoring.

SSM19-04 Diagnostic Yield of Cervical Spine MRI in the Setting of Angiogram-Negative Spontaneous Intracranial Subarachnoid Hemorrhage

Participants

Gelareh Sadigh, MD, Atlanta, GA (Presenter) Nothing to Disclose
Chad A. Holder, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Jason W. Allen, MD, PhD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

PURPOSE

To assess the diagnostic yield of cervical spine (c-spine) magnetic resonance imaging (MRI) in identifying a structural cause for angiogram-negative spontaneous subarachnoid hemorrhage (SAH).

METHOD AND MATERIALS

Consecutive patients 18 years or older presenting with acute spontaneous (non-traumatic) intracranial SAH between February 2009
and October 2014 at two University Hospitals whose catheter angiography results did not reveal an etiology for the SAH, and who underwent c-spine MRI as part of the angiogram-negative SAH protocol, were eligible. Patients with acute intracerebral, subdural or epidural hematoma, parenchymal contusion, recent history of trauma, or previously known cervical vascular malformation were excluded. All patients underwent noncontrast head CT, CT angiography of the head and neck, and MRI of the brain and c-spine as part of the angiogram-negative SAH protocol. Radiology reports from c-spine MRI scans, interpreted by board-certified (CAQ) neuroradiologists, were retrospectively reviewed, with IRB approval.

RESULTS

232 patients met inclusion criteria (mean age 54 years; 50% male; 53% white; 26% African-American). 77% of patients presented to the hospital within 24 hours of experiencing symptoms. SAH was diagnosed by head CT in 97% of cases and by lumbar puncture in 3%. Of 135 patients with reported Hunt and Hess classification of SAH in the electronic medical record, 70% were scored 1, 4% scored 2, 18% scored 3, 7% scored 4, and 1% scored 5. Catheter angiography was performed within the first 4 days after admission in all cases (median of 12 hours). C-spine MRI was performed within the first 19 days after admission in all cases (median of 24 hours). In all 232 patients (100%), c-spine MRI was negative for an etiology to explain the SAH.

CONCLUSION

In our large retrospective series, c-spine MRI following angiogram-negative spontaneous SAH, specifically following a negative head and neck CTA, had no diagnostic yield and is not routinely needed.

CLINICAL RELEVANCE/APPLICATION

C-spine MRI following angiogram-negative SAH has very low to no diagnostic yield. Our data indicate that routine MRI for cervical sources of intracranial SAH after a negative angiogram is not warranted.

SSM19-05 Blood Brain Barrier Permeability Imaging Correlates with Cerebrospinal Fluid Matrix Metalloproteinase-2 (MMP-2) Levels in Aneurysmal Subarachnoid Hemorrhage

Wednesday, Dec. 2 3:40PM - 3:50PM Location: N229

Participants

Jana Ivanidze, MD, PhD, New York, NY (Presenter) Nothing to Disclose
Omar N. Kallas, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Ashley E. Giambrone, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose
Michael Lerario, New York, NY (Abstract Co-Author) Nothing to Disclose
Alan Z. Segal, New York, NY (Abstract Co-Author) Nothing to Disclose
Ajay Gupta, MD, New York, NY (Abstract Co-Author) Research Consultant, Biomedical Systems; Research support, General Electric Company
Moonsoo Jin, New York, NY (Abstract Co-Author) Nothing to Disclose
Pina C. Sanelli, MD, Manhasset, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE

CT Perfusion (CTP) allows assessment of quantitative blood brain barrier permeability (BBBP) parameters, including PS (flow across the vessel wall to the extravascular extracellular space (EES)), Ktrans (plasma flow per unit tissue volume), and VE (EES volume). However, sensitivity has to date not been established in the clinical setting. Matrix metalloproteinase 2 (MMP-2) is a known molecular upregulator of BBBP. The purpose of our study was to correlate quantitative BBBP parameters on CTP with MMP-2 cerebrospinal fluid (CSF) protein levels in aneurysmal subarachnoid hemorrhage (SAH) patients to assess the ability of CTP to detect BBB dysfunction in the clinical setting.

METHOD AND MATERIALS

In this prospective IRB-approved study, 10 SAH patients underwent extended whole brain CTP with an axial shuttle mode protocol on day 0-3 after aneurysmal rupture. CTP data were post-processed into quantitative PS, Ktrans and VE maps using Olea Sphere software (Olea Medical, La Ciotat, France). Global mean values were calculated from standardized cortically based ROIs. CSF was collected via ventriculostomy catheter (placed for intracranial pressure management) within 24 hours of CTP. MMP-2 protein levels were measured in CSF supernatant using multiplex microbead immunoassay technology (Luminex Corp, Austin, TX). Spearman correlation analysis was performed to determine correlation between MMP-2 levels with each BBBP parameter.

RESULTS

Median patient age was 55 years, and the median modified Fisher score was 4. 80% of patients had hydrocephalus and 70% had global cerebral edema at presentation. There was a statistically significant positive correlation between MMP-2 CSF levels and PS (r = 0.6565; p = 0.0448), Ktrans (r = 0.8024; p = 0.0075), and VE (r = 0.7477; p = 0.0164), respectively.

CONCLUSION

Elevation of PS, Ktrans and VE indicates increased flow across the BBB into the EES, or increased BBBP. MMP-2 is an established indicator of BBBP. We demonstrate that elevated BBBP, as evaluated by CTP, correlates with elevated CSF levels of MMP-2 in patients with SAH, further establishing CTP as a promising tool to assess BBB dysfunction in the clinical setting.

CLINICAL RELEVANCE/APPLICATION

This preliminary study supports the clinical application of quantitative BBBP imaging with CTP. In SAH, where elevated BBBP has been shown to correlate with poor clinical outcomes, this application may become an important prognostic indicator in future studies.

SSM19-06 Preliminary Evaluation of Arterial Spin Labeling as a Method to Predict Clinically Significant Vasospasm Following Aneurysmal Subarachnoid Hemorrhage

Wednesday, Dec. 2 3:50PM - 4:00PM Location: N229

Participants

Jalal B. Andre, MD, Seattle, WA (Presenter) Research Grant, Koninklijke Philips NV; Consultant, Hobbitview, Inc; Research Grant, Toshiba Corporation;
PURPOSE
To evaluate a multidelay, pseudocontinuous arterial spin labeling (MDpCASL)-based screening tool for the diagnosis of vasospasm (VSP) in patients with aneurysmal subarachnoid hemorrhage (aSAH).

METHOD AND MATERIALS
Patients with clinically suspected VSP after aSAH (based on clinical and/or Transcranial Doppler exam) underwent a 10-minute MDpCASL MRI en route to digital subtraction angiography (DSA) for endovascular VSP intervention. The multi-parametric MDpCASL sequence was performed with background suppression and 3-dimensional gradient- and spin-echo readout, at 4 postabel delays (=1.5/2/2.5/3s), and processed using an in-house post-processing pipeline to generate quantitative CBF maps. DSA images were independently reviewed by two blinded, expert neurointerventional readers at a PACS station for the presence, location and extent of VSP, and asked to provide treatment recommendations. Readers were then shown corresponding ASL images and asked how this information influenced treatment recommendations. ASL images were evaluated by a third, blinded expert reader with extensive ASL experience. DSA and ASL findings were aggregated into 5 major vascular territories per patient (anterior left and right, middle left and right and posterior) for comparison. Associations between DSA and ASL were analyzed using logistic regression based on generalized estimating equations to account for repeated measurements per patient.

RESULTS
Ten patients were studied. ASL perfusion deficits were significantly associated with spasm on DSA (p=0.002). ASL detected clinically significant perfusion deficits in nearly 31% of evaluated vascular territories, in which no significant (≥50%) DSA spasm was identified. 25% of territories with significant spasm had minimal perfusion deficits by ASL. Expert neurointerventionalists also agreed that having ASL images available prior to performing DSA would have changed treatment recommendations in 60% of cases. Blinded two-reader neurointerventional assessment of ASL images suggested that evaluation of ASL-derived CBF would have prevented 3 of 10 patients from undergoing an unnecessary DSA.

CONCLUSION
Perfusion information from MDpCASL prior to DSA may reduce unnecessary DSA in select patients and modify therapy in others, possibly improving patient triage and management.

CLINICAL RELEVANCE/APPLICATION
Obtaining MDpCASL prior to DSA may alter treatment in patients suspected of VSP following aSAH.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Yoshimi Anzai, MD - 2014 Honored Educator
MSES44A  Cystic Neck Masses

Participants
Barton F. Branstetter IV, MD, Pittsburgh, PA, (BFB1@pitt.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Categorize cystic neck masses in adults and children. 2) Indicate specific differentiating diagnostic criteria.

ABSTRACT
A nonenhancing, fluid-filled mass is a common finding on cross-sectional imaging of the neck. The location of the mass and its relationship to surrounding structures are critical for categorization of the mass and for providing a specific diagnosis. While congenital causes of cystic neck masses are often discussed, they are less frequent than infectious, developmental, or neoplastic causes. The purpose of this session is to review common and uncommon causes of cystic neck masses and to review the imaging characteristics that differentiate them. Potential pitfalls of imaging will be emphasized.

Active Handout: Barton F. Branstetter

MSES44B  Adult Orbital Neoplasms

Participants
Tanya J. Rath, MD, Pittsburgh, PA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Understand the relevant compartmental anatomy of the orbit. 2) Differentiate the characteristic imaging features of benign and malignant adult orbital neoplasms. 3) Define the role of cross-sectional imaging in the management of orbital neoplasms. 4) Review non-neoplastic mimics of orbital neoplasms.

ABSTRACT
Cross-sectional imaging complements ophthalmologic examination in the evaluation of orbital neoplasms. A relevant succinct differential diagnosis for an orbital mass can be generated based on the morphology, location and extent of a lesion. MRI is critical for treatment planning by characterizing the orbital compartments involved and assessing for intracranial and perineural spread of disease. The purpose of this session is to review the characteristic imaging features of benign and malignant orbital neoplasms. Non-neoplastic processes that can mimic orbital neoplasms will also be discussed. Imaging findings that affect management will be emphasized.

Active Handout: Tanya Jaitley Rath
http://abstract.rsna.org/uploads/2015/15001763/MSES44B AA 12.2.15 FINAL RSNA ORBITS.pdf

MSES44C  Imaging Dementia and Memory Loss

Participants
Meike W. Vernooij, MD, Rotterdam, Netherlands, (m.vernooij@erasmusmc.nl) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Describe the minimum requirements for an MRI protocol to image patients suspected of dementia. 2) Read scans from a memory clinic in a standardized way, using available rating scales. 3) Construct a structured radiological report with useful recommendations for the referring clinician.

Active Handout: Meike Willemijn Vernooij
RSNA/ESR Emergency Symposium: General Principles, Pediatric and ENT Emergencies (An Interactive Session)

Wednesday, Dec. 2 3:30PM - 5:00PM Location: S402AB

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Ronald J. Zagoria, MD, San Francisco, CA, (ron.zagoria@ucsf.edu) (Moderator) Nothing to Disclose
Andras Palko, MD, PhD, Szeged, Hungary (Moderator) Medical Advisory Board, Affidea Group;

Sub-Events
MSSR44A Polytrauma

Participants
Ulrich Linsenmaler, MD, Munich, Germany (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Demonstrate general principles of diagnostic imaging in Emergency Radiology in traumatic and non-traumatic emergencies. 2) Analyze etiology, background and management of common radiological emergencies. 3) Identify the role, indications and protocols for US, CR, MDCT in modern emergency radiology.

ABSTRACT
Multiple trauma / polytrauma remains the leading cause of death in a patient population below the age of 45 years. Modern Emergency Radiology plays today a key role in an interdisciplinary team guiding diagnosis and treatment in the initial clinical workup. This lecture will cover the following topics: To describe background, incidence and regional differences in patients with polytrauma / multiple trauma. To appreciate the clinical significance and to analyze critical triage criteria to undergo ER / shock room admission and concepts of initial clinical management (ATLS). To review imaging techniques and radiological management and logistic concepts for patients with polytrauma / multiple trauma within a clinical algorithm. To review the use of whole body computed tomography (WBCT), CTA as well as conventional radiography (CR) and ultrasound (US) in the initial work-up. To describe common and uncommon imaging findings. Image reading and data management, individualized CT protocols and outcome control.

MSSR44B Challenges of Imaging Pediatric Abdominal Emergencies

Participants
Susan D. John, MD, Houston, TX (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Understand the variations of pathology that cause abdominal pain and vomiting in infants and children. 2) Plan safe and effective imaging protocols using US, CT, and MRI. 3) Recognize pitfalls in the diagnosis of pediatric abdominal emergencies with imaging.

ABSTRACT

MSSR44C Imaging in ENT Emergencies

Participants
Diego B. Nunez JR, MD, MPH, New Haven, CT, (diego.nunez@yale.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Analyze imaging findings in patients presenting with acute head and neck conditions using a systematic spatial approach. 2) Demonstrate understanding of the role and indications of CT and MR in acute non-traumatic ENT case management. 3) Identify the extent of disease and recognize specific complications of cervicofacial infections.

ABSTRACT
RSNA Diagnosis Live™: Neuro and MSK

Wednesday, Dec. 2 4:30PM - 6:00PM Location: E451B

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Paul J. Chang, MD, Chicago, IL, (pchang@radiology.bsd.uchicago.edu) (Presenter) Co-founder, Stentor/Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Medical Advisory Board, lifeIMAGE Inc; Medical Advisory Board, Merge Healthcare Incorporated
Gregory L. Katzman, MD, Chicago, IL (Presenter) Nothing to Disclose
Neety Panu, MD, FRCPC, Thunder Bay, ON (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) The participant will be introduced to a series of radiology case studies via an interactive team game approach designed to encourage "active" consumption of educational content. 2) The participant will be able to use their mobile wireless device (tablet, phone, laptop) to electronically respond to various imaging case challenges; participants will be able to monitor their individual and team performance in real time. 3) The attendee will receive a personalized self-assessment report via email that will review the case material presented during the session, along with individual and team performance. This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.
Controversy Session: Concussion and Dementia: Will Football be the Tobacco of this Century?

Wednesday, Dec. 2 4:30PM - 6:00PM Location: E351

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Michael N. Brant-Zawadzki, MD, Newport Beach, CA (Moderator) Nothing to Disclose

LEARNING OBJECTIVES
1) Understand the functional as well pathophysiologic consequences of concussion. 2) Understand the overlap between chronic traumatic encephalopathy and Alzheimer's disease. 3) Understand the prevalence of chronic traumatic encephalopathy, its demographics, and distinguish those features from the more widely prevalent aspects of Alzheimer's dementia related disorders. 4) Properly understand the prognostic risk of contact sports as they relate to the prevalence of dementia in the population at large.

Sub-Events

SPSC42A CTE (Chronic Traumatic Encephalopathy) and Dementia: Causation?

Participants
Michael T. Modic, MD, Cleveland, OH (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

SPSC42B Guilt by Association

Participants
William R. Shankle, MD, MS, Newport Beach, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Understand the distinction between correlation and cause. 2) Understand how one can distinguish between a reported effect that is causal and one that is associational. 3) Apply this approach to Traumatic Brain Injury to examine the evidence of a causal vs. associative effect.

ABSTRACT
Guilt By AssociationWR Shankle, MS MD FACPTraumatic Brain Injury (TBI) is one condition where it seems intuitively obvious that brain trauma CAUSES brain dysfunction. In the past decade, methodological advances in computer science have led to the development of a mathematics called CAUSAL INFERENCE, that can be used to analyze risk factors and distinguish whether they are likely to CAUSE an outcome (e.g. brain dysfunction) or are simply ASSOCIATED with the outcome's occurrence. This methodology combines probability theory with graph theory to accomplish this distinction. Causal Inference is very useful because it can analyze observational and other non-randomized studies. Interestingly, a search of the TBI literature identified no studies that have tested the assumption that TBI CAUSES brain dysfunction. One very useful causal inference method, called Targeted Maximum Likelihood Estimation, has been used in observational studies to minimize the chance that a causal effect is not detected due to some type of bias in the study. In simple terms, I will present how TMLE can be used to test the assumption that TBI causes brain dysfunction. Performing such a study on observational data would be of enormous value because of the extremely high probability that TBI does, in fact, cause brain dysfunction. Other risk factors, in which the question of causality is much less clear, can then be examined using TMLE with reference to what TMLE informs us about about TBI.

URL
Controversy Session: CT Perfusion (CTP) and Stroke: RIP?

Wednesday, Dec. 2 4:30PM - 6:00PM Location: S406B

NR CT ER

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Gordon K. Sze, MD, New Haven, CT (Moderator) Investigator, Remedy Pharmaceuticals, Inc

LEARNING OBJECTIVES

1) Understand the most important acute ischemic stroke physiology factors for patient outcomes and their relative importance. 2) Recognize the role of the ischemic core size in selecting patients with large vessel occlusion for endovascular therapy. 3) Review the animal literature on the use of CT perfusion for measuring the ischemic core and its value compared to diffusion MRI. 4) Recognize the source and magnitude of measurement error when using CTP including using the 95% confidence interval in ischemic core estimates in individual patients.

ABSTRACT

Recent trials have shown that intervention procedures favorable outcomes when acute ischemic stroke patients are selected using CTP. Does that mean that CTP is adequate to decide whether an INDIVIDUAL patient should undergo treatment? The answer is "no". CTP is simply too imprecise to reliably measure the infarct core - the critical parameter for excluding from therapy patients who are at great risk of hemorrhagic complications, and are unlikely to benefit. Moreover, there is a more precise alternative, diffusion MRI. CTP measures hemodynamics, not tissue status. Hence, although a marker for irreversible injury absent timely reperfusion, CTP - which reflects a snapshot-in-time - is not a marker for treatment futility. Not surprisingly, validation studies in animal models are sparse and have not been reproduced. All published clinical data are consistent: CTP core estimates have high error. Although CTP may be adequate for selection of patients with small cores, where large measurement errors are of little consequence, the cost is exclusion of many with a high likelihood of treatment benefit. CTP core-lesions segmented using automated software offer the illusion of quantitative accuracy that simply does not exist. CTP and DWI are different. The inherently poor signal-to-noise ratio (SNR) of post-processed CTP images is another fundamental weakness of the technique. Low SNR measurements may be useful if repeated and a mean calculated; this cannot be done for individual patients. That a strong linear correlation exists between CTP and DWI derived ischemic lesion volumes is not surprising, since both result from the same arterial occlusion. High correlation in a population, however, does not confer high measurement accuracy in an individual. As Bland and Altman pointed out almost 30 years ago, regression analyses are inappropriate to judge the validity of a quantitative clinical test. More appropriate are difference tests that establish the 95% confidence limits. As shown by Schaefer et al, a CBF core measurement of 70 ml could actually range from 11-to-124 ml within the 95% confidence limits; other papers in the CTP literature reveal similar variability. Although this large variability does not preclude using CTP to enroll patients into clinical trials, it does make such selection inherently less efficient compared to using "reference standard" DWI. Indeed, power calculations show that, for a simulated treatment study designed to detect a 20 ml improvement in final infarct volume, using CTP instead of DWI would require at least twice as many patients to reach significance. Given CTP's relative inaccuracy in delineating "core", what is the reason for the good outcome rate using a CTP-based selection strategy? The answer lies in its patient selection criteria. The successful trials used a highly conservative selection strategy, "cherry picking" the very best patients with very small cores who were likely to do well even with alteplase alone. Targeting small cores minimizes the effects of large measurement errors, at the cost of excluding many who might benefit. All agree that clinical trials have demonstrated that thrombolysis and thrombectomy are effective treatments for stroke caused by large vessel occlusion. All agree that identifying a target occlusion is important, and that measurement of the infarct-core is critical. The question centers on whether core measurement by CTP is sufficiently precise to be used for treatment selection in individual patients? A wealth of theoretical, experimental, and clinical evidence suggests the answer is "no". Many argue that "CTP may be short of perfect, yet close enough." Would an internist accept a blood glucose or INR measurement of >50% error as "close enough"? No, she would not. Why, then, should stroke physicians accept a core measurement error of >50% as "close enough"? Clearly, they should not - especially when a more accurate alternative is readily available. Bland JM, Altman DG. Statistical methods for assessing agreement between two methods of clinical measurement. Lancet. 1986 Feb 8;1(8476):307-10. Schaefer PW, Souza L, Kamalian S, Hirsch JA, Yoo AJ, Kamalian S, Gonzalez RG, Lev MH. Limited reliability of computed tomographic perfusion acute infarct volume measurements compared with diffusion-weighted imaging in anterior circulation stroke. Stroke. 2015 Feb;46(2):419-24.

Participants
Max Wintermark, MD, Lausanne, Switzerland, (max.wintermark@gmail.com) (Presenter) Advisory Board, General Electric Company;

LEARNING OBJECTIVES

1) To review the indications of perfusion CT imaging in patients suspected of acute ischemic stroke.

ABSTRACT

Perfusion-CT is an imaging method used to assess the ischemic core and penumbra in acute stroke patients. A prospective multicenter study reported that an absolute cerebral blood volume (CBV) threshold reflected the ischemic core and that a relative mean transit time (MTT) threshold most accurately reflected the penumbra. However, in more recent and larger studies, relative cerebral blood flow (rCBF) was found to be more predictive of the ischemic core (nonviable tissue) than absolute CBV. There is a need for
standardization of the PCT methods used to define the ischemic core and the penumbra. Determination of tissue viability based on imaging has the potential to individualize thrombolytic therapy and extend the therapeutic time window for some acute stroke patients. Although perfusion imaging has been incorporated into acute stroke imaging algorithms at some institutions, its clinical utility has not been proven. It is important to note that perfusion imaging has many applications beyond characterization of the penumbra and triage of patients to acute revascularization therapy. The negative results of the MR RESCUE trial do not negate these potential benefits. These applications include, but are not limited to: (1) improving the sensitivity and accuracy of stroke diagnosis (in some cases, a lesion on PCT leads to more careful scrutiny and identification of a vascular occlusion that was not evident prospectively, particularly in the M2 and more distal MCA branches), (2) excluding stroke mimics, (3) better assessment of the ischemic core and collateral flow, and (4) prediction of hemorrhagic transformation and malignant edema.
ED009-TH

Neuroradiology Thursday Case of the Day
Thursday, Dec. 3 7:00AM - 11:59PM Location: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants
Thiru A. Sudarshan, DMRD, FRCR, Dundee, United Kingdom (Presenter) Nothing to Disclose
Avinash K. Kanodia, MD, Perth, United Kingdom (Abstract Co-Author) Nothing to Disclose
Jonathan Weir-McCall, MBBS, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose
Anu Kamalasanan, MBBS, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose
Bangalore Anil Kumar, MD, FRCR, Slough, United Kingdom (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1.) Review the diagnosis of a specific condition by using either a single-modality or multimodality approach. 2.) Identify state-of-the-art imaging and methods of treatment for various pathologic conditions. 3.) Assess new research on applications of various imaging and therapeutic modalities.
Learning Objectives

1) Improve basic knowledge and skills relevant to clinical practice. 2) Practice formulating a differential diagnosis for pathologic diseases involving the brain, spine, head and neck. 3) Apply principles of critical thinking to challenging diagnostic imaging cases.

Abstract

The learning objectives are to enable attendees to: 1. Improve basic knowledge and skills relevant to clinical practice. 2. Practice formulating a differential diagnosis for pathologic diseases involving the brain, spine, head and neck. 3. Apply principles of critical thinking to challenging diagnostic imaging cases.

Sub-Events

MSCN51A  Adult Brain

Participants
Pina C. Sanelli, MD, Manhasset, NY (Director) Nothing to Disclose

Learning Objectives

1) Recognize the key neuroimaging characteristics of various adult cerebral disease entities. 2) Use pertinent imaging features and key clinical factors to formulate a pertinent differential diagnosis for various adult cerebral pathologies. 3) Discuss the utility of various imaging techniques for evaluating various adult cerebral disorders. 4) Review pertinent anatomy as it pertains to common adult cerebral pathologies.

MSCN51B  Adult Spine

Participants
Gordon K. Sze, MD, New Haven, CT (Presenter) Investigator, Remedy Pharmaceuticals, Inc

Learning Objectives

1) To analyze findings on imaging examinations of the spine. 2) To characterize unusual findings and provide a differential diagnosis.

Abstract

Lesions of the spine and of the spinal cord can be divided into broad categories. Use of an organized approach to the analysis of difficult cases will allow one to refine a differential diagnosis. Cord lesions, in particular, often superficially resemble one another. By exploring and applying the broad categories of diseases that affect the cord, subtle differences can be brought out.

MSCN51C  Adult Head and Neck

Participants
Hugh D. Curtin, MD, Boston, MA (Presenter) Nothing to Disclose

Learning Objectives

1) To use imaging findings to differentiate head and neck lesions that can occur in similar locations. 2) To identify and evaluate imaging landmarks that determine changes in treatment.
Brain Aneurysms

Thursday, Dec. 3 8:30AM - 10:00AM Location: S102AB

NR ER

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Steven W. Hetts, MD, San Francisco, CA (Moderator) Consultant, Silk Road Medical Inc Consultant, Medina Medical Inc Research Grant, Stryker Corporation Data Safety Monitoring Board, Stryker Corporation
Darren Orbach, MD, Boston, MA, (darren.orbach@childrens.harvard.edu) (Moderator) Nothing to Disclose

Sub-Events

RC605A Management of the Unruptured Brain Aneurysm

Participants
Robert Fahed, MD, MSc, Quebec, QC (Presenter) Nothing to Disclose

Handout: Jean Raymond

RC605B Pediatric Arteriopathy: A Neurointerventionalist’s Perspective

Participants
Darren Orbach, MD, Boston, MA, (darren.orbach@childrens.harvard.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Understand the most common causes of pediatric arterial ischemic stroke. 2) Contextualize arterial ischemic stroke within overall cerebrovascular conditions in children (hemorrhagic and venous). 3) Distinguish between progressive and fixed arteriopathies, in terms of natural history and treatment strategies. 4) Differentiate etiologies and treatment challenges of stroke in children versus adults.

ABSTRACT

RC605C Flow-diversion Technology for Treatment of Cerebral Aneurysms

Participants
Philip M. Meyers, MD, New York, NY, (pmm2002@cumc.columbia.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) The participant will understand the design of certain flow-diverters used to treat cerebral aneurysms. 2) The participant will be familiar with the on-label and some off-label application of the most commonly used flow diverters in the United States. 3) The participant will be familiar with common radiographic outcome metrics, imaging markers for clinical success and potential complications.

ABSTRACT

Flow diversion is becoming an increasingly important method to treat cerebral aneurysms, now encompassing nearly 40% of all endovascular treatment procedures for unruptured intracranial aneurysms. In this lecture, the meeting participant will learn about the design and application of flow diversion technologies to the treatment of cerebral aneurysms and about some of the imaging manifestations associated with their use.
Open Wide! Imaging the Oral Cavity and Jaw

Thursday, Dec. 3 8:30AM - 10:00AM Location: E451B

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC606A  Odontogenic and Non-odontogenic Diseases of the Jaw

Participants
Joel K. Cure, MD, Birmingham, AL (jcure@uabmc.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Perform technically optimized CT examinations to evaluate jaw lesions. 2) Identify imaging features that predict an odontogenic vs. non-odontogenic origin of imaged jaw lesions. 3) Stratify a differential diagnosis for jaw lesions by employing principles conveyed in this presentation. 4) Identify cases requiring clinical action.

ABSTRACT
After considering the clinical presentation and patient demographics, a differential diagnosis for imaged jaw lesions is facilitated by optimized imaging and identification of features that predict an odontogenic vs. non-odontogenic lesion origin and that predict lesion behavior. Location of the lesion in tooth-bearing vs. non-tooth-bearing portions of the jaw, the spatial relationship of the lesion to individual teeth, and the condition of the affected/involved dentition are all noteworthy features. Analysis of lesion attenuation, margins, growth patterns, and soft tissue components can help discriminate similar-appearing lesions and inform patient management.

RC606B  Benign Oral Cavity Disease

Participants
Kristen L. Baugnon, MD, Atlanta, GA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Differentiate the spaces of the oral cavity and develop a differential diagnosis for lesions arising in those locations. 2) Identify some of the most frequently encountered benign lesions in the oral cavity, including anatomic variant, infectious/inflammatory, developmental, and benign neoplastic lesions. 3) Recommend optimal imaging techniques for detection of oral cavity pathology.

ABSTRACT
Benign lesions in the oral cavity can often be detected incidentally on imaging, and can present a diagnostic challenge. The imaging findings of the most frequently encountered benign lesions in the oral cavity are depicted, including anatomic variants, infectious/inflammatory, developmental, and benign neoplastic lesions. The spaces of the oral cavity, including the root of the tongue, sublingual space, and submandibular space are reviewed, and a systematic approach to assessing lesions occurring in these locations is presented. CT and MRI imaging techniques and pitfalls in imaging the oral cavity are discussed.

Active Handout: Kristen Lloyd Baugnon

RC606C  Malignant Oral Cavity Disease

Participants
Kristine M. Mosier, DMD, PhD, Indianapolis, IN (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) To be familiar with the most common malignant neoplasms of the oral cavity and the key elements for differential diagnosis. 2) To understand staging of oral cavity cancer and be familiar with the critical elements for accurate staging.

ABSTRACT
In this session we will review the most common oral cavity malignant neoplasms with practice pearls to help guide the differential diagnoses of these lesions, as well as less common lesions. We will review current staging for oral cavity cancer and identify those key anatomical features critical to staging. Finally we will review spread patterns for oral cavity cancer.
Participants

Sub-Events

**RC613A  Imaging of Sensorineural Hearing Loss in Children**

Participants
Maura E. Ryan, MD, Chicago, IL, (mryan@luriechildrens.org) *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review pertinent anatomy of the inner ear structures. 2) Describe pathologic CT and MRI findings of the inner ear, membranous labyrinth and cochlear nerve associated with pediatric sensorineural hearing loss.

**Active Handout:** Maura E. Ryan

**RC613B  Imaging Approach to Seizures in Children**

Participants
Luke L. Linscott, MD, Cincinnati, OH, (luke.linscott@cchmc.org) *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify major causes of seizures in children. 2) Understand importance of optimal MR imaging technique for epilepsy evaluation.

**RC613C  Perinatal Imaging of Congenital Posterior Fossa Anomalies**

Participants
Ashley J. Robinson, MBChB, Doha, Qatar, (ASH@RADIOLOGIST.NET) *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) Revise the relevant embryology of the posterior fossa, including the brainstem, cerebellum and cisterna magna. 2) Review several criteria for evaluation of congenital posterior fossa anomalies using a case-based approach.

**ABSTRACT**

**Active Handout:** Ashley James Robinson
LEARNING OBJECTIVES
1) To understand the role/indications for MR neurography in the multidisciplinary diagnostic work-up of brachial plexus and upper extremity nerve pathologies. 2) To understand the technical requirements and challenges of MR neurography in the brachial plexus and upper extremities. 3) To get familiar with the anatomy and normal MR imaging appearance of the brachial plexus and upper extremity nerves. 4) To recognize commonly encountered pathologies and their differential diagnoses in brachial plexus and upper extremity nerves.

ABSTRACT
Continuous improvements in magnetic resonance scanner, coil, and pulse sequence technology have resulted in the ability to perform routine, high-quality imaging of the brachial plexus and upper extremity nerves. MR neurography has evolved into a very helpful diagnostic tool in the work-up of peripheral nerve and plexus pathologies. It is commonly used for the detection and preoperative staging of neural mass lesions, in evaluating inflammatory and traumatic brachial plexus changes, confirming and/or complementing electrophysiologic exams. This talk will focus on the technical requirements for imaging the brachial plexus and upper extremities, discuss the anatomy, and demonstrate relevant examples of normal and abnormal findings.

LEARNING OBJECTIVES
1) Employ new techniques for LS plexus and lower extremity evaluation. 2) Understand the differences between normal and abnormal imaging appearances of LS plexus and lower extremity peripheral nerves. 3) Discuss the differential diagnosis of various LS plexus and lower limb nerve pathologies based on available clinical history and imaging findings. 4) Learn how to incorporate the MRN modality in the diagnostic algorithm of plexopathies and related peripheral neuropathies in a multi-disciplinary fashion.

ABSTRACT
Lumbosacral plexus has a complex anatomy with a number of nerve convergences and divergences resulting in formation of multiple essential peripheral nerves that provide motor and sensory function to the pelvis and lower extremities. Due to the deep location and complexity, MR neurography (MRN) plays a major role in evaluation of its normalcy and pathologic states. This talk will discuss current state of the art techniques available for LS plexus evaluation and show normal and abnormal imaging appearances of various common and uncommon pathologic states involving LS plexus and its branch nerves. The talk will specifically address new 3D techniques that suppress vessel signal effectively while preserving effective nerve visualization. Role of MRN in chronic pelvic pain, nerve injuries and its incremental value over conventional lumbar spine imaging will be discussed. Current role of functional DTI in qualitative and quantitative assessment of nerve pathology and tumors will be highlighted.

LEARNING OBJECTIVES
1) Identify the basic microanatomy of peripheral nerves, main pathologic conditions, and physiologic principles of diffusion-weighted tensor imaging (DTI). 2) Apply diffusion-weighted tensor imaging (DTI) to imaging protocols for peripheral neuropathies, used for both, research and clinical practice. 3) Analyze diffusion-weighted tensor imaging (DTI) images both quantitatively and qualitatively. 4) Understand the current applications but also limitations of diffusion-weighted tensor imaging (DTI) of peripheral nerves.

ABSTRACT
Diffusion tensor imaging (DTI) is an MR imaging technique which uses the random motion (diffusion) of water molecules within
PET and MR Methods to Image Pain

Diffusion tensor imaging (DTI) is an MR imaging technique which uses the random motion (diffusion) of water molecules within biologic tissues. Due to the tissues ` distinct structural properties, the diffusion is hindered in some directions but at the same typically not hindered in other directions. DTI is a well known imaging technique in the brain and central nervous system, but its application to the peripheral nervous system was limited in the past due to multiple technical reasons. However, numerous recent studies show now that the technique cannot only be applied successfully to image peripheral nerves, but they also showed that the technique is very sensitive and specific for the detection of peripheral nerve injuries and other neuropathies. DTI may also serve as a biomarker for the demyelination of axons and the extent of nerve fiber loss. The refresher course will cover the basic principles of DTI, the challenges and limitations for imaging protocols, as well as the evaluation of DTI images (both quantitatively and qualitatively). MR tractography of peripheral nerves will also be covered.

Participants
Sandip Biswal, MD, Stanford, CA (Presenter) Co-founder, SiteOne Therapeutics Inc; Research Grant, General Electric Company; Stockholder, Atreus Pharmaceuticals Corporation

LEARNING OBJECTIVES
1) Understand the challenges of current conventional imaging approaches in diagnosing peripheral pain generators. 2) Understand the basis for identifying specific molecular and cellular biomarkers of pain and how these biomarkers can be exploited with molecular and cellular imaging techniques. 3) Demonstrate both clinical and pre-clinical PET/MR or advanced MRI approaches in identifying pain generators.

ABSTRACT
Chronic pain is now the prevalent disease in the world. The chronic pain sufferer is currently faced with a lack of objective tools to identify the source of their pain. The goal of this session is to describe new clinical molecular imaging and emerging molecular/cellular imaging methods to more accurately localize chronic pain generators/drivers so that we may objectively identify and more intelligently act upon the cause in a pain sufferer. Successful imaging of pain is relying heavily upon a multidisciplinary effort that include expertise from of a number of scientists and clinicians in the fields of synthetic chemistry, radiochemistry, magnetic resonance physics/engineering, molecular pain neurobiology, clinical pain, radiology and others. A number of clinical and emerging pre-clinical approaches in positron emission tomography (PET) and magnetic resonance imaging (MRI) will be described. These imaging methods will demonstrate how the site of increased nociceptive activity is highlighted in the peripheral nervous system and spinal cord.
MR Safety I
Thursday, Dec. 3 8:30AM - 10:00AM Location: S105AB

LEARNING OBJECTIVES
1) Understand safety issues in MRI, particularly those caused by the main magnetic field, magnetic field gradients, and transmit RF.
2) Understand guidance from the ACR, and governmental regulations designed to address these issues.
3) Describe the importance of an MR Safety program including comprehensive patient screening in the clinical setting.
4) Briefly address safety issues regarding MRI contrast agents.

LEARNING OBJECTIVES
1) Describe various types of neurostimulators and their clinical applications.
2) Understand the underlying MR physics associated with the risks of scanning patients with neurostimulators.
3) Learn the precaution steps to ensure the safety of the patient with neurostimulators during MR scanning.

ABSTRACT
The demands and applications for neurostimulators continue to increase as the technology advances. MRI is an important diagnostic tool for postoperative evaluation and potential future workup. The presence of the neurostimulator poses potential safety risks in the MR scanning environment. By observing certain precautions, MRI can be performed with an extremely low risks. It is important to follow the manufacturers’ MRI guidelines to ensure the safety of the patients and continuous functioning of the device.
Radiomics Mini-Course: Oncologic Applications

Thursday, Dec. 3 8:30AM - 10:00AM Location: S103AB

Participants
Sandy Napel, PhD, Stanford, CA (Director) Medical Advisory Board, Fovia, Inc; Consultant, Carestream Health, Inc; Scientific Advisor, EchoPixel, Inc

Sub-Events

RC625A Breast Cancer with PET-CT

Participants
Richard L. Wahl, MD, Saint Louis, MO (Presenter) Research Consultant, Nihon Medi-Physics Co, Ltd;

LEARNING OBJECTIVES
1) Describe the FDG pet uptake characteristics before therapy of 'triple - negative' breast cancers vs other subtypes.

ABSTRACT

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Richard L. Wahl, MD - 2013 Honored Educator

RC625B Radiogenomics of Lung Cancer

Participants
Michael D. Kuo, MD, Los Angeles, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) To discuss the principles behind lung cancer radiogenomics. 2) Highlight clinical applications of lung cancer radiogenomics.

ABSTRACT

RC625C Brain Cancer: Radiomics, Radiogenomics, and Big Data

Participants
Rivka R. Colen, MD, Houston, TX, (rcolen@mdanderson.org) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Define the field of radiomics and imaging genomics. 2) Apply radiomics and imaging genomics in brain tumors. 3) Describe the use of MRI as a biomarker for genomic signatures and profiles. 4) Define role of MRI in personalized medicine for target discovery of therapeutic targets. 5) Explain the use of MRI in drug development and clinical trials. 6) Assess the research available in imaging genomics and radiomics. 7) Define and describe the integration of radiomics and imaging genomics into big data platforms.

ABSTRACT

This objective of this course is to introduce the recently emerged field of radiomics and imaging genomics (radiogenomics) in brain tumors, specifically glioblastoma (GBM). Emphasis will be on radiomics with regards to the high-dimensional, high-throughput feature extraction of imaging features from medical images, specifically MRI; the second emphasis will be on the use of imaging in relation to underlying tumor genomics, how to use MRI as a biomarker, surrogate and correlate of tumor genomics as well as the use of MRI as a genomic target discovery tool and its application in therapeutic discovery and drug development. The role of radiomics and imaging genomics in the era of big data and how we can leverage the imaging-omic data will also be discussed.
LEARNING OBJECTIVES

1) Describe the sonographic characteristics of thyroid nodules that are suspicious for malignancy. 2) a. Discuss the Bethesda Cytology Classification of Thyroid FNA results and the risk of malignancy associated with each category. b. Describe the indications for two new genetic tests that may be performed on FNAs obtained from thyroid nodules with indeterminate cytology. 3) a. Describe the technique of US-guided biopsy of thyroid nodules and cervical lymph nodes in patients who have undergone thyroidectomy for thyroid cancer. b. Discuss the rationale and method of performance of US-guided ethanol ablation of malignant cervical adenopathy in post thyroidectomy patients.

ABSTRACT

This presentation will consist of three individual presentations. The first will review the sonographic characteristics of thyroid nodules that are suggestive of malignancy. Recommendations for selecting which thyroid nodules require ultrasound-guided biopsies which have been provided by both Radiology consensus conferences and published Endocrinology guidelines will be discussed. The second presentation will review with the Bethesda Cytology Classification of Thyroid FNA results and the risk of malignancy associated with each category. Additionally this presentation describes the indications for two new genetic tests that may be performed on FNAs obtained from thyroid nodules with indeterminate cytology. The last presentation will provide a detailed description of the technique for performing ultrasound guided biopsy of thyroid nodules and cervical lymph nodes. Various methods will be discussed and required equipment outlined. Possible complications, though rare, will be described. A comparison of the typical sonographic features of normal versus abnormal lymph nodes will be presented in an effort to identify those patients in whom sonographic follow up can be used instead of biopsy. A discussion of the possible advantages of adding thyroglobulin assay to cytoclogic evaluation will be provided. The rationale for and technique of performing ultrasound guided ethanol ablation of malignant cervical lymph nodes in patients with thyroid cancer will be undertaken.
Case-based Review of Neuroradiology (An Interactive Session)

Thursday, Dec. 3 10:30AM - 12:00PM Location: S100AB

Participants
Pina C. Sanelli, MD, Manhasset, NY (Director) Nothing to Disclose

 LEARNING OBJECTIVES
1) Improve basic knowledge and skills relevant to clinical practice. 2) Practice formulating a differential diagnosis for pathologic diseases involving the brain, spine, head and neck. 3) Apply principles of critical thinking to challenging diagnostic imaging cases.

ABSTRACT
The learning objectives are to enable attendees to: 1. Improve basic knowledge and skills relevant to clinical practice. 2. Practice formulating a differential diagnosis for pathologic diseases involving the brain, spine, head and neck. 3. Apply principles of critical thinking to challenging diagnostic imaging cases.

Sub-Events

MSCN52A  Pediatric Brain

Participants
Tina Y. Poussaint, MD, Boston, MA (Presenter) Nothing to Disclose

 LEARNING OBJECTIVES
1) To select the appropriate modality or modalities in evaluating a suspected or diagnosed case of pediatric CNS disease with focus on MR imaging. 2) To review key MR imaging features of pediatric brain diseases. 3) To evaluate neuroimaging of pediatric CNS disease as it relates to understanding the developing brain in childhood.

ABSTRACT
Pediatric brain diseases will be discussed in a case based format.

MSCN52B  Pediatric Spine

Participants
Christopher G. Filippi, MD, Grand Isle, VT, (cfilippi@nshs.edu) (Presenter) Research Consultant, Regeneron Pharmaceuticals, Inc; Research Consultant, Syntactx

 LEARNING OBJECTIVES
1) Identify the basic anatomic, physiologic and pathologic features of diseases affecting the pediatric spine. 2) Identify the key imaging features of various common pediatric spine diseases. 3) Recognize common patterns for spine and spinal cord pathology and organize these patterns into categories of diseases processes.

ABSTRACT
Common pediatric spine and spinal cord diseases will be discussed in a case-based format.

MSCN52C  Pediatric Head and Neck

Participants
Laurie A. Loevner, MD, Gladwyne, PA (Presenter) Stockholder, General Electric Company; Stockholder, Pfizer Inc; Stockholder, Merck & Co, Inc; Stockholder, Johnson & Johnson; Stockholder, Angen Inc; Stockholder, GlaxoSmithKline plc

 LEARNING OBJECTIVES
1) Identify the salient imaging features of common pathologies of the pediatric head and neck. 2) Identify pertinent anatomy in the neck and skull base through the illustration of head and neck pathology. 3) Recognize patterns for disease that allow a succinct differential diagnosis. 4) Apply radiologic findings to identify next appropriate steps in patient work-up.
**MSES52**

**Essentials of Trauma Imaging**

Thursday, Dec. 3 10:30AM - 12:00PM Location: S406B

**Participants**

**Sub-Events**

**MSES52A Cervical Spine Trauma**

Participants
Peter J. MacMahon, MD, Dublin, Ireland, (pmacmahon@mater.ie) *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify the stabilizing anatomical structures of the cervical spine. 2) Appraise the indications for the various cervical spine imaging modalities. 3) Classify cervical spinal injuries based on the mechanism of injury and stability. 4) Differentiate the most common cervical spine injuries. 5) Detect subtle soft tissue and bony injuries of the cervical spine.

**MSES52B A Simplified Approach to Imaging Acetabular Fractures**

Participants
Ustun Aydingoz, MD, Ankara, Turkey, (ustunaydingoz@yahoo.com) *(Presenter)* Speaker, AbbVie Inc; Spouse, Stockholder, Edita Medical Writing Editing Ltd; Spouse, Employee, Edita Medical Writing Editing Ltd;

**LEARNING OBJECTIVES**

1) Identify the imaginary lines on radiographs to determine the presence of an acetabular fracture. 2) List five most common acetabular fractures that comprise approximately 90% of all. 3) Apply an algorithm to detect the five most common acetabular fractures on radiographs and/or CT. 4) Explain the most relevant information for the clinician regarding imaging assessment of acetabular fractures.

**ABSTRACT**

Imaging plays an indispensable role in detecting and classifying acetabular fractures. This live activity will focus on: A) identifying acetabular fractures on radiographs and CT, B) using an algorithm to classify the five most common acetabular fractures (that comprise approximately 90% of all), and C) mentioning clinically relevant points on imaging reports to help decision-making for better management of the patient’s condition.

**Handout:** Ustun Aydingoz

**MSES52C Blunt Trauma of Lung, Pleura, Airways, and Chest Wall**

Participants
Guillermo P. Sangster, MD, Shreveport, LA, (gsangs@lsuhsc.edu) *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) Substantiate the advantages of multidetector computed tomography (MDCT) over Chest x-ray for the initial screening of chest trauma. 2) Identify the MDCT imaging findings of the non-vascular traumatic thoracic injuries.

**ABSTRACT**

Chest radiography has been the traditional screening technique to evaluate traumatic thoracic injuries. The information obtained is usually sub optimal for the diagnosis of non-vascular thoracic injuries. The benefits of MDCT for its diagnosis are discussed in this live activity. Images from our level I trauma center database are shown, including: A) Thoracic wall injuries: diaphragmatic rupture, sternum and scapular fractures, sterno-clavicular dislocation and flail chest. B) Pleuro-pulmonary injuries: contusion, laceration, hemothorax, pneumothorax, and hemothorax. C) Intrathoracic traqueo-bronchial laceration.
The purpose is to compare the image quality and artifact reduction of model-based iterative reconstruction (MBIR), adaptive statistical IR (ASIR), and filtered back projection (FBP), for post-processing both low and standard radiation dose head CT exams.

METHOD AND MATERIALS
We compared 35 standard radiation-dose and 35 ultra-low dose unenhanced head, face and sinus CT studies from Feb-Mar 2015 on a 64-slice scanner, reconstructed at 0.625 and 5 mm slices using FBP, ASIR-90% blend, and MBIR-NR40. Gray-white matter (GM/WM) signal- and contrast-to-noise ratios (SNR, CNR) were computed from Hounsfield Unit measurements. Blinded visual ratings by an experienced neuroradiologist were performed for 15 cases from each group that had MRI reference-standard. Rated areas included: posterior fossa artifact/beam hardening, deep GM/WM matter differentiation, sharpness of aqueduct of sylvius margins, and bleed/infarct (if present). Analysis of variance, T-test, and Kruskal-Wallis test were used.

RESULTS
Mean CTDI radiation dose was 10.6 ± 5.2 mGy for the ultra-low and 40.1 ± 12.9 mGy for the standard-dose groups. Mean CNR for the low-dose group was 1.1 ± 0.4 FBP, 1.5 ± 0.5 ASIR, and 2.5 ± 0.6 MBIR (all P < 0.001). Mean CNR for the standard-dose group was 1.5 ± 0.4 FBP, 2.1 ± 0.6 ASIR, and 2.6 ± 0.6 MBIR (P < 0.001). All GM/WM-SNRs were similarly higher in exams processed with MBIR versus FBP or ASIR (P<0.05). Blinded qualitative review of all three rated areas in the low-dose group showed better image quality with MBIR (P<0.05). Standard-dose scans with MBIR had markedly better reduction of beam hardening effect and streak artifact in the posterior fossa versus ASIR and FBP (P < 0.001). Of the 6 cases with MR-proven pathology in the standard-dose group, MBIR was superior or equal to ASIR in 5 cases (83%).

CONCLUSION
Compared to FBP and ASIR, MBIR improves overall image quality in ultra-low dose head CT scans and markedly reduces beam hardening effect and streak artifact in the posterior fossa in standard-dose exams.

CLINICAL RELEVANCE/APPLICATION
There is strong interest in lowering radiation dose while maintaining image quality and reducing artifact in clinical head CT scans. MBIR shows great potential in achieving this goal.
Despite the relatively high radiation dose used in CT perfusion (CTP), the quality of CTP maps is not always great. It is critical to develop methods to simultaneously reduce radiation dose and further improve image quality. The purpose of this work is to demonstrate that the use of a new tube current modulation scheme and iterative image reconstruction algorithm can achieve a factor of five radiation dose reduction with improved CTP maps.

**METHOD AND MATERIALS**

The limiting factors to the CTP maps were identified using a newly developed four-dimensional imaging chain model. This model enabled a fundamental understanding of how bias and noise were generated, amplified, and propagated to the final functional maps. As a result, the baseline image noise was discovered to be the primary factor impacting final CTP image quality. Once this limiting factor was identified, a novel tube current modulation scheme was developed to increase the mAs level for the baseline image acquisition to reduce noise, while lowering the exposure level and applying iterative reconstruction for the remaining acquisitions. The net result of this mA modulation scheme was a total radiation dose reduction by a factor of five. The proposed method was validated through an IACUC-approved in vivo canine stroke model. An additional CTP dataset acquired at high exposure level (300%) was used as the reference for image quality and quantitative accuracy, with which CTP maps acquired at both standard and reduced doses (20%) were compared.

**RESULTS**

In addition to the factor of five dose reduction with the proposed tube current modulation scheme, the canine CTP maps demonstrated significant reduction in both bias and noise. The 20% dose dataset demonstrated only 10% bias and 14% relative increase in noise compared with the 300% dose reference dataset. In comparison, the conventional CTP technology generated 700% bias and 540% relative increase in noise at 20% dose.

**CONCLUSION**

The proposed new tube current modulation scheme in conjunction with an iterative reconstruction algorithm enables a radiation dose reduction by a factor of five and improved quality in CTP maps.

**CLINICAL RELEVANCE/APPLICATION**

The technique proposed here allows for lowering radiation dose while improving the quality of perfusion maps, both of which are crucial for patient selection for endovascular therapy of acute ischemic strokes.

**SSQ16-03  Low Dose CT Perfusion Using Projection View-Sharing**

**Thursday, Dec. 3 10:50AM - 11:00AM Location: N228**

**Participants**

Thomas B. Martin, BS, Los Angeles, CA (Presenter) Nothing to Disclose
John M. Hoffman, BS, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Michael F. McNitt-Gray, PhD, Los Angeles, CA (Abstract Co-Author) Institutional research agreement, Siemens AG; Research support, Siemens AG; ; ; ;
Danny J. Wang, PhD, Los Angeles, CA (Abstract Co-Author) Research Grant, Siemens AG Research Grant, Biogen Idec Inc Shareholder, Translational MRI, LLC

**PURPOSE**

CT Perfusion (CTP) is widely used in clinical practice for the evaluation of cerebrovascular disorders such as acute ischemic stroke. However, CTP involves high radiation dose (>=~200mGy) as the X-ray source remains continuously on during the scan. The purpose of this study is to present a novel low dose CTP technique using a projection view-sharing reconstruction algorithm originally developed for dynamic MRI - "K-space Weighted Image Contrast" (KWIC) - under substantially reduced dose conditions in both phantom and a clinical case.

**METHOD AND MATERIALS**

A clinical CTP scan (45s, 1160 projections per turn, 1s/turn, CTDIvol 217 mGy) was retrospectively undersampled to correspond to 50% and 25% of the original dose. The data sets were reconstructed using filtered back projection (FBP) and KWIC, based on an angle bisection scheme. In KWIC, FFT was performed on each projection to form a "k-space" like CT data space. As a projection view-sharing technique, KWIC preserves undersampled CTP quality by proportionately increasing the number of encoded projections for more distant regions of "k-space". An FBP reconstruction was used as the fully sampled gold standard. The above procedures were also performed on a FORBILD head phantom, including reconstructions down to 12.5% of the original set of projections, containing simulated time-varying objects. A map of the relative cerebral blood volume (rCBV), and the time-to-peak (TTP) and the full width half-maximum (FWHM) of the dynamic values were computed to assess potential dispersions in the dynamic CTP signals between the image reconstructions.

**RESULTS**

The rCBV map, TTP, and the FWHM for all of the KWIC CTP reconstructions were unaffected by the undersampling/dose reduction (down to 25% dose) compared to the fully sampled FBP reconstruction.

**CONCLUSION**

This pilot study demonstrates that KWIC preserves image quality and perfusion metrics at a reduced number of projections and that the unique contrast weighting of KWIC could provide substantial dose-savings for perfusion CT scans.

**CLINICAL RELEVANCE/APPLICATION**

This technique may substantially reduce dose to patients undergoing CTP exams; alternatively, patients could potentially have multiple low dose CTP exams to have their diseases monitored more regularly, which could improve patient outcome.

**SSQ16-04  Efficacy of Fine Focal Spot Scanning in CT Carotid Angiography**

**Thursday, Dec. 3 11:00AM - 11:10AM Location: N228**

**Participants**

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PURPOSE

CT carotid angiography (CTCA) has been established as an important imaging tool for carotid artery assessment, in particular prior to surgical/radiological intervention. Its advantages in comparison to digital subtraction angiography (DSA) are shorter examination, non-invasive nature, less procedural complications and the ability to study soft tissue structure around the blood vessels. Calcified plaques are common at carotid bifurcations that produces beam-hardening artifact and often limits an accurate luminal assessment. The latest improvement of tube technology permits the use of fine focal spot (FFSS) in CTA that may provide better spatial resolution. The aim of this retrospective study was to assess the efficacy of FFSS in vessel wall clarity improvement and calcification artifact reduction on CTCA.

METHOD AND MATERIALS

Consecutive adult patients of all age and gender who presented for CTCA were included. Patients who did not give consent or whose images were markedly degraded by metal and motion artifacts were excluded. All CTCA were scanned with standard focal-spot size (SFSS) in initial 4 months while with FFSS in the following 4 months. Vessel clarity and calcifications artefacts of aortic arch, brachiocephalic, subclavian, common carotid, carotid bifurcation, internal carotid, external carotid and vertebral arteries were randomly and blindly assessed using 5-point scale by 2 blinded radiologists. Results were compared.

RESULTS

There were 43 patients (mean age of 60) with 97 calcified arterial segments in SFSS and 48 patients (mean age of 62) with 113 calcified arterial segments in FFSS. 30% patients have >50% carotid artery stenosis. Interobserver agreement was excellent (κ = .834). Mann-Whitney test showed FFSS performed significantly better for vessel clarity (U: 48238.50, p < .001, r: 0.556) and calcification artefact reduction (U: 2040.50, p< .001, r: 0.564). The carotid bifurcation lumen were better defined in FFSS.

CONCLUSION

FFSS technique improves vessel clarity and reduces calcification blooming artefacts in CTCA which aids accurate assessment of vascular pathology.

CLINICAL RELEVANCE/APPLICATION

The lumen of the carotid bifurcation is often obscured by blooming artifacts from calcified plaques that may lead to misleading result. The FFSS scanning technique may become an future imaging tool to minimize this diagnostic difficulty and provide better plaque morphology assessment.

PURPOSE

Tumor volume parameter is one of the most important prognostic factors in glioma. Determining the glioma tumor volume is a problematic task due to its irregularity in shape, involvement of different parts of brain and wide variety in contrast enhancement degrees. Objectives of the study were to design image processing-based software to determine the volume of glioma and evaluating its efficiency in comparison with radiologist estimation.

METHOD AND MATERIALS

The software was designed and calibrated based on 7 pathologically approved glioma patients. The software exploited enhancement regions in FLAIR and T1 Gadolinium contrast MRI using image segmentation technique to determine tumor volume, based on region growing of manually selected seed points. Consecutively, the volumes of brain glioma in 42 cases were estimated by an expert radiologist as well as the designed software and the data was analyzed for comparison.

CONCLUSION

Estimation of brain glioma volume with the designed software has the same accuracy as the expert estimation in a more time efficient manner. The main application restriction for the designed software is its limitation to well-enhanced regions after Gadolinium injection.

CLINICAL RELEVANCE/APPLICATION

Tumor volume is a main prognostic factor in brain glioma. Volume estimation by software via segmentation technique had the same accuracy as expert reading in a time efficient manner.
Magnetic resonance spectroscopic imaging (MRSI) of the brain allows to map several metabolites and provide complementary metabolic information to the conventional MR imaging methods. High field systems (e.g. 7 T) offer increased SNR and spectral resolution which can be transformed to the increased spatial resolution or better characterization of overlapping metabolites (e.g. NAA and NAAG). In addition FID-CSI with ultra short acquisition delays (TE*) adds additional SNR, in particular for J-coupled resonances. We compared MRSI in six volunteers using a FID-CSI sequence with high spatial resolution and ultra-short TE* of 1.5 ms at 3 and 7 Tesla.

METHOD AND MATERIALS

Six healthy volunteers (5m/1f; age: 28.3±2.4) were measured at 3T and 7T (3T Trio, 7T Magnetom, Siemens, Erlangen, Germany) using a 32-channel head coil. A FID-CSI sequence with 64 x 64 phase encoding steps, FOV=220 x 220mm2, TR=600ms, TE*=1.5ms, in plane voxel size 3.4 x 3.4 mm2, and a slice thickness of 10 mm was used (scan time 30min). Spectra were processed using LCModel. Metabolic maps were created using Matlab and MINC (Minc tools; v2.0; McConnell Brain Imaging Center, Montreal, Canada). SNRs were computed using the pseudo-replica method in time domain.

RESULTS

Satisfactory data quality was achieved from all subjects measured at 3 T and 7 T. SNR was 2.8 times higher at 7 T compared to 3 T. CRLBs were below 10% for all metabolites measured at 7 T including glutamate and glutamine. Compared to techniques using pre-localization techniques (e.g. STEAM, PRESS) FID-CSI allows to acquire whole slices. The high matrix size and hamming filtering prevented fat contamination from the sculp. With the high in-plane resolution of 3.4 x 3.4 mm2 metabolic maps showing anatomical details could be created.

CONCLUSION

This study revealed 2.8 times higher SNR and decreased CRLBs of brain metabolites measured with MRSI at 7 T compared to that measured at 3T. We could compute metabolic maps with anatomical details at both field strengths. Improved spectral resolution allowed NAAG separation from NAA at 7 T but not at 3 T. In addition the ultra-short acquisition delay allows to quantify J-coupled metabolites even measured with a high spatial resolution.

CLINICAL RELEVANCE/APPLICATION

MRSI at 7T can be performed with high spatial resolution and ultrashort TE*. This allows the quantification of metabolites such as NAAG, glutamate, glutamine and myo-inositol with low CRLBs.

SSQ16-08 Optimized Clinical MRI Protocols for Ex Vivo Whole Brain - A New Tool for Radiology-Pathology Correlation

Participants

Mary Brown, RT, New York, NY (Presenter) Nothing to Disclose
Ryan Brown, New York, NY (Abstract Co-Author) Nothing to Disclose
Guillaume Madelin, New York, NY (Abstract Co-Author) Nothing to Disclose
Pippa Storey, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose
Henri Rusinek, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose
Timothy M. Shepherd, MD, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE

Autopsies with neuropathology protocols are used to investigate sudden, unexpected patient deaths, but it is difficult to obtain comparable MR images with the autopsied brain due to chemical fixation and temperature differences. We measured these changes, then adapted MRI sequence pulse parameters to re-create a robust clinical MRI protocol for ex vivo whole brain imaging.

METHOD AND MATERIALS

Donated ex vivo whole brains immersion-fixed in formalin for 2 weeks were washed in phosphate-buffered saline for 8 weeks with repeated solution exchanges. Invasion recovery and multiecho sequences at 3-T MRI showed the T1/T2 values of gray and white matter decreased to 267/73 and 168/43 ms respectively in formalin-fixed ex vivo whole brains. Multiple MRI sequences were adjusted iteratively for these relaxation changes based on spin dynamics theory to give consistent image contrast, resolution and quality compared to in vivo MRI protocols.

RESULTS

Optimal MRI sequences at 3-T were different compared to standard in vivo MRI protocols - a) FLAIR: TR/TE/TI= 3000/45/1100 ms, 0.5 x 0.5 x 2-mm resolution, b) TSE T2: TR/TE = 5000/76 ms, 0.5 x 0.5 x 0.8-mm resolution, c) 3-D Gradient Echo: TR/TE = 20/10 ms with 180 flip angle, 0.46-mm isotropic resolution, and d) Diffusion Tensor Imaging: TR/TE = 3500/90 ms, b-values = 0, 1000 & 2000 s/mm² with 64 directions, 3-mm isotropic resolution. Decreased echo-train-length also reduced gray-white blurring. Volumetric 3-D image contrast is degraded by the short T1's, but may be improved by a multi-segmented approach. The overall scan required <2 hrs overnight using an outpatient 3-T scanner and 64-channel coil.

CONCLUSION

We successfully created a "clinical" MRI protocol for ex vivo brains with similar image quality and contrast to routine radiology protocols. This can be used for detailed radiology-pathology correlations in clinical cases of sudden death. The protocol also may help detect abnormalities in Sudden Unexplained Death in Epilepsy (SUDEP) or directly correlate MRI property changes with underlying Alzheimer's pathology.
CLINICAL RELEVANCE/APPLICATION
We describe an ex vivo whole brain MRI protocol that recapitulates standard clinical protocols well to guide clinical or research radiology-pathology studies in a variety of patient populations.

SSQ16-09 Amide Proton Transfer Imaging of Neonatal Brain Development and Brain Injury: A Preliminary Study

Thursday, Dec. 3 11:50AM - 12:00PM Location: N228

Participants
Yang Zheng, Shenyang, China (Presenter) Nothing to Disclose
Xiaoming Wang, MD, Shenyang, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate neonatal brain development and injury at the internal environmental level with the application of amide proton transfer (APT) imaging by measuring the APT values of several part of the brain.

METHOD AND MATERIALS
A total of 51 neonatal patients who underwent MR examination were enrolled in the study. Among them, there were 38 newborns with no abnormalities and 13 cases with brain injury who underwent conventional MR (T1WI, T2WI, DWI) examination. After obtaining informed consent and permission of clinicians, routine MR was followed by additional APT scan. APT imaging is single slice scanning, performed at the basal ganglia level in all neonates, and in the case group, with increased localization at the level of lesion, and with the contralateral relatively normal area as self-control. The APT values of bilateral frontal subcortical white matter, basal ganglia and occipital subcortical white matter were measured for all neonates, as well as the APT values of the lesion and contralateral areas. Several statistical methods were used for statistical analysis.

RESULTS
In the control group, bilateral frontal subcortical white matter, basal ganglia and occipital subcortical white matter had no significant difference in APT value (P > 0.05). Between the different parts of the brain, APT values were significantly different (P < 0.05), and were associated with gestational age linear positive correlation. In the case group, there were significant differences in APT values between the lesion side and contralateral area, being significantly lower in lesion side than the contralateral side (P < 0.05). In the case group, the APT values of different parts of the brain were lower than the control group with the same gestational age (P < 0.05).

CONCLUSION
From changes in the protein and pH level in the neonatal brain, APT imaging can help understand neonatal brain development and evaluate brain injury.

CLINICAL RELEVANCE/APPLICATION
Amide proton transfer (APT) imaging is a noninvasive imaging method of MR, and it is capable of detecting mobile cellular proteins and peptides and monitoring pH effects.
Neuroradiology (Advanced Neuroimaging of Alzheimer Disease)

Thursday, Dec. 3 10:30AM - 12:00PM Location: N229

PURPOSE
The hippocampus texture as recorded in T1 MRI has been shown to be a strong predictor of conversion from MCI to probable AD and has been suggested for enrichment of AD trials. We investigate the relation of the hippocampal texture to CSF amyloid and tau load, and glucose metabolism of the hippocampus and its potential prediction of conversion in amyloid and tau positive subject respectively.

METHOD AND MATERIALS
The study dataset consisted of the 504 subjects from the "complete annual year 2 visits" standardized Alzheimer's Disease Neuroimaging Initiative (ADNI) dataset including 234 baseline MCI subjects. MRI analysis consisted of segmenting the hippocampi using cross-sectional FreeSurfer (v.5.1.0), computation of the baseline hippocampal fraction (HF, hippocampal volume divided by intra-cranial volume), hippocampal atrophy (baseline, 12 month, 24 month regression percentage volume loss), and texture scoring of the hippocampus using our in-house method. CSF amyloid (Aβ42), respectively total tau (t-tau), and tau phosphorylated at the threonine 118 position (p-tau) were defined as positive by Aβ42 <= 192 pg/ml, t-tau >= 93 pg/ml, and p-tau >= 23 pg/ml. Normalized FDG-PET measurements constrained to the hippocampus were averaged over left and right hippocampus. Age and gender adjustment was performed.

RESULTS
The subpopulations having available amyloid, tau, and FDG-PET measurements did not significantly differ from the full 504 subjects in age, gender, MMSE, or HF. Hippocampal texture predicted conversion from MCI to AD in 12 months with an AUC of 0.71. In Aβ42, p-tau and t-tau positive subjects, the AUC of MCI to AD conversion were respectively 0.71, 0.72, and 0.69 (not significantly different from the whole population). The Pearson's R between hippocampus texture and AB42, p-tau, t-tau, FDG-PET, and hippocampal atrophy was respectively -0.32, 0.31, 0.28, -0.62, and 0.50. All AUC's and R's remained significant after decorrelation using HF.

CONCLUSION
Hippocampal texture predicts MCI-to-AD conversion independent of AB42, p-tau, t-tau. It relates weakly to AB42, p-tau, t-tau and strongly to glucose metabolism and future hippocampal atrophy.

CLINICAL RELEVANCE/APPLICATION
Hippocampus MRI T1 texture is a promising marker for prediction of fast Alzheimer’s progression and enrichment of clinical trials.

SSQ17-02 Default Mode Network Structural-functional Connectivity and Beta-Amyloid Pathology in Autosomal Dominant Familial Alzheimer’s Disease

Thursday, Dec. 3 10:40AM - 10:50AM Location: N229

Awards
Trainee Research Prize - Resident

Participants
Jeffrey W. Prescott, MD, PhD, Durham, NC (Presenter) Nothing to Disclose
P. M. Doraiswamy, MD, Durham, NC (Abstract Co-Author) Research Consultant, Bristol-Myers Squibb Company Research Consultant, Eli Lilly and Company Research Consultant, Neuronetrix, Inc Research Consultant, Medivation, Inc Research Grant, Bristol-Myers Squibb Company Research Grant, Eli Lilly and Company Research Grant, Neuronetrix, Inc Research Grant, Medivation, Inc Stockholder, Sonexa Therapeutics, Inc Stockholder, Clarimedix, Inc Speaker, Forest Medical, LLC
Jeffrey R. Petrella, MD, Durham, NC (Abstract Co-Author) Advisory Board, Johnson & Johnson Speakers Bureau, Quintiles Inc Advisory Board, Piramal Enterprises Limited
Early onset familial Alzheimer's disease (FAD) is inherited in an autosomal dominant manner and provides a model for studying how amyloid may affect disease onset and synaptic failure. Our goal was to use data from Dominantly Inherited Alzheimer's Disease Network (DIAN) to evaluate relationships between structural connectivity, functional connectivity, and amyloid burden.

### PURPOSE

Evaluation of structural-functional connectivity breakdown in subjects with FAD may provide imaging biomarkers for patients in the preclinical stages of AD.

### RESULTS

76 subjects from DIAN were analyzed. 38 subjects had an FAD mutation (24 normal cognition (NC), 3 mild cognitive impairment (MCI), 11 dementia (AD)). 38 subjects did not have an FAD mutation (37 NC, 1 MCI). There was a significant association between functional and structural connectivity; specifically, as structural global efficiency decreased, functional timeseries correlation decreased. Functional and structural connectivity significantly decreased with age in mutation carriers, but not in controls.

### CONCLUSION

Among DIAN subjects, there is a significant association between functional and structural connectivity metrics. There is a significant decrease in functional and structural connectivity with increasing age in mutation carriers, but not in controls.

### CLINICAL RELEVANCE/APPLICATION

Evaluation of structural-functional connectivity breakdown in subjects with FAD may provide imaging biomarkers for patients in the preclinical stages of AD.

### SSQ17-03 Comparison of Several Computational Pipelines for Atrophy Computation in Longitudinal Alzheimers Studies

Participants
Akshay Pai, Copenhagen, Denmark (Presenter) Nothing to Disclose
Stefan Sommer, PhD, Copenhagen, Denmark (Abstract Co-Author) Nothing to Disclose
Sune Darkner, Copenhagen, Denmark (Abstract Co-Author) Nothing to Disclose
Lauge Sorensen, Copenhagen, Denmark (Abstract Co-Author) Research funded, Biomediq A/S
Jon Sporning, Copenhagen, Denmark (Abstract Co-Author) Co-founder, DigiCorpus ApS Shareholder, DigiCorpus ApS
Mads Nielsen, PhD, Copenhagen, Denmark (Abstract Co-Author) Stockholder, Biomediq A/S Research Grant, Nordic Bioscience A/S
Research Grant, SYNARC Inc Research Grant, AstraZeneca PLC

To evaluate the newly developed diffeomorphic image registration framework using stationary velocity fields parameterized by wendland kernel bundle framework in atrophy estimation. In this study, we compare the diagnostic group separation (Alzheimer’s and Normals) abilities of the proposed framework against other state-of-art registration schemes and the Boundary shift integral (BSI) based on atrophy scores in several brain regions.

### METHOD AND MATERIALS

Baseline and month 12 MRI scans from the "complete annual year 2 visits" 1.5-T standardized ADNI dataset were used [169 normal controls (NC), 101 AD]. Segments for atrophy quantifications were obtained using Freesurfer cross-sectional pipeline. Each image was corrected for intensity inhomogeneities using N3 from freesurfer. Each of baseline and month 12 scans were non-linearly aligned using the proposed framework and existing methods like SyN, NiftyReg, LCC-Demons. Atrophy was then estimated from the deformation field of the proposed framework using the proprietary Cube Propagation and on the rest, using Jacobian determinants. BSI was also used to evaluate atrophy in the regions of WB, Hip and Ventricles.

### RESULTS

The proposed framework yields better AUC and Cohens’D for AD v/s NC when compared to the other registration schemes. The highest separation (AUC/Cohen’s D) among the registration frameworks was using the proposed framework - WB 0.76/ 0.94, hippocampus 0.82/1.26, MTL 0.86/1.43, CGM 0.85/1.29, ENCTX 0.80/1.13 and FG 0.76/0.98. Overall, BSI provided a better separation on WB (0.81/1.18), hippocampus (0.86/1.15). However, BSI was not designed to provide scores for any other region.

### CONCLUSION

Although, BSI provides a better separation, the method can be used only in regions the software is designed for, for instance whole brain, hippocampus and ventricles. The proposed registration framework not only provides good comparable group separation (and better than other registration frameworks), it provides the flexibility to measure atrophy in any user-defined region.

### CLINICAL RELEVANCE/APPLICATION

The proposed method can reliably estimate atrophy in any brain region unlike BSI which is specifically designed to estimate atrophy only in certain regions of the brain.

### SSQ17-04 Altered Spontaneous Activity in aMCI and AD Revealed by Resting-state fMRI

Baseline and month 12 MRI scans from the "complete annual year 2 visits" 1.5-T standardized ADNI dataset were used [169 normal controls (NC), 101 AD]. Segments for atrophy quantifications were obtained using Freesurfer cross-sectional pipeline. Each image was corrected for intensity inhomogeneities using N3 from freesurfer. Each of baseline and month 12 scans were non-linearly aligned using the proposed framework and existing methods like SyN, NiftyReg, LCC-Demons. Atrophy was then estimated from the deformation field of the proposed framework using the proprietary Cube Propagation and on the rest, using Jacobian determinants. BSI was also used to evaluate atrophy in the regions of WB, Hip and Ventricles.

### RESULTS

The proposed framework yields better AUC and Cohens’D for AD v/s NC when compared to the other registration schemes. The highest separation (AUC/Cohen’s D) among the registration frameworks was using the proposed framework - WB 0.76/ 0.94, hippocampus 0.82/1.26, MTL 0.86/1.43, CGM 0.85/1.29, ENCTX 0.80/1.13 and FG 0.76/0.98. Overall, BSI provided a better separation on WB (0.81/1.18), hippocampus (0.86/1.15). However, BSI was not designed to provide scores for any other region.

### CONCLUSION

Although, BSI provides a better separation, the method can be used only in regions the software is designed for, for instance whole brain, hippocampus and ventricles. The proposed registration framework not only provides good comparable group separation (and better than other registration frameworks), it provides the flexibility to measure atrophy in any user-defined region.

### CLINICAL RELEVANCE/APPLICATION

The proposed method can reliably estimate atrophy in any brain region unlike BSI which is specifically designed to estimate atrophy only in certain regions of the brain.
Cerebral iron deposition plays a key role in pathophysiology of neurodegenerative processes. Iron concentrations are elevated in cortical and basal ganglia regions in Alzheimer Disease (AD), indicating a disruption of its homeostasis. Higher iron concentrations in AD may increase the possibility of free iron catalyzing lipid peroxidation leading to cell membrane damage and cell death. The aim of this study is to investigate the correlation of brain iron accumulation with the severity of vascular damage and cerebral perfusion in mild-AD patients.

METHOD AND MATERIALS

18 mild-AD patients evaluated by means of neuropsychological tests were enrolled in the study and compared with 18 aged matched healthy volunteers. Iron concentration was derived from R2* measurements obtained with multi-echo gradient echo sequences (1 mm in-plane resolution, slice thickness 4 mm, 30 axial slices; TR= 68 ms; TE1=4.9 ms, delta TE = 4.9 ms, 12 echoes) and data were collected from 14 ROI in cortical and subcortical grey matter. Regional cerebral blood flow (CBF) was obtained by means of a pseudocontinuous Arterial Spin Labeling (pCASL) sequence (T2* EPI; TR/TE = 4000/11 ms, 35 tag-control volumes consisting of 19 slices with 3.5x3.5x6 mm3 resolution; label duration = 1650 ms, post label delay = 1600 ms, background suppression pulses). Vascular damage was evaluated on conventional images according to Fazekas scale.

RESULTS

R2* shows a significant correlation with the severity of white matter vascular damage in the right frontal cortex (p<0.05) and with Mini Mental State Examination (MMSE; p<0.02) in the left frontal cortex in mild AD group compared to controls. CBF modifications in mild-AD patients shows no significant correlation with MMSE and a significant correlation with vascular damage (p<0.05) in the left lateral orbito-frontal cortex. Moreover a significant decreased CBF was observed in bilateral nucleus caudatus in mild-AD group (p<0.05) compared to controls.

CONCLUSION

Iron concentration positively correlates with the severity of vascular impairment and negatively correlates with CBF in mild-AD patients, indicating that it may be used as biomarkers to evaluate the progression of AD.
RESULTS

Small-world parameters of AD-First and AD-Second slightly decreased compared with HC respectively (Sparsity 10%-30%) (Fig1). For nodal EF, AD-First in left inferior parietal (r=0.44, p=0.02), right angular gyrus (r=0.42, p=0.03), left rectus (r=0.40, p=0.03) and AD-Second in right superior orbital Frontal lobe (r=0.40, p=0.04), right supplementary motor area (r=0.40, p=0.04), bilateral rectus (r=0.43, p=0.02 for left, r=0.45, p=0.01 for right) are positive correlation with MMSE score(Fig2). Nodal BC on AD-First in right medial orbital frontal lobe (r=0.40, p=0.03) is positive and in right precuneus (r=-0.42, p=0.02) is negative correlation with MMSE; BC on AD-Second in bilateral supplementary motor areas (r=0.46, p=0.02 for left, r=0.47, p=0.01 for right) and right medial orbital frontal lobe (r=0.41, p=0.03) are positive correlation with MMSE (Fig2). (r>=0.4 or r<=-0.4, p<0.05)

CONCLUSION

Brain network had a slight decline in the optimal small-world architecture in the progression of AD. The involved nodes which have positive and negative correlation of nodal BC and EF with MMSE score exhibited underlying dynamic disrupted patterns of functional connectivity in AD.

CLINICAL RELEVANCE/APPLICATION

Resting-state fMRI is a useful noninvasive tool to identify the disrupted functional connectivity in progression of AD.

SSQ17-07 Comprehensive, Radiological Evaluation of Strategic Structures in Patients with Mild Cognitive Impairment and Early Alzheimer’s Disease

Thursday, Dec. 3 11:30AM - 11:40AM Location: N229

Participants
Tomasz Nesteruk, MD, Warsaw, Poland (Abstract Co-Author) Nothing to Disclose
Marta J. Nesteruk, MD, Warsaw, Poland (Abstract Co-Author) Nothing to Disclose
Maria Styczynska, PhD, Warsaw, Poland (Abstract Co-Author) Nothing to Disclose
Jerzy M. Walecki, MD, PhD, Warszawa, Poland (Presenter) Nothing to Disclose

PURPOSE

The aim of the study was to evaluate the diagnostic value of two measurement techniques in patients with cognitive impairment. The first was automated volumetry of the hippocampus, entorhinal cortex, parahippocampal gyrus, posterior cingulate gyrus, cortex of the temporal lobes, corpus callosum and the second was fractional anisotropy (FA) measurements of the corpus callosum in diffusion tensor imaging technique.

METHOD AND MATERIALS

Ninety six patients underwent brain magnetic resonance imaging - 33 healthy controls (HC), 33 patients with diagnosed mild cognitive impairment (MCI) and 30 patients with probable AD of mild degree (AD). Severity of the dementia was evaluated with the neuropsychological battery test. Volumetric measurements were performed automatically with FreeSurfer imaging software. Measurements of the FA values were performed manually with region of interest tool.

RESULTS

Volumetric measurement of the temporal lobe cortex had the highest correct classification rate - 68,7%, the lowest was for the FA measurements of the corpus callosum - 51%. Highest sensitivity and specificity when discriminating patients MCI vs early AD was achieved with the volumetric measurement of the corpus callosum - these are 73% and 71% and the correct classification rate was 72%. Highest sensitivity and specificity when discriminating HC and patients with early AD was achieved with the volumetric measurement of the entorhinal cortex - these are 94% and 100% and the correct classification rate was 97%. Highest sensitivity and specificity when discriminating HC and patients with MCI vs AD was achieved with the volumetric measurement of the temporal lobe cortex - these are 90% and 93% and the correct classification rate was 92%.
CONCLUSION
Diagnostic value varied depending on the measurement technique. Volumetric measurements proved to be the strongest imaging biomarker which allowed distinction between groups of patients. Corpus callosum volume assessment proved to be useful in discriminating patients MCI vs early AD.

CLINICAL RELEVANCE/APPLICATION
By evaluation of the two measurement methods authors wanted to find the best imaging technique, which would help clinicians to evaluate patients and make the correct diagnosis.

SSQ17-08  Heritability of Brain Atrophy on MRI in Advanced Age: A Twin Study of Healthy Middle-aged to Elderly Japanese Adults

Participants
Matthew W. Lukies, MBBS, Osaka, Japan (Presenter) Nothing to Disclose
Yoshiyuki Watanabe, MD, PhD, Suita, Japan (Abstract Co-Author) Nothing to Disclose
Soshiro Ogita, Osaka, Japan (Abstract Co-Author) Nothing to Disclose
Kayakoro Amura, Osaka, Japan (Abstract Co-Author) Nothing to Disclose
Noriyuki Tomyama, MD, PhD, Suita, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE
Brain atrophy, a common finding on MRI, is part of the aging process and neurodegenerative diseases. The purpose of this study was to determine the heritability of brain atrophy and volume in advanced age using classical twin analyses of healthy Japanese middle-aged to elderly adult twin volunteers.

METHOD AND MATERIALS
74 individuals, 20 monozygotic (M2) twin pairs (10MM 10FF, mean age 61y min 42y max 75y) and 17 dizygotic (DZ) twin pairs (8MM 8FF 1MF, mean age 64y min 41y max 85y), were selected with advanced age and gender match from the Osaka University Center for Twin Research registry. 3D T1 volume images from 3.0T MRI were used to measure volumes (L) for white matter (WM), grey matter (GM), cerebrospinal fluid (CSF) and total brain volume (TBV) calculated as WM + GM with statistical parametric mapping (SPM) 12 (University College London). Volume differences, correlations, twin modelling and heritability estimates (H2), controlled for age and gender, were performed using statistical platform R (v3.1.2) with OpenMx (v2.0.1).

RESULTS
The one male-female DZ twin pair was excluded due to significant difference in mean TBV based on gender (Welch two sample t-test p=0.027). For all twins together, TBV (coefficient -0.450, p<0.01) and GM (-0.528, p<0.01) negatively correlated with age, where as CSF (0.646, p<0.01) positively correlated with age and WM (-0.055, p=0.04) was not significant. The differences in volume measurements between monozygotic twin pairs were significantly smaller than those for dizygotic twin pairs (T-TEST: TBV p=0.01, GM p<0.01, WM p<0.01, CSF p=0.03). Heritability (H2) estimates, AE (additive genetics / unique environment) models for TV, GM and WM were 92.73%, 93.39% and 87.12% respectively. AE models were selected based on Akaike information criterion (AIC) for best fit and simplicity in twin studies. CSF best fit with a CE (common environment / unique environment) model, implying a stronger correlation with age and/or gender rather than heritance.

CONCLUSION
Brain volume and atrophy have strong heritability of around 90% into advanced age, as demonstrated in this Japanese twin population. Further analysis of heritability of atrophy in specific brain locations is planned.

SSQ17-09  Integrative Bayesian Analysis of Neuroimaging-Genetic Data with Application to Cocaine Dependence

Participants
Shabnam Azadeh, Houston, TX (Presenter) Nothing to Disclose
Brian Hobbs, PhD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Liangsuo Ma, Richmond, VA (Abstract Co-Author) Nothing to Disclose
David A. Nielsen, Houston, TX (Abstract Co-Author) Nothing to Disclose
F. Gerard Moeller, Richmond, VA (Abstract Co-Author) Nothing to Disclose
Veera Baladandayuthapani, PhD, Houston, TX (Abstract Co-Author) Nothing to Disclose

PURPOSE
To explore the underlying neurobiology of white matter integrity of cocaine-dependent subjects by integrative neuroimaging-genetic analysis of diffusion tensor imaging (DTI) and genetic, demographic and clinical features.

METHOD AND MATERIALS
We propose a novel computationally efficient method called integrative Bayesian analysis of neuroimaging-genetic (iBANG) to analyze large-scale imaging-genetics data. The iBANG methods uses a three-step component-wise analysis pipeline (i) estimate the association between each genetic and demographic variable via voxel-based Bayesian model averaging and obtain posterior probability maps (PPMs), (ii) incorporate spatial information pertaining to voxel locations to smooth the PPMs, and (iii): use Bayesian false discovery rates to delineate regions of brain activation while controlling for multiple testing. Our methods are motivated by and applied to a retrospective study in cocaine addiction where voxel-wise fractional anisotropy (FA) values were acquired over the white matter space spanning the entire brain in addition to twenty-one candidate SNPs known to be previously associated with addiction.
RESULTS

Our study suggests that the impact of GAD1a (rs1978340) and GAD1b (rs769390) SNPs on FA values of the white matter of the brain was extensive in comparison to the other SNPs using iBANG. Significantly a total of 5217 voxel locations associated with GAD1a and the total number of 1332 voxel locations associated with GAD1b were found. Both GAD1a and GAD1b SNPs are associated with synthesis of GABA which plays a critical role in drug-reward and drug seeking behavior. Figure 1 depicts the multi-slice sagittal views of the neuroanatomic locations of significant regions in the white matter of the brain that were impacted by GAD1a. FA values on the white matter of the brain were significantly impacted by cocaine abuse to the extent of 3100 voxels.

CONCLUSION

GAD1a and GAD1b SNPs are associated with synthesis of GABA led to FA enhancement in the most regions of the John Hopkins University (JHU) white matter atlas. Cocaine consumption caused FA diminishment in the most regions of the JHU white matter atlas.

CLINICAL RELEVANCE/APPLICATION

Cocaine abuse and some of the candidate SNPs, GAD1a and GAD1b, show noticeable impact on FA alteration of white matter which cause changes on white matter integrity of the brain.
Pretreatment Apparent Diffusion Coefficient Values in Predicting Induction Chemotherapy Response in Locally Advanced Nasopharyngeal Carcinoma

PURPOSE
The aim of this study was to predict response to induction chemotherapy in patients with locally advanced nasopharyngeal carcinoma (NPC) by pretreatment apparent diffusion coefficient (ADC) values.

METHOD AND MATERIALS
35 patients with locally advanced NPC underwent ADC studies prior to 2-weeks induction chemotherapy. The patients were divided into CR (complete response) group, PR (partial response) group and SD (stable disease) group according to the tumor response at the end of treatment. The responders include CR and PR group. The patients were divided into non-keratinizing undifferentiated carcinoma group and non-keratinizing differentiated carcinoma group according to the pathological type. The patients were divided into T2 group, T3 group and T4 group according to the T-staging (UICC 2010). Independent-Samples T test was used to compare the pretreatment ADC parameters between each groups.

RESULTS
The average pretreatment ADC values of CR, PR, responders and SD group were 0.70±0.06×10^{-3} \text{ mm}^2/\text{s}, 0.72±0.04×10^{-3} \text{ mm}^2/\text{s}, 0.71±0.04×10^{-3} \text{ mm}^2/\text{s} and 0.85±0.02×10^{-3} \text{ mm}^2/\text{s}. The average pretreatment ADC value of the SD group was significantly higher than the PR group and responders. The average pretreatment ADC value of children-adolescents and adults group were 0.73±0.07×10^{-3} \text{ mm}^2/\text{s} and 0.75±0.07×10^{-3} \text{ mm}^2/\text{s}, which showed no significant differences. The average pretreatment ADC value of non-keratinizing undifferentiated carcinoma and non-keratinizing differentiated carcinoma group were 0.76±0.08×10^{-3} \text{ mm}^2/\text{s} and 0.74±0.06×10^{-3} \text{ mm}^2/\text{s}, which showed no significant differences. The average pretreatment ADC values of T2, T3 and T4 group were 0.78±0.05×10^{-3} \text{ mm}^2/\text{s}, 0.77±0.07×10^{-3} \text{ mm}^2/\text{s} and 0.75±0.08×10^{-3} \text{ mm}^2/\text{s}. Although there were no significant differences between T2, T3 and T4 group, a trend towards lower ADC was observed with increasing tumor T-staging.

CONCLUSION
Pretreatment ADC value is a valuable quantitative parameter used for predicting induction chemotherapy response in locally advanced nasopharyngeal carcinoma.

CLINICAL RELEVANCE/APPLICATION
ADC value is a valuable parameter used for predicting induction chemotherapy response in locally advanced nasopharyngeal carcinoma.

Effect of Single-energy Projection-based Metal-artifact Reduction Algorithm on the Computed Tomography Detection of Oral Cavity Cancers

PURPOSE
We investigated the effect of the single-energy projection-based metallic artifact reduction (SEMAR) technique on tumor visualization and staging in patients with oral cavity cancers.

METHOD AND MATERIALS
Contrast-enhanced CT was performed on 40 patients with dental metalwork. Of these, 18 patients had pathologically confirmed...
NAA and NAAG). In addition, FID-CSI with ultra short acquisition delays (TE*) adds additional SNR, in particular for J-coupled resolution which can be transformed to the increased spatial resolution or better characterization of overlapping metabolites (e.g. metabolic information to the conventional MR imaging methods). High field systems (e.g. 7 T) offer increased SNR and spectral resolution. Magnetic resonance spectroscopic imaging (MRSI) of the brain allows to map several metabolites and provide complementary information to the conventional MR imaging methods. High field systems (e.g. 7 T) offer increased SNR and spectral resolution.

PURPOSE

Wolfgang Siegfried, Gilbert Bernhard, Lenka Eva, Participants

THA4

Comparison

Spectroscopic Imaging with High Spatial Resolution and Ultra Short TE* at 3 and 7 Tesla - A Comparison

NR361-SD-THA3

Value of Diffusion Tensor Imaging in Differentiating Malignant from Benign Parotid Gland Tumors

CONCLUSION

SEMAR reconstruction significantly improved oral cavity cancer visualization and the diagnostic confidence level by removing artifacts and noise from dental metalwork.

CLINICAL RELEVANCE/APPLICATION

SEMAR algorithm can reduce metal artifact due to dental metalwork and improve diagnostic performance of oral cavity cancer.

NR360-SD-THA3

Value of Diffusion Tensor Imaging in Differentiating Malignant from Benign Parotid Gland Tumors

RESULTS

SEMAR image artifact was significantly lower than the conventional image (38.4±18.0 HU vs. 187.7±162.7 HU; P<0.01). Reviewers-1 and -2 detected 10 and 7 more lesions with SEMAR, respectively. Areas under the curve for conventional and SEMAR reconstruction were 0.761 and 0.942, respectively, for reviewer-1 and 0.701 and 0.864, respectively, for reviewer-2.

CONCLUSION

SEMARG reconstruction significantly improved oral cavity cancer visualization and the diagnostic confidence level by removing artifacts and noise from dental metalwork.

CLINICAL RELEVANCE/APPLICATION

SEMARG algorithm can reduce metal artifact due to dental metalwork and improve diagnostic performance of oral cavity cancer.

NR360-SD-THA3

Value of Diffusion Tensor Imaging in Differentiating Malignant from Benign Parotid Gland Tumors

RESULTS

Mean ADC and FA values were 0.85 ± 0.24 × 10⁻³ mm²/s and 0.30 ± 0.12 in malignant tumors, and 1.19 ± 0.50 ×10⁻³ mm²/s and 0.17 ± 0.05 in benign tumors, respectively. ADC values showed no significant difference between malignant and benign tumors (p=0.056). FA values of malignant tumors were significantly higher than those of benign tumors (p<0.001). The area under the ROC curve of FA was significantly higher than that of ADC (0.891 vs. 0.702, p<0.005). ADC at the cut-off value of 0.95 and FA at the cut-off value of 0.23 for diagnosing malignant tumors had sensitivity of 88.9 and 77.8%, and specificity of 46.9 and 87.8%, respectively.

CONCLUSION

Diffusion tensor imaging, especially FA, can help differentiate malignant from benign parotid gland tumors.

METHOD AND MATERIALS

The study population consisted of 52 patients with 58 parotid tumors (24 Warthin tumor, 19 pleomorphic adenomas, 6 other benign tumors, and 9 malignant tumors). Single-shot echo planar DTI was performed in the transverse plane with diffusion gradients along 30 noncollinear directions (b = 1000 sec/mm²) at 3T. Apparent diffusion coefficient (ADC) and fractional anisotropy (FA) in each parotid lesion were measured within an ovoid region of interest (ROI) drawn as large as possible. Care was taken to avoid vessels and cystic parts within the tumors. The ADC and FA values were compared between benign and malignant tumors by using the Mann-Whitney U test. The receiver-operating characteristic (ROC) analysis was used to assess the ability of the ADC and FA values to differentiate malignant from benign tumors. Sensitivity and specificity were calculated by using a threshold criterion that would maximize the average of sensitivity and specificity.

RESULTS

Comparison

Spectroscopic Imaging with High Spatial Resolution and Ultra Short TE* at 3 and 7 Tesla - A Comparison

NR361-SD-THA3

Value of Diffusion Tensor Imaging in Differentiating Malignant from Benign Parotid Gland Tumors

CONCLUSION

Diffusion tensor imaging can improve diagnostic performance in the characterization of parotid tumors.

CLINICAL RELEVANCE/APPLICATION

Diffusion tensor imaging can improve diagnostic performance in the characterization of parotid tumors.

NR361-SD-THA3

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NR361-SD-THA3

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RESULTS

Mean ADC and FA values were 0.85 ± 0.24 × 10⁻³ mm²/s and 0.30 ± 0.12 in malignant tumors, and 1.19 ± 0.50 ×10⁻³ mm²/s and 0.17 ± 0.05 in benign tumors, respectively. ADC values showed no significant difference between malignant and benign tumors (p=0.056). FA values of malignant tumors were significantly higher than those of benign tumors (p<0.001). The area under the ROC curve of FA was significantly higher than that of ADC (0.891 vs. 0.702, p<0.005). ADC at the cut-off value of 0.95 and FA at the cut-off value of 0.23 for diagnosing malignant tumors had sensitivity of 88.9 and 77.8%, and specificity of 46.9 and 87.8%, respectively.

CONCLUSION

Diffusion tensor imaging, especially FA, can help differentiate malignant from benign parotid gland tumors.

CLINICAL RELEVANCE/APPLICATION

Diffusion tensor imaging can improve diagnostic performance in the characterization of parotid tumors.
resonances. We compared MRSI in six volunteers using a FID-CSI sequence with high spatial resolution und ultra-short TE* of 1.5 ms at 3 and 7 Tesla.

**METHOD AND MATERIALS**
Six healthy volunteers (5m/1f; age: 28.3±2.4) were measured at 3T and 7T (3T Trio, 7T Magnetom, Siemens, Erlangen, Germany) using a 32-channel head coil. A FID-CSI sequence with 64×64 phase encoding steps, FOV=220×220mm², TR=600ms, TE*=1.5ms, in plane voxel size 3.4×3.4 mm², and a slice thickness of 10 mm was used (scan time 30min). Spectra were processed using LCModel. Metabolic maps were created using Matlab and MINC (Minc tools; v2.0; McConnell Brain Imaging Center, Montreal, Canada). SNRs were computed using the pseudo-replica method in time domain.

**RESULTS**
Satisfactory data quality was achieved from all subjects measured at 3 T and 7 T. SNR was 2.8 times higher at 7 T compared to 3 T. CRLBs were below 10% for all metabolites measured at 7 T including glutamate and glutamine. Compared to techniques using pre-localization techniques (e.g. STEAM, PRESS) FID-CSI allows to acquire whole slices. The high matrix size and hamming filtering prevented fat contamination from the sculp. With the high in-plane resolution of 3.4×3.4 mm² metabolic maps showing anatomical details could be created.

**CONCLUSION**
This study revealed 2.8 times higher SNR and decreased CRLBs of brain metabolites measured with MRSI at 7 T compared to that measured at 3 T. We could compute metabolic maps with anatomical details at both field strengths. Improved spectral resolution allowed NAAG separation from NAA at 7 T but not at 3 T. In addition the ultra-short acquisition delay allows to quantify J-coupled metabolites even measured with a high spatial resolution.

**CLINICAL RELEVANCE/APPLICATION**
MRSI at 7T can be performed with high spatial resolution and ultra-short TE*. This allows the quantification of metabolites such as NAAG, glutamate, glutamine and myo-Inositol with low CRLBs.

**PURPOSE**
To evaluate the detection ability and diagnostic accuracy of spectral CT for papillary thyroid microcarcinomas (PTMCs), in comparison with high frequency ultrasound.

**METHOD AND MATERIALS**
31 patients with suspected PTMC underwent contrast-enhanced neck CT with dual-energy spectral CT mode. The CT scanning parameters for the fast kVp-switching between 80 and 140 kVp were: tube current fixed at 260mA; helical pitch 0.984 and rotation speed 0.7s/r. CT images were divided into 2 groups: 140 kVp polychromatic images and monochromatic images. Two radiologists analysed all CT images. Ultrasonography of thyroid was performed with a 7- to 12-MHz linear array transducer by an experienced radiologist. The number, size, shape, location, boundaries, density (internal echo), calcification of nodules in the gland and cervical lymph nodes were observed and recorded. The detection ability and diagnostic accuracy for the primary lesion and metastatic cervical lymph node of the two methods were determined by comparing the results to the pathology reports after surgery. Statistical analyses were done using SPSS 19.0.

**RESULTS**
46 lesions in 31 patients were confirmed PTMC by pathology. The mean size of lesions was 0.69±0.04 cm. The optimal energy level for obtaining the best lesion-to-thyroid CNR in spectral CT was 65.83±2.01keV. The polychromatic images, monochromatic images and high frequency ultrasound showed 40, 44, and 45 lesions with detection rates of 87.0%, 95.7% and 97.8% respectively. There was no significant differences in the diagnostic performance by using the two diagnostic methods to display the shape, boundaries, density (echo) and microcalcifications (P>0.05). 25 patients (80.6%) were confirmed with lymph node metastasis involved 82 levels in total. Preoperative CT and ultrasound diagnosed lymph node metastasis in 67 and 63 levels respectively. The sensitivity and specificity of ultrasound and spectral CT to diagnose cervical lymph node metastasis were (76.8% and 99%) and (81.7% and 99.3%) respectively. There was no significant difference in the diagnostic accuracy obtained by spectral CT and ultrasound (p=0.125).

**CONCLUSION**
Spectral CT images were superior to polychromatic images and similar to frequency ultrasound in the detection ability and diagnostic accuracy.

**CLINICAL RELEVANCE/APPLICATION**
Single-source dual-energy computed tomography imaging is helpful in the detection and diagnosis the PTMCs.
PURPOSE

Cervical spondylosis is a common degenerative disease that causes several types of motor and sensory dysfunction. Diffusional kurtosis imaging (DKI) has shown greater promise than DTI in evaluating the microstructure and pathologic condition of neuronal tissue. The goal of this study is to investigating microstructural changes in the spinal cord in patients with cervical spondylosis by using diffusional kurtosis imaging (DKI).

METHOD AND MATERIALS

Twenty one patients with cervical myelopathy were selected in this study. All images were acquired on a 3.0 T MR scanner (Skyra, Siemens Medical Systems, Germany). The imaging parameters for DKI were as follows: repetition time/echo time, 3000/91ms; number of excitations, 2; slice thickness/gap, 4/0 mm; number of slices, 17; field of view, 230 × 230 mm; spatial resolution, 1.3 × 1.3 × 4.0; three b-values (0, 1000, and 2000 s/mm²) with diffusion encoding in 20 directions for each b-value. Values for fractional anisotropy (FA), apparent diffusion coefficient (ADC), and mean diffusional kurtosis (MK) were calculated and compared between unaffected and affected spinal cords.

RESULTS

In all patients MK was significantly lower in normal appearing spinal cord near affected cervical spinal cords than in normal cervical spinal cords (0.701 ± 0.183 vs. 0.936 ± 0.157, P < 0.01), but the difference of FA and ADC was no significant (P > 0.05). The affected cervical spinal cords had lower MK (0.610 ± 0.162), FA and ADC than normal cervical spinal cords (p<0.01).

CONCLUSION

MK values in the cervical spinal cord may reflect microstructural changes of spinal cord damage in cervical myelopathy, and it could potentially provide more information that obtained with conventional diffusion metrics.

CLINICAL RELEVANCE/APPLICATION

MK values in the spinal cord could reflect microstructural changes of spinal cord damage. It is useful for showing the cervical spinal cord changing in cervical myelopathy, and it could be used in clinic.

PURPOSE

To exploit the clinical application value of DKI on brain microstructure damage in PD

METHOD AND MATERIALS

Thirty-five clinically confirmed PD patients were included (18 males and 17 females, mean age 67.00±8.76 years). Twenty-three age and gender matched healthy volunteers were recruited as control group (12 males, 11 females, mean age 66.48±5.2 years). All patients performed conventional MRI and DKI sequence. Bilateral MK value, Ka value, Kr value, MD value, Da value, Dr value and FA value of the head of caudate nuclei, putamen, globus pallidus, thalamus, red nucleus, substantia nigra were measured. Two independent samples t-test was used to compare the mean values of parameters in all brain regions between the PD and HC groups. Receiver operating characteristic (ROC) test was used to assess the ability of each DKI parameter in every region in distinguishing the two groups. The correlations of between DKI parameters and MMSE score of each nuclei of PD group were all
RESULTS

Compared to the HC group, the mean value of MK in PD group significantly decreased in substantia nigra, while markedly increased in globus pallidus; Ka value decreased in thalamus, red nucleus, substantia nigra; Kr value decreased in putamen, red nucleus while increased in globus pallidus and substantia nigra. MD value in PD group significantly increased in putamen, globus pallidus, thalamus, red nucleus and substantia nigra; Da value increased in globus pallidus, thalamus, red nucleus and substantia nigra; Dr value increased in globus pallidus and substantia nigra. FA value in PD group significantly decreased in putamen while increased in globus pallidus and red nucleus. The biggest area under ROC curve (AUC) value of 0.830 belongs to Dr value in the globus pallidus. In all regions, MK, Ka and Kr values showed positive correlation with MMSE score, among which, the Ka value in globus pallidus has the best correlation with MMSE score ($r=0.458$, $P=0.006$). Simultaneously, the diffusivity parameters exhibited the several negative correlations with MMSE score, among which, the MD value in thalamus showed the best correlation with the MMSE score ($r=-0.408$, $P=0.019$).

CONCLUSION

DKI can qualitatively diagnose PD and also quantitatively evaluate the change of microstructure in extrapyramidal system gray matter nucleus of PD patients.

CLINICAL RELEVANCE/APPLICATION

DKI can reflect the Brain Microstructure Change of PD.

NR366-SD-THB3

Quantitative Image Reconstruction of Dopamine-transporter 99mTc-TRODAT-1 (TRODAT) SPECT Improves to Establish Age-dependent Normal Reference Values (NRV) with LEHR Collimation

Station #3

Participants
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Chih-Yuan Lin, Taipei, Taiwan (Abstract Co-Author) Nothing to Disclose
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Bailing Hsu, N. Bilenica, MA (Abstract Co-Author) Nothing to Disclose

PURPOSE

TRODAT SPECT to assess dopamine transporter activity (DTA) has been utilized as a clinical tool to evaluate Parkinson’s disease (PD) in Taiwan. However, because of historical development pathway, a systematic research to generate normal reference value (NRV) with LEHR collimation was not yet established.

METHOD AND MATERIALS

Twenty-nine normal healthy subjects with ages ranging from 42 to 82 and divided into 4 decade groups were recruited to accept TRODAT SPECT and T1-3D MRI scans. The SPECT protocol injected 30 mCi TRODAT and imaged 4 hours post injection. SPECT images were reconstructed with FBP and quantitative SPECT reconstruction system (QSRS), including corrections for attenuation, scatter, resolution and noise. SPECT images were fused with MRI images to analyze brain area with the SPM program. A set of region template was applied to obtain absolute uptake in striatum (S), caudate (C) and putamen (P) areas. Mean and SD of specific uptake ratio (SPR) as $S/(S-Background)$ and C-P ratio (CPR) as $C/P$ were calculated, and then compared with the result of fan-beam collimation (Weng, JNM 2004).

RESULTS

From visual inspection, SPECT and MRI images were closely registered perfectly. Among all patients, mean uptake in S, C and P were $20.9\pm10.8$, $17.2\pm6.2$, and $22.4\pm8.8$ kBq/ml. With FBP, the relation of SBR(y) to decade(x) was $y=-0.016x+1.55$ ($R^2=0.93$) and $y=0.033x+3.47$ ($R^2=0.96$) for QSRS ($p=0.0001$). There was two-fold difference among QSRS and FBP corresponding to age effect, and the slope of FBP result matched with fan-beam collimation (Weng, JNM 2004). CPR was $y=-0.0019x+0.96$ ($R^2=0.72$) for FBP and $y=-0.0005x+0.75$ ($R^2=0.63$) for QSR ($p=0.035$). FBP presented slightly higher CPR value than QSRS ($\Delta=0.21$).

CONCLUSION

Dopamine-transporter activity in striatum consistently decreased with elevated ages, but the activity ratio in caudate and putamen stayed unchanged. QSRS provided two-fold more profound SBR scale to separate age effect in normal subjects than FBP, in which it can be positioned as a more sensitive parameter while applied to diagnose PD.

CLINICAL RELEVANCE/APPLICATION

In contrast to fan-beam collimator, LEHR collimator is a type of collimator most widely utilized in all hospitals in Taiwan. The result of QSRS not only provided normal reference values for LEHR collimation, but also created more sensitive scale to detect difference of dopamine transporter activity in striatum area over fan-beam collimation.

NR367-SD-THB4

Application of Volume-based Morphometric Analysis Method in AD Spectrum

Station #4

Participants
Zhigang Qi, Beijing, China (Presenter) Nothing to Disclose
Tianyi Qian, PhD, Beijing, China (Abstract Co-Author) Nothing to Disclose
Guillaume Bonnier, Lausanne, Switzerland (Abstract Co-Author) Nothing to Disclose
Benedicte Marechal, Lausanne, Switzerland (Abstract Co-Author) Nothing to Disclose
Kuncheng Li, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose

PURPOSE

To evaluate the feasibility of an individual-level volume-based morphometric analysis method in the clinical differential diagnosis of
METHOD AND MATERIALS
Three groups of elderly subjects were enrolled in this study, including 28 AD patients, 35 MCI patients, and 28 normal controls. High resolution 3D T1-weighted MR images were collected with a MAGNETOM Trio 3T MR scanner (Siemens AG, Erlangen, Germany). The volumes of each brain region were obtained with a prototype morphometry tool. The volume of each part of the brain was obtained with absolute value including grey matter, white matter, CSF. And the grey matter was divided into anatomical areas, such as frontal lobe, parietal lobe, temporal lobe, occipital lobe, hippocampus, cingulate, insula, and some neocortices, like thalamus, Putamen, et al. Then the volumes in lm were normalized to an index number of percentage using the volume of the whole brain. The normal range of each area was determined based on the large population dataset and the index out of the bound will be marked as abnormal brain areas.

RESULTS
Areas including hippocampus, cingulate, insula, frontal lobe, parietal lobe, and temporal lobe, showed positive correlation with MMSE score, MoCA score. And in these areas, significant difference was observed among the three groups, and pairwise comparison showed significant difference can be observed between AD and MCI, and between AD and normal control. From the ROC curve we could find, between AD and MCI, right cingulate has the highest specificity (97.1%) and left frontal lobe has the highest sensitivity (96.4%). Compared AD with NC, the highest specificity (96.3%) were found in right hippocampus and the highest sensitivity (92.9%) shows in left temporal lobe.

CONCLUSION
With the individual-level morphometric analysis method, differential diagnosis can be done between AD and MCI, and between AD and normal control. Conjoint analysis of several areas can be more informative. And the change of insula can be an index to be investigated in the next step.

CLINICAL RELEVANCE/APPLICATION
The volume based morphometric analysis could be done in 1 min after the scan. So it could be used in routine clinical MR scan in AD diagnosis and could provide useful information for screening.

NR368-SD- THBS
A Highly Effective Improvement of SWI Small Vessel Contrast by using FSBB

Participants
Tetsuya Yoneda, PhD, Kumamoto, Japan (Presenter) Nothing to Disclose
Takashi Oikawa, RT, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose
Takeshi Ohta, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose
Satomi Taji, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose
Yuichi Yamashita, Otawara, Japan (Abstract Co-Author) Employee, Toshiba Corporation
Masato Ikedo, Otawara, Japan (Abstract Co-Author) Nothing to Disclose
Hirofumi Wada, RN, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose
Akira Sasao, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE
The purpose of this study is to show very small b-value can effectively delineate small vessels in SWI-image even in shorter TE, which may help to shorten scan duration in clinical case.

METHOD AND MATERIALS
To evaluate effect of additional small b-value MPG to phase value, we made phantom in which 3 tubes as vessels with 2.1 mm inner diameter were put in gelatin (20% by weight, Nacalai tesque). Each tubes run along the x, y and z direction (z: parallel to B0 field) and physiological saline was flowed in the tube. Flow speed changed from 0 to 10 cm/s. Both of phantom and human study, MRI scans were done in 3T-MRI (Vantage Titan3T, Toshiba Medical Systems, Japan) with Flow Sensitive Black Blood (FSBB) with b = 0 and 3, TE/TR = 14.5 (only for human) 20, 25, and 35/51 ms, pixel size = 0.39*0.39 mm^2 (FOV = 200*200 mm^2, matrix size = 512*512), slice thickness = 1 mm, FA = 15 deg, parallel imaging factor = 2, and scan duration = about 5 min. Phase images were derived as Dicom format files and SWI-images were reconstructed from homodyne filtered phase images with kernel size = 128*128 applied to each slice data.

RESULTS
Phantom study showed that filtered phase value was not linearly proportional to flow speed. Especially for low flow speed < 2 cm/s, filtered phase value was not enough to make SWI contrast when b = 0 (that is less than order of SD of filtered phase), but is enough when b = 3. For human study, minimum intensity projected SWI-image over 12 mm with TE = 14.5 ms and b = 0 did not reasonably delineate small vessels compared with image with TE = 20 ms and b = 0. SWI-images with TE = 14.5 ms and b = 3, however, highly delineated small vessels and simultaneously realize high SNR and less phase wrap artifact.

CONCLUSION
MPG rationally affected to phase shift of slow speed flow due to phase dispersion. Therefore, SWI with MPG could rationally show higher vessel contrast. Especially for slow speed flow, MPG with small b-value made high contrast of such slow flow. Additionally, short TE scan enables phase imaging to reduce susceptibility and phase wrap artifacts.

CLINICAL RELEVANCE/APPLICATION
Our suggested method has several advantages for clinical cases; 1) FSBB is already used in clinical MRI, 2) Short TE scan consequently reduces scan duration and susceptibility artifact.
PURPOSE
To determine the relation between the quantitative MRI biomarkers and clinical performance reflecting cognitive morbidity and clinical outcome.

METHOD AND MATERIALS
17 MRI scans and cognitive evaluations were performed on patients with CO intoxication. The ADC ratios of the affected vs. the unaffected centrum semiovale (CS), globus pallidus, and corpus callosum (CC) were obtained. In cases where no involved area was visible, the ratio was determined to be 1. The SI ratios between the affected CS and the normal pons in T2-FLAIR images were obtained. The Mini-Mental State Exam (MMSE) representing general intelligence, and the clinical outcome score determined by relative degree of neurologic improvement, were used for evaluation of clinical performance. The clinical outcome was graded on a scale of 0 to 4: 0, complete recovery; 4, no improvement, coma, or death. Correlation coefficients were calculated between the MRI markers and the clinical markers using Spearman’s rank correlation. The patients were further classified into two groups on the basis of clinical performance (good vs. poor), and imaging parameters were compared between the two groups using Fisher’s exact test and the Mann–Whitney U test.

RESULTS
The SI ratios between the affected CS and the normal pons in T2-FLAIR images were significantly higher in the poor outcome group than in the good outcome group (p=0.001) and were strongly correlated with the clinical outcome score (r=-0.764, p<0.001), and moderately correlated with the MMSE results (r=-0.511, p=0.036). In ADC analysis, the ADC ratio between the affected and the unaffected CC was moderately correlated with the clinical outcome score (r=-0.535, p=0.04). The ADC ratios in the CS and globus pallidus did not show significant correlation with the clinical performances.

CONCLUSION
The SI ratios between the CS and the normal pons in T2-FLAIR images, and the ADC ratio between the affected and the unaffected CC correlated well with clinical severity. Thus, higher SI in the CS and a lower ratio of the ADC values between the affected and the unaffected CC may indicate the presence of more severe white matter injury and clinical impairment.

CLINICAL RELEVANCE/APPLICATION
T2-SI ratio and ADC value are imaging biomarkers for the prediction of clinical performance in patients with CO intoxication.
Hot Topic Session: Molecular Neuroimaging in Dementia: State-of-the-Art and Emerging Techniques

Thursday, Dec. 3 3:00PM - 4:00PM Location: E350

LEARNING OBJECTIVES

1) Explain potential clinical applications of different molecular pathology PET tracers. 2) List different targets for neuroinflammation PET imaging. 3) Describe advantages and disadvantages of different PET targets for neuroinflammation imaging. 4) Identify challenges for the development of molecular pathology tracers for neurodegenerative disorders.

ABSTRACT

Clinical classifications of neurodegenerative disorders are often based on neuropathology. The term „proteinopathies” includes disorders that have in common abnormal proteins as a hallmark, e.g. amyloidoses, tauopathies, synucleopathies, ubiquitinopathies. Different proteins can also co-exist in the same disease. To further complicate the pathophysiology scenario, not only different proteins, but also cells are believed to play an active role in neurodegeneration, in particular those participating in neuroinflammatory processes in the brain, such as activated microglia and astrocytes. In clinical practice, differentiating pathology from clinical symptoms to allow accurate clinical classification of these disorders during life, becomes difficult in absence of biomarkers for these pathology hallmarks. PET imaging can be a useful tool in this context. Using PET tracers targeting misfolded proteins it will be possible to identify the presence or absence of the target, to depict the cerebral distribution and to quantify the protein load in different cerebral regions, as well as to monitor changes over time. Beta-amyloid is one of the proteins involved in neurodegenerative disorders, which is currently suitable to be imaged by means of PET. Research efforts are currently ongoing in order to identify new PET tracers targeting non-amyloid PET tracers for neurodegeneration. This presentation will focus on the investigational PET tracers targeting tau and alpha-synuclein as misfolded proteins, and activated microglia and astrocytes as cellular targets for neuroinflammation.

URL

SPSH52A Potential of Amyloid Imaging versus MRI in the Diagnostic Workup of Dementia

Participants

Clifford R. Jack JR, MD, Rochester, MN (Presenter) Stockholder, Johnson & Johnson; Research Consultant, Eli Lilly and Company; ;

LEARNING OBJECTIVES

1) Explain the utility of structural MRI and amyloid PET in characterizing the pattern of neurodegeneration and pathologic involvement in dementia syndromes. 2) Identify the advanced MRI techniques that provide information on disease pathophysiology in dementia. 3) Discuss cases for which MRI and amyloid PET would provide critical information for clinical assessment.

ABSTRACT

Development of molecular imaging agents for fibrillar β-amyloid (Aβ) positron emission tomography (PET), brought molecular imaging of Alzheimer’s disease (AD) pathology into the spotlight. Large cohort studies with longitudinal follow-up in cognitively normal, mild cognitive impairment and AD patients indicate that Aβ deposition can be detected many years, even decades before the onset of symptoms with molecular imaging and its progression can be followed longitudinally. The role of molecular imaging in AD clinical trials is growing rapidly especially in an era when preventive interventions are designed towards eradicating the pathology targeted by molecular imaging agents. The utility of Aβ PET in differential diagnosis of AD is greatest when there is no pathologic overlap between the two dementia syndromes such as in frontotemporal lobar degeneration and AD. However Aβ PET alone may be insufficient in distinguishing dementia syndromes that commonly have overlapping Aβ pathology, such as dementia with Lewy bodies and vascular dementia, which represent the two most common dementia pathologies after AD. MRI is recommended during the initial evaluation of dementia, in order to determine potentially treatable causes such as tumors, subdural hematoma or normal pressure hydrocephalus. In addition, presence and extent of cerebrovascular disease, which may contribute to cognitive impairment and dementia, can be determined during this initial MRI evaluation. Pattern of structural MRI changes reflect neurodegenerative pathology and are closely associated with the clinical disease severity in AD. Although Aβ deposition is the most common pathologic process observed in dementia patients, other pathologic processes such as loss of neuronal integrity and connectivity can be measured with the advanced MRI techniques and complement Aβ PET.

URL

SPSH52B Imaging Inflammation and Molecular Pathology in Dementia

Participants

Ana M. Catafau, MD, PhD, Barcelona, Spain, (ana.catafau@piramal.com) (Presenter) Employee, Piramal Imaging GmbH

LEARNING OBJECTIVES

1) Explain potential clinical applications of different molecular pathology PET tracers. 2) List different targets for neuroinflammation PET imaging. 3) Describe advantages and disadvantages of different PET targets for neuroinflammation imaging. 4) Identify challenges for the development of molecular pathology tracers for neurodegenerative disorders.

ABSTRACT

Different proteins can also co-exist in the same disease. To further complicate the pathophysiology scenario, not only different proteins, but also cells are believed to play an active role in neurodegeneration, in particular those participating in neuroinflammatory processes in the brain, such as activated microglia and astrocytes. In clinical practice, differentiating pathophysiology from clinical symptoms to allow accurate clinical classification of these disorders during life, becomes difficult in absence of biomarkers for these pathology hallmarks. PET imaging can be a useful tool in this context. Using PET tracers targeting misfolded proteins it will be possible to identify the presence or absence of the target, to depict the cerebral distribution and to quantify the protein load in different cerebral regions, as well as to monitor changes over time. Beta-amyloid is one of the proteins involved in neurodegenerative disorders, which is currently suitable to be imaged by means of PET. Research efforts are currently ongoing in order to identify new PET tracers targeting non-amyloid PET tracers for neurodegeneration. This presentation will focus on the investigational PET tracers targeting tau and alpha-synuclein as misfolded proteins, and activated microglia and astrocytes as cellular targets for neuroinflammation.

URL
Participants
Jonathan E. McConathy, MD, PhD, Saint Louis, MO (Presenter) Research Consultant, Eli Lilly and Company; Research Consultant, Blue Earth Diagnostics Ltd; Research Consultant, Siemens AG; Research support, GlaxoSmithKline plc

LEARNING OBJECTIVES
1) Participants will be familiar with the current status of PET tracers targeting tau that are being used in human research studies and understand their potential roles in therapeutic trials and clinical neuroimaging.

ABSTRACT
Imaging biomarkers for Alzheimer's disease (AD) and other neurodegenerative diseases are playing an increasingly important role in both research and patient care. Abnormal deposition of the tau and beta-amyloid proteins are pathologic hallmarks of AD, and several PET tracers targeting tau are now available for human research studies. The optimal use and sequencing of imaging biomarkers in the evaluation of cognitive impairment and dementia are active areas of investigation. In this presentation, current and potential future applications of tau-PET will be discussed in the context of both research studies and possible clinical applications.
LEARNING OBJECTIVES
1) How to properly protocol an MRI of the brain for developmental delay. 2) How the proper protocol depends on the age of the patient at the time of the scan. 3) Where to get information to help you to perform the best sequences ('developmental delay' is often not sufficient).

ABSTRACT
Developmental delay is a common indication for brain imaging in children, most commonly in the first few years of life. To be a useful study, the imaging examination must assess the brain for the most common causes of delayed development. These include malformations (genetic or acquired), injury from prior vascular event or infection (pre- or postnatal), inborn errors of metabolism and phakomatoses. Sometimes the presenting history will give a clue that helps to protocol the scan, but other times it is not until the first or second sequence is reviewed that the cause of the delay begins to become clear. This lecture will discuss: 1. The optimal imaging protocols for the diagnoses of these disorders 2. Clues from imaging as to the etiology of the brain abnormality 3. When additional sequences are necessary and how they should be performed. The following structures must always be assessed in Developmentally Delayed patients: a. Midline structures: cerebral commissures, hypothalamus, pituitary gland, tectum, 4th ventricle, cerebellar vermis, brain stem. b. Cerebral Cortex: too thick (pachygyria), too thin (injury or insufficient neuron production/migration), too few sulci (oligogyria), too many sulci (if tiny, consider polymicrogyria). c. White matter: If too little white matter, consider a primary axonal disorder, either axonal navigation or axonal formation. If too much white matter (much less common) consider an overgrowth syndrome. If hypomyelinated, consider metabolic hypomyelination syndrome or delayed myelination due to illness or malnutrition. If damaged white matter, think of infection (usually asymmetric), inflammatory condition, or metabolic disorder (usually symmetric and often associated with symmetric deep gray matter, brain stem or cerebellar white matter damage). If heterotopic gray matter is present, think of in utero ependymal disruption or malformation syndrome. d. Midline Structures: Look for interhemispheric fissure; if gray matter crosses the midline from one hemisphere to the other, consider holoprosencephaly. If septum pellucidum is absent, look for gray matter crossing midline, look for optic nerve hypoplasia, ectopic posterior pituitary or small anterior pituitary (Septo-Optic Dysplasia); also look at the cerebellum for missing vermis (rhombencephalosynapsis), especially if hydrocephalus is present. Look at cerebral aqueduct. e. Posterior fossa: Make sure the cerebellum is completely formed, is of normal size compared to the cerebrum and that the vermis and hemisphere are proportional. Make sure all the lobules of the vermis are present. Look at the brain stem for proper proportions of the midbrain, pons and medulla.

EVIDENCE-BASED IMAGING OF THE TRAUMATIZED PEDIATRIC SPINE

LEARNING OBJECTIVES
1) Be familiar with the current evidence regarding the value of radiographs, computer tomography, and magnetic resonance imaging in the evaluation of the traumatized pediatric spine. 2) Apply evidence-based imaging protocols to the evaluation of pediatric patients suspected of cervical spine trauma at your home institution.

ABSTRACT
Imaging of the traumatized pediatric spine has unique requirements due to the anatomy and injury patterns in the developing spine, susceptibility to soft tissue injury in the absence of fracture, and radiation dose sensitivity. Radiology Departments may be incorrectly applying imaging protocols developed for adult patients to make their injured pediatric patients. Judicious use of radiographs, appropriately-dosed CT scanning, and MRI must be in the setting of a dedicated clinical protocol for the evaluation of the pediatric cervical spine. We will review the current literature on pediatric cervical spine trauma and the clinical/radiological pathway currently being implemented at The Children’s Hospital of Philadelphia.

A PATTERN-BASED APPROACH TO PEDIATRIC METABOLIC DISEASE

LEARNING OBJECTIVES
1) Become familiar with frequent and less frequent metabolic diseases that may injure the neonatal brain. 2) How to approach the imaging findings using a pattern recognition approach.
ABSTRACT

Neuroimaging pattern recognition in white matter disorders was initiated by Marjo van der Knaap and Jaap Valk, a pediatric neurologist and a pediatric neuroradiologist, and first published in 1991. This approach not only simplified and guided the diagnosis of many gray and white matter disorders, but also made it possible to cluster patients with identical or similar MR patterns, allowing further clinical, laboratory, genetic and molecular exploration. Multiple, initially unknown or unclassified disease entities could consequently be identified along this track. In the current lecture the pattern recognition approach will be discussed and applied in a variety of pediatric metabolic disorders to demonstrate its value in facilitating the correct diagnosis of inherited white and gray matter diseases. In addition, we will discuss why various patterns of neuroimaging findings are best explained.
The Temporal Bone: Anatomy, Inflammation and Tumors

Thursday, Dec. 3 4:30PM - 6:00PM Location: E450A

Participants

Sub-Events

RC706A Temporal Bone Imaging: Anatomy

Participants
John I. Lane, MD, Rochester, MN, (lane.john@mayo.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) The learner will be able to easily identify the clinically relevant anatomic structures of the temporal bone after completing the course. 2) The learner will have a better appreciation of the orientation of the auditory ossicles and the benefits of multiplanar oblique reconstructions from MDCT datasets for demonstrating normal ossicular anatomy and pathology. 3) The learner will have a better appreciation of the normal and pathologic appearance of the cochlea, vestibule, semicircular canals, and vestibular aqueduct on high resolution CT and MR.

RC706B Temporal Bone Imaging: Inflammation

Participants
Joel D. Swartz, MD, Gladwyne, PA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) The learner will be able to understand and analyze the most common varieties of inflammation involving the external auditory canal, middle ear, mastoid and inner ear. 2) The learner will understand the appropriate use of computed tomography and MRI. 3) The learner will be able to differentiate cholesteatoma from other middle ear maladies and understand the pathophysiology of the entities discussed in the presentation. 4) The learner will understand the imaging approach to inner ear inflammation.

ABSTRACT

This presentation will follow an anatomically organized template. The external ear entities emphasize will include necrotizing external otitis, keratitis obturans, granulation tissue and EAC cholesteatoma. There will be special attention to middle ear cholesteatoma with a discussion of diffusion weighted imaging and differentiation of this lesion of granulation tissue and cholesterol granuloma. The pathophysiology of labyrinthitis will also be emphasized.

RC706C Temporal Bone Imaging: Tumor

Participants
Amy F. Juliano, MD, Boston, MA, (amy Juliano@meei.harvard.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand temporal bone anatomy and identify the various portions of the temporal bone. 2) Know the most common neoplasms that occur in different areas of the temporal bone, and recognize their imaging characteristics. 3) Know the differential diagnosis of tumors in the temporal bone region by location and imaging appearance.

ABSTRACT

Temporal bone neoplasms are overall not very common. It is useful to think of the temporal bone in terms of its various subsites, as the tumors that may be found in each subsite is different, and being able to localize an imaging finding to a particular subsite greatly aids in establishing a differential diagnosis. When there are classic imaging features, one can even quite easily arrive at the specific diagnosis. The subsites to be discussed are: the internal auditory canal/cerebellopontine angle cistern, middle ear cavity, mastoid, external auditory canal, petrous apex, and the facial nerve.
Participants

Sub-Events

**RC710A** Thyroid Nodules: When and What to Biopsy

Participants

Jill E. Langer, MD, Philadelphia, PA (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Discuss the sonographic characteristics that are associated with a high probability that a thyroid nodule is likely malignant or likely benign. 3) Gain an understanding of the rationale of the current guidelines for recommending thyroid fine needle aspiration.

**ABSTRACT**

As an overview, this presentation will review the epidemiology of thyroid nodules and correlate the sonographic findings with the risk of malignancy or the likelihood that the appearance represents a benign hyperplastic thyroid nodule rather than a true neoplasm. Additionally, the rationale for current guidelines for recommending thyroid fine needle aspiration will be discussed. The prevalence of palpable thyroid nodules is estimated to be 6.4% in women and 1.5% in men between 30 to 60 years of age, living in iodine-sufficient regions. However, high resolution sonography of the neck has been shown to be a much more sensitive technique than palpation, detecting nodules in 19 to 67% of randomly selected adults, with detection rates greater in women and increasing with age for both genders. Fortunately the vast majority of sonographically detected thyroid nodules are benign, hyperplastic regions of the thyroid. Fine-needle aspiration biopsy (FNA) is still considered the most reliable diagnostic test to determine if a thyroid nodule is malignant. Malignant nodules account for approximately 5% of all nodules that undergo palpation-guided FNA and approximately 10 to 15% of nodules that undergo sonography-guided FNA procedures. Analysis of the sonographic features of thyroid nodules has become the preeminent non-invasive tool for analyzing the risk of malignancy of thyroid nodules and aids in selecting which nodules should undergo fine needle aspiration (FNA). A number of recently published guidelines and consensus statements emphasize that the sonographic appearance of a nodule is a superior predictor of malignancy compared with nodule size or palpability and that when sonographic features of malignancy are noted, the nodule should undergo FNA. A number of sonographic features have shown a high specificity for the diagnosis of thyroid cancer and include marked hypoechogenicity, the presence of microcalcifications, infiltrating or micro-lobulated borders, and a taller-

**RC710B** Post-Thyroidectomy Neck

Participants

Carl C. Reading, MD, Rochester, MN (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Recognize the sonographic appearance of recurrent and metastatic disease, and other abnormalities, in the post-operative neck.

**ABSTRACT**

In the post-thyroidectomy neck, ultrasound surveillance is a highly effective method to evaluate for residual and recurrent disease. Recurrence can occur anywhere within the neck, but typically is located in the mid and low internal jugular chains and thyroid bed region. Abnormal cervical lymph nodes can be recognized with a high degree of accuracy due to abnormal size, shape, internal architecture, and color Doppler appearance. In patients with suspected metastatic papillary cancer, the presence of internal fluid or calcifications is highly predictive of malignancy. Abnormal nodal color Doppler flow including peripheral (non-hilar), increased, and irregular flow is highly predictive of malignancy. Within the post-operative thyroid bed, itself, residual thyroid tissue, tumor recurrence, and suture granulomas can occur. FNA for cytologic analysis of suspected abnormalities can be performed, and the addition of thyroglobulin and calcitonin assay of the specimen, for papillary and medullary cancer, respectively, adds a high degree of accuracy to this procedure.

**RC710C** Parathyroid and Other Neck Masses

Participants

Mary C. Frates, MD, Sharon, MA, (mfrates@partners.org) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify abnormal parathyroid glands based on sonographic characteristics 2) Develop an accurate differential for cystic lesions in the neck based on sonographic characteristics, lesion location and clinical circumstances. 3) List the most common etiologies of solid lesions located between the thyroid and the superior mediastinum.

**ABSTRACT**
Participants

LEARNING OBJECTIVES

Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

Sub-Events

RC713A  Fetal Ear and Orbital Anomalies

Participants
Maria A. Calvo-Garcia, MD, Cincinnati, OH (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify major fetal external ear and orbital malformations. 2) Apply useful search patterns during US and fetal MRI evaluation of external ear and orbital anomalies.

ABSTRACT

Assessment of the fetal face is an important part of the sonographic structural survey. Craniofacial abnormalities occur as an isolated phenomenon or in the context of syndromes, chromosomal abnormalities or environmental insults. Along the course of this presentation we will review the standard facial anatomic survey with US and the main embryologic steps involved in the development of the face. Subsequently we will discuss major malformations involving the external ear and orbits and their expected association. The presentation will include clinical cases evaluated with US and fetal MRI and their postnatal correlations.

RC713B  Fetal Chest Anomalies

Participants
Teresa Victoria, MD, PhD, Philadelphia, PA, (victoria@email.chop.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) To discuss the most common fetal lung masses. 2) To identify imaging algorithms and patterns that can be helpful in reaching a diagnosis.

ABSTRACT

Accurate diagnosis of fetal lung lesions is crucial for appropriate counseling and management of the abnormalities in hand. During the lecture, the normal appearance of the fetal chest will be briefly done, in order to approach a review of the most common pulmonary lesions encountered during the fetal period. Diagnostic clues that will guide accurate diagnosis will be discussed. Rare lung lesions and their imaging diagnostic approach will also be discussed.

RC713C  Fetal GI Anomalies

Participants
Erika Rubesova, MD, Stanford, CA (Presenter) Researcher, Siemens AG

LEARNING OBJECTIVES

1) After the presentation, the learners should be able to recognize the normal appearance of developing fetal bowel, as well as the most common and uncommon presentations of congenital bowel anomalies on ultrasound and MRI. They will become familiar with the specific information provided by each of the two modalities. The course will present a review of bowel anomalies of the fetus and will be illustrated by representative cases with the objective for the learners to understand the systematic approach of image analysis that can lead to the accurate diagnosis or limited list of differential diagnoses.

ABSTRACT

Diagnosis of fetal bowel anomalies usually presents on ultrasound as bowel dilatation or echogenic bowel. Echogenic bowel is associated with multiple other congenital conditions such as chromosomal anomalies, viral infections or cystic fibrosis. Dilatation of bowel may have various etiologies and systematic review of the findings including bowel wall thickening, number of distented bowel loops or the increased echogenicity of the content may help to localize bowel obstruction and narrow the list of differential diagnosis. Fetal MRI adds precious information to the ultrasound thanks the larger field of view, better tissue contrast but mainly thanks to high T1 signal intensity of meconium. Meconium is formed in the entire bowel and accumulates in the rectum that acts as a reservoir. While meconium is seen in the small bowel and colon in the second trimester, it is mainly seen in the fetal colon after 30 weeks of gestational age. Meconium acts as intraluminal contrast, similar to a barium enema. Systematic review of the distribution of meconium and analysis of the bowel caliber in comparison to normal values for gestational age helps to establish or narrow the list of differential diagnoses of fetal gastrointestinal abnormalities. In this presentation, we will review the advantages and limitations of ultrasound and MRI for diagnosis of fetal anomalies, we will discuss and illustrate, by representative cases, the approach to the most common and some more rare or atypical congenital bowel anomalies on ultrasound and MRI, in order to establish a single or short list of differential diagnoses.
Handout: Erika Rubesova
Common Spinal Injection Procedures for Diagnosis and Treatment of Back Pain (Hands-on)

Thursday, Dec. 3 4:30PM - 6:00PM Location: E263

MARK

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
A. Orlando Ortiz, MD, MBA, Mineola, NY (Presenter) Nothing to Disclose
Bassem A. Georgy, MD, MSc, San Diego, CA (Presenter) Consultant, Johnson & Johnson; Consultant, DFINE, Inc; Stockholder, DFINE, Inc; Stockholder, Spine Solutions, Inc;
Allan L. Brook, MD, Bronx, NY (Presenter) Advisor, Johnson & Johnson Advisor, Medtronic, Inc
Afshin Gangi, MD, PhD, Strasbourg, France (Presenter) Nothing to Disclose
Todd S. Miller, MD, Bronx, NY, (Tmiller@montefiore.org) (Presenter) Nothing to Disclose
Stanley Golovac, MD, Merritt Island, FL (Presenter) Consultant, St. Jude Medical, Inc; Investigator, Vertos Medical Inc; Investigator, St. Jude Medical, Inc

LEARNING OBJECTIVES
1) Describe and demonstrate methods for patient selection, evaluation and technique for Image-guided injection procedures used in spine pain management. 2) These procedures will include epidural steroid injections, nerve root blocks, facet blocks, sacroiliac joint injections, lumbar synovial cyst therapy, radiofrequency ablations. 3) Review procedural complications and how to avoid them. 4) Discuss pertinent anatomy, instruments and pharmacology. 5) These objectives will be accomplished using didactic lectures complemented by procedure videos, supervised hands on lab work with training models and round table case discussions.

ABSTRACT
Neck and back pain complaints are very common in the general population. Radiologists can contribute to the diagnosis and management in patients who are not responding to conservative management. Spine injection procedures can frequently be performed on an outpatient basis with a brief recovery phase. These procedures are performed with imaging guidance, such as a multi-directional fluoroscope or under CT guidance, in order to correctly localize the specific anatomic sites in or about the spine for diagnostic and or therapeutic needle localization. An understanding of patient selection, indications and contraindications, are paramount to the safety and success of these procedures. The diagnostic and therapeutic potential of these procedures is also facilitated by a thorough evaluation of the spine, with respect to both anatomy and potential pathology, with cross sectional imaging techniques as well as other radiologic tests. Communication of these results between the Radiologist and the spine proceduralist will contribute to optimal patient outcomes.

Handout: Afshin Gangi

Active Handout: Todd Stuart Miller
**Multiple Sclerosis: What the Clinician Wants to Know**

**Participants**
Aaron S. Field, MD, PhD, Madison, WI (Moderator) Nothing to Disclose
Timothy M. Shepherd, MD, PhD, New York, NY (Moderator) Nothing to Disclose

**LEARNING OBJECTIVES**
1) Describe both typical and atypical appearances of MS on conventional MRI. 2) List the most common differential diagnoses for these imaging findings. 3) Recognize the distinguishing features that often allow discrimination of MS from potential mimics.

**ABSTRACT**
This presentation will review typical and atypical appearances of MS in brain and spinal cord on conventional MRI along with alternative diagnoses that often mimic MS and must be considered when these findings are present.

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**New Multimodal Imaging Approaches for MS**

**Participants**
Matilde Inglese, MD, New York, NY (matilde.inglese@mssm.edu) (Presenter) Consultant, Vaccinex; Research Grant, Novartis AG;

**LEARNING OBJECTIVES**
1) Describe novel MRI techniques to study MS pathophysiology. 2) Discuss how novel MRI techniques contribute to monitoring of MS progression. 3) List the advantages of a multimodal imaging approach for predicting clinical outcomes.

**ABSTRACT**
The presentation will review novel MRI techniques applied to the study of MS patients to improve understanding of disease pathophysiology, to identify new and reliable markers of disease progression and effective predictors of short- and long-term clinical outcomes.

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**Differential Diagnosis in MS**

**Participants**
Aaron S. Field, MD, PhD, Madison, WI (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
1) Describe both typical and atypical appearances of MS on conventional MRI. 2) List the most common differential diagnoses for these imaging findings. 3) Recognize the distinguishing features that often allow discrimination of MS from potential mimics.

**ABSTRACT**
This presentation will review typical and atypical appearances of MS in brain and spinal cord on conventional MRI along with alternative diagnoses that often mimic MS and must be considered when these findings are present.
LEARNING OBJECTIVES

1) Review imaging techniques of nontraumatic adult head and neck emergencies. 2) Recognize non-traumatic adult head and neck emergencies and diagnose the extent of disease and its complications.

LEARNING OBJECTIVES

1) Familiarize the audience with imaging protocols that should be used for assessing pediatric head and neck emergencies. 2) Recognize pediatric head and neck emergencies and effectively diagnose the extent of disease and its complications. 3) Provide reports that enable the referring clinician to effectively treat pediatric head and neck emergencies.

ABSTRACT

The talk will focus on pediatric airway obstruction. Please see attached pdf of the talk including two articles for reference regarding pediatric nasal lesions.

Abstract Handout: Caroline Diana Robson

LEARNING OBJECTIVES

1) Demonstrate the most common traumatic lesions that are encountered in the head and neck. 2) Discuss the important traumatic complications of the face, orbit, skull base, temporal bone, and blood vessels. 3) Discuss imaging strategies to effectively diagnose these traumatic lesions and their complications.

ABSTRACT

Traumatic injury of the head and neck is one of the most important and common diagnostic problems that radiologists will encounter in daily practice. Because of the vulnerability of important bony and soft tissue structures in this region, significant traumatic and potentially life-altering complications may be encountered with blunt and penetrating traumatic forces. Traumatic forces may cause injury of the bony and soft tissue structures of the orbit, including the globe, extraocular muscles, optic nerve, and 3rd-6th cranial nerves. This may result in ocular rupture, extraocular muscle entrapment, retrobulbar hemorrhage, proptosis, traumatic optic neuropathy, and superior orbital fissure syndrome. Diagnosis and management of these orbital injuries will be reviewed. Significant dental malocclusion or malunion may arise from displaced fractures of the mandible. Critical airway compromise may be caused by traumatic injury of the mandible, larynx, and trachea. Skull base and temporal bone trauma may produce a number of important complications that will be addressed in this lecture. These include conductive and sensorineural hearing loss, cerebrospinal fluid leak, traumatic facial palsy, lower cranial nerve injury, as well as cerebrovascular injury. Cerebrovascular injury is one of the most important and potentially life-altering complications that may be encountered with both blunt and penetrating craniocervical trauma. The vulnerable position of the extracranial and intracranial cerebral vasculature makes these vessels highly susceptible to traumatic injury. Fractures of the skull base or cervical spine may cause a variety of critically important traumatic lesions (dissection, pseudoaneurysm, occlusion, rupture, arteriovenous fistula). This lecture will discuss high risk imaging signs that suggest the possibility of cervical or intracranial cerebrovascular trauma. The rational for effective imaging workup and identification of these injuries will be emphasized.
Image-guided Biopsy of the Spine (Hands-on)

Friday, Dec. 4 8:30AM - 10:00AM Location: E260

MK NR IR

AMA PRA Category 1 Credit™: 1.50
ARRT Category A+ Credits: 1.50

Participants
John L. Go, MD, Los Angeles, CA (Moderator) Nothing to Disclose

LEARNING OBJECTIVES
1) Discuss and demonstrate spine biopsy techniques including CT and fluoroscopic approaches, anatomic landmarks, needle selection, special technical considerations for dealing with soft tissue masses, and fluid accumulations, lytic and blastic lesions, and hypervascular conditions. 2) Hands on exposure will be provided in order to familiarize participants with the vast number of biopsy devices that are clinically available. 3) Training models will also be used in order to teach technical skills with respect to approach and technique. 4) Advantages and disadvantages of various biopsy devices and techniques, and improve their understanding of how to maximize the reliability and safety of these spine biopsy procedures.

ABSTRACT

Sub-Events

RC850A Pre- and Post Biopsy Assessment

Participants
Richard Silbergleit, MD, Royal Oak, MI (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Be familiar with all required aspects of the pre-biopsy work-up, including medications, laboratory values, and review of relevant prior imaging. 2) Be familiar with solutions to address to complications or other unexpected events which may arise during the course of spine biopsy. 3) Be comfortable in performing the post procedure assessment of the patient after spinal biopsy.

RC850B Equipment Used for Image-guided Biopsies of the Spine

Participants
Michele H. Johnson, MD, New Haven, CT (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Demonstrate the types of needles used for spine biopsy. 2) Selecting the proper types of needles used for spine biopsy. 3) Case demonstration of the proper use of single or coaxial needle sets for spine biopsy and the advantages or disadvantages of each.

RC850C Thoracic and Lumbar Biopsies

Participants
John L. Go, MD, Los Angeles, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Review the anatomy of the thoracic and lumbar spine relevant to spine biopsy. 2) Describe the approaches used to approach various anatomical regions within the thoracic and lumbar spine. 3) Provide case examples of various approaches used to biopsy the thoracic and lumbar spine.

ABSTRACT

RC850D Cervical Spine Biopsies

Participants
A. Orlando Ortiz, MD, MBA, Mineola, NY (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Demonstrate the various approaches used to biopsy lesions of the cervical spine. 2) Determine the selection of the proper needles to use to biopsy the spine. 3) Provide case examples of cervical biopsies and the thought process used to perform these procedures.

ABSTRACT

Cervical spine biopsies can be challenging procedures to perform, hence they tend to be performed by a limited number of proceduralists. C-spine biopsy is often performed to evaluate potential neoplastic or infectious processes of the cervical spine. The key to performing these procedures effectively and safely is in appropriate patient selection, careful image analysis in order to properly position the patient and choose an approach, identification of critical structures (such as the carotid artery) and neck spaces that should be avoided, and use of coaxial biopsy techniques. The procedure can be safely performed with CT and/or CT fluoroscopy. Specimen sampling principles and specimen handling are also discussed they can help to optimize this procedure.

RC850E Disc Biopsy and Aspiration
Participants
Amish H. Doshi, MD, New York, NY, (amish.doshi@mountsinai.org) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.
Participants

LEARNING OBJECTIVES

1) An important aspect of Nuclear Medicine and Molecular Imaging is that the same core compound of the administered radiopharmaceutical can be labeled with both gamma emitters (for diagnostic) and beta (or alpha) emitters (for therapy), allowing for the targeted treatment of lesions. This is an expression of theranostics, the combination of therapy and diagnostics that is based on the specific tumor biology of each patient’s disease. This proposed session will provide several examples of such paired diagnostic studies and treatments using Nuclear Medicine methods.

Sub-Events

SPNM61A  Radioactive Iodine and Thyroid Cancer - Current Use and Controversies

Participants
Douglas Van Nostrand, MD, Washington, DC, (douglas.van.nostrand@medstar.net) (Presenter) Speakers Bureau, sanofi-aventis Group

LEARNING OBJECTIVES

1) Define remnant ablation, adjuvant treatment, and treatment of locoregional/distant metastases. 2) Discuss the indications and controversies of 131I for each. 3) Discuss the range of prescribed activity of 131I for each.

SPNM61B  Bone Scintigraphy and the Use of Radionuclides in the Management of Patients with Metastatic Castrate-Resistant Prostate Cancer

Participants
Hossein Jadvar, MD, PhD, Los Angeles, CA, (jadvar@med.usc.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) To review bone scintigraphy with single photon and PET radiotracers in the imaging evaluation of patients with prostate cancer. 2) To summarize the results of the ALSYMPCA clinical trial for 223Ra dichloride therapy in patients with castrate resistant metastatic prostate cancer.

SPNM61C  Updates on the Use of PET/CT (and PET/MRI) and Radioimmunotherapy in NHL

Participants
Erik S. Mittra, MD, PhD, Stanford, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPNM61D  Peptide Receptor Radionuclide Imaging and Therapy: Where Are We in Europe and What Shall the US Do to Catch Up?

Participants
Frederik L. Giesel, MD, MBA, Heidelberg, Germany (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the concept of theragnostic. 2) Identify promising candidates for PRRT. 3) Challenges and limitations of PRRT. 4) Future perspective using alpha-emitters.

ABSTRACT

Well-differentiated neuroendocrine tumors (NETs) demonstrate modest responses to conventional chemotherapy due to their slow proliferation rate. However, the expression of somatostatin receptors by NET enables targeting with high affinity peptides. When these octreotide analogue peptides are labelled with beta emitters such as 90Y or 177Lu promising anti-tumor effects have been observed. The presentation will introduce the concept of theragnostic (68Ga-DOTATOC and 90Y/177Lu-DOTATOC) for improved patient stratification. Today, PRRT is well established for a long time in NET-patients. However challenges and limitations will be discussed in regard to other systemic therapies such as everolimus or sunitinib. Finally, outlook will be given in regard to the novel of targeted alpha therapy in NET-patients and its implication to other tumor entities.

URL
Selective Internal Radiation Therapy for Hepatic Malignant Lesions

Ghassan El-Haddad, MD, Tampa, FL, (ghassan.elhaddad@moffitt.org) (Presenter) Speaker Bureau, Bayer AG

LEARNING OBJECTIVES

View learning objectives under main course title.
Neuroradiology (Cerebrovascular Imaging)

Friday, Dec. 4 10:30AM - 12:00PM Location: N226

NR VA MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Jalal B. Andre, MD, Seattle, WA (Moderator) Research Grant, Koninklijke Philips NV; Consultant, Hobbitview, Inc; Research Grant, Toshiba Corporation;

Sub-Events

SST09-01 Subclinical Cardiac Dysfunction Relates to Imaging Markers of Subclinical Brain Disease in the General Population

Friday, Dec. 4 10:30AM - 10:40AM Location: N226

Participants
Hazel I. Zonneveld, MD,MSc, Rotterdam, Netherlands (Presenter) Nothing to Disclose
Wiro Niessen, PhD, Rotterdam, Netherlands (Abstract Co-Author) Co-founder, Quantib BV; Scientific Director, Quantib BV; Shareholder, Quantib BV
Aad Van Der Lugt, MD, PhD, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Gabriel P. Krestin, MD, PhD, Rotterdam, Netherlands (Abstract Co-Author) Consultant, General Electric Company; Research Grant, General Electric Company; Research Grant, Siemens AG; Speakers Bureau, Siemens AG
Mohammad A. Ikram, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Meike W. Vernooij, MD, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose

PURPOSE
To investigate the association between NT-proBNP, a marker of heart disease, and imaging markers of subclinical brain disease on magnetic resonance imaging (MRI) in community-dwelling persons who are free of stroke, dementia, and a clinical diagnosis of cardiovascular disease.

METHOD AND MATERIALS
In 2,475 persons (mean age 56.6 years; 57.3% women) from a prospective population-based study we measured NT-proBNP in serum. All persons underwent brain MRI on a 1.5-tesla MRI system, yielding imaging markers for global brain structure, focal abnormalities (lacunes, white matter lesions, cerebral microbleeds), and microstructural white matter integrity. We used multivariable linear and logistic regression models to investigate the association between NT-proBNP (continuous levels and per tertile) and markers of subclinical brain disease.

RESULTS
Higher NT-proBNP was associated with smaller total brain volume (mean difference per SD increase in NT-proBNP: -0.023, 95% confidence interval [CI] -0.036; -0.009, p=0.001), predominantly driven by grey matter volume (mean difference per SD increase in NT-proBNP: -0.037, 95%CI -0.057; -0.017, p<0.001), and less by white matter volume. Higher NT-proBNP was associated with larger white matter lesion volume (mean difference per SD increase in NT-proBNP: 0.099, 95%CI 0.060; 0.137, p<0.0001), and with lower fractional anisotropy and higher mean diffusivity in white matter.

CONCLUSION
In community-dwelling persons, subclinical cardiac dysfunction as reflected by serum NT-proBNP levels, is associated with global and microstructural imaging markers of subclinical brain disease.

CLINICAL RELEVANCE/APPLICATION
Our data provide more insight into the heart-brain connection, which is essential since both cardiac dysfunction and subclinical brain disease are growing problems in an aging population.

SST09-02 Endovascular Management of Post-irradiated Carotid Blowout Syndrome

Friday, Dec. 4 10:40AM - 10:50AM Location: N226

Participants
Feng-Chi Chang, MD, Taipei, Taiwan (Presenter) Nothing to Disclose
Chao-Bao Luo, MD, Taipei, Taiwan (Abstract Co-Author) Nothing to Disclose
Ting-Yi Chen, MS, Taipei, Taiwan (Abstract Co-Author) Nothing to Disclose
Chung-Jung Lin, MD, PhD, Taipei, Taiwan (Abstract Co-Author) Nothing to Disclose
Wan-Yuo Guo, MD, PhD, Taipei, Taiwan (Abstract Co-Author) Nothing to Disclose
Jiing-Feng Lirng, MD, Taipei, Taiwan (Abstract Co-Author) Nothing to Disclose

PURPOSE
Purpose: To retrospectively evaluate the clinical and technical factors related to the outcomes of endovascular management in patients with head-and-neck cancers associated with post-irradiated carotid blowout syndrome (PCBS)

METHOD AND MATERIALS
Between 2000 and 2013, 96 patients with PCBS underwent endovascular management. The 40 patients with the pathological lesions located in the external carotid artery were classified as group 1 and were treated with embolization. The other 56 patients
with the pathological lesions located in the trunk of the carotid artery were divided into 2 groups as follows: group 2A comprised
the 38 patients treated with embolization, and group 2B comprised the 18 patients treated with stent-graft placement. Fisher's
exact test was used to examine endovascular methods, clinical severities, and postprocedural clinical diseases as predictors of
outcomes.

RESULTS

Technical success and immediate hemostasis were achieved in all patients. The results according to endovascular methods (group 1
vs 2A vs 2B) were as follows: technical complication (1/40[2.5%] vs 9/38[23.7%] vs 9/18[50.0%], P=0.0001); rebleeding
(14/40[35.0%] vs 5/38[13.2%] vs 7/18[38.9%]), P=0.0435). The results according to clinical severity (acute vs ongoing PCBS)
were as follows: technical complication (15/47[31.9%] vs 4/49[8.2%), P=0.0035); rebleeding (18/47[38.3%] vs 8/49[16.3%],
P=0.0155). The results according to post-procedural clinical disease (regressive vs progressive change) were as follows: alive
(14/21[66.7%] vs 8/75[10.7%], P<0.0001); survival time (34.1±30.6[0.3-110] vs 3.6±4.0[0.07-22] months, P<0.0001).

CONCLUSION

We suggest that taking embolization whenever this is possible, performing endovascular intervention in slight clinical severity and
aggressive management of the post-procedural clinical disease can improve the outcomes of endovascular management.

CLINICAL RELEVANCE/APPLICATION

As embolization is the best option of PCBS, application of pre-procedural and post-procedural CT/CTA for disease predication and
follow-up can be a central role of its management. Aggressive management of the post-procedural clinical disease is also
mandatory.

SST09-03 3D Black-Blood T1-mVISTA for the Diagnosis of Temporal and Ophthalmic Involvement in Patients
with Giant Cell Arteritis

Friday, Dec. 4 10:50AM - 11:00AM Location: N226

Participants
Nora N. Kammer, MD, Munich, Germany (Presenter) Nothing to Disclose
Karla Maria Treidl, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Eva M. Coppenrath, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Hendrik Kooijman, Hamburg, Germany (Abstract Co-Author) Employee, Koninklijke Philips NV
Maximilian F. Reiser, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Tobias Saam, MD, Munich, Germany (Abstract Co-Author) Research Grant, Diamed Medizintechnik GmbH; Research Grant, Pfizer Inc

PURPOSE

To assess the diagnostic accuracy of a modified, sub-millimeter isotropic whole-brain 3D black-blood T1w-TSE sequence (T1-
mVISTA) for the diagnosis of temporal and ophthalmic involvement in patients with giant cell arteritis.

METHOD AND MATERIALS

28 patients were included in this study: 9 patients with clinically diagnosis of temporal arteritis (age: mean: 70.4; median 73; 5
male) and 19 controls (age: mean: 62.3 median 63; 7 male). Among patients with temporal arteritis, 5 were also positive for non-
atherosclerotic anterior ischemic optic neuropathy (AION) as defined by fundoscopy. A contrast-enhanced T1-mVISTA sequence
(resolution=0.8mm isotropic, scan time 4:43 minutes) was acquired at 3T, additionally to the standard MRI sequences. Two
radiologists assessed the images in consensus blinded to the clinical diagnosis. Left/right temporal and short posterior ciliary arteries
were evaluated for the presence of mural thickening and contrast enhancement of the vessel wall, indicating arteritis (overall 112
arterial segments). Regional fat suppression (3-point Likert scale), over all image quality (4-point Likert scale) and diagnostic
confidence for the presence or absence of arteritis (5-point Likert scale) were also assessed.

RESULTS

Contrast-enhanced T1-mVISTA sequence had a high sensitivity and specificity (100% and 94.7%, respectively) for the diagnosis of
temporal arteritis. Positive and negative predictive values (PPV and NPV) were 90.0% and 100%, respectively. Sensitivity and
specificity for vasculitis of the short posterior ciliary arteries in patients with clinical confirmed AION was 83.3% and 75.0%,
respectively resulting in PPV of 83.3% and NPV of 75.0%. Over all image quality (mean: 3.8±0.6; median: 4) and regional fat
suppression were good (temporal: mean: 2.8±0.4; median: 3; ophthalmic: mean: 2.5±1.2; median: 3) and diagnostic confidence
was high (mean: 4.8±0.5; median: 5).

CONCLUSION

3D black-blood T1-mVISTA allows an accurate diagnosis of involvement both for the temporal arteries, as well as the short ciliary
arteries in patients with giant cell arteritis.

CLINICAL RELEVANCE/APPLICATION

Whereas sonography, biopsy and fundoscopy were the methods of choice for diagnosing affection of the extracranial arteries, new
MRI sequences with black-blood technique can accurately diagnose this on cross-sectional imaging.

SST09-04 Diffusion Tensor Measurement of the Corpus Callosum Correlate with Cognitive Dysfunction in Patients
of Subcortical Ischemic Vascular Disease

Friday, Dec. 4 11:00AM - 11:10AM Location: N226

Participants
Lin Lin, Fuzhou, China (Presenter) Nothing to Disclose
Yunjing Xue, MD, Fuzhou, China (Abstract Co-Author) Nothing to Disclose
Hailong Lin, Fuzhou, China (Abstract Co-Author) Nothing to Disclose
Qing Duan, MD, Fuzhou, China (Abstract Co-Author) Nothing to Disclose
ShaoFan Jiang, Fuzhou, China (Abstract Co-Author) Nothing to Disclose
Chengsheng Wang, Fuzhou, China (Abstract Co-Author) Nothing to Disclose
PURPOSE
To evaluate correlation between microstructure changes of the corpus callosum and cognitive dysfunction in subcortical ischemic vascular disease (SIVD) patients using atlas-based diffusion tensor analyses.

METHOD AND MATERIALS
50 right-handed SIVD patients were recruited and divided into vascular cognitive impairment no dementia (VCIND) group and normal cognition (NC) group. 22 VCIND patients and 28 NC patients were underwent in DTI scanning and neuropsychological assessment. Atlas-based analysis (ABA) were performed on each subject for extracting fractional anisotropy (FA) and mean diffusivity (MD) measures from all subregions of the corpus callosum. The correlation between DTI measures and MoCA scores were evaluated. Receiver operating characteristic curves were used to test for the parameter with the best sensitivity and specificity for cognitive function discrimination.

RESULTS
Among VCIND, as compared to NC patients, FA were significantly lower and MD were higher in the genu, body, splenium, left and right tapetum of the corpus callosum (all P<0.001). Moreover, MoCA scores correlated with DTI values in all subregions of the corpus callosum (all P<0.01). In addition, the highest sensitivity and specificity for discriminating between VCIND and NC patients were found for FA (77.27% and 89.29%, respectively) and MD (95.45% and 64.29%, respectively) in the body of the corpus callosum. Optimal thresholds for FA and MD in the body of the corpus callosum for differentiating VCIND and NC patients were 0.421 and 1.038, respectively.

CONCLUSION
The corpus callosum damage occurs in SIVD patients with cognitive impairment, and the damage correlate with cognitive dysfunction. Using Atlas-based DTI analysis can evaluate the severity of this disease.

CLINICAL RELEVANCE/APPLICATION
The DTI measures of the corpus callosum can reflect cognitive impairments in SIVD patients and serve as imaging biomarkers for early diagnosis and disease progression of cognitive impairments.

SST09-05 Accuracy of Carotid In-Stent Stenosis Measurement in a Phantom Model Using Effective Atomic Number Imaging Produced by Dual Layer Dual Energy CT

Friday, Dec. 4 11:10AM - 11:20AM Location: N226

Participants
Elieh Ben-David, MD, Jerusalem, Israel (Presenter) Nothing to Disclose
John M. Gomori, MD, Jerusalem, Israel (Abstract Co-Author) Consultant, Medymatch Technology Ltd
Issac Leichter, PhD, Jerusalem, Israel (Abstract Co-Author) Nothing to Disclose
Zimam Romman, Haifa, Israel (Abstract Co-Author) Employee, Koninklijke Philips NV
Jacob Sosna, MD, Jerusalem, Israel (Abstract Co-Author) Consultant, ActiViews Ltd Research Grant, Koninklijke Philips NV

PURPOSE
In-stent plaque stenosis is difficult to assess in CT angiography of the neck. Effective Atomic Number (EAN) is a projection-space reconstruction of the spectral raw data that calculates the effective atomic number of the voxels. Our purpose was to examine accuracy of in-stent plaque measurement using EAN imaging produced by dual layer dual energy CT in a phantom model.

METHOD AND MATERIALS
A Conichrome stent containing an enhanced radiopaque tantalum core (WALLSTENT, Boston Scientific) and a Nitinol stent (PRESCISE PRO RX, Cordis), both of 0.2mm thickness and 8 mm diameter, were deployed around water-equivalent tubes of 1.5mm wall thickness and 5.0mm lumen. Each tube was filled with iodine solution (16mg/ml), immersed in a water-filled cylinder, and placed in a 10cm diameter water-equivalent phantom (model of in-stent stenosis). The phantom was scanned using a dual layer dual energy CT (Philips Healthcare, Cleveland, OH, USA) at 120kVp and 250mAs and generated simultaneous conventional 120 kV and EAN datasets. Full Width at Half Maximum (FWHM) technique was used to measure accuracy and reproducibility of tube lumen and wall thickness in both datasets.

RESULTS
In the conventional dataset, the average wall thickness and lumen diameter of the Conichrome and Nitinol stents were 0.8 and 4.8mm, and 1.1 and 4.7mm, respectively, reflecting a deviation of -40.7%, -10.0% and -26.7.0%, -6.0% from actual dimensions. In the EAN dataset, the measurements were 1.3, 4.3 mm and 1.2, and 4.6mm, respectively, reflecting a deviation of -13.3%, -14.0% and -20.0%, -8.0% from actual dimensions. For the Conichrome stent blooming artifact in the conventional dataset was reduced in EAN imaging, and the visualization of the tube wall mimicking the stenosis was improved. For the Nitinol stent, both datasets showed comparable visualization.

CONCLUSION
In our model, EAN imaging, produced by dual layer dual energy CT, improves visualization and increases accuracy of in-stent stenosis assessment in a tantalum-core Conichrome stent.

CLINICAL RELEVANCE/APPLICATION
Carotid in-stent stenosis in high-attenuation metallic metal stents may be more accurately evaluated using effective atomic number (EAN) imaging produced by dual layer dual energy CT.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/
An Assessment on the Incremental Value of High-resolution Magnetic Resonance Imaging to Identify Culprit Plaques in Atherosclerotic Disease of the Middle Cerebral Artery

Participants
Wenxia Peng, MD, PhD, Shanghai, China (Presenter) Nothing to Disclose
Qian Zhan, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Yuanliang Jiang, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Xuefeng Zhang, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Qi Lu, MD, PhD, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Jiaping Lu, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose

Purpose
This study was designed to quantify the incremental value of high-resolution, multi-contrast magnetic resonance imaging (hrMRI) to derive culprit atherosclerotic lesions in the middle cerebral artery (MCA) over luminal stenosis, suggesting an optimal combination of anatomic parameters to identify lesions responsible for clinical symptoms.

Method and Materials
Patients suspected with atherosclerotic stenosis of MCA underwent hrMRI. Luminal stenosis was measured from TOF images. Lumen and outer wall boundary were manually segmented, allowing calculation of plaque burden (PB), volume (PV), length (PL) and minimum luminal area (MLA). A culprit plaque was defined as a lesion arising on the ipsilateral side to an ischemic stroke on neuroimaging with accompanying clinical symptoms, whilst a non-culprit plaque was defined as either a plaque occurring in a contralateral artery of a symptomatic patient or one in asymptomatic controls.

Results
MR data from 165 lesions (112 culprit and 53 non-culprit) in 139 individuals were included. Culprit lesions were larger and longer with a narrower lumen and increased PB compared with non-culprit lesions. More culprit lesions showed contrast enhancement. Both PB and MLA were better indicators than stenosis in differentiating lesion types with AUC being 0.649, 0.732 and 0.737 for stenosis, PB and MLA, respectively. Further analysis demonstrated that combinations of PB, MLA and stenosis could improve positive predictive value (PPV) and specificity significantly. An optimal combination of stenosis≥50%, PB≥77% and MLA≤2.0mm² produced a
Evaluation of Cervical Carotid Plaque Using 3D T1-weighted Black-blood MR Imaging at 3T: Comparison of Turbo Field-echo and Turbo Spin-echo Sequences

Friday, Dec. 4 11:50AM - 12:00PM Location: N226

Participants
Katsukihiro Inoue, Tsu, Japan (Abstract Co-Author) Nothing to Disclose
Masayuki Maeda, MD, Tsu, Japan (Presenter) Nothing to Disclose
Maki Umino, MD, Tsu, Japan (Abstract Co-Author) Nothing to Disclose
Tsunehiro Yamahata, Tsu, Japan (Abstract Co-Author) Nothing to Disclose
Hajime Sakuma, MD, Tsu, Japan (Abstract Co-Author) Departmental Research Grant, Siemens AG; Departmental Research Grant, Koninklijke Philips NV; Departmental Research Grant, Bayer AG; Departmental Research Grant, Guerbet SA; Departmental Research Grant, DAIICHI SANKYO Group; Departmental Research Grant, FUJIFILM Holdings Corporation; Departmental Research Grant, Nihon Medi-Physics Co, Ltd

PURPOSE
3D black-blood (BB) MRI can provide high-resolution images and improved anatomic coverage with retrospective visualization of the vessel wall using multiplanar reconstruction. However, no report has described the comparison between the two 3D T1-weighted (T1-W) sequences including 3D turbo spin-echo (TSE) and 3D turbo field-echo (TFE) T1-W BB MRI. The aim of our study is to compare the capability in the delineation of cervical carotid plaque and the difference of signal-intensity ratio of the plaque to adjacent muscle between 3D T1-W TSE and T1-W TSE BB MRI in patients with cervical carotid stenosis.

METHOD AND MATERIALS
43 patients with moderate or severe cervical carotid stenosis confirmed by 3D rotational angiography were studied with 3D T1-W TSE and 3D T1-W TFE BB MRI at 3T (Achieva, Philips). The border between plaque and the lumen was rated visually (four-point analysis) and quantitatively (contrast-to-noise ratio; CNR). The signal-intensity ratio (SIR) of the plaque to adjacent muscle was also measured. The data were analyzed statistically between 3D T1-W TSE and 3D T1-W TFE using a Wilcoxon signed-rank test.

RESULTS
Visual analysis and quantitative analysis revealed that the border between plaque and lumen was better delineated on 3D T1-W TSE BB than on 3D T1-W TSE BB MRI (p<0.01, respectively). 3D T1-W TSE BB MRI occasionally showed incomplete suppression of blood signal, resulting in poor rating particularly in cases with iso-signal-intensity plaques. The SIR of plaque to adjacent muscle was higher on 3D T1-W TSE BB than on 3D T1-W TSE BB MRI (p<0.05). High-signal-intensity plaques with a SIR greater than 1.5 (intraplaque hemorrhage) were underestimated in 20 % of cases using 3D T1-W TSE BB MRI.

CONCLUSION
Our results showed that 3D T1-W TSE BB MRI was superior to 3D T1-W TSE BB MRI for plaque delineation. However, high-signal-intensity plaque suggesting intraplaque hemorrhage was underestimated using 3D T1-W TSE BB MRI. We need to know both advantages and disadvantages of the two 3D T1-W BB MRI sequences.

CLINICAL RELEVANCE/APPLICATION
3D T1-weighted black-blood MRI can demonstrate carotid plaque morphology and intraplaque hemorrhage and is recommended in the evaluation of cervical carotid artery stenosis.
**Neuroradiology/Head and Neck (New Techniques in Head and Neck Imaging)**

**SST10-01 Using Semi-quantitative Dynamic Contrast-enhanced Magnetic Resonance Imaging Parameters to Evaluate Tumor Hypoxia: A Preclinical Feasibility Study in a Maxillofacial VX2 Rabbit Model**

Friday, Dec. 4 10:30AM - 10:40AM Location: N227

Participants
Gaurang V. Shah, MD, Ann Arbor, MI (Moderator) Nothing to Disclose

Sub-Events

**PURPOSE**
To test the feasibility of semi-quantitative dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) parameters for evaluating tumor hypoxia in a maxillofacial VX2 rabbit model.

**METHOD AND MATERIALS**
Eight New Zealand rabbits were inoculated with VX2 cell solution to establish a maxillofacial VX2 rabbit model. DCE-MRI were carried out using a 1.5 Tesla scanner. Semi-quantitative DCE-MRI parameters, maximal enhancement ratio (MER) and slope of enhancement (SLE), were calculated and analyzed. The tumor samples from rabbits underwent hematoxylin-eosin (HE), pimonidazole (PIMO) and vascular endothelial growth factor (VEGF) immunohistochemistry (IHC) staining, and the PIMO area fraction and VEGF IHC score were calculated. Spearman's rank correlation analysis was used for statistical analysis.

**RESULTS**
The MER values of eight VX2 tumors ranged from 1.132 to 1.773 (1.406±0.258) and these values were negatively correlated with the corresponding PIMO area fraction (p = 0.0000002), but there was no significant correlation with the matched VEGF IHC score (p = 0.578). The SLE values of the eight VX2 tumors ranged from 0.0198 to 0.0532 s⁻¹ (0.030±0.011 s⁻¹). Correlation analysis showed that there was a positive correlation between SLE and the corresponding VEGF IHC score (p= 0.0149). However, no correlation was found between SLE and the matched PIMO area fraction (p = 0.662). The VEGF positive staining distribution predominantly overlapped with the PIMO adducts area, except for the area adjacent to the tumor blood vessel.

**CONCLUSION**
The semi-quantitative parameters of DCE-MRI, MER and SLE allowed for reliable measurements of the tumor hypoxia, and could be used to noninvasively evaluate hypoxia during tumor treatment.

**CLINICAL RELEVANCE/APPLICATION**
This preclinical feasibility study shows that DCE-MRI could serve as a potentially non-invasive and translational tool for tumor pathophysiological feature evaluation in clinical practice.

**SST10-02 Improved Image Quality in Head and Neck CT Using a 3D Iterative Approach to Reduce Metal Artifacts**

Friday, Dec. 4 10:40AM - 10:50AM Location: N227

Participants
Wolfgang Wust, MD, Erlangen, Germany (Presenter) Speakers Bureau, Siemens AG
Michael M. Lell, MD, Erlangen, Germany (Abstract Co-Author) Research Grant, Siemens AG; Speakers Bureau, Siemens AG; Research Grant, Bayer AG; Speakers Bureau, Bayer AG; Research Consultant, Bracco Group; 
Michael Uder, MD, Erlangen, Germany (Abstract Co-Author) Speakers Bureau, Bracco Group; Speakers Bureau, Siemens AG; Research Grant, Siemens AG;
Matthias S. May, Erlangen, Germany (Abstract Co-Author) Speakers Bureau, Siemens AG

**PURPOSE**
Metal artifact from dental fillings and other devices degrades image quality and may compromise the CT detection and evaluation of lesions in the oral cavity and oropharynx. The aim of this study was to evaluate the effect of iterative metal artifact reduction (IMAR) on CT of the oral cavity and oropharynx.

**METHOD AND MATERIALS**
Data from 50 consecutive patients with metal artifact from dental hardware were reconstructed with standard filtered backprojection (FBP), linear interpolation metal artifact reduction (MAR) and IMAR. The image quality of slices containing metal was analyzed for the severity of artifacts and diagnostic value.
RESULTS
A total of 455 slices, 9.1±4.1 slices per patient, contained metal and were evaluated with each reconstruction method. Slices without metal were not affected by the algorithms and demonstrated identical image quality. 38% of the slices were considered nondiagnostic with FBP, 31% with MAR, but only 7% with IMAR. 33% of slices had poor image quality with FBP, 46% with MAR, and 10% with IMAR. 13% of slices with FBP, 17% with MAR and 22% with IMAR were of moderate, 16% of slices with FBP, 5% with MAR and 36% with IMAR were of good and 1% of slices with MAR and 31% with IMAR of excellent image quality.

CONCLUSION
IMAR yields the highest image quality in comparison to FBP and MAR in patients with metal hardware in the head and neck area.

CLINICAL RELEVANCE/APPLICATION
The 3D iterative approach to metal artifact reduction can significantly improve the imaging of the head and neck region whenever dental hardware might disturb clinical imaging.

SST10-03  Role of Arterial Spin Labelling in Characterizing Skull-Base Lesions
Friday, Dec. 4 10:50AM - 11:00AM Location: N227

Participants
Nadya Pyatigorskaya, Paris, France (Presenter) Nothing to Disclose
Stephanie Trunet, MD, Paris, France (Abstract Co-Author) Nothing to Disclose
Sophie Gerber, Paris, France (Abstract Co-Author) Nothing to Disclose
Bruno Law-Ye, JD, Paris, France (Abstract Co-Author) Nothing to Disclose
Melika Sahli Amor, Paris, France (Abstract Co-Author) Nothing to Disclose
Samia Belkacem, MD, Paris, France (Abstract Co-Author) Nothing to Disclose
Peggy Bienvenot, MD, Paris, France (Abstract Co-Author) Nothing to Disclose
Damien P. Galanaud, MD, PhD, Paris, France (Abstract Co-Author) Research Consultant, Olea Medical
Odier Dormont, MD, Paris, France (Abstract Co-Author) Nothing to Disclose
Delphine Leclercq, MD, Paris, France (Abstract Co-Author) Nothing to Disclose

PURPOSE
Classical dynamic susceptibility-contrast MRI (DSC-MRI) is a challenging technique in studying the skull base because of the air-interface artefacts. This work was aimed at investigating whether the pseudo-continuous Arterial Spin Labeling (pcASL)-MRI perfusion method can be used to adequately evaluate tumor perfusion of skull base tumors, as well as evaluating the diagnostic value of characterizing tumors by the ASL method.

METHOD AND MATERIALS
Forty-eight patients with skull baselesions were retrospectively enrolled. The lesions found were meningiomas (n=10), schwannomas (n=4), paragangliomas (3), chondrosarcoma (1), plasmocytomas (4), metastatic lesions (4), parotid lesions (4), epidermoid carcinomas (5), pituitary adenomas (5), cholesteatoma (1), hemangioblastoma (1), lymphoma (1), cystic lesions (3), and infections (2). Relative Tumor Blood Flow (rTBF) was calculated based on the pcASL data. Two expert neuroradiologists analyzed all the images. PcASL imaging was correlated to the pathology results for the lesions that underwent surgical resection (33), to other post-contrast enhancement perfusion methods (9), to the lesion morphology, and to follow up results (10). The normalized rTBF values for the lesions in the same anatomical region were compared, at the significant level set to p<0.05.

RESULTS
The pcASL method allowed characterizing all the enrolled lesions. Moreover, there was a significant rTBF difference between cerebellopontine angle schwannoma and meningioma and between schwannoma and metastasis. For pituitary lesions, there was a significant difference between pituitary adenoma and meningioma. For jugular foramen region, there was a significant difference between paraganglioma, chondrosarcoma, and cholesteatoma.Interestingly, one case of osteomyelitis, showed a pseudotumoral increased rTBF, and a plasmocytoma under treatment, showed low rTBF, in relation with treatment response.

CONCLUSION
The present preliminary study shows the interest of pcASL-MRI in evaluating tumor perfusion in the tumors that are located in the skull-base region. Moreover, pcASL can be helpful in the differential diagnosis of the tumors in this region without using contrast materials.

CLINICAL RELEVANCE/APPLICATION
This study shows that pcASL-MRI can be a powerful tool for detecting and characterizing skull-base lesions; it can be easily implemented in clinical practice.

SST10-04  Feasibility and Preliminary Experience of Quantitative T2 Star Mapping in the Differentiation of Benign and Malignant Thyroid Nodules in Comparison with Diffusion-weighted Imaging
Friday, Dec. 4 11:00AM - 11:10AM Location: N227

Participants
Lianming Wu, Shanghai, China (Presenter) Nothing to Disclose

PURPOSE
To investigate the feasibility of T2 star relaxation time for distinguishing benign from malignant thyroid node in comparison with diffusion-weighted (DW) imaging.

METHOD AND MATERIALS
A total of 56 consecutive patients (43 women and 13 men; age range, 23-76 years; mean [+SD] age, 51+12.3 years) with thyroid nodules, who were referred for fine-needle aspiration biopsy by endocrinology or general surgery clinics, were prospectively underwent 3.0T magnetic resonance imaging by using a multi-echo T2 star and DW imaging (maximum b value, 800 sec/mm2).
Parametric maps were obtained for apparent diffusion coefficient (ADC) and T2 star value. Two radiologists reviewed these maps and measured ADC and T2 star value. Data were analyzed by using mixed-model analysis of variance and receiver operating characteristic curves.

RESULTS

The T2 star values of the cancerous node (mean: 23.21 ± 0.87 ms) were significantly lower (P < 0.001) than those of benign node (mean: 5.08 ± 0.32 ms). Adopting a threshold value of 12.35 ms, Quantitative T2 star mapping resulted in 91.2% sensitivity, 79.3% specificity in the identification of thyroid cancer. The ADC values of the cancerous node (mean: 0.83 ± 0.37 ms) were significantly lower (P < 0.001) than those of benign node (mean: 1.53 ± 0.28 ms). Adopting a threshold value of 1.03 ms, ADC mapping resulted in 90.3% sensitivity, 73.2% specificity. Quantitative T2 star mapping showed significantly greater specificity for differentiating cancerous node from benign node than ADC mapping (79.3% vs 73.2%, P < 0.001), with equal sensitivity (91.2% vs 90.3%, P > 0.05).

CONCLUSION

Preliminary findings suggest the feasibility of performing T2 star mapping of the thyroid node acquired by using multi-echo T2 star that may provide increased sensitivity to the diagnostic performance of thyroid cancer compared with DWI. Further larger studies to confirm these preliminary findings are warranted.

CLINICAL RELEVANCE/APPLICATION

Preliminary findings suggest the feasibility of performing T2 star mapping of the thyroid node may provide increased sensitivity to the diagnostic performance of thyroid cancer compared with DWI.

PURPOSE

To assess the quantitative diffusion-weighted imaging (DWI) in distinguish papillary thyroid carcinoma (PTC) from benign thyroid nodules, and to evaluate the efficiency of DWI under different b values in discriminating between PTC and benign thyroid nodules, with pathologic analysis after surgery as reference standard.

METHOD AND MATERIALS

DWI was performed in 32 patients with thyroid nodules followed by surgery. DWI was examined by single-shot echo planar imaging (SE-EPI) under different b values including 0, 250, 500, 750, 1000, 1500, 2000 s/mm². The diffusion-weighted image quality of six b value groups was evaluated. Apparent diffusion coefficient (ADC) values were counted in region of interest (ROI) for b values of 0 and for each b value from 250 to 2000 s/mm². Mean ADC values in ROI and the difference between PTC regions and benign thyroid nodules were calculated using two independent sample t-test. Sensitivity, specificity and area under the curve (AUC) were acquired by ROC curve.

RESULTS

The contrast-to-noise ratio (CNR) and signal-to-noise ratio (SNR) were not satisfied when b value 1500 or 2000 s/mm² was adopted. The qualitative image quality was not enough to meet diagnostic requirement. The mean ADC values (± standard deviation) of the PTC regions were 1.33 ± 0.47, 0.92 ± 0.35, 0.69 ± 0.31, 0.57 ± 0.26, 0.43 ± 0.20, and 0.32 ± 0.15 x 10⁻³ mm²/s and were significantly lower than those of benign thyroid nodules (P < 0.005). b=500 acquired the highest AUC among all the b values. Applying a threshold ADC value of 1.32 x 10⁻³ mm²/s at b=500, the sensitivity is 73.7% and the specificity is 92.3%.

CONCLUSION

Quantitative DWI can distinguish PTC from benign thyroid nodules. The optimal b value for DWI at 3T MRI to identify PTC may be 500 s/mm².

CLINICAL RELEVANCE/APPLICATION

Quantitative DWI for thyroid can play important role in the diagnose of the thyroid nodules. The optimal b value may be 500 s/mm².

PURPOSE

Human papilloma virus (HPV) positive tumors carry a better prognosis than HPV negative ones. Although HPV positivity is proven to be independent of other known prognostic factors including age and TNM staging, yet treatment failure has been recorded. In our study we used Intra Voxel Incoherent Motion, dynamic contrast enhanced magnetic resonance perfusion imaging (DCE-MRI) and 2D, 3D volumetric parameters to find out which is the best predictor of treatment response in HPV positive oropharyngeal squamous
carcinoma.

METHOD AND MATERIALS

Patients with pathologically proven HPV positive oropharyngeal SCC were included in this study under an IRB approved protocol with signed study specific informed consent forms as a part of prospective ongoing clinical trial. All patients underwent two MRI studies, baseline scan within 1week before treatment and mid-treatment scan. According to response to treatment, patients were then categorized into 2 groups; complete responders (CR) in whom the primary has completely disappeared and partial responders (PR) where there was still a residual tumoral tissue. All morphological image analyses and segmentation were done using 3D Slicer 4.3.1 (slicer.org) and reviewed in consensus by 2 neuroradiologists. Multiple quantitative imaging features were identified including IVIM (D, D*, and f), MR-Perfusion (Ktrans, Vp, Ve, and Kep) as well as 2D and 3D volumes of the primary tumor at the first time point.

RESULTS

Median of the time between the two MRI was 25 days. Based on the second MRI, 75% of patients had complete response to treatment. Mann-Whitney U Exact test was used to compare baseline variables between patient with complete and partial response to therapy. Kep mean and Ktrans mean significantly higher in patients who showed partial response to treatment. Logistic Regression analysis was performed to determine the association between each of the perfusion parameters and response to treatment. Higher Ktrans had a significant association with partial response to treatment.

CONCLUSION

Treatment response in HPV positive oropharyngeal squamous cell carcinoma patients can be reliably predicted through different advanced MRI parameters.

CLINICAL RELEVANCE/APPLICATION

HPV positive OPCC response to treatment are detected using multiple advanced and conventional MRI

SST10-07 Differentiation of the Metastatic Lymph Nodes from Thyroid Carcinoma and Squamous Cell Carcinoma and Lymphoma with Dual-Energy CT Monoenergetic Imaging

Friday, Dec. 4 11:30AM - 11:40AM Location: N227

Participants
Yang Yaying I, MD, Kunming, China (Presenter) Nothing to Disclose
Li Qing, MD, Kunming, China (Abstract Co-Author) Nothing to Disclose
Zhao Wei, MD, Kunming, China (Abstract Co-Author) Nothing to Disclose
Yang Bin, MD, Dali, China (Abstract Co-Author) Nothing to Disclose

Background

Objective To explore the value of dual-energy CT monoenergetic imaging in differential diagnosis of the metastatic cervical lymph nodes in thyroid carcinoma, squamous cell carcinoma and lymphoma.

Evaluation

The spectrum curve slope of arterial phase and parenchymal phase can be used to differentiate lymph node metastasis of in thyroid carcinoma, the metastatic lymph nodes from lymphoma in the neck.

Discussion

Results Of 79 enlarged lymph nodes, 23 were metastatic lymph nodes from thyroid carcinoma, 24 from squamous cell carcinoma and 32 were lymphoma. With the increase of keV values (from 60 to 180 keV), the corresponding CT values of the three kinds of malignant lymph nodes were decreased. The higher the keV value, the smaller the CT value decrease, and the spectrum curve appeared as "drop type". The spectrum slope curve of the metastatic lymph nodes of thyroid carcinoma in arterial phase (1.23±0.41) and parenchymal phase (0.85±0.33) are maximal and the slope curve of lymphoma in arterial phase (0.40±0.16) and parenchymal phase (0.47±0.09) are the lowest. The spectrum slope curve of metastatic lymph nodes from the squamous cell carcinoma in arterial phase and parenchymal phase is 0.88±0.10 and 0.62±0.28, respectively. The spectrum curve slope of the three kinds of malignant lymph nodes have statistical significance. Comprehensive analysis showed, if 0.36 < K < 0.24 in arterial phase, it is most probably lymphoma; If 0.81 ≥ K ≥ 0.78, it is most probably the metastatic lymph nodes; and if 1.65 ≥ K > 0.98, it is most probably lymph node metastasis from thyroid carcinoma. In parenchymal phase, if 0.38 > K ≥ 0.34, it is most probably the metastatic lymph nodes, If 0.52 > K ≥ 0.38, it is most probably lymphoma, if 1.18 ≥ K ≥ 0.56, it is most probably lymph node metastasis from thyroid carcinoma.

Conclusion

The spectrum curve slope of arterial phase and parenchymal phase can be used to differentiate lymph node metastasis of in thyroid carcinoma, the metastatic lymph nodes from lymphoma in the neck.

SST10-08 High Resolution Diffusion Weighted Imaging of Thyroid Gland Using Reduced FOV Technique: A Preliminary Clinical Application at 3T MRI

Friday, Dec. 4 11:40AM - 11:50AM Location: N227

Participants
Hao Yonghong, MD, Wuhan, China (Presenter) Nothing to Disclose
Wenzhen Zhu, MD, PhD, Wuhan, China (Abstract Co-Author) Nothing to Disclose
Jianpin Qi, PhD, Wuhan, China (Abstract Co-Author) Nothing to Disclose

PURPOSE

DWI has been shown to be useful for differentiation between benign and malignant thyroid nodules. However, due to severe susceptibility and distortion artifacts and image blurring, the diagnostic value of clinical thyroid DWI is limited. The purpose of this study was to evaluate the performance of reduced field of view (r-FOV) diffusion weighted imaging and compare the diagnostic value of r-FOV diffusion imaging and conventional diffusion imaging in patients with thyroid nodules.
METHOD AND MATERIALS

79 consecutive patients who were clinically suspected with thyroid malignant lesions by ultrasound or/and scintigraphy and 12 healthy controls were included in this study. All participants underwent r-FOV diffusion imaging and f-FOV diffusion imaging with a 3T MRI scanner. Image quality and lesion identifications were visually evaluated by two independent reviewers and image properties (SNR, CNR, geometric distortion) were quantified. The apparent diffusion coefficient values of thyroid lesions and normal thyroid parenchyma were calculated and compared between two diffusion methods. The ROC analyses for both DWI methods were performed and differences in the area under the curve were assessed.

RESULTS

Agreement between two reviewers was good for image quality and lesion identification. The image quality and lesion identification of r-FOV diffusion imaging was rated higher than that of f-FOV DW imaging (p<0.001). The geometric distortions for f-FOV DW imaging were significant higher than that for r-FOV imaging, while SNR of r-FOV imaging was slightly lower than that of conventional DW imaging. The mean ADCs of r-FOV diffusion imaging were lower than that of f-FOV diffusion imaging ignore of different tissue types (1.42± 0.44 ×10-3 mm/s vs 1.54±0.45×10-3 mm/s, p<0.001). There was significant difference among the ADCs of different tissue groups obtained from both r-FOV and f-FOV DWI. The areas under the curve for r-FOV (0.962) and conventional DW imaging (0.951) were not statistically different.

CONCLUSION

r-FOV diffusion imaging provide higher image quality and lesion identification than f-FOV diffusion imaging by reducing susceptibility artifacts, spatial distortion, image blurring, and were of comparable diagnostic values in nodules thyroid.

CLINICAL RELEVANCE/APPLICATION

high resolution DWI of thyroid could improve the identification and interpretation of nodules, especially for microcarcinoma.

SST10-09 The Optimization Weighting Factors of Linear Image Blending in Dual-Energy Computed Tomography for the Diagnosis of Laryngeal Carcinoma

METHOD AND MATERIALS

Patients with biopsy-proven untreated primary laryngeal carcinoma who underwent DECT scan (100kVp/Sn140 kVp) of neck were retrospectively evaluated. Ten (9 men, 1 woman; age range, 46–76 years old) cases were enrolled. Linearly blended images series with 11 weighting factors (0 to 1.0 in steps of 0.1) were reconstructed. For objective assessment, attenuation of lesion, various anatomic landmarks, image noise, lesion contrast-to-noise ratio and signal-to-noise ratio were compared between different image datasets. For subjective assessment, two independent blinded radiologists rated overall image quality, lesion delineation, image sharpness, and image noise of each image dataset on a 5-point grading scale.

RESULTS

The mean attenuation of lesion, sternocleidomastoid muscle, internal jugular vein, and submandibular gland increased stepwise with decreasing tube voltage from Sn140 kVp through 100 kVp. CNR was the highest in the weighting factors of 0.8 (M_0.8; 11.7±5.5; P=0.123), M_0.7 (12.3±5.6; P=1.000), M_0.9 (12.5±5.6; P=1.000) and M_1.0 (12.2±5.5; P=1.000), but differed significantly compared to the linearly blended image series M_0, M_0.1, M_0.2, M_0.3, M_0.4 and M_0.5 (P<0.05). SNR was the highest in the weighting factors of 0.7 (35.0±6.1). M_0.7 images showed no significant differences between linearly blended image series M_0.6 (34.7±6.1; P=1.000). Overall image quality was higher in M_0.9 (4.7) and M_1.0 (4.7) images, although differences to the M_0.8 (4.4) images did not reach statistical significance (P=0.083). Delineation of the tumour was rated significantly better in M_0.9 (4.4) and M_1.0 (4.5) images compared to other linearly blended image series. Scoring of the image sharpness revealed equally good results in all image series.

CONCLUSION

The linear-blending images of DECT data at the weighting factors of 0.9 and 1.0 can provide higher image quality for the diagnosis of laryngeal carcinoma.

CLINICAL RELEVANCE/APPLICATION

Linear image blending in DECT could provided more information about laryngeal carcinoma, which improved diagnostic confidence in the assessment of laryngeal carcinoma.
PURPOSE
Edited magnetic resonance spectroscopy (MRS), using the MEGA-PRESS sequence, is the most widely used technique for detecting gamma-aminobutyric acid (GABA) in the human brain. However, this method required a relatively large volume of interest (VOI), so the accuracy of VOI placement is important to ensure the reliability of GABA quantification. In this study the MRS voxels overlap of intra- and inter-subject were evaluated.

METHOD AND MATERIALS
Fifteen healthy volunteers (8 men and 7 women, 44.87±3.42 years) underwent MRS examinations. All subjects were examined on a 3T scanner using MEGA-PRESS sequence and T1-weighted 3D TFE images were used as a localizer. The unsuppressed water signal was obtained for quantification. The VOI was chosen in the parietal region (3x3x3 cm^3). MEGA-PRESS was analyzed using 'Gannet' in Matlab with Gaussian curve fitting to the GABA peaks. GABA levels (institutional units) were calculated for each subject. In one subject, four continuous scans were conducted within a period of 3 weeks. The VOI was chosen in the three areas: frontal region (3x3x3 cm^3), parietal region (3x3x3 cm^3) and temporal region (4x2x2 cm^3). Each pixel in the T1-weighted images was segmented as gray matter, white matter, or cerebrospinal fluid using the FSL software. VOIs were co-registered to the anatomical images using the "Re-creation of VOI" Matlab tool. The VOIs and anatomical images were registered to the baseline images (intra-subject) or standard space (inter-subject) using the SPM software. The Dice overlap coefficient was used to calculate the MRS voxels overlap of intra- and inter-subject.

RESULTS
The MRS voxels overlap of inter-subject was 78.87% ± 8.85% in parietal region. No correlation between GABA levels and gray matter volume within VOI was found in parietal region for all subjects (r=0.13, p=0.64). The MRS voxels overlap of intra-subject was 85.88% ± 5.36% in frontal region, 88.86% ± 2.45% in parietal region and 81.31% ± 3.38% in temporal region.

CONCLUSION
The high degree of MRS voxels overlap of intra- and inter-subject and low correlation between gray matter volume and GABA levels, suggesting that VOI placement using MEGA-PRESS has great repeatability, and the small variations in VOI placement and subject anatomy do not affect the GABA levels.

CLINICAL RELEVANCE/APPLICATION
VOI placement using MEGA-PRESS has great repeatability and MEGA-PRESS is recommended to measure GABA levels in vivo in the human brain.

PURPOSE
Repeated intravenous administration of Gadolinium-based contrast agents (Gd-CA) has been associated with increased MRI signal.
Repeated intravenous administration of Gadolinium-based contrast agents (Gd-CA) has been associated with increased MRI signal intensity in T1-weighted sequences in dentate nuclei (DN). Our aim is to perform, for the first time, a quantitative MRI (qMRI) assessment of DN relaxometry in patients receiving multiple doses of Gd-CA using 0.7x0.7x1.3 mm3 resolved Gradient-Echo (GRE) sequences.

**METHOD AND MATERIALS**

From a total of 92 Multiple Sclerosis patients with normal renal function, we retrospectively selected 21 patients [Group A, M/F=5/16, age: 41±11 years, disease duration (DD): 15.9±8.1 years] who had performed, during the course of the disease, 9 or more contrast-enhanced (CE) MRI scans, and 28 patients (Group B, M/F=14/14, age: 36±11 years, DD: 7.8±6.8 years) who underwent less than 4 CE-MRI scans. A group of 28 age/sex-matched healthy controls (HC, M/F=11/17, age: 38±13 years), who underwent only unenhanced MRI, was also studied. In patients and HC, GRE sequences (TR=28ms, TE=[7,22]ms, FA=[3,20]°) were acquired at 3T and processed with an in-house software, providing quantitative estimates of R1, R2* and magnetisation transfer (QSM) of the brain. ROIs were hand-drawn on the axial slice with the best representation of DN. Group differences in qMRI data were tested both in terms of absolute DN values and of ratios between DN and a brainstem (BS) ROI, used as internal reference.

**RESULTS**

The DN/BS ratio for R1 was significantly higher in Group A (1.17±0.09) when compared to Group B (1.10±0.08) and HC (1.11±0.07), p-values being 0.008 and 0.009, respectively. Instead, the DN/BS ratio for R1 did not differ between Group B and HC (p=0.79). Also, no significant differences were found between the 3 groups in terms of R2* or QSM DN/BS ratios, nor of R1, R2* and QSM absolute DN values.

**CONCLUSION**

Our in vivo high-resolution quantitative relaxometric MRI analysis showed higher R1 values in patients undergoing repeated CE-MRI scans, supporting the hypothesis that Gd-CA accumulate in DN. Further longitudinal quantitative analysis of the mechanisms of Gd-CA clearance in the brain are warranted.

**CLINICAL RELEVANCE/APPLICATION**

Repeated administration of Gd-based contrast agents is associated with long-term changes in brain relaxometry, thus indirectly confirming the concerns about the stability of Gd-chelation over time.

**SST11-03 Metabolic Changes in the Bilateral Visual Cortex of Monocular Blindness Macaque Monkeys: A Multi-voxel Proton Magnetic Resonance Spectroscopy Study**

Friday, Dec. 4 10:50AM - 11:00AM Location: N230

Participants
Lingjie Wu, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Zuohua Tang, PhD,MD, Shanghai, China (Presenter) Nothing to Disclose

**PURPOSE**

To study adaptive plasticity and reorganization in the visual cortex of the monocular blind macaque using multi-voxel proton magnetic resonance spectroscopy study (1H-MRS).

**METHOD AND MATERIALS**

Four healthy neonatal macaques were randomly divided into 2 groups. One group served as control group (group A). Optic nerve transecting was performed in the right eye of the other group (group B), to establish the monocular blind model. Sixteen (group B16M) and thirty-two (group B32M) months after monocular optic nerve transecting, multi-voxel 1H-MRS was performed on the bilateral visual cortex of all monkeys, respectively. We compared NAA/Cr, Ins/Cr, Cho/Cr and Glx/Cr in the visual cortex between group A and group B as well as between the left and right visual cortices of group A and B in each time points, respectively. All of the metabolic changes detecting by multi-voxel 1H-MRS were further compared with the hematoxylin-eosin and immunofluorescent staining findings.

**RESULTS**

Compared with group A, in bilateral visual cortex, NAA/Cr in both group B16M and group B32M, as well as Glx/Cr in group B32M were all significant decrease (p<0.05), whereas the Cho/Cr and Ins/Cr of group B32M were significant increase (p<0.05). Meanwhile, significant difference of NAA/Cr in group B32M was found between the left and right visual cortex, whereas no statistical difference of Ins/Cr, Cho/Cr and Glx/Cr between the left and right visual cortex was found in both group B16M and group B32M. All of these findings were further confirmed by the hematoxylin-eosin and immunofluorescent staining using anti-NeuN antibody, anti-Choline Acetyltransferase antibody and anti-EAAT3 antibody.

**CONCLUSION**

Multi-voxel 1H-MRS was able to detect the different metabolic changes in the visual cortex, which was valuable for investigating its adaptive plasticity and reorganization.

**CLINICAL RELEVANCE/APPLICATION**

Such alterations in the metabolism of the bilateral visual cortex could provide valuable information for future studies of adaptive plasticity and reorganization in visual loss or other sensory deprivation in animal models and human beings.

**SST11-04 Physiology-based MRI Assessment of CSF Flow in Chiari I Malformation (CMI)**

Friday, Dec. 4 11:00AM - 11:10AM Location: N230

Participants
Rafeeqe A. Bhadelia, MD, Chestnut Hill, MA (Presenter) Nothing to Disclose
Neel Madan, MD, Boston, MA (Abstract Co-Author) Consultant, Near Infrared Imaging, LLC; Board Member, Quindec Inc
Carl B. Heilman, Boston, MA (Abstract Co-Author) Nothing to Disclose
David B. Khatami, MD, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Yansong Zhao, Boston, MA (Abstract Co-Author) Researcher, Koninklijke Philips NV
PURPOSE

Invasive pressure studies have suggested that in patients with Chiari I malformation (CMI), CSF flow across the foramen magnum transiently decreases after coughing in the presence of a clinically significant obstruction. The purpose of this study was to demonstrate this phenomenon non-invasively by assessing CSF flow response to coughing in CMI patients using MR pencil beam imaging (PBI) and compare it to healthy participants.

METHOD AND MATERIALS

7 CMI patients and 6 healthy participants were studied using PBI with a temporal resolution of ~50ms. Patients and participants were scanned for 90-seconds to continuously record cardiac-cycle related CSF flow waveforms as well as the heart rate and respiratory motion during resting, coughing and post-coughing periods. CSF flow waveform amplitude (ACSF), CSF stroke volume (SVCSF), and CSF flow rate (FRCSF; SVCSF x heart rate) in resting and immediate post-coughing periods were determined. Post-coughing values of all three parameters were calculated as a percentage of resting values, and compared between patients and healthy participants.

RESULTS

There was no significant difference in ACSF, SVCSF and FRCSF between CMI patients and healthy participants during rest. However, after coughing, a significant decrease in ACSF (p<0.001), SVCSF (p =0.001) and FRCSF (p =0.001) was observed in CMI patients compared to healthy participants.

CONCLUSION

Coughing decreases CSF flow across the foramen magnum in CMI patients but not in healthy participants. Real-time MRI measurement of CSF flow response to coughing may provide objective quantitative assessment of foramen magnum obstruction in CMI patients.

CLINICAL RELEVANCE/APPLICATION

Physiology-based MRI measurement of CSF flow may provide objective assessment of foramen magnum obstruction in CMI patients.

Cerebral Perfusion Relates to Regional Cortical Thickness in the General Population

Friday, Dec. 4 11:10AM - 11:20AM Location: N230

Participants

Hazel I. Zonneveld, MD, MSc, Rotterdam, Netherlands (Presenter) Nothing to Disclose
Wiro Niessen, PhD, Rotterdam, Netherlands (Abstract Co-Author) Co-founder, Quantib BV; Scientific Director, Quantib BV; Shareholder, Quantib BV
Aad Van Der Lugt, MD, PhD, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Gabriel P. Krestin, MD, Rotterdam, Netherlands (Abstract Co-Author) Consultant, General Electric Company; Research Grant, General Electric Company; Research Grant, Siemens AG; Speakers Bureau, Siemens AG
Mohammad A. Ikram, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Meike W. Vernooij, MD, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose

PURPOSE

To investigate whether cerebral perfusion is associated with regional cortical thickness on magnetic resonance imaging (MRI) in community-dwelling persons free of stroke and a clinical diagnosis of dementia.

METHOD AND MATERIALS

2,961 persons (mean age 59.6 years; 54.5% women) from a prospective population-based study underwent brain MRI on a 1.5-tesla MRI system, yielding cortical thickness of 34 cortical regions using automated segmentation technique (FreeSurfer). Total cerebral blood flow (tCBF) was determined using 2D phase-contrast MRI by adding flow rates for the carotid arteries and the basilar artery and expressed in ml/min. Parenchymal CBF (mL/min/100mL) was calculated by dividing tCBF by each individual's brain volume (mL) multiplied by 100. We used multivariable linear regression models to investigate the association between cerebral perfusion and regional cortical thickness.

RESULTS

Both lower tCBF and pCBF were associated with thinner regions of the cortex predominantly involving the frontal lobe, and the medial posterior regions. Strongest association was found for tCBF with cortical thickness of the superior-frontal and rostral-middle-frontal region.

CONCLUSION

In community-dwelling persons, cerebral perfusion relates to cortical thickness variations in different brain regions.

CLINICAL RELEVANCE/APPLICATION

Our findings provide further insight into the pathophysiological role of cerebral perfusion in neurodegeneration in aging.

A Diffusional Kurtosis Imaging Study of Type-2 Diabetic Brain

Friday, Dec. 4 11:20AM - 11:30AM Location: N230

Participants

Ying Xiong, MD, Chicago, IL (Presenter) Nothing to Disclose
Yi Sui, PhD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Jinliang Niu, MD, PhD, Shanxi, China (Abstract Co-Author) Nothing to Disclose
Qiang Zhang, PhD, Wuhan, China (Abstract Co-Author) Nothing to Disclose
Kejia Cai, PhD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Wenzhen Zhu, MD, PhD, Wuhan, China (Abstract Co-Author) Nothing to Disclose

PURPOSE

A Diffusional Kurtosis Imaging Study of Type-2 Diabetic Brain

Friday, Dec. 4 11:20AM - 11:30AM Location: N230

Participants

Ying Xiong, MD, Chicago, IL (Presenter) Nothing to Disclose
Yi Sui, PhD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Jinliang Niu, MD, PhD, Shanxi, China (Abstract Co-Author) Nothing to Disclose
Qiang Zhang, PhD, Wuhan, China (Abstract Co-Author) Nothing to Disclose
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**SST11-07** Adaptive Tissue Cluster Tracking on Quantitative MRI for Fully Automatic Brain Segmentation on Young Children

Friday, Dec. 4 11:30AM - 11:40AM Location: N230

**Participants**
Marcel Warnjes, Linkoping, Sweden (Presenter) Employee, SyntheticMR AB
Suraj Serai, PhD, Cincinnati, OH (Abstract Co-Author) Nothing to Disclose
James L. Leach, MD, Cincinnati, OH (Abstract Co-Author) Nothing to Disclose
Blaise V. Jones, MD, Cincinnati, OH (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
Multi-parametric quantitative MRI of longitudinal T1 relaxation, transverse T2 relaxation and proton density (PD) can be achieved within a clinically acceptable scan time. It has been shown that values of T1, T2 and PD rapidly change during the first years of life. The purpose of this study was to create an algorithm that adaptively tracks the grey matter and white matter tissue properties in qMRI data, in order to segment grey matter, white matter and cerebrospinal fluid volumes of the brain, independent of age.

**METHOD AND MATERIALS**
A group of 23 quantified datasets at 3T of paediatric clinical cases in the range 0-20 years old was used to develop an algorithm to automatically track the mean T1, T2 and PD values of GM, myelinated WM and CSF. The positions of the tissue clusters were then used to define GM, myelinated WM and CSF partial volume. The sum of all partial volumes in the intracranial volume resulted in an estimation of total GM, WM and CSF volumes.

**RESULTS**
The observed T1/T2 relaxation times for GM changed from 1850/110 ms to 1360/86 ms in the first two years of life, whereas myelinated WM changed from 1080/98 ms to 720/70 ms. After two years the T1 and T2 relaxation were relatively constant. CSF had T1/T2 = 4200/1600 ms for all ages. Application of adaptive tissue cluster tracking on GM and WM showed that myelinated WM volume, an average, increased from 0 to 252 mL, CSF decreased from 241 mL to 40 mL and total brain volume increased from 403 mL to 1225 mL in the first 4 years of life. Without tissue cluster tracking the estimated WM volume was significantly lower and CSF volume was significantly higher.

**CONCLUSION**
Using adaptive tissue cluster tracking the differences in T1 and T2 relaxation between young children and adults can be corrected for, allowing fully automatic brain segmentation on all ages.

**CLINICAL RELEVANCE/APPLICATION**
Quantitative MRI provides absolute values and improved means of statistics in clinical MRI. Automatic brain segmentation using qMRI may provide more precise monitoring and follow-up throughout life.
Computational analysis of multi-parametric MRI data can lead to the extraction of informative and comprehensive features.

CONCLUSION

The proposed method successfully identified the EGFRvIII mutation, with 83% accuracy and the area under the ROC curve changing the threshold in the range of the model's output values. The accuracy of the model was calculated for the threshold equal to 0. The output of the predictive model is a value between -1 and 1. Values closer to 1 indicate higher probability for the subject to harbor the mutation, and values closer to -1 the opposite. A receiver operating characteristic (ROC) curve was calculated by retrospectively analyzing. Appropriate imaging features were extracted to create an integrative predictive model of EGFRvIII mutation, based on Support Vector Machines. The utilized features comprise the age of the patient, the size of the enhancing tumor, non-enhancing tumor, and edema; the tumor location, the mass-effect parameters, and the distribution of intensities of GB from multiple MRI modalities may lead to non-invasively determining expression of molecular tumor characteristics, and particularly of the EGFRvIII oncogene.

RESULTS

We identified 65 ROIs (23 E versus 42 NE). Logistic regression model identified specific texture features (sum variance p=0.014, sum average p=0.019, cluster shade p=0.028, cluster prominence p=0.046, correlation p=0.09) related with the homogeneity that allowed discrimination between E and NE ROIs. The AUC of the logistic regression model was 93.59% (86.58% cross-validated), specificity/sensitivity of 97.31%/74.17%. Tree-bagging model resulted in an AUC of 88.19% and specificity/sensitivity of 80.95%/86.96%.

CONCLUSION

Radiomic texture analysis of fMRI can be a useful tool for detecting areas of true functional activity and serve as a tool for eliminating false-positive or non-task related activity.

CLINICAL RELEVANCE/APPLICATION

Radiomic texture analysis can discriminate those areas of true functional task-related activity and thus allow for precise pre-surgical detection and mapping of areas of true functional eloquence in order that maximal extent of neurosurgical resection can occur while simultaneously maintaining intact neurological function.

SST11-09 Non-Invasive Determination of Epidermal Growth Factor Receptor Variant III Expression in Glioblastoma through Analysis of Multi-Parametric Magnetic Resonance Imaging

Friday, Dec. 4 11:50AM - 12:00PM Location: N230

Participants

Hamed Aikari, MD, PhD, Philadelphia, PA (Presenter) Nothing to Disclose
Spyridon Bakas, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Martin Rozyczki, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Xiao Da, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Jared Pisapia, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Michel Bilello, MD, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Donald O’Rourke, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Christos Davatzikos, Philadelphia, PA (Abstract Co-Author) Shareholder, Gliomics LLC

PURPOSE

Epidermal growth factor receptor variant III (EGFRvIII) is the target of ongoing investigational drug trials for the treatment of glioblastoma (GB). However, tissue-based genetic testing of the EGFRvIII status is costly and not widely available. The goal of this study is to combine multi-parametric magnetic resonance imaging (MRI) data, with the intention of non-invasively determining the mutation status of EGFRvIII in patients with GB. We hypothesize that quantification of subtle, yet important, imaging phenotypes of GB from multiple MRI modalities may lead to non-invasively determining expression of molecular tumor characteristics, and particularly of the EGFRvIII oncogene.

METHOD AND MATERIALS

Preoperative multi-parametric MRI data (i.e. T1, T1-Gad, T2, T2-FLAIR, rCBV, DTI, and DSC) from 41 solitary de novo GB patients were retrospectively analyzed. Appropriate imaging features were extracted to create an integrative predictive model of EGFRvIII mutation, based on Support Vector Machines. The utilized features comprise the age of the patient, the size of the enhancing tumor, non-enhancing tumor, and edema; the tumor location, the mass-effect parameters, and the distribution of intensities of each region across all MRI modalities. Leave-one-out cross validation was used to test how well the predictive model generalizes on new unseen patient data. The results were compared with the EGFRvIII status obtained through tissue-based diagnostics.

RESULTS

The output of the predictive model is a value between -1 and 1. Values closer to 1 indicate higher probability for the subject to harbor the mutation, and values closer to -1 the opposite. A receiver operating characteristic (ROC) curve was calculated by changing the threshold in the range of the model's output values. The accuracy of the model was calculated for the threshold equal to 0. The proposed method successfully identified the EGFRvIII mutation, with 83% accuracy and the area under the ROC curve equal to 0.82.

CONCLUSION

Computational analysis of multi-parametric MRI data can lead to the extraction of informative and comprehensive features.

METHOD AND MATERIALS

10 right-handed (5 male, 5 female) healthy individuals underwent a functional MRI study using the sentence completion task. IRB approval and informed consent were obtained in this HIPAA compliant study. fMRI data analysis was performed using statistical parametric mapping approach (SPM8). The resultant functional map was individually thresholded to optimize visualization of language area. A board-certified neuroradiologist classified different clusters into Expected (E) and Non-Expected (NE) based on their anatomical locations. Texture Analysis was performed using the mean EPI volume for each individual, and 20 rotation-invariant texture features were obtained. Logistic regression and treebagging models were used to identify significant discriminatory texture features and build predictive models for the E versus NE ROIs.
Computational analysis of multi-parametric MRI data can lead to the extraction of informative and comprehensive features, representative of the distinctive imaging phenotypes related to the EGFRvIII mutation status in patients with GB.

CLINICAL RELEVANCE/APPLICATION

Analysis of multi-parametric MRI data reveals EGFRvIII mutation phenotypes in GB, hence assists in personalizing treatment whilst avoiding costly and not widely-available tissue-based genetic testing.
**SST12-01**  
**Comparison of CBF Measured with Velocity-selective Arterial Spin Labeling (ASL) MRI and Pulsed ASL MRI in Pediatric Patients with Prolonged Arterial Transit Times Due to Mooyama Disease**

**Participants**  
Manohar M. Shroff, MD, Toronto, ON (Moderator) Consultant, Guerbet SA; Consultant, Magellan Health, Inc  
Jeremy Y. Jones, MD, Bellaire, TX (Moderator) Nothing to Disclose

**PURPOSE**  
To show that velocity-selective arterial spin labeling (VS-ASL) MRI is superior to pulsed ASL (PASL) MRI for measuring cerebral blood flow (CBF) in Mooyama patients, as VS-ASL is theoretically insensitive to arterial transit delays (ATD) that can render PASL approaches inaccurate.

**METHOD AND MATERIALS**  
Five pediatric Mooyama patients (2F, 3M, ages 3-9), two with unilateral and three with bilateral disease, one pre- and four post-synangiosis, were imaged with both VS-ASL and PASL MRI at 3T (Siemens). VS-ASL parameters were VC=2.1 cm/s and TI=1300ms. PASL parameters were TI1=700 ms, TI2=2000-2400ms, tag width=100mm, and gap=21-25mm. Perfusion time-series data for PASL and VS-ASL were generated by performing pairwise subtractions between tag and control images. CBF maps were generated by averaging voxels across the perfusion time series and calibrating via ASL signal equations. CBF maps and values from gray matter (GM) are reported.

**RESULTS**  
For all patients, PASL shows large focal perfusion deficits and macrovascular flow artifacts, consistent with tag accumulating in large vessels and failing to reach target microvasculature. These findings highlight PASL sensitivity to increased regional ATD, resulting in artifact and apparent lack of parenchymal perfusion, a finding that could be misinterpreted as ischemia. VS-ASL, on the other hand, yields symmetric parenchymal perfusion bilaterally, and thus appears largely insensitive to the known ATD's seen in these patients. Angiographic data from one patient correlates the findings; both hemispheres show capillary blush, albeit delayed on the diseased side, as this tissue is primarily supplied by delayed flow through pial-pial collaterals. Quantitatively, VS-ASL GM CBF is similar in both hemispheres and in physiologic range (50.8± 9.8 ml/100g-min). PASL GM CBF, on the other hand, is more heterogeneous due to both perfusion deficit and macrovascular artifact, and measures below the normal physiological range (29.2± 9.0 ml/100g- min).

**CONCLUSION**  
VS-ASL MRI is largely insensitive to arterial transit delays and as such more accurately images CBF and parenchymal perfusion in Mooyama patients, compared to traditional PASL MRI.

**CLINICAL RELEVANCE/APPLICATION**  
VS-ASL has great potential for assessing perfusion in stroke, carotid stenosis, and Mooyama patients, who often have delayed arterial transit due to large artery stenosis and secondary collateralization.

**SST12-02**  
**Non-invasive Quantification of Cerebral Oxygen Metabolism in Children with Sickle Cell Disease**

**Participants**  
Paula L. Croal, PhD,MSc, Toronto, ON (Presenter) Nothing to Disclose  
Jackie Leung, Toronto, ON (Abstract Co-Author) Nothing to Disclose  
Andrea Kassner, PhD, Toronto, ON (Abstract Co-Author) Nothing to Disclose

**PURPOSE**  
Ischemic stroke is a serious complication of sickle cell disease (SCD) that manifests in more than 10% of children SCD by the age of 20. It occurs when oxygen (O2) availability is inadequate to meet cerebral metabolic demands, despite the compensatory increase in cerebral blood flow (CBF) in SCD. The cerebral metabolic rate of O2 (CMRO2) may be a potential disease biomarker for ischemic risk in SCD. However, CMRO2 has not yet been quantified in children with SCD. Here, we combine MRI measurements of oxygen extraction fraction (OEF) and CBF to provide the first non-invasive quantitative measurement of CMRO2 in children with SCD.

**METHOD AND MATERIALS**
Five SCD patients (11-18 yrs) and 4 healthy controls (12-18 yrs) were imaged on a 3T MRI scanner. Gray matter CBF was obtained using PICORE-Q2TIPS pulsed arterial spin labelling (TR/TE=2500/13ms, TI1/TI2=700/1800ms, voxel=3.4×3.4×4.5mm), quantified with a single-compartment kinetic model. T1 of blood was assumed to be 1660ms for a hematocrit (Hct) of 0.4 and corrected for reduced Hct on an individual basis. Global OEF is calculated from the arteriovenous difference, where arterial O2 saturation (SaO2) is assumed to be 1 in healthy controls and measured using pulse oximetry in patients. Using a 3D-FLASH GRE sequence (TR/TE=28/20ms, voxel=0.8x0.7x1.2mm), venous O2 saturation (SvO2) was measured from the phase difference between blood in the superior sagittal sinus and surrounding tissue. From Fick's principle, CMRO2 can be computed from the product of OEF, CBF, and arterial O2 content, which is a function of SaO2 and Hct. Statistical comparisons were made between groups using an independent samples Student’s t-test (SPSSv22).

RESULTS

There was a trend for elevated GM CBF in SCD (87.3±20 ml/min/100g vs. 68.7±21 ml/min/100g), while significant reductions were observed in arterial O2 content (5.1±0.8 μmol O2/ml vs. 7.4±0.4 μmol O2/ml, p<0.01) and OEF (0.18±0.05 vs. 0.30±0.04, p<0.01). This resulted in a significantly reduced CMRO2 (78.4±23.4 μmol O2/min/100g vs. 149.4±44.9 μmol O2/min/100g, p=0.42) (Figure 1).

CONCLUSION

Global CMRO2 is significantly reduced in children with SCD and may present a novel biomarker for assessing stroke risk in this population.

CLINICAL RELEVANCE/APPLICATION

CMRO2 may provide a novel non-invasive biomarker for assessment of stroke risk in children with sickle cell disease.

SST12-03 Quantification of Age and Gender Dependence of Normal Cardiac and Intracranial Blood Flow in Pediatric Volunteers Using 2D Phase Contrast and 4D Flow MR Imaging

METHOD AND MATERIALS

ECG-gated 4D flow MRI with volumetric coverage of the major intracranial vessels (spatial resolution =1.2mmx1.2mmx1.5mm, temporal resolution=44ms. acquisition time~10 min) was performed on volunteers under 18 years (range 6 months - 17 years) with no history of cardio/cerebrovascular diseases on 1.5 and 3T MRI scanners. In addition, 2D PC-MRI with through-plane velocity encoding at the level of proximal ascending aorta (AAo) and descending aorta (DAo) was performed in the same imaging session for all subjects. Following pre-processing, intracranial blood flow was quantified at manually positioned 2D planes orthogonal to the vessels (Fig. a). Total cerebral blood flow (TCBF) was defined as the sum of flow in bilateral intracranial carotid (ICA) and basilar arteries (BA). Aortic flow was quantified by manual segmentation of the AAo and DAo flow contours. Demographics, body mass index (BMI), and body surface area (BSA) were obtained. Cardiac index (CI) was defined as AAo flow/BSA. Pearson correlation coefficient and polynomial and multiple regression models were used for statistical analyses.

RESULTS

Fifty two volunteers (mean age (yr) ± SD: 7.95 ± 5.04) were recruited. Both females (31) and males (21) had similar distributions of age, BMI, BSA, TCBF, and CI. An excellent correlation was observed between age and AAo/Dao flow (P<0.001, r=0.80/0.85, Fig. b). TCBF and TCBF/AAo ratio vs. age were best fitted with cubic polynomial models (P<0.001, r=0.84, r=0.93, respectively, Figs. c, d). Overall, a moderate but significant inverse correlation was detected between age and TCBF (P<0.013, r=-0.34), TCBF/AAo ratio and CI were inversely correlated with age (p<0.001, r=-0.90 -0.65, respectively) (Figs. d, e). Stepwise multiple regression analysis selected CI as the only independent variable that was a predictor of TCBF (P=0.006).

CONCLUSION

These findings highlight the importance of age matched control data for the characterization of intracranial and aortic hemodynamics in children with anthropometric changes.

CLINICAL RELEVANCE/APPLICATION

Providing a control dataset for age-specific cardiac and cerebral hemodynamics in children is crucial to detect abnormal hemodynamics especially in cerebrovascular diseases’ early stages.
SST12-05  Lesional Hyperperfusion in Leigh Disease Demonstrated by Arterial Spin-labeling

Participants
Matt Whitehead, MD, Washington, DC (Presenter) Nothing to Disclose
Bonmyong Lee, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Andrea L. Gropman, MD, Washington, DC (Abstract Co-Author) Nothing to Disclose

PURPOSE
Leigh disease is a metabolic disorder of the respiratory chain or related components culminating in symmetric necrotizing lesions in the basal ganglia and/or brainstem among other locations. Apart from the classical gliotic and necrotic lesions found on histopathology, small vessel proliferation is also characteristic. Arterial spin-labeling (ASL) imaging has become a powerful adjunct for the detection of perfusion abnormalities during brain MR imaging. We have observed several cases of lesional hyperperfusion demonstrated by ASL sequences in patients with Leigh disease. The aim of this study is to evaluate lesional ASL perfusion characteristics in patients with Leigh disease and compare them to aged-matched normal exams.

METHOD AND MATERIALS
The brain MR imaging database from a single academic children’s hospital was searched for the terms “ASL, arterial spin labeling, perfusion, and Leigh” to build a cohort for analysis. Each patient’s electronic medical record was reviewed to confirm a diagnosis of Leigh disease. MR exams with excessive motion artifact, technical limitations, and without ASL images were excluded. ASL perfusion images were evaluated by a board certified neuroradiologist for the degree and extent of cerebral blood flow and relationship to brain lesions. Images were compared to normal exams from an aged-matched cohort.

RESULTS
The search yielded 33 exams; 23 were excluded. 10 exams from 5 separate Leigh patients were analyzed. 10 normal exams from aged-matched patients were also evaluated. In general, Leigh brain lesions ranged from hyperintense (n=8) to hypointense (n=2) on ASL perfusion images. Gliotic and necrotic lesions tended to be hypointense/hypoperfused. More active or recent lesions with associated restricted diffusion demonstrated hyperperfusion. ASL perfusion patterns differed significantly from aged-matched normal studies (p=<.0001).

CONCLUSION
Leigh disease patients have abnormal perfusion to brain lesions. Hyperperfusion is associated with more recent or active brain lesions, possibly corresponding to small vessel proliferation characteristic to the disease.

CLINICAL RELEVANCE/APPLICATION
ASL hyperperfusion could help distinguish Leigh disease from other similar appearing metabolic abnormalities and disease mimickers.

Awards
Trainee Research Prize - Resident
CONCLUSION

Evaluation of the SWI sequence shows evidence that pentobarbital administration is associated with higher concentrations of deoxyhemoglobin in cerebral venous blood. At the doses used for conscious sedation, this appears to be mediated by pentobarbital's known effect on cerebral blood flow (decreased) rather than arterial hypoxia and central hypoventilation. This raises the concern for temporary cerebral hypoxia associated with pentobarbital use, and needs to be further investigated. SWI sequence appears to be promising in evaluating cerebral hypoxia.

CLINICAL RELEVANCE/APPLICATION

SWI sequence proves an important, non-invasive method to evaluate the oxygenation status of the brain.

SST12-07 Whole-brain T2 qMRI Relaxometry of Extremely Low Gestational Age Newborn (ELGAN) Children at Ten Years of Age: Gender Differences

PURPOSE

Extremely low gestational age newborns (ELGANs) are defined as infants born before the 28th week after gestation. The purpose herein was to study the whole-brain qMRI distributions of the transverse relaxation time (T2) in a population of ELGAN infants at nine to ten years of age. A further objective was to detect potential brain tissue T2 gender differences.

METHOD AND MATERIALS

Children were MRI scanned at twelve ELGAN participating sites: all scanners were 3T (GE, Philips and Siemens), except one 1.5T (GE). The dual-echo turbo spin echo (DE-TSE) MR images of ninety-eight subjects (38 males and 60 females) were qMRI processed resulting in three-dimensional T2 maps covering the whole head. All tissues contained in the intracranium (intracranial matter (ICM) = gray matter plus white matter plus meninges and cerebrospinal fluid) were segmented using a dual-clustering algorithm programmed in Mathcad. The ninety-eight ICM T2 histograms were tabulated in Excel as a function of increasing ICM volume and separated by gender; these were further processed in Mathcad to yield individual and population measures: mean and standard deviation brain T2 values.

RESULTS

The mean brain T2 values are graphed in Fig. 1 (top) for males (left) and females (right): the population T2 averages are 90.5±13.5 ms and 89.5±12.6 ms for males and females respectively. The combined population histograms are shown in Fig. 1 (bottom): note the much higher T2 data uniformity for female versus male infants (dotted red lines).

CONCLUSION

Both graphic data displays (Fig. 1 top and bottom) as well as the statistical measures point to a significantly higher T2 heterogeneity for the ELGAN brains of male versus female infants. This initial finding could indicate a higher vulnerability of very early preterm birth in males versus females.

CLINICAL RELEVANCE/APPLICATION

T2 qMRI relaxometry could become a valuable clinical tool for assessing the brain tissue integrity of children in the context of preterm birth.
**SST12-08 Neuroimaging Findings in a New Pattern of Neonatal Ischemic Encephalopathy Associated with Excessive Uterine Activity**

Friday, Dec. 4 11:40AM - 11:50AM Location: N229

Participants
Jill V. Hunter, MD, Houston, TX (Presenter) Author with royalties, UpToDate, Inc
Stewart Ater, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Michelle L. Murray, PhD,RN, Albuquerque, NM (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To test the null hypothesis that a pattern of neonatal, predominantly cortical, ischemic injury would not be associated with a labor and delivery during which there were extended periods of shortened resting interval.

**METHOD AND MATERIALS**
The neonatal imaging in 10 full term children with established motor and cognitive delays, in whom perinatal infection and metabolic disorders had been ruled out, was retrospectively reviewed and correlated with the electronic fetal monitoring (EFM) strips.

**RESULTS**
The children had a pattern of cortical laminar necrosis that was not a classic watershed, and with a lesser degree of deep gray nuclear ischemia that did not conform to the established patterns of a typical prolonged partial or acute profound hypoxic-ischemic injury. Most of these infants, (8/10), were delivered with a pH >7.0 and without features of systemic asphyxia. Retrospective analysis of the EFM in these 10 cases revealed a pattern of more than 2 hours of continuous excessive uterine activity with resting intervals of less than 60 seconds duration. Nine of the 10 mothers were nulliparous.

**CONCLUSION**
The null hypothesis is not proven and the results suggest an association between shortened resting intervals and a previously unrecognized pattern of neonatal, predominantly cortical, ischemic injury.

**CLINICAL RELEVANCE/APPLICATION**
Cerebral palsy and the sequelae of a previously unrecognized pattern of ischemic encephalopathy has enormous fiscal implications. These neonates do not meet current criteria for hypothermia therapy which may help improve their outcome. In addition if the underlying causes of a shortened resting interval can be recognized prospectively and terminated by the more judicious use of uterine stimulants then it may be feasible to prevent or minimize this cause of neonatal brain injury.

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**SST12-09 An Intraoral B0 Field Correction Device for Decreasing Magnetic Susceptibility Artifacts on Brain MRI Induced by Stainless Steel Orthodontic Appliances**

Friday, Dec. 4 11:50AM - 12:00PM Location: N229

Participants
Zhiyue J. Wang, PhD, Dallas, TX (Presenter) Nothing to Disclose
Yong Jong Park, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Youngseob Seo, PhD, Daejeon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Michael C. Morriss, MD, Pinehurst, TX (Abstract Co-Author) Nothing to Disclose
Nancy K. Rollins, MD, Dallas, TX (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
Susceptibility artifacts from orthodontia are a common problem that can interfere with MRI for acute CNS diseases. The artifacts result from ferromagnetic materials in the orthodontia and alteration in B0 field. Recently available rare earth iron permanent magnets have the potential in cancellation of the unwanted B0 effects. We report the initial experience with a prototype field correction device.

**METHOD AND MATERIALS**
Commercial NdFeB rectangular prism magnets (grade N38EH, intrinsic coercivity 30 kOe) were embedded in front of the teeth between 2 layers of dental plastic sheets in the shape of a mouth-guard, with the magnetization opposing the B0 field. The first prototype had one upper and one lower piece for maxillary and mandibular arches with a total magnetic moment of 0.124 A·m². Subsequent modifications used multiple upper and lower pieces to cover a range of magnetic moment from 0.010 to 0.200 A·m². Human subject studies were conducted with IRB approval at 1.5T without sedation. We studied 3 volunteers with orthodontia and one patient. Brain MRI scans were acquired without and with the subject wearing the field correction device.

**RESULTS**
Based on B0 map, the total induced magnetic moment of braces in the subjects ranged from 0.009 to 0.194 A·m², with a median value of 0.134 A·m². For the case of the lowest magnetic moment, the braces were essentially non-magnetic and the artifact arose from a unilateral ferromagnetic implant. The device improved B0 homogeneity. In 3 subjects adequate quality EPI-DWI scans were acquired with the device. However, complete correction of geometric distortions was not achieved. Sufficient correction of...
Susceptibility artifacts from orthodontia can be decreased with a novel B0 field correction device. This approach is promising although further improvement is needed.

CLINICAL RELEVANCE/APPLICATION

The study may lead to a device that enables diagnostic quality MR examinations for patients wearing braces.
**SPFR61A CNS Infection**

Participants
Christopher P. Hess, MD, PhD, Mill Valley, CA, (christopher.hess@ucsf.edu) (Moderator) Research Grant, General Electric Company; Research Grant, Quest Diagnostics Incorporated; Research Grant, Cerebrotech Medical Systems, Inc;

LEARNING OBJECTIVES
1) Recognize basic imaging patterns of CNS infection in the immunocompetent patient
2) Use imaging features of specific pathogens along with clinical characteristics to narrow the imaging differential diagnosis and guide treatment.
3) Recognize imaging features of opportunistic infections in the immunocompromised patient.

ABSTRACT
The radiologist plays a crucial role in identifying and narrowing the differential diagnosis of CNS infection. This case-based review aims to outline a practical imaging approach based on 5 basic imaging patterns: 1) Extra-axial infection 2) Ring-enhancing lesion 3) Temporal lobe lesion 4) Basal ganglia lesion 5) White matter abnormality. For extra-axial patterns of infection, it is key to search the paranasal sinuses, middle ear, and mastoid air cells for a source. It is also very important to look out for complications including brain abscess, dural sinus thrombosis, infarction, and hydrocephalus. The ring-enhancing pattern is the classic mimicker, and there is a long list of differential considerations. Frequently, the primary differential can be narrowed to infection versus neoplasm. However, close attention to the imaging features is critical to recognize non-operative ring-enhancing lesions such as tumefactive demyelination, subacute infarct, and subacute hematoma. The imaging characteristics that favor infection over neoplasm include a thin, smooth, ring-enhancement, "daughter cysts", a thinner ring of enhancement toward the ventricular surface and, of course, the "light bulb bright DWI" of a pyogenic abscess. When the temporal lobe imaging pattern is encountered, the primary diagnostic consideration should always be herpes encephalitis! Primary differential considerations for bilateral basal ganglia and white matter abnormalities include infection, toxic-metabolic etiologies, venous ischemia, hypoxic-ischemic injury and neoplasm. It is critical to know the patient's history and specifically their immune status. Within these broad imaging categories, a thorough understanding of the characteristic imaging features of specific pathogens and clinical history are essential to narrow the differential considerations and propose a more specific diagnosis. Neuroimaging also plays a pivotal role in diagnosing and monitoring the therapeutic response in opportunistic infections in the setting of HIV. This subset of infections will also be discussed within the context of the five basic imaging patterns listed above. References: 1) Aiken AH. Central Nervous System Infection. Neuroimaging Clin N Am. 2010 Nov; 20 (4): 557-80

**URL**
http://abstract.rsna.org/uploads/2015/15002667/CNSinfection.handout.RSNA.12.4.15.pptx

**SPFR61B Evaluation and Management of Acute Stroke**

Participants
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LEARNING OBJECTIVES
1) To review the classic imaging features of acute ischemic stroke. 2) To review the role of imaging selection in evaluation and management of acute stroke. 3) To review stroke mimics.

ABSTRACT
The landscape of acute ischemic stroke treatment is rapidly changing with multiple positive endovascular trials. In the current scenario, neuroimaging plays a vital role in the diagnosis, triage and treatment of acute ischemic stroke patients. Comprehensive evaluation of brain parenchyma, vessel status and tissue perfusion is critical in patient selection. This case based course will highlight the practical aspects of acute ischemic stroke evaluation in the emergency setting.

**URL**

**SPFR61C Intracranial Hemorrhage: Pearls and Pitfalls**

Participants
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LEARNING OBJECTIVES
1) Gain a deeper understanding of how etiology, location, and timing of intracranial hemorrhage may affect patient disposition and
Intracranial hemorrhage has been traditionally classified as intra- versus extra-axial in location, and can arise from a variety of etiologies. We will focus on the above learning objectives through a case-based exploration of intracranial hemorrhage and associated complications as they pertain to the following locations: 1) Intraventricular 2) Intraparenchymal 3) Subarachnoid 4) Subdural 5) Epidural.