Neuroradiology
Pitfalls of SyMRI

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TEACHING POINTS
To understand the limitations of SyMRI in terms of the accuracy of quantitative values, image acquisition and artifacts. Quantitative standardization may be required among vendors.

TABLE OF CONTENTS/OUTLINE
(Introduction) Novel Quantitative MR Imaging Technique: Features and Clinical Application (Pitfall 1) Standardization of Quantitative Values (Pitfall 2) Partial Volume Effect (Pitfall 3) Artifacts by Chemical Shift and Fat Saturation (Pitfall 4) Vascular/ Cerebrospinal Fluid Flow SyMRI is a wide-spreading quantitative MRI with the parameters of T1, T2 and proton density. Although it has the advantage of reducing acquisition time, there are four main pitfalls: (1) Quantitative values are slightly different among imaging equipment, since only two separate echo times are applied to quantify relaxation times and proton density. (2) On synthetic FLAIR images, brain surface is liable to be hyperintense and shown as mimic subarachnoid hemorrhage, probably due to a partial volume effect of brain tissues with cerebrospinal fluid. (3) SyMRI technique can create artifacts caused by chemical shift and fat saturation. (4) It is difficult to distinguish slow flow from fast flow, because SyMRI utilizes black blood methods. These pitfalls should be noted for expected clinical application of SyMRI.

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TEACHING POINTS
The learner will be provided with the information needed to understand the value of quantitative MRI in the assessment of AD with the several techniques that are currently being used in CAD systems. Each technique has advantages and disadvantages which will be presented on the poster. The learner will understand which structures of the brain are better to be used in the assessment of AD and specifically in both classification of subjects and prognosis of the disease. A volume analysis will be presented where two of the most frequently Regions of Interest will be evaluated between Normal vs AD patients, Normal vs MCI subjects and MCI vs AD subjects. Furthermore, it will be suggested which of the two structures is better to be used in the prediction of conversion from MCI to AD.

TABLE OF CONTENTS/OUTLINE
Neurodegeneration in Alzheimers Disease - Medial Temporal Lobe - Hippocampus and Entorhinal cortex The role of Quantitative MRI in the assessment of Alzheimer's Disease - Volume Analysis - Shape Analysis - Texture Analysis Scientific data to support presentation - Volume changes of the entorhinal cortex and the hippocampus between: - NC vs AD - NC vs MCI - MCI vs MCI converters - MCI vs AD Results
Neurocryptococcosis: A Pictorial Review

All Day Room: NA Custom Application Computer Demonstration

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TEACHING POINTS
This education exhibit aims: 1. To review the definition, epidemiology, relevance, physiopathology, clinical presentations of Neurocryptococcosis, highlighting the most useful aspects to assist the radiologist to consider this hypothesis in the proper context. 2. To illustrate the central nervous system involvement forms detected with the use of computed tomography and magnetic resonance imaging, including the use of advanced image acquisition techniques, in order to provide the substrate for precise image diagnosis of this condition. We will use cases from our database system to demonstrate the above.

TABLE OF CONTENTS/OUTLINE
Definition of Neurocryptococcosis Physiopathology Clinical aspects Findings of imaging methods - Computed tomography with and without iodinated contrast - Conventional nuclear magnetic resonance - Diffusion weighted imaging - Perfusion weighted imaging - Susceptibility weighted imaging - MR spectroscopy Conclusions
An Update on Hybrid PET/MRI in Neuro-imaging

TEACHING POINTS

Hybrid PET/MR scanner is a novel technology with increased availability for clinical use at any site with the resources and desire to acquire and maintain them. The purpose of this exhibit is: To review the clinical application of hybrid PET/MR in neuroimaging. To discuss the advantages and limitation of interpretation. To discuss the characteristic imaging findings of hybrid PET/MRI and to improve the diagnostic accuracy in neuroimaging.

TABLE OF CONTENTS/OUTLINE

Review the advantages and limitations of hybrid PET/MR in neuro-oncologic imaging and new tracers. Discuss with illustrative cases of the added value of PET/MR in initial diagnosis, differentiating treatment effects from recurrent progressive tumor, and also assessing treatment response. Discuss with illustrative cases of the impact of hybrid PET/MR on non-oncologic neuroimaging, including discriminating different types of neurodegenerative conditions and epilepsy evaluation. Future directions and summary.
MRI Appearance of Secondary Central Nervous Lymphoma

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TEACHING POINTS

The secondary central nervous system lymphoma (SCNSL) is defined as CNS involvement in patients with primary systemic lymphoma. According to Haldorsen et al. (2011) approximately two-thirds of the SCNSL present with leptomeningeal spread and one-third with parenchymal disease. However, our experience is different. We would like to demonstrate the diversity of the SCNSL imaging patterns in our group of 11 patients and show the way the SCNSL may present itself. Therefore, it could be earlier diagnosed and the proper treatment management could be initiated.

TABLE OF CONTENTS/OUTLINE

1) General characteristic of the SCNSL. 2) We are presenting a group of 11 patients (7 females, 4 men; median age 72 years) with verified SCNSL either by flow cytometry, stereotactic biopsy or autopsy. The patients were evaluated by standard diagnostic MRI examination because of the presence of new clinical/nerological complaints. 3) Our results demonstrate wide variability of SCNSL appearance. Opposed the literature data isolated meningeal involvement of SCNSL was rare, present only in 2 cases of the 11. In 2 other cases there was combination of meningeal and intraxial involvement. Cranial nerves and ependymal tissue were commonly involved, in 6 and 5 from 11 patients respectively. The midline and paramedial structures were frequently affected as well, in 7 of 11 cases.
Synthetic Dual Energy CT for the Head

All Day Room: NA Hardcopy Backboard

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TEACHING POINTS
The major teaching point of this exhibit is to show the clinical usefulness and future directions of synthetic dual energy CT for the head.

TABLE OF CONTENTS/OUTLINE
The major teaching point of this exhibit is to show the clinical usefulness and future directions of synthetic dual energy CT for the head.

1. General statement of the dual energy CT
   The advantage of dual energy CT is the ability for material characterization and differentiation, based on high- and low- peak voltage acquisitions.

2. General application of the dual energy CT for the head
   2-1) Virtual non-contrast map and Iodine map
   2-2) Automated bone removal CT
   2-3) Monoenergetic CT using DECT

3. Future directions
   3-1) Virtual Gray matter Map called "X-Map"
   3-2) Development of Synthetic dual energy Map
   3-3) Rho Map and Electron density Map

4. Summary
**Awards**

**Certificate of Merit**

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**TEACHING POINTS**

The major teaching point of this exhibit is to show the clinical usefulness of conventional and advanced MRI for intracranial arteriovenous fistulas (DAVF).

**TABLE OF CONTENTS/OUTLINE**

- General statement of DAVF  
- 1-1) Etiology  
- 1-2) Location and Symptom  
- 1-3) Classification  
- 1-4) Treatment  
- Review of MRI findings  
- 2-1) Conventional MRI  
- 2-2) Susceptibility-weighted imaging (SWI)  
- 2-3) 3D-TOF-MRA  
- 2-4) MR digital subtraction angiography (MRDSA)  
- 2-5) Dynamic susceptibility contrast (DSC)  
- 2-6) Arterial spin labeling (ASL)  
- Non-contrast Dynamic MRA using ASL  
- Sample cases  
- 3-1) Cases of Cognard type I  
- 3-2) Cases of Cognard type IIa  
- 3-3) Cases of Cognard type IIb  
- 3-4) Cases of Cognard type IIa+b  
- 3-5) Cases of Cognard type III-IV  
- 3-6) Postoperative follow-up Cases  
- Future directions  
- Summary
Extreme Lateral Interbody Fusion (XLIF): Review of Surgical Technique and Spectrum of Post-treatment Imaging Findings that Radiologists Need to Know

All Day Room: NA Hardcopy Backboard

Awards
Certificate of Merit

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TEACHING POINTS

The purpose of this study is to retrospectively review imaging of patients who have undergone XLIF in order to 1) review the surgical technique of XLIF and 2) provide illustrative examples of potential complications for interpreting radiologists.

TABLE OF CONTENTS/OUTLINE

Spinal fusion is one of the most commonly performed spinal surgery for treatment of spinal abnormalities related to a variety of conditions. Posterior/posterolateral and anterior approaches are traditional techniques which can achieve adequate exposure for spinal fusion. However, these are performed using an open surgical approach which can require increased hospital stay and can be associated with significant complications such as visceral and/or vascular injury. As such, there has been a great effort over the past decade to develop minimally invasive techniques for spinal interbody fusions. Extreme lateral interbody fusion (XLIF) is one of such novel techniques. It is performed via a lateral approach accessing the intervertebral disc through the retroperitoneal fat and psoas muscles. The approach avoids encountering the major vessels and eliminates excessive retraction of the posterior paraspinal musculature. Previously reported complications related with XLIF include nerve root injuries causing neurological deficits, injury to lumbar artery, hardware failure, and bowel perforation.
Ophthalmic Artery: Embryological Development, Imaging Anatomy, Variation and Embolization

All Day Room: NA Hardcopy Backboard

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TEACHING POINTS
1. To describe arterial anatomy and variations of the ophthalmic artery and its branches with description of the embryological development of the ophthalmic artery. 2. To describe potential anastomoses of the ophthalmic artery and relevant arteries including external carotid arterial branches and internal carotid branches with comprehensive schemas. 3. To demonstrate important anatomy and variations for embolization of ophthalmic arterial branches and relevant arteries with illustrative cases.

TABLE OF CONTENTS/OUTLINE
Imaging anatomy and variations of the ophthalmic artery and its branches
Embryological development of the ophthalmic artery
Potential anastomoses of the ophthalmic artery with relevant arteries including the middle meningeal artery, maxillary artery, infraorbital artery, superficial temporal artery, facial artery, and the anterior cerebral artery
Illustrative cases of embolization including parasellar meningioma, dural arteriovenous shunt, orbital/facial arteriovenous malformation, others hypervascular lesions
Summary
A Practical Illustrated Guide to Understanding both the 2017 ACR Thyroid Imaging, Reporting and Data System (TI-RADS) and the ATA Guidelines for Thyroid Nodules and Differentiated Cancer: How to Not Lose Your Mind!

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TEACHING POINTS
In daily practice the thyroid nodules characterized by ultrasound are a challenge for the radiologist, the ACR TIRADS is a renovated attempt to approach this issue and now competes with the 2015 American Thyroid Association Guidelines for Thyroid Nodules and Differentiated Cancer. The purpose of this exhibit is to describe in an easy and illustrated way the concepts that ACR TIRADS provide as characterization, diagnosis and management of thyroid nodules in ultrasound as well as comparative analysis with the ATA guidelines.

TABLE OF CONTENTS/OUTLINE
1. Learning Objectives
2. Introduction
3. ACR TIRADS development
4. Case-based review of the ACR TIRADS System
5. Illustrated comparison with ATA guidelines
6. Structured reporting
7. Learning game
8. Summary
**Implication of Systemic Lupus Erythematosus in the Brain: How Does it Affect It?**

**All Day Room: NA Hardcopy Backboard**

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**TEACHING POINTS**

Review the most frequent neurological pathologies in SLE Knowing the common causes of application of neuroimaging studies
Common findings in neuroimaging studies

**TABLE OF CONTENTS/OUTLINE**

Central nervous system involvement is one of the main causes of morbidity and mortality in patients with SLE. The most frequent clinical manifestations that lead these patients to imaging studies are: headache, altered mental status, focalization, seizures, and cognitive deficit. The diagnosis of the causes of these alterations is usually complex, in which neuroimaging studies play a vital role. MRI is widely described as the gold standard study. Initial assessment with CT helps to detect ischemic and hemorrhagic pathologies. Within the expected findings in neuroimaging we can make a division between acute and chronic. We reviewed 45 patients who came to our center for neurological pathology with previous diagnosis of SLE, who underwent imaging studies during the period of March 2016 to March 2017. It was found that the most frequent cause of request for imaging studies in patients with SLE was headache. Although 22 of the 45 patients no abnormalities in their imaging studies were found, it is important to study patients with neuropsychiatric disorders to rule out structural abnormalities that contribute to increased morbidity and mortality of the patients.
NR015-EB-X

Spectrum of Mixed Post-RT Necrosis with Recurred Tumor on Perfusion MRI with Pathological Correlation

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TEACHING POINTS
It is difficult to differentiate between radiation necrosis and recurred tumor (especially mixed type) after radiation therapy because they have similar conventional MR imaging features. Value of rCBV in perfusion MRI with MRS gives the only information to differentiate between them.

TABLE OF CONTENTS/OUTLINE
Purpose There are three spectrums after radiation therapy of brain tumor: type 1 (entirely post-RT recurred tumor), type 2 (entirely post-RT necrosis), and type 3 (mixed post-RT recurred tumor and necrosis). Type 1 and type 2 are well known, but features of type 3 on perfusion MRI correlated with pathology have not been well reported. The aim of this exhibition is to show difference of three groups on perfusion MR correlated with pathology. Content organization We retrospectively reviewed clinical findings and MR images (including conventional MR sequences, perfusion MR, and MR spectroscopy) in the patients with post-RT recurred tumor and/or post-RT necrosis correlated with pathology. Among them, we divided them into three groups: type 1 (entirely post-RT recurred tumor), type 2 (entirely post-RT necrosis), and type 3 (mixed post-RT recurred tumor and necrosis). We found the differentiated imaging feature between the patients with post-RT recurred tumor and/or post-RT necrosis.
Postmortem MRI Microscopy for Teaching Neuroanatomy

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TEACHING POINTS

Neuroanatomy curriculums have traditionally been based on gross examinations of whole cerebral hemisphere(s) and 1-cm thick brain slices supplemented by histology images for the internal brainstem nuclei. Radiology is changing clinical medicine and being incorporated into anatomy curriculums to enhance student learning. MRI microscopy of ex-vivo brains allows for application of enhanced clinical sequences to provide extraordinary contrast and spatial resolution, highlighting subtle anatomic detail otherwise not clearly seen (e.g. the mamillotegmental fasciculus and the medullary pyramid decussation in Figures 1, 4 respectively). We will demonstrate that it is straightforward to obtain high-quality MRI microscopy of ex vivo whole brain even with 1.5-T scanners. MRI examinations of ex-vivo brains allow learners to visualize relevant neuroanatomical tracts in 3 planes simultaneously, this can dramatically improve understanding of neuroanatomy. Further, while the MRI microscopy images are not currently feasible in vivo, the anatomy is depicted in a familiar modality and does not require the learner to superimpose histologic staining onto a different modality.

TABLE OF CONTENTS/OUTLINE

Introduction MRI microscopy technique Cortical anatomy White matter anatomy Thalamic and basal ganglia anatomy Brainstem anatomy Advanced structures
Overview of Response Assessment Criteria for Neuro-Oncology (RANO): Application for High-Grade vs Low-Grade Glioblastoma

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TEACHING POINTS
1- To describe key aspects of Response Assessment Criteria for Neuro-Oncology (RANO) for evaluating high-grade (HGG) and low-grade (LGG) glioblastoma
2- To highlight importance of clinical data in RANO assessments of HGG and LGG
3- To describe challenges and mitigation strategies associated with image acquisition and RANO criteria

TABLE OF CONTENTS/OUTLINE
RANO is an attempt to standardize the evaluation of treatment in HGG and LGG patients in pharmaceutical clinical trials. Per RANO, MRI is the modality of choice for assessing treatment strategies, and clinical data and medication history are also included in the central review. The goal of this exhibit is to compare key considerations related to the implementation of the RANO criteria in HGG and LGG population: A) Assessment of HGG lesions on contrast enhanced T1w MRI versus LGG lesions on FLAIR images, including description of target and non-target lesions. B) RANO dictates bi-dimensional measurements for HGG and LGG lesions, volumetric measurements of LGG lesions may be more sensitive to assess response to therapy. C) Steroid data and clinical status is an integral part of RANO assessments. Furthermore, for both HGG and LGG, data acquisition and independent reviewer assessment standardization present major challenges, and strategies to overcome these challenges will be discussed.
The Challenges of the Radiological Evaluation of Autoimmune Encephalitis

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TEACHING POINTS
1. Autoimmune encephalitis (AE) is a clinically challenging diagnosis, often presenting with nonspecific neurological symptoms. Early diagnosis is important while the patient is responsive to immunotherapy and to avoid irreversible damage. Some cases of AE are part of a paraneoplastic syndrome and the neurological symptoms could precede the diagnosis of cancer in up to 60% of cases. 2. Although the imaging findings are frequently nonspecific, brain Magnetic Resonance Imaging (MRI) and 18FDG-PET are the main imaging diagnostic tools. Brain 18FDG-PET/CT seems to be more sensitive than MRI in cases of Autoimmune Encephalitis. 3. Brain 18FDG-PET imaging can also be helpful in the assessment of severity of AE cases, with potential implications for the follow-up and therapy monitoring of these patients.

TABLE OF CONTENTS/OUTLINE
1. Introduction
2. Clinical presentation versus auto-antibodies in autoimmune encephalitis
3. Brain MRI and auto-antibodies
4. Brain 18FDG-PET and auto-antibodies
5. Brain 18FDG-PET/CT versus MRI
6. Brain 18FDG-PET/CT as a follow-up imaging tool
7. Conclusion
The Influence of Magnetization Transfer Effects on Simultaneous Multi-Slice Turbo Spin-Echo Sequence

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TEACHING POINTS
1 to understand the basics of simultaneous multi-slice turbo spin echo (SMS-TSE) sequence. 2, to understand relation between slice excitation time interval (SETI) and magnetization transfer (MT) effect. SETI is the time from excitation of a slice to excitation of the next slice. Shorter SETI increases MT effect. Because SMS-TSE sequence is SETI shortened to the limit, it is strongly affected to MT effect.

TABLE OF CONTENTS/OUTLINE
1 Multi-Band and Controlled Aliasing in Parallel Imaging Results in Higher Acceleration (CAIPIRINHA) techniques in SMS-TSE sequence 2 What’s slice excitation time interval 3 Relation between SETI and MT effect 4 Compare to conventional TSE and SMS-TSE in human brain T1 weighted image and T2 weighted image 5 Discussion of future perspectives and clinical application of SMS-TSE sequence
NR022-EB-X

Interpretation of Bilateral Deep Grey Matter Diseases in Children Using Magnetic Resonance Imaging

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TEACHING POINTS

Glioblastoma and Primary Central Nervous System Lymphoma: Could We Go Without Advanced Techniques?

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TEACHING POINTS
Primary central nervous system lymphoma (PCNSL) is a rare, aggressive neoplasm, which involves the brain, meninges, spinal cord and eyes without systematic lymphomatous involvement and accounts for 2-6% of primary brain tumors. Glioblastoma (GBM) is the most frequent and severe glioma subtype, accounting for approximately 50% of diffuse gliomas. Primary treatment for GBM is surgery followed by radiotherapy and chemotherapy. PCNSL is treated primary by chemotherapy. It has been suggested that morphological MRI has limited potential in differentiating between PCNSL and GBM and several studies have used advanced MRI techniques. According to literary data and to our experience based on review of more than 100 cases, we believe that morphological MRI could differentiate between both tumors in many cases. GBM is often presented as a supratentorial lesion with non-homogenous enhancement and central necrosis. PCNSL is commonly presented as multiple lesions with homogenous enhancement and restricted diffusion, often with cranial nerve infiltration.

TABLE OF CONTENTS/OUTLINE
1. Introduction of both tumors
2. Common morphological MRI appearances of GBM and PCNSL
3. Decision making process in considering both tumors; providing guidelines helping in diagnostic process
4. Tricky MRI appearances of both tumors
5. Summary
NR024-EB-X

When Sleeping Becomes a Nightmare: Computer Tomography Evaluation of Sleep Apnea Syndrome with Muller Maneuver

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Awards
Certificate of Merit

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TEACHING POINTS
Review essential aspects of sleep apnea and pharynx’s anatomy. Describe the technique of Müller maneuver in the study of snoring and sleep apnea. Review the findings of normal and abnormal studies using the Müller maneuver. Obstructive sleep apnea is a disorder that is characterized by obstructive apneas and hypopneas caused by the collapse of the upper airway during sleep. The diagnosis should be considered whenever a patient presents with symptoms such as snoring, choking or gasping during sleep, particularly in the presence of risk factors such as obesity, male gender, and advanced age. Müller maneuver consist in an attempt of inspiration that is made with closed mouth and nose, whereby the negative pressure in the chest and lungs is made subatmospheric; it’s a kind of reverse Valsalva maneuver. The intention is to evaluate the collapsibility of the pharynx that should explain the snoring and/or the sleep apnea and can have correlation with the Müller maneuver done in the physical examination by the otolaryngologist.

TABLE OF CONTENTS/OUTLINE
Introduction. Overview of obstructive sleep apnea Anatomy of pharynx Protocol used of pharynx evaluation with Müller maneuver Normal and abnormal findings of studies with Müller maneuver Summary
DWI Features of Uncommon Acute Infectious Meningoencephalitis (AIE)

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FDA Discussions may include off-label uses.

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TEACHING POINTS
1. There are various uncommon causes of acute infectious meningoencephalitis. 2. They have relatively characteristic DWI features correlated with clinical findings. 3. It is important to interpret DWI images about uncommon acute infectious meningoencephalitis and it can be helpful for differential diagnosis.

TABLE OF CONTENTS/OUTLINE
NR100-ED-X

Imaging of Extracranial Head and Neck Lesions: A Symptom-based Approach in Cancer Patients

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

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TEACHING POINTS

This exhibit will discuss the skull base and extracranial lesions during multidisciplinary management in cancer patients by using a neurological symptom-based approach. Neurological symptoms associated with head and neck lesions are induced in a complicated manner by various causes. Imaging plays a critical role in the diagnosis, treatment planning, and management of cancer patients. Therefore, radiologists need to be familiar with the anatomical structures of the head and neck region, which should be checked in cancer patients having neurological symptoms. The purposes of this exhibit are as follows: 1. To discuss imaging findings by using a neurological symptom-based approach. 2. To review the anatomy of the skull base and neck from a neurological point of view.

TABLE OF CONTENTS/OUTLINE

1. Review of the neuroanatomy of the head and neck region 2. Case illustrations using a neurological symptom-based approach - Visual disturbance, Diplopia, Facial numbness and pain, Syncope, Dizziness, Facial nerve paralysis, Dysphagia, Dysarthria, etc. 3. Summary
Advanced Functional MR Imaging of Head and Neck Squamous Cell Carcinoma: Current Status and Future Prospective

All Day Room: NA Digital Education Exhibit

Participants
Ahmed Abdel Razek, MD, Mansoura, Egypt (Presenter) Nothing to Disclose

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TEACHING POINTS

1-To review principles and techniques of advanced functional MR imaging of head and neck squamous cell carcinoma (HNSCC) 2-To illustrate the clinical applications of advanced functional MR imaging in HNSCC 3-To identify the role of functional MR imaging to differentiate recurrent HNSCC from post treatment changes and monitoring after therapy

TABLE OF CONTENTS/OUTLINE

1-Basic background and tailored techniques of advanced MR imaging sequences of head and neck as diffusion weighted MR imaging, diffusion tensor MR imaging, dynamic contrast MR imaging, dynamic susceptibility contrast MR imaging, arterial spin labeling perfusion and MR spectroscopy 2-Imaging appearance and biomarkers of advanced MR imaging in HNSCC 3-Role of advanced MR imaging in nodal staging of HNSCC 4-Role of whole body diffusion weighted MR imaging in metastatic staging of HNSCC 5-Correlation of advanced MR imaging biomarkers with grading and prognostic parameters of HNSCC 6-Role of advanced MR imaging biomarkers in prediction treatment response 7-Role of advanced MR imaging in differentiation of recurrent/residual HNSCC from post treatment changes and in monitoring patients after therapy 8-Role of advanced MR imaging in differentiation HNSCC from simulating lesions 9-Merits and limitations of different MR imaging sequences 10- Summary and future prospective
Peripheral Nerve Sheath Tumors of Head and Neck: Spectrum of Imaging Findings

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
1) To review the 4th WHO classification of peripheral nerve sheath tumors. 2) To present the imaging appearance of benign and malignant peripheral nerve sheath tumors of head and neck. 3) To review syndrome associated with peripheral nerve sheath tumors. 4) To discuss role of diffusion weighted MR imaging in differentiation of benign from malignant peripheral nerve sheath tumors.

TABLE OF CONTENTS/OUTLINE
1- Basic background about peripheral nerve sheath tumors 2- Update 4th WHO classification of nerve sheath tumors 3- Imaging appearance of schwannomas and its variants of head and neck 4- Imaging appearance of neurofibromas either plexiform, localized or diffuse form 5- Imaging of uncommon benign tumors as perineuromas, granular cell tumor, neurothecoma, benign triton tumors and nasal glial heterotopia 6- Imaging of malignant peripheral nerve sheath tumors of head and neck and their variants 7- Imaging of uncommon malignant tumors as malignant granular cell tumor and ectomesenchymoma 8- Review associated syndromes as neurofibromatosis, multiple endocrine neoplasia syndrome, Cowden syndrome, and Carney complex. 9- Role of diffusion weighted MR imaging in characterization of peripheral nerve sheath tumors 10- Summary and conclusion
NR103-ED-X

Imaging and Classification of Paragangliomas of Head and Neck

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
1) To review basic background about paragangliomas of the head and neck. 2) To present imaging appearance and classification of different types of paragangliomas of head and neck. 3) To review imaging findings suggestive of atypical sclerosed form, malignant or inherited paragangliomas.

TABLE OF CONTENTS/OUTLINE
1-Basic background about parangangiomas 2-Cross sectional imaging with CT and MR imaging for diagnosis of parangangiomas 3-Pre-operative mapping of parangangiomas with MR angiography, CT angiography and conventional angiography 4-Anatomical locations of parangangiomas in head and neck 5-Value of classification of parangangiomas of head and neck in treatment planning 6-CT and MR imaging and classification of carotid body tumors 7-CT and MR imaging findings and staging of glomus jugulare 8-Imaging findings and classification of glomus tympanicum 9-Imaging appearance and classification of glomus vagale 10-Imaging of glomus in atypical sites such as nasal cavity and nasopharynx 11-Diffusion weighted MR imaging in parangangiomas 12-Imaging findings suggestive of atypical sclerosed and malignant forms of parangangiomas 13-Imaging findings suggestive of inherited and genetic syndromes with parangangiomas of head and neck 14-Conclusion and future directions
Routine and Advanced Cross-sectional Imaging of Lymphomas of Head and Neck

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
1- Basic background, updated WHO classification and Lugano staging of lymphomas
2- Cross-sectional imaging of nodal and extranodal lymphomas of head and neck
3- Advanced CT and MR as perfusion CT (CTP), diffusion-weighted MR imaging (DWI) and dynamic contrast MR imaging (DCE) in prediction of aggressive lymphomas, response to therapy and differentiation from simulating lesions

TABLE OF CONTENTS/OUTLINE
1- Basic background about lymphomas
2- Updated WHO 2016 classification of lymphomas
3- Imaging characteristics of mature B cell, C cell, NK lymphomas and Hodgkin lymphomas of head and neck
4- Imaging of common and uncommon nodal lymphomas of head and neck
5- Imaging of extra-nodal lymphomas in common and uncommon locations
6- Role of CTP, DWI and DCE in prediction of aggressive lymphomas and response to therapy
7- Role of CTP, DWI and DCE in differentiating extra-nodal lymphomas from squamous cell carcinomas
8- Update Lugano staging 2015 of lymphoma and role of whole body imaging in staging of lymphomas
9- Imaging surveillance and work up of lymphomas
10- Summary of key imaging features and workup strategies
**Pictorial Review of Fungal Diseases of the Paranasal Sinuses**

All Day Room: NA Digital Education Exhibit

**Participants**
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**TEACHING POINTS**
1) Classification of fungal diseases of the paranasal sinuses. 2) Typical and atypical imaging appearance of invasive and non-invasive fungal diseases of the paranasal sinuses. 3) Role of contrast and diffusion weighted MR imaging in invasive fungal sinusitis. 4) Imaging features used to differentiating fungal infection from simulating lesions.

**TABLE OF CONTENTS/OUTLINE**
1-Bacteriology and clinical presentation of fungal diseases of the paranasal sinuses 2-Classification of fungal infection 3-Imaging of non-invasive fungal infection of paranasal sinuses 4-Imaging and staging of allergic fungal infection 5-Imaging appearance of fungal ball 6-Imaging findings of acute invasive fungal infection 7-Imaging of chronic invasive fungal infection of paranasal sinuses 8-Imaging of chronic granulomatous invasive infection 9-Intra-orbital and intracranial complications of fungal infection 10-Role of contrast and diffusion-weighted MR imaging in invasive fungal sinusitis 11-Differentiating fungal infection of paranasal sinuses from neoplastic and other simulating lesions 12-Summary and conclusion
Diffusion Tensor Imaging and Tractography of Multiple Sclerosis: Current Status and Future Prospective

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
1- To discuss tips and tricks of diffusion-tensor imaging and tractography of multiple sclerosis 2-Diffusion tensor imaging of plaques, normal appearing white matter and cortical lesions 3-Effect of multiple sclerosis on white matter tracts at diffusion tensor tractography and their correlation with prognostic parameters 4-Diffusion tensor imaging of disease activity and monitoring after therapy

TABLE OF CONTENTS/OUTLINE
1-Basic background about diffusion tensor tractography 2-Tips and tricks of diffusion-tensor imaging and tractography of multiple sclerosis 3-Characterization of plaques, cortical lesions, deep grey matter and NAWM with diffusion tensor imaging 4-Diffusion tensor imaging of phenotypes of the disease 5-Correlation of diffusion tensor imaging parameters with clinical presentation and prognostic parameters 6-Effect of multiple sclerosis on adjacent white matter tracts with diffusion tensor tractography 7-Diffusion tensor tractography of optic nerve and spinal cord 8-Diffusion tensor imaging of disease activity and monitoring after therapy 9-Diffusion tensor imaging and tractography in monitoring patients after therapy 10-Diffusion tensor imaging and tractography of simulating lesion 11-Current status and future prospective
Diagnostic Imaging in the Setting of Adult Brain Death: Possibilities and Pitfalls

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
1) To gain an overview of the diagnostic imaging studies used to support a clinical brain death diagnosis. 2) To understand potential advantages and pitfalls of each imaging modality.

TABLE OF CONTENTS/OUTLINE
- Definition of brain death- Brief explanation of clinical findings in the setting of brain death and the importance of prerequisites-
- Overview of ancillary tests a) EEG b) Transcranial Doppler c) Cerebral scintigraphy d) 4-vessel cerebral angiography- Detailed description and explanation of each radiologic imaging modality- Imaging examples consistent with brain death a) Transcranial Doppler b) Cerebral scintigraphy c) 4-vessel cerebral angiogram- Discussion of advantages and potential pitfalls for each diagnostic imaging approach- Imaging examples not consistent with brain death a) cerebral Scintigraphy b) 4-vessel cerebral angiogram-
- Current opinion on the use of CT and MR angiography for the diagnosis of brain death- Imaging examples of CT and MR angiography
NR108-ED-X

Can You Hear Me Now? A Case-based Review of Sensorineural Hearing Loss

All Day Room: NA Digital Education Exhibit

Participants
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TEACHING POINTS
1. Highlight relevant anatomic structures in assessment of hearing loss
2. Review ACR appropriateness criteria for imaging of hearing loss
3. Review various causes of sensorineural hearing loss

TABLE OF CONTENTS/OUTLINE
1. Brief anatomy review
2. Discern sensorineural from conductive hearing loss
3. Review ACR appropriateness criteria of hearing loss imaging
Lymphoma: What Differential May Include

1. Review the multifaceted presentations of intracranial lymphoma. 2. Case-based review of different lesions that lymphoma may mimic

TABLE OF CONTENTS/OUTLINE
1. Review imaging characteristics of primary (immunocompetent versus immunocompromised) and secondary CNS lymphoma. 2. Review ancillary imaging including MR spectroscopy, perfusion and nuclear medicine studies that can help tease out a diagnosis of lymphoma from its vast differential diagnoses. 3. Case-based review of the various presentations of CNS lymphomas. Lymphoma is a near universal differential diagnosis for intracranial lesions. The particular emphasis of this presentation will be placed on the various pathologies that lymphoma can mimic including: a. Gliomas b. Leptomeningeal involvement mimicking metastases c. Meningioma d. Toxoplasmosis infection e. Infarction
Glioma Response Assessment: Classic Pitfalls, Novel Confounders, and Emerging Imaging Tools

All Day Room: NA Digital Education Exhibit

FDA Discussions may include off-label uses.

Awards
Magna Cum Laude

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TEACHING POINTS

1) Glioma imaging is complicated by mimics of progression and response. 2) Tumor appearance may be altered by medications (i.e. corticosteroids), surgery, radiation, chemotherapy, and novel treatments such as immunotherapy and alternating electric fields. 3) Advanced imaging techniques including MR perfusion, MR diffusion, MR spectroscopy, and amino acid PET may allow more precise assessment of tumor response.

TABLE OF CONTENTS/OUTLINE

1. Pitfalls prior to initial surgery (e.g. corticosteroid therapy) 2. Post-surgical issues (i.e. Post-operative necrosis mimicking progression 3. Post-chemoradiotherapy issues (i.e. pseudoprogression, and RANO recommendations) 4. Bevacizumab (Avastin™) and "pseudoresponse" 5. Novel therapies and implications for glioma assessment Immunotherapy (immunotherapy RANO (iRANO), and shortcomings of iRANO) Optune™ (Alternating electrical fields) and potential for pseudoprogression 6. Future advances in imaging an response assessment Advanced MRI techniques (e.g. perfusion, diffusion, spectroscopy) Positron Emission Tomography (PET) techniques 7. Summary
The Lateral C1-C2 Puncture: Indications, Technique, and Potential Complications

Awards
Certificate of Merit

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TEACHING POINTS

Access to the subarachnoid space can be obtained by lateral puncture of the posterior spinal canal between C1 and C2. While the lateral C1-C2 puncture is less commonly performed now than in years past, the indications for the procedure are still relevant today. A 2009 survey showed that over 85% of radiology departments had performed at least one lateral C1-C2 puncture in the past year and over 90% of radiology departments reported that they would perform one if MRI was not available and the subarachnoid space could not be accessed via a lumbar puncture. It is important that radiologists that perform lumbar puncture and myelography are familiar and comfortable with this procedure and understand the potential complications and ways in which they can be avoided. Teaching Points: 1. Review the indications for performing a lateral C1-C2 puncture 2. Discuss the technical aspects of performing the procedure 3. Show examples of several vascular variants that can complicate the procedure, which highlight the importance of excellent technique.

TABLE OF CONTENTS/OUTLINE

A. Historical Perspective B. Indications and contraindications C. Technique D. Complications - including a discussion of normal and variant arterial anatomy
Fourth Ventricle: What Can We Find Inside It?

All Day Room: NA Digital Education Exhibit

Participants
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TEACHING POINTS
1) To remember the anatomy of the fourth ventricle and its anatomical boundaries. 2) To know the imaging findings of the main disorders affecting the fourth ventricle. 3) To try to make a differential diagnosis as accurate as possible of an intraventricular mass using clinical, demographic and radiological findings.

TABLE OF CONTENTS/OUTLINE
NR115-ED-X

Trouble at the Neurovascular Hub: Imaging Spectrum of Cavernous Sinus Lesions

All Day Room: NA Digital Education Exhibit

Awards
Identified for RadioGraphics

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TEACHING POINTS
Highlight the multimodality imaging spectrum of cavernous sinus pathologies emphasizing role of clinico-pathological correlation
Identify specific clues on magnetic resonance imaging to aid in differential diagnosis

TABLE OF CONTENTS/OUTLINE
Anatomy of cavernous sinus
Cavernous sinus syndrome - clinical manifestations
Imaging features with pathological correlation
Neoplastic- origin from cavernous sinus/extension from adjacent structures/metastatic or systemic
Inflammatory/infective
Vascular-
aneurysm/fistula/thrombosis
Miscellaneous Pitfalls in interpretation Imaging pearls and clues to aid in differential diagnosis
NR116-ED-X

Cystic Lesions of the Jaws: Imaging Approach and Diagnostic Pearls

All Day Room: NA Digital Education Exhibit

Participants
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TEACHING POINTS

1. To classify and discuss the pathology of the cystic lesions of the jaws. 2. To highlight the imaging findings and diagnostic pearls for their specific diagnosis.

TABLE OF CONTENTS/OUTLINE

Cystic lesions of the mandible and maxilla can be either odontogenic or non-odontogenic. Odontogenic cysts are further divided into developmental or inflammatory in origin. We retrospectively reviewed the imaging studies of 122 patients with jaw lesions, which form the basis of this exhibit. We classify these lesions into those arising from the BONE and those from the SOFT TISSUE. BONY CYST are further characterized into: A. Epithelial: developmental and inflammatory; and B. Non-epithelial. Developmental epithelial cyst includes: Odontogenic [dentigerous, eruption, lateral periodontal, gingival cyst, keratocyst, calcifying odontogenic] and Non Odontogenic: [nasopalatine duct cyst, incisive cyst, globulomaxillary, median palatine]. Inflammatory Epithelial cyst include: radicular, Residual, Paradental, collateral. B. Non-epithelial include: latent bone cyst/Stafne cyst, simple/traumatic, aneurysmal bone cyst, mucosal cyst of maxillary sinus, and ranula. SOFT TISSUE CYSTS include: nasolabial, dermoid, thyroglossal duct cyst, branchial cleft. Imaging findings, location of lesion, internal architecture, borders and relationship can often lead to a specific diagnosis.
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TEACHING POINTS
1. To review with illustrations the presurgical radiologic findings which influence the otolaryngologist’s decision on the surgical approach.
2. To present the intra and postoperative imaging findings in a patient with a cochlear implant.

TABLE OF CONTENTS/OUTLINE
Retrospective review of the imaging studies of 53 patients with cochlear implant surgery for hearing loss forms the basis of this exhibit. All patients had presurgical MRI-IAC and CT-Tbone. 51 had follow-up CT-Tbone. Exhibit is presented in three parts: 1. Pre-operative assessment of CT-T bone, and MRI-IAC. 2. Intra-operative assessment. 3. Postoperative follow-up. Pre-operative review includes: evaluation of the cochlear nerve, cochlear and vestibular malformations (cochlear aplasia/ hypoplasia common cavity); Anatomical variations and associated pathologies: Middle ear and mastoid cells (aeration of the mastoid and of the middle ear, mastoiditis); Vascular supply variants (prominent/dehiscent jugular bulb, aberrant carotid artery); cranial nerves (variants anomaly of the pathway of the VII nerve, facial nerve dehiscence, the size of the internal auditory meatus); Vestibular aqueduct and endolymphatic duct; Ossifying labyrinthitis and otosclerosis. Postoperative follow-up: CSF fistula, facial nerve lesions, electrode malpositioning; infection, bleeding, and extrusion of the receptor/stimulation.
Blurry Vision in Focus: Pictorial Review of Anatomy, Pathology and Complications

All Day Room: NA Digital Education Exhibit

Participants
Susan J. Yoon, DO, Philadelphia, PA (Presenter) Nothing to Disclose
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TEACHING POINTS
1. Review of various disease processes that contribute to visual changes and diplopia will be presented organized within the categories of neoplastic, inflammatory, vascular, infection, and post-traumatic.
2. Review of various anatomic locations important to vision, including the orbit, orbital apex, cavernous sinus, sella turcica, optic pathway, and cranial nerves responsible for extraocular muscular innervation.

TABLE OF CONTENTS/OUTLINE
Purpose Approach Cases Organized by etiology, including: neoplastic, inflammatory, vascular, infectious, and posttraumatic causes for proptosis and visual disturbances Imaging findings Review of orbital anatomy Complications Summary/Conclusion
TEACHING POINTS

Nodular thyroid disease is detected in 3-75% of the general population, and in 20-76% at ultrasound (US). In the last years, non-surgical minimally invasive techniques have been developed to treat this pathology, starting from percutaneous ethanol injection (PEI), to laser ablation (LA), radiofrequency ablation (RFA) and, most recently, microwave ablation (MWA).

TABLE OF CONTENTS/OUTLINE

- Introduction about MWA as a new, promising technique among the minimally invasive treatments of thyroid nodules - Preablation assessment - Procedure - Reduction analysis - Side effects - Conclusion
CT Anatomy of the Pharynx and Larynx with Endoscopic Correlate

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit
Identified for RadioGraphics

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TEACHING POINTS
1. Identify normal anatomic structures of the pharynx and larynx on CT and endoscopy 2. Discuss the basics of endoscopic work-up and how CT and endoscopy complement each other 3. Describe pathology and extent of disease on CT using surgically and endoscopically relevant landmarks

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NR121-ED-X

What do 'U' Know About the 'U' Fibers? Pictorial Review of Subcortical U Fibers Diseases

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

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TEACHING POINTS

The aim of this exhibit is to review the normal anatomy and physiology of the subcortical U fibers, the timeline of the U fibers involvement in various disease processes and the underlying patho-physiology.

TABLE OF CONTENTS/OUTLINE

Subcortical U fibers are located in cortex and subcortical white matter. They connect adjacent gyri and are among the last to myelinate with very slow myelin metabolism. They are spared initially in diseases affecting myelin turnover in contrast to their early involvement in diseases affecting oligodendroglial cells. We would like to present a pictorial review of early and late involvement of these fibers in different diseases. Anatomy and physiology of U fibers Diseases with late involvement of U fibers: Chronic small vessel ischemic diseases CADASIL Toxic leukoencephalopathy HIV encephalopathy Leucodystrophies Metabolic disorders Diseases which affect U fibers relatively early: Multiple sclerosis PML (Progressive Multifocal Leukoencephalopathy) ADEM (Acute Disseminated Encephalomyelitis)
NR122-ED-X

Evaluation of Pediatric Brain Perfusion with Arterial Spin Labeling: Theoretical Underpinnings with a Selection of Illustrative Cases

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit
Identified for RadioGraphics

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TEACHING POINTS
1. To review and understand the physics and pulse sequence utilized in Arterial Spin Labeling
2. To illustrate the specific advantages of ASL in the pediatric population
3. To discuss the potential clinical significance of abnormal ASL values

TABLE OF CONTENTS/OUTLINE

1. Introduction
   What is Arterial Spin Labeling (ASL)? How are ASL images acquired? ASL pulse sequence, step by step ASL mathematical model: why basic understanding is essential to clinical practice
   2. Technical Underpinnings: Extra-CNS causes of ASL signal alterations
      Abnormal systemic flow hemodynamics
      Congenital cardiopathy
      Post cooling protocol
      Hypercarbia
      Achondroplasia
      Hydrocephalus
      Abnormal vascular configuration
      Menkes disease
      Unilateral tortuosity of internal carotid artery or vertebral artery
      Post ECMO
      Moyamoya, with or without EDAS
      Erroneous assumptions in ASL flow quantification
      Sickle cell
      ASL post Gadolinium
      Suboptimal technique
      Tagging artifact
      Nonoptimized post labeling delay
      Suboptimal angulation
      Motion artifact
**NR123-ED-X**

**Submillimeter Spatial Resolution of High Quality Black-blood Imaging by DANTE T1-SPACE: Blood Signal Should Be Suppressed**

All Day Room: NA Digital Education Exhibit

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**TEACHING POINTS**

1. To introduce the characteristics of 0.56 mm isotropic voxel 3D black-blood imaging called as delay alternating with nutation for tailored excitation (DANTE) T1-SPACE. 2. To explain the benefit of DANTE T1-SPACE in intracranial neurovascular diseases. 3. To explain the benefit of DANTE T1-SPACE in extracranial vascular diseases. 4. To show the clinical information provided by DANTE T1-SPACE in intracranial tumors.

**TABLE OF CONTENTS/OUTLINE**

Introduction of 3D DANTE T1-SPACE. Clinical images of 3D DANTE T1-SPACE. Normal anatomyBrain, vessels and cranial nerves; Head and neck, vessels, muscles, and glands; cervical spine, nerve roots. Intracranial neurovascular disease Artery, vulnerable plaques, dissection of ICA, VA-BA, Aneurysms; vein, dural sinus thrombosis. Cervical vascular disease Artery, dissection of ICA, VA-BA, aneurysms; vein, thrombosis. Intracranial tumors Visualization of tumor: Extra-axial tumors such as meningioma, other tumors. The relationship between tumors and surrounding tissues: Dural sinus invasion, dural tail sign. Leptomeningeal disorders Intracranial hypertrophic pachymeningitis, leptomeningeal carcinomatosis. Skull disorders Skull tumors. Future directions and summary of 3D DANTE T1-SPACE.
NR124-ED-X

**Imaging of Skull Vault Tumors in Adults: Diagnosing in No-man's Land**

All Day Room: NA Digital Education Exhibit

**Awards**

Cum Laude

**Participants**

Pablo Naval Baudin, MD, Hospital de Llobregat, Spain (*Presenter*) Nothing to Disclose
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Javier Hernandez Ganan, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Paloma Mora JR, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Xavier Sanjuan, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
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**TEACHING POINTS**

Review tumoral and pseudotumoral lesions in the skull vault and establish a narrowed imaging differential. Present common diagnostic dilemmas and problem-solving findings. Assess the role of advanced imaging techniques (DWI, perfusion, MR-spectroscopy).

**TABLE OF CONTENTS/OUTLINE**

Background: The skull vault has its own limited spectrum of disease, with some unique entities and other ubiquitous lesions that have specific features in this location. It is caught between neuro and musculoskeletal radiology. Some benign entities look aggressive when faced using classical bone-tumor paradigms. The knowledge of specific presentations will lead to proper patient management, avoiding harmful procedures:

- **Pseudolesions:** Anatomic, developmental and acquired variants
- **Lytic lesions:** Fibrous dysplasia, epidermoid & dermoid cyst, hemangioma/<40 years: eosinophilic granuloma, giant cell tumor, aneurysmal bone-cyst, lymphoma/>40 years: plasmacytoma, metastasis, lymphoma
- **Mixed or sclerotic lesions:** Metastasis, osteosarcoma, meningioma, lymphoma, Paget, osteoma
- **Meningeal and bone involvement:** Meningioma, hemangiopericytoma, metastasis, lymphoma
- **Miscellany:** Metabolic, inflammatory-infectious and systemic diseases

Potential role of advanced imaging techniques: DWI, perfusion, emphasizing on MR-spectroscopy

Take-home messages
TEACHING POINTS

The diagnosis of spinal vascular disorders remains challenging. Patients presenting with nonspecific acute or chronic myelopathies and screened with routine noninvasive imaging techniques are often initially misdiagnosed. As a consequence, appropriate therapeutic measures are frequently delayed, if offered at all. The purpose of this exhibit is to 1) Provide a review of the vascular supply of the spinal cord 2) Discuss key image findings that suggest a vascular anomaly on routine noninvasive imaging and should direct patients towards more specific imaging modalities (i.e. MRA, spinal DSA). 3) Highlight commonly encountered causes of radiological misdiagnosis when investigating spinal cord vascular abnormalities, emphasizing in particular the difference existing between so-called classic presentations and the imaging patterns actually observed in the routine clinical practice.

TABLE OF CONTENTS/OUTLINE

1. Spinal cord vascular anatomy 2. Key imaging findings in spinal vascular imaging 3. Frequent causes of missed diagnoses during routine noninvasive imaging of spinal cord vascular diseases, including lack of expected ‘classic’ features, such as the absence of flow voids or of an expected vascular territory or documentation of findings generally attributed to other conditions (e.g. cord enhancement in non-inflammatory myelopathies).
NR126-ED-X

Nasal Cavity Neoplasm and Mimics: A Pictorial Review

All Day Room: NA Digital Education Exhibit

Participants
Sungmin Moon, Gwangju, Korea, Republic Of (Presenter) Nothing to Disclose
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Byung Hyun Bae, Gwang Ju, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Yun Young Lee, Gwangju, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Yoo Kyeong Nah, Jeonnam, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

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TEACHING POINTS
1) To review the relevant anatomy of nasal cavity. 2) To explain the utility of CT and MRI in the differential diagnosis of nasal cavity lesion. 3) To review imaging findings of nasal cavity neoplasms and mimics.

TABLE OF CONTENTS/OUTLINE
NR128-ED-X

Pearls and Pitfalls in Staging the Adamkiewicz Artery using High-resolution MR Angiography

All Day Room: NA Digital Education Exhibit

Participants
Johannes K. Richter, MD, Bern, Switzerland (Presenter) Nothing to Disclose
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TEACHING POINTS

This poster will focus on 4 major areas, making use of routine clinical exams to convey the benefits of high-resolution MR imaging at 3T in visualizing the Adamkiewicz artery (AKA, A. radicularis magna). (1) Standard anatomy of AKA and its variation including diagnostic pitfalls. (2) Workflow illustration to meet expectations from referring clinical partner. (3) Technical basis and requirements needed for MRA implementation and successful image acquisition.

TABLE OF CONTENTS/OUTLINE

Background
The neurological deficits caused by spinal ischemia are potentially debilitating. We focus on supporting vascular surgery to avoid loss of blood supply via the AKA after open aortic repair. Aim is to describe the exact localization of the origin of the relevant posterior intercostal artery. Imaging
Normal spinal artery anatomy is demonstrated as well as its variants. The poster provides the clinical radiologist with relevant clinical case examples provided by high-resolution 3T MRA. Essential technical preparatory details including sequence design are provided. Conclusion
High-resolution MRA of the spinal arteries can be achieved with excellent image quality using standard clinical equipment. Advantages of MRA over micro-invasive catheter-based angiography (DSA) become evident with proper image acquisition, processing as well as focused reporting.
Lymphoid Associated Lesions Within the Parotid Glands

All Day Room: NA Digital Education Exhibit

Participants
Cody R. Larson, MD, Phoenix, AZ (Presenter) Nothing to Disclose
Dan G. Gridley, MD, Phoenix, AZ (Abstract Co-Author) Nothing to Disclose

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TEACHING POINTS

1) Lymphatic tissue is incorporated within the parotid glands during embryologic development. This is unique to the parotid gland and not seen with submandibular, sublingual, or minor salivary glands. 2) Pathologic processes unique to the parotid glands can be attributed to intraparotid lymphatic tissue, including Warthin tumor, lymphoepithelial cysts, lymphoma, and lymphatic spread of head and neck/dermal malignancies. 3) Familiarity with the appearances of lymphoid associated lesions of the parotid gland is imperative for the practicing radiologist to help guide clinical management.

TABLE OF CONTENTS/OUTLINE

Table of Contents/Outline: A. Anatomy and Development Variant anatomy Surgical approach to parotid lesions B. Developmental Lesions Branchial cleft anomalies Vascular/lymphatic malformations Lipoma Sialocele/mucocele C. Lymphoid Lesions Metastasis Lymphoma Lymphoepithelial cysts Warthin tumor Sjogren's syndrome Sarcoidosis
How to Not Go Mad Diagnosing Creutzfeldt-Jakob Disease: What the Radiologist Needs to Know

All Day Room: NA Digital Education Exhibit

Participants
Katelyn Ziggas, Pittsburgh, PA (Presenter) Nothing to Disclose
Deborah P. Sokolowski, DO, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
Michael F. Goldberg, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Matthew S. Hartman, MD, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
Amy Hartman, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Provide background information on prion diseases including microbiology, pathology, clinical features, and the different variants of CJD. 2. Review the key imaging features of CJD to allow the radiologist to efficiently diagnose this rapidly progressive disease. 3. Discuss the biosafety practices for patients with CJD; important for the radiologist who is often performing lumbar puncture for CSF analysis.

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/ Matthew S. Hartman, MD - 2016 Honored Educator
Important Imaging Findings Easily Overlooked on Brain MR Imaging

All Day Room: NA Digital Education Exhibit

Participants
Toshihide Ogawa, MD, Yonago, Japan (Presenter) Nothing to Disclose
Yuki Shinohara, MD,PhD, Yonago, Japan (Abstract Co-Author) Nothing to Disclose
Shinya Fujii, MD, Yonago, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) To describe the imaging findings easily overlooked on brain MR imaging. 2) To describe the clinical importance of these imaging findings. 3) To discuss the pitfalls of diseases easily overlooked on brain MR imaging.
R2* Map by IDEAL IQ for Cerebrovascular Disease

Participants
Yuki Shihohara, MD,PhD, Yonago, Japan (Presenter) Nothing to Disclose
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Keita Kuya, MD, Yonago, Japan (Abstract Co-Author) Nothing to Disclose
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Toshihide Ogawa, MD, Yonago, Japan (Abstract Co-Author) Nothing to Disclose

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TEACHING POINTS
Magnetic resonance imaging is widely used for diagnosing cerebrovascular disease (CVD). Although computed tomography has been considered as the best modality to detect paramagnetic substances including hemorrhage, recent studies have shown the utility of T2*-weighted or susceptibility weighted imaging for detecting acute thrombus and hemorrhage. The purpose of this exhibit is to provide the readers with current applications and advantages of R2* map generated by iterative decomposition of water and fat with echo asymmetry and least-squares estimation quantitation sequence (IDEAL IQ) for CVD. The representative cases using R2* map by IDEAL IQ will also be reviewed.

TABLE OF CONTENTS/OUTLINE
MRI Findings in Lyme Disease

All Day Room: NA Digital Education Exhibit

Participants
Federica Vasselli, MD, Rome, Italy (Presenter) Nothing to Disclose
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TEACHING POINTS
Lyme disease, also known as Lyme borreliosis, is an infectious disease caused by bacteria of the Borrelia type.

TABLE OF CONTENTS/OVERSE
Lyme disease is transmitted to humans by the bite of infected ticks of the Ixodes genus. The disease process has three stages, which may overlap or may occur alone. The mechanism of the central nervous system involvement could consist in direct brain invasion, immunologic mechanisms, or vasculitic processes. The most common neurologic manifestations of Lyme disease are meningitis, cranial neuritis, and radiculoneuritis. Facial palsy, including bilateral facial palsy, is common in neuro-Lyme disease and helps to differentiate it from other diseases. MR imaging findings in cases of Lyme disease almost exclusively concern white matter lesions. The findings are usually focal lesions in the white matter of the brain or nerve-root or meningeal enhancement. The distribution of involvement of white matter including the callosal interface fuels speculation as to a secondary autoimmune mechanism with imaging features mimicking primary demyelinating disease. Rare instances of LNB vasculitis with ischemic stroke, subarachnoid hemorrhage, and intracerebral hemorrhage have been reported.
Untangling Head and Neck Vascular Anomalies

All Day Room: NA Digital Education Exhibit

Participants
Hugo Tames, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Jorge T. Takahashi, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Bruno C. Olivetti, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
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TEACHING POINTS
The purpose of this exhibit is: - To describe the imaging and clinical characteristics of head and neck vascular anomalies and their most common locations. - To adequately classify the vascular anomalies according to the 2014 revised classification of vascular lesions from the International Society of Vascular Anomalies. - To be able to select the best imaging method for the diagnosis. - To understand the role of time-resolved magnetic resonance angiogram for accessing vascular anomalies.

TABLE OF CONTENTS/OUTLINE
1. Classification of vascular anomalies
2. Vascular tumors
   Benign
   Locally aggressive
   Malignant
3. Vascular malformations
   Simple
   - Capillary
   - Venous
   - Lymphatic
   - Arteriovenous malformation
   - Arteriovenous fistula
   Combined
   Those of major name vessels
   Those associated with other anomalies
4. Topographic based differential diagnosis in vascular anomalies
5. Take home messages
Teaching Points

The WHO 2017 Classification of Head and Neck Tumors has just published and tumors in the nasal cavity and paranasal sinuses were newly classified. Among nasal and paranasal benign mass lesions, papillomas and inflammatory diseases are common and other benign mass lesions are relatively rare but appropriate diagnosis is crucial; for example, papillomas sometimes recur because of incomplete resection and have potential for malignant transformation, inflammatory diseases may present as tumor-like lesions and could be misdiagnosed as malignant tumors before surgical resection, and rare hypervascular tumors, such as hemangioma and solitary fibrous tumor, may cause massive bleeding. Therefore, understanding the CT and MR imaging features of various nasal and paranasal benign mass lesions is clinically important for appropriate therapy. The purposes of this exhibit are: 1) To learn clinical characteristics and incidence of each of nasal and paranasal benign mass lesions classified according to the WHO 2017 Classification of Head and Neck Tumors along with inflammatory diseases; 2) To review the imaging features and learn how to differentiate from other nasal and paranasal mass lesions.

Table of Contents/Outline

1. General epidemiology and clinical characteristics
2. Reviewing CT/MR imaging features with pitfalls and diagnostic tips
3. Differential diagnoses
NR136-ED-X

Craniocerebral Neuroblastoma: What a Radiologist Needs to Know and to Report

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Emma Gangemi, Rome, Italy (Presenter) Nothing to Disclose
Rosellina Russo, Rome, Italy (Abstract Co-Author) Nothing to Disclose
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Serena Stagliano, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Giuseppe M. Di Lella, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Simona Gaudino, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Francesco Maria Giordano, Roma, Italy (Abstract Co-Author) Nothing to Disclose
Chiara Ciardi, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Cesare Colosimo, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose

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TEACHING POINTS

The purpose of this exhibit is: - to review the neuroimaging findings of primary and secondary craniocerebral neuroblastoma (NB), describing morphological and non-morphological imaging features; - to guide the radiologist in the differential diagnosis with other embrional tumors and in monitoring the response to chemoradiotherapy.

TABLE OF CONTENTS/OUTLINE

Introduction to "the great mimicker": metastatic and very rare primary craniocerebral neuroblastoma (NB). Craniocerebral NB and the 2016 WHO Classification of Tumors of The Central Nervous System. Radiological appearances of NB: - morphological imaging features; - non-morphological imaging features (diffusion weighted imaging, perfusion weighted imaging, MR spectroscopy); Sample cases and differential diagnosis with other embrional tumors. Role of imaging in the assessment of response to chemoradiotherapy. Summary.
NR137-ED-X

Subtle, but They're There: Transaxonal Degenerations of Cerebellar Connections

All Day Room: NA Digital Education Exhibit

Participants
Eduardo P. Reis, MD, Campinas, Brazil (Presenter) Nothing to Disclose
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Paula C. Azevedo, Campinas, Brazil (Abstract Co-Author) Nothing to Disclose
Fabiano Reis, Campinas, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To review the cerebellar connections and the role of structures (dentate nucleus; superior, middle and inferior cerebellar peduncles; cerebellar hemispheres; red nucleus; olive; pontine tegmentum) to preserve these synapses 2. To Discuss the relationship between lesions and subsequent degenerations involving these synapses 3. To illustrate the role of MRI in identifying these degenerations 4. To describe the clinical presentation of each transaxonal cerebellar degeneration, and show how it can help us to remember this diagnosis between the possibilities 5. To make the radiologist familiarized to these diagnoses, since their presentation is peculiar and often subtle, avoiding misdiagnoses (such as ischemic event, neurodegenerative diseases, demyelinating disease or even tumors)

TABLE OF CONTENTS/OUTLINE
Major cerebellar connections Relationship between lesions in anatomical structures and development of these degenerations Review of imaging findings Correlation with clinical manifestations (a video of palatal mioclonus will be showed) Summary
NR139-ED-X

Acute Non-traumatic Neck Pathology: Looking Beyond the Clinic

All Day Room: NA Digital Education Exhibit

Participants
Santiago Correa, MD, Donostia, Spain (Presenter) Nothing to Disclose
Inigo Goicoechea, MD, Bilbao, Spain (Abstract Co-Author) Nothing to Disclose
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Juan Vega Eraso, San Sebastian, Spain (Abstract Co-Author) Nothing to Disclose

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TEACHING POINTS
1 - To describe the most frequent acute neck pathological entities, excluding neck trauma 2 - To discuss the role of imaging (with emphasis on CT), in the management of these pathologies 3- To review their imaging appearance

TABLE OF CONTENTS/OUTLINE
Non-traumatic emergencies of the neck are uncommon, so they are not well known and represent a challenge for the radiologist. These patients usually come to the emergency department with a variety of acute conditions, in general with nonspecific clinical manifestations. Therefore, the radiologist becomes essential to make a prompt diagnosis and evaluate the extent of the disease. We describe the characteristic imaging findings (X-ray, US, CT and MRI) of the non-traumatic urgent cervical pathology in the adult as well as in pediatric population. We have developed a system-based approach (vascular, musculoskeletal, soft tissues, neurological) with attention to particularities in pediatric patients that helps the radiologic management and diagnosis. As CT is considered the first-line imaging modality in the emergency setting and it has become routine, knowledge of the imaging findings of these conditions is of utmost importance. CT findings help guiding management, using either a surgical or a conservative treatment.
**MRI-guided Head and Neck Lesion Laser Ablation: How To Do It**

All Day Room: NA Digital Education Exhibit

**Participants**
Daniel Ginat, MD, Chicago, IL *(Presenter)* Nothing to Disclose
Steffen Sammet, MD, Chicago, IL *(Abstract Co-Author)* Research Grant, Koninklijke Philips NV Medical Advisory Board, Radiology Resources International LLC Advisory Board, Guerbet SA
Gregory J. Anthony, BA, Chicago, IL *(Abstract Co-Author)* Nothing to Disclose
Gregory A. Christoforidis, MD, Columbus, OH *(Abstract Co-Author)* Nothing to Disclose

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**TEACHING POINTS**

1) This exhibit explains how to perform MRI-guided laser ablation in the head and neck region using a phantom. 2) This exhibit also describes the use of MRI thermography for monitoring laser ablation.

**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/ Daniel Ginat, MD - 2016 Honored Educator
Communication or Miscommunication? Pictorial Review of Various Applications of CSF Flow Study using Phase Contrast Technique

All Day Room: NA Digital Education Exhibit

Participants
Tejas H. Kapadia, MBBS, MD, Mumbai, India (Presenter) Nothing to Disclose
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Archana Fanse, DMRD, MBBS, Mumbai, India (Abstract Co-Author) Nothing to Disclose

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TEACHING POINTS

1. To demonstrate technique of CSF flow study using phase contrast imaging for optimizing application to various pathologies. 2. To review and explain the utility of phase contrast imaging showing pulsatile flow voids and calculating stroke volume to diagnose shunt responsive normal pressure hydrocephalus (NPH), aqueductal stenosis and Type I Chiari malformations requiring decompression. 3. Differentiate NPH from involutional chronic ischemic changes, communicating from obstructive hydrocephalus, communicating from non-communicating arachnoid cyst, mega cisterna magna from arachnoid cyst and syringomyelia from myelomalacia. 4. To demonstrate role of CSF flow study using phase contrast technique in postoperative patients for determining patency of VP shunt, ventriculostomy stoma, arachnoid cyst stoma and post decompression of cranio-cervical junction obstruction.

TABLE OF CONTENTS/OUTLINE

Introduction and literature review
CSF anatomy and physiology
Phase contrast MRI technique: quantitative imaging and technical review
Applications of phase contrast MRI technique- Diagnose- Differentiate- Post-operative applications
Future directions and summary
WHO 2016 Classification of CNS Neoplasms & Tumor Markers: What Every Radiologist Must Know

All Day Room: NA Digital Education Exhibit

Participants
Christopher M. Knaus, MD, Bethesda, MD (Presenter) Nothing to Disclose
Brett J. Theeler, MD, Bethesda, MD (Abstract Co-Author) Nothing to Disclose
Benson R. Langdon, MD, Chapel Hill, NC (Abstract Co-Author) Nothing to Disclose
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TEACHING POINTS
The learner will be able to recognize the imaging findings, describe common tumor markers, and contrast the prognosis of:
Circumscribed & Fluid-Secreting Gliomas
Adult Diffusely Infiltrating Gliomas
Diffuse Midline Gliomas in Children
Glioblastoma

TABLE OF CONTENTS/OUTLINE
Using a quiz format, we present Circumscribed gliomas: Pilocytic astrocytomas: enhancing fluid-secreting neoplasms of childhood, in the cerebellum and diencephalon. WHO Grade I with BRAF Fusion mutations Pilomyxoid astrocytoma: enhancing near the hypothalamus and 3rd ventricle, WHO Gr II with BRAF V600E mutation Pleomorphic xanthoastrocytoma: enhancing fluid-secreting neoplasms, WHO Gr II with BRAF V600E mutation Ganglioglioma: enhancing fluid-secreting neoplasms WHO Gr II, with BRAF Fusion mutation and, Diffusely Infiltrating gliomas: IDH wild-type Astrocytoma: generally homogeneous and non-enhancing, WHO Gr II-III IDH 1/2 mutant - either astrocytoma or oligodendroglioma with additional 1p19q co-deletion, WHO Gr II-III IDH wild-type Primary glioblastoma: enhancing and necrotic, WHO Gr IV IDH mutant Secondary glioblastoma: enhancing and necrotic, WHO Gr IV Diffuse midline glioma of childhood: involving more than 50% of the brainstem, variable enhancement, WHO Gr IV, histone mutation H3 K27M -
NR143-ED-X

MR Imaging of Nigrosome1 RevMR Anatomy, Pathology with Illustrative Interpretation Checklist for Diagnostic Characterization Parkinsonism and Its Mimics: Illustrated Pictorial Essay

All Day Room: NA Digital Education Exhibit

Participants
Rammohan Vadapalli, MD, Hyderabad, India (Presenter) Nothing to Disclose
Abhinav S. Vadapalli, Pune, India (Abstract Co-Author) Nothing to Disclose
Suvarna Alladi, Hyderabad, India (Abstract Co-Author) Nothing to Disclose
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TEACHING POINTS
- Elucidate the MR anatomy of Nigrosome 1 - Illustrate the role Neuro melanin sensitive T1 weighted imaging and its role in diagnostic characterization of Idiopathic Parkinsonism.
- Share the tips and tricks of localization of neuromelanin rich areas like SN,(substantia Nigra) and Locus coerulus on Neuro melanography sequences with high resolution anatomy correlation.

TABLE OF CONTENTS/OUTLINE
- MR anatomy of Nigrosome on various Imaging sequences including T2WI and SWI is illustrated
- Neuromelanin in normal brain and its signal characteristics on neuromelanin sensitive T1 weighted sequences and T2 weighted and SWI sequences are discussed.
- Structural Imaging localization of Neuromelanin rich areas in brain(Substantia Nigra,Locus coerulus in midbrain) is highlighted.
- Key MR imaging findings of PD(parkinson's disease) are illustrated.
- Thinning of pars compacta , blooming effect at the interface between red nucleus and substantia nigra.serrated margins of anterior margins of SN. Absent Swallow Tail sign of lateral SN a, Ischemia patterns strategic infarcts (vascular parkinsonism,Abnormalities of DRPLA(Denato Rubro pallido Luysian axis)

Conclusion: This educational exhibit emphasizes role of T1 sensitive neuro melanin sensitive sequences in Parkinson's disease MR Imaging protocols.
NR144-ED-X

Head and Neck Neuroendocrine Tumors: Making Sense of Many Diseases from a Common Histology

All Day Room: NA Digital Education Exhibit

Participants
Alex C. Essenmacher, MD, Iowa City, IA (Presenter) Nothing to Disclose
Justin J. Guan, MD, Iowa City, IA (Abstract Co-Author) Nothing to Disclose
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TEACHING POINTS

Neuroendocrine tumors are a heterogeneous group of neoplasms with both epithelial and non-epithelial origins encompassing tumors which can arise in and metastasis to the head and neck. There is ongoing investigation of the cell line of origin of some of the rarer entities. Malignancies arising from the same cells sometimes receive different designations based on degree of dysplasia. Viewers of this exhibit will become familiar with the imaging appearance of a variety of neuroendocrine tumors involving the head, neck, and sinuses by CT, ultrasound and MRI including DWI. A viewer will also be able to define the differences between neuroendocrine tumors and neuroendocrine carcinomas and learn their appearance by established nuclear medicine studies (In-111 pentetreotide, F-18 FDG, Ga-68 DOTATOC).

TABLE OF CONTENTS/OUTLINE

Following a discussion of neuroectodermal histology, cases will be presented with accompanying didactics pertinent to imaging findings in multiple modalities. Cases include: 1.) Paragangliomas of the a.) carotid body, b.) jugular foramen, and c.) vagus nerve, 2.) sinonasal cavity tumors including a.) enthesioneuroblastoma and b.) undifferentiated carcinoma, 3.) primary neuroendocrine tumors of the larynx 4.) and middle ear, and 5.) metastatic diseases. Medullary thyroid, pituitary adenomas, and melanoma are beyond the scope of this review.
May It Recur No More: An Enhanced Look at the Radiopathologic Spectrum and Future Treatment Aims of Myxopapillary Ependymoma

All Day Room: NA Digital Education Exhibit

Participants
Justin J. Guan, MD, Iowa City, IA (Presenter) Nothing to Disclose
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TEACHING POINTS
1. Myxopapillary Ependymoma (MPE) has good overall survival but is also plagued with high rates of recurrence and dissemination, especially in children. 2. Genetic overexpression and/or underexpression of specific enzymes cause the Warburg phenotype of MPE, while other enzymes are linked with more aggressive cases. Targeting these key enzymes with small-molecule inhibitors/activators may represent a novel MPE treatment strategy. 3. Many benign and malignant tumors of the CNS may mimic MPE in radiologic appearance, and diffusion imaging can often clarify the diagnosis. Differentiating MPEs from similar-appearing tumors is crucial before surgery, as MPE has a high potential to recur and seed throughout the neuroaxis, accentuating the need for complete resection.

TABLE OF CONTENTS/OUTLINE
**Imaging of Neurologic Conditions During Pregnancy and Postpartum Period**

All Day Room: NA Digital Education Exhibit

**Participants**

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**TEACHING POINTS**

1) To review the physiologic change associated with pregnancy. 2) To review the imaging finding of several common neurological diseases associated with pregnancy that can lead to significant morbidity and mortality in women during pregnancy and the postpartum period.

**TABLE OF CONTENTS/OUTLINE**


Conclusions
NR147-ED-X

Development of Brain Phantom for MRI Based On New Approach: Phantom Preparation Method by Approximating T1 and T2 Values and Morphology to the Body Based On a Simple Technique

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
1. Provide normal brain tissue (white matter, gray matter, cerebrospinal fluid) and simplified preparation method of simulated lesion
2. Provide a result that prepared brain phantom shows signal variation similar to that of the living brain.

TABLE OF CONTENTS/OUTLINE

No phantom has been established for contrast measurement in MRI. We have developed a phantom using an approach to emulsify powder starch. This approach is based on a versatile and simplified technique to prepare phantom by encapsulating a drug into a syringe to be mixed with purified water through a T shape stopcock. It is possible to prepare a phantom which approximates T1 and T2 values of normal brain tissue and simulated lesion to those of living brain. Prepared phantom showed signal variation similar to that of living brain. We believe it possible to provide many researchers with useful information regarding brain phantom preparation.
Cystic Lesions of the Parotid Gland: Radiologic-pathologic Correlation with Update of the Latest WHO 2017 Classification of Head and Neck Tumors

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
The latest WHO 2017 Classification of Head and Neck Tumors includes a new chapter on tumors and tumor-like lesions of the neck and lymph nodes. Tumor-like lesions include a variety of cystic lesions of the parotid gland. Cystic lesions of the parotid gland can be divided into three groups: non-neoplastic cysts, benign tumors with macrocystic change, and malignant tumors with macrocystic change. It is important to distinguish each group because each treatment and patient's management are different. The purpose of this exhibit is to describe the findings of MRI and scintigraphy, and the histopathological characteristics of each parotid gland lesion based on the latest WHO 2017 Classification of Head and Neck Tumors, and to summarize the key points of differential diagnosis for cystic lesions of the parotid gland.

TABLE OF CONTENTS/OUTLINE
1. Definition, clinical features of each cystic lesion of the parotid gland. 2. Histopathological characteristics based on the latest WHO 2017 Classification. 3. Findings of MRI and scintigraphy with emphasis on radiologic-pathologic correlation.
NR149-ED-X
Tumefactive Tuberculomas: Multi Parametric Imaging Pearls and Pitfalls and Misdiagnosis Nightmares and Wisdom Mantras Shared For the Resident
All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
Illustrate the conventional MRI, Diffusion Imaging, Contrast perfusion, ASL and MRS features of Tumefactive tuberculomas with radio pathological correlation. Key Imaging features for considering a tumor mimicking Tuberculoma over a tumor are illustrated with clinical examples.

TABLE OF CONTENTS/OUTLINE
- Diffusion, ADC, T2weighted and FLAIR imaging features of these lesions are discussed with examples with emphasis on biomarkers of cellularity, caseation necrosis. - Contrast enhancement patterns and wall and matrix Architecture characteristics of Tumefactive tuberculomas are highlighted. - MR spectroscopic features overlapping between infective and neoplastic lesions causing diagnostic dilemmas are illustrated. - Contrast and non contrast perfusion (Arterial Spin labeling) indices of tumor mimicking tuberculomas and biomarkers of neoangiogenesis are elucidated. - Key mantras and biomarkers of atypical tuberculomas are showcased.
T2 Bright Lesions of the Brainstem Using Clinical and MRI Findings to Make the Diagnosis

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
1. Formulate a differential diagnosis for lesions in the brainstem on MRI. 2. Recognise some lesions with classical radiological features. 3. Role of imaging in the diagnostic paradigm for non-specific cases.

TABLE OF CONTENTS/OUTLINE
Rhombencephalitis Infectious Listeria TB Viral Inflammatory Sarcoïd MS/ADEN CLIPPERS PML Bickerstaff Encephalitis Neoplastic Lymphoma Glioma Ischaemic Arterial Venous Radiologically characteristic brainstem lesions Mixed etiology May or may not be of clinical significance Wallerian Degeneration Osmotic Demyelination MSA Chasing the Dragon Hypertrophic Olivary Degeneration Capillary Telangectasia and Cavernous Venous Malformation
Symmetrical Signal Abnormality in the Rhombencephalon Can Leave You Scratching the Back of Your Head!

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
1. Symmetrical abnormality in the posterior fossa is easily missed and when present should raise suspicion for unusual diagnosis
2. Identification of certain radiological features combined with clinical presentation helps towards early and more specific diagnosis
3. This case review should help the learner interpret what can be rather daunting findings on MRI and gain an appreciation of the role of the specialist MDT and clinical genetics in diagnosis of some of these rare appearances

TABLE OF CONTENTS/OUTLINE
1. Anatomy of the rhombencephalon
2. Differential diagnosis and review of cases with symmetrical findings in the rhombencephalon:
   Multiple system atrophy
   Alexander's disease
   Fragile X-associated tremor/ataxia syndrome
   Cerebrotendinous Xanthomatosis
   Hypertrophic Olivary Degeneration
   Progressive multifocal leukoencephalopathy
   Heroin toxicity
   POLG mutation
3. Pearls and differentials of more specific signs
4. Summary
Sutton's Law for Epilepsy Imaging: Narrowing the Differential for Seizure Disorders Using an Anatomic Based Approach

All Day Room: NA Digital Education Exhibit

Participants
David Gedeon, MD, Orange, CA (Abstract Co-Author) Nothing to Disclose
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TEACHING POINTS
MR imaging is an essential component of evaluation for medically intractable seizures. The success of epilepsy surgery is dependent on the ability to accurately define and resect the epileptogenic zone. Thus, it is essential for the radiologist to be familiar with common seizure disorders, which are often associated with subtle abnormalities. The purpose of this exhibit is 1) To review the MRI findings of common seizure disorders using an anatomic based approach 2) To provide a case based review of common causes of medically uncontrollable seizures, including a post-review quiz.

TABLE OF CONTENTS/OUTLINE
A. Epidemiology of seizure disorders
B. Case based review of common seizure disorders using an anatomic approach
  1. Temporal lobe epilepsy - Mesial temporal sclerosis - Middle cranial fossa meningoencephaloceles - Encephalitis
  2. Cortical based lesions - Cortical based tumors (DNET, Oligodendroglioma, Ganglioglioma) - Focal cortical dysplasia - Polymicrogyria - Encephalotrigeminal angiomatosis - Cortical scars
  3. Lesions involving ectopic grey matter - Grey matter heterotopia - Schizencephaly
  4. Lesions involving a single hemisphere - Hemimegalencephaly - Rasmussen encephalitis
C. Post-review quiz
Where are the Lateral Ventricles: How to Diagnose and Distinguish Aventriculi from the Other Holoprosencephaly Variants

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
- To review the main imaging findings of the main anomalies of ventral prosencephalon development.
- To demonstrate a case and the main imaging findings of aventriculi, a rare variant of holoprosencephaly with few cases reported in the literature.

TABLE OF CONTENTS/OUTLINE

1 Introduction
Holoprosencephaly is a multifactorial complex brain malformation in which incomplete cleavage of the prosencephalon leads to a wide variety of brain and facial anomalies, usually with underdevelopment of the midline structures. A rare variant of holoprosencephaly termed as aventriculi has been scarce reported, with only four cases reported in the literature to date, characterized by absence of lateral and third ventricles and complex brain malformation.
2 Anatomy and embryology - Gyrus and sulcus - Corpus callosum - Basal ganglia - Thalamus
3 Review of imaging findings of anomalies of ventral prosencephalon development.
- Alobar holoprosencephaly
- Semilobar holoprosencephaly
- Lobar holoprosencephaly
- Syntelencephaly
- Septopreoptic holoprosencephaly
4 Describe main imaging findings of aventriculi.
5 Sample cases Demonstration of the most important magnetic resonance findings of the holoprosencephaly spectrum using selected cases from authors archives.
Videofluoroscopic Evaluation of Functional Impairment in Oropharyngeal Swallowing

Awards
Certificate of Merit
Identified for Radiographics

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TEACHING POINTS
- To analyze the indications of videofluoroscopic evaluation of oropharyngeal swallow study.
- To describe oropharyngeal region anatomy and mechanism of swallowing.
- To illustrate normal and abnormal imaging findings in videofluoroscopic swallow studies in the evaluation of functional causes of swallowing impairment.
- To emphasize diagnostic difficulties and differential diagnosis

TABLE OF CONTENTS/OUTLINE
Videofluoroscopic oropharyngeal swallow study is the best technique for diagnosis of oropharyngeal dysphagia. Not only diagnosis of a dysfunction can be made, but also decisions on management including texture modification and therapeutic strategies are possible. We present:
- Normal anatomy of the oropharynx and mechanism of swallowing.
- Indications for videofluoroscopic oropharyngeal swallow study.
- Imaging findings. Motility disorders: Bolus transport from oral cavity, Laryngeal vestibular penetration, Pharynx residue, Transglottic aspiration.
- Implications for treatment. Meal consistency Different manoeuvres improving swallowing

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TEACHING POINTS
- To analyze the indications of videofluoroscopic evaluation of oropharyngeal swallow study.
- To describe oropharyngeal region anatomy and mechanism of swallowing.
- To illustrate normal and abnormal imaging findings in videofluoroscopic swallow studies in the evaluation of functional causes of swallowing impairment.
- To emphasize diagnostic difficulties and differential diagnosis

TABLE OF CONTENTS/OUTLINE
Videofluoroscopic oropharyngeal swallow study is the best technique for diagnosis of oropharyngeal dysphagia. Not only diagnosis of a dysfunction can be made, but also decisions on management including texture modification and therapeutic strategies are possible. We present:
- Normal anatomy of the oropharynx and mechanism of swallowing.
- Indications for videofluoroscopic oropharyngeal swallow study.
- Imaging findings. Motility disorders: Bolus transport from oral cavity, Laryngeal vestibular penetration, Pharynx residue, Transglottic aspiration.
- Implications for treatment. Meal consistency Different manoeuvres improving swallowing
**Tips and Tricks in Head and Neck Imaging: From Missed Diagnosis to Imaging Pearls**

All Day Room: NA Digital Education Exhibit

**Awards**

**Certificate of Merit**

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**TEACHING POINTS**

To review radiological error classification system To identify the most common sources of misinterpretation in H&N imaging To highlight some pearls and suggest general strategies to avoid misdiagnosis in H&N imaging

**TABLE OF CONTENTS/OUTLINE**

The interpretation of H&N imaging can be challenging and prone to error. The exhibit will describe the categories of radiological errors and give some pearls using a case-based approach:

- Variants that shouldn't be mistaken for disease.
- Variants with surgical risk.
- Tricky diagnosis in sinus disease.
- Avoiding misinterpretations in cystic lesions of the neck.
- Our 10 favorites missed diagnosis:
  1. Back to basics! Infection spread to the mediastinum.
  2. Papillary thyroid carcinoma arising from a thyroglossal duct cyst.
  3. Perineural tumor spread: the most missed in H&N.
  4. Neck pain—think out of the box! Calcification of the transverse ligament of the atlas and periodontoid pseudotumor.
  5. Ectopic and cystic parathyroid adenoma.
  6. Adenopathies in blind spots: retropharyngeal and retropectoral.
  7. Don't miss complications in otomastoiditis.
  10. Bisphosphonate-related osteonecrosis.
- Strategies to avoid misdiagnosis.
- Tips and tricks.
Swallowing Abnormalities Associated with Disorders of the Central Nervous System: Diagnosis by Videofluoroscopy and Rapid Digital Sequences

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
The fluoroscopic examination of deglutition in patients with neurologic disorders is essential for the diagnosis of aspiration into the airway and other swallowing abnormalities that prevent the patients to get their necessary nutrients. The purpose of the exhibit is:
• To describe the brain and neck anatomic structures involved in the swallowing
• To analyze the cerebral cortical and brainstem control of deglutition
• To review the neurologic diseases like vascular, trauma, tumors, degenerative, post op and their anatomic locations, that may probably generate swallowing disorders
• To illustrate the swallowing abnormalities using Videofluoroscopy and Rapid Digital Sequence images and the neurologic damages that caused them, with CT and MR.

TABLE OF CONTENTS/OUTLINE
• Anatomy and physiology of the swallowing mechanism
• Pathophysiology of swallowing disorders caused by diseases that damage the central nervous system, including the brainstem centers that control the deglutition
• Review of the radiologic techniques used for assessment of swallowing disorders
• Description of abnormal radiologic findings
• Sample cases of neurologic damage and the corresponding swallowing abnormalities
• Summary

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https://www.rsna.org/Honored-Educator-Award/ Alberto I. Carbo, MD - 2015 Honored Educator
NR160-ED-X

Post-thyroidectomy Surveillance Ultrasound of Thyroid Cancer: Review of Anatomy, Thyroidectomy Variants, Tumor Recurrence and Pitfalls

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

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TEACHING POINTS
- Review normal anatomy of the neck
- Show examples of surgical options to treating thyroid cancer
- Recognize the most common locations and appearance of loco-regional disease recurrence
- Stress importance of cine views and radiologist self-scanning for any abnormality
- Demonstrate pitfalls that mimic tumor recurrence

TABLE OF CONTENTS/OUTLINE
NORMAL PRE-SURGICAL NECK ANATOMY - Normal thyroid, including several common embryologic variants - Cervical lymph node classification using US images. See Figure 1 for an example. - Review of normal cervical LN size
SURGICAL TECHNIQUES OF THYROIDECTOMY - Total v. Lobectomy - Central compartment LN dissection - Modified v. Selective dissection
NORMAL POST-THYROIDECTOMY - Necessary US views - Expected appearance of surgical changes - Importance of comparison studies and cine views - Limitations due to reliance upon technologist; recommend radiologist scanning for any concerns
LOCOREGIONAL RECURRENCE - Thyroidectomy bed nodules: size, shape, calcifications, interval change - Lymph nodes, including malignant features specific to subtypes of thyroid cancer
COMMON PITFALLS - Surgery related mimics: suture granuloma, surgical material, hematoma, seroma - Adjacent anatomy: thyroid cartilage nodule, thoracic duct, tracheal or esophageal diverticulum, tortuous vessels
Lumbar Puncture Under Fluoroscopy Guidance: An Evidence-Based Technical Review for Radiologists

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
How to workup a patient for fluoroscopy-guided lumbar puncture (FGLP). Review pertinent anatomy and fundamental cerebrospinal fluid mechanics. Review the indications and complications of the procedure. Review techniques to perform a FGLP with tips from evidence-based literature to reduce complications.

TABLE OF CONTENTS/OUTLINE
A. Introduction: There are many differences in fluoroscopy guided lumbar puncture (FGLP) technique among radiologists. Even within the same institution, there are a variety of preferences among proceduralists with individual perspectives based on the literature, training and/or experience. Our aim is to provide familiarity with various techniques involved in FGLP, and understand how to improve patient outcomes. We will also address possible controversial points regarding FGLP using an evidence-based approach. B. Basic cerebrospinal fluid (CSF) mechanics and anatomy of the lumbar spine. C. Indications, contraindications and complications of FGLP. D. Technical considerations: 1. Patient position: Prone vs lateral decubitus. 2. Planning needle trajectory. 3. Needle selection. 4. Directing a needle and methods to overcome obstacles 5. Measuring opening pressure. 6. Considerations to decrease complications. 7. Tips for difficult situations.
Can the Pattern of Intracranial Calcifications be Helpful in Differentiating Zika from Other Congenitally Acquired Infections?

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
- The purpose of this exhibit is to expose radiologists to different patterns of calcifications seen in congenital Zika infection, including elongated, curvilinear calcifications at the junction between the cortex and subcortical white matter which may help differentiate Zika from other congenitally acquired infections. A review of other associated neuroimaging findings will be included to stress that Zika infection is associated with various malformations of the brain in addition to microcephaly.

TABLE OF CONTENTS/OUTLINE
- Introduction to congenital Zika infection
  - Review of associated brain abnormalities
  - Description of different patterns of intracranial calcifications
  - Discussion of curvilinear calcifications at the junction between the cortex and subcortical white matter, possibly unique to Zika infection
  - Ultrasound, CT and MR images from 6 patients exposed to the Zika virus prenatally with subsequent PCR-proven Zika infection, 3 of whom demonstrate the above mentioned pattern of curvilinear calcifications
  - Overview of various patterns of calcifications in other congenital infections, such as TORCH infections
Ultrasound Assessment and Sampling of Salivary Gland and Neck Nodal Lesions: Paving the Way for an Optimal Outcome

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
1) Discuss how and why ultrasound assessment of salivary and neck node lesions can help to decide and plan sampling. 2) Highlight the strengths and limitations of key ultrasound guided sampling techniques and sample analysis, principally fine needle aspiration (FNA) and core needle biopsy (CNB). 3) Illustrate with a variety of cases how triple assessment (clinical, radiological and cytological) can optimise the final outcome. 4) Review the latest evidence and provide a measured and sensible evaluation of the topic.

TABLE OF CONTENTS/OUTLINE
1. Introduction. 2. Provide an overview of the ultrasound features of salivary gland and neck node lumps which necessitate further evaluation with sampling. 3. Discuss how careful ultrasound assessment can help in deciding and planning sampling, being mindful of the outcome. 4. Provide a measured overview of FNA and CNB and subsequent analysis: i) Illustrate each technique briefly with images. ii) Discuss their risks and benefits including diagnostic yield, accuracy and safety, in light of the evidence in the literature. iii) Discuss the value and limitations of the subsequent sampling analysis. 5. Illustrate through a series of cases the value of triple assessment, incorporating the clinical, radiological and cytological input in working towards an accurate final diagnosis.
Main Anatomical Variations of the Intracranial Arteries

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
To recognize the normal anatomy of the intracranial arteries. To recognize main anatomical variations of the intracranial arteries. To pinpoint the characteristics of each anatomical variation.

TABLE OF CONTENTS/OUTLINE
1. Introduction Intracranial arterial variants include fenestrations, persistent carotid-basilar anastomoses, carotid artery hypoplasia/agenesis and internal carotid artery reorientations. This education exhibit reviews the most important and clinically relevant variants in these categories. 2. Anatomy Normal anatomy of intracranial arteries. Main intracranial arteries variations: - Anterior cerebral artery trifurcation - Azygos anterior cerebral artery - Fenestrations of carotid-vertebrobasilar system - Internal carotid artery hypoplasia/agenesis - Persistent trigeminal artery - Persistent hypoglossal artery - Persistent primitive maxillary artery - Fetal origin of posterior cerebral artery 3. Sample cases Demonstration of the above mentioned intracranial arterial variants using cases from our database, highlighting the main imaging findings with magnetic resonance imaging angiography (MRA) and multidetector computed tomography angiography (CTA).
Videofluoroscopic Diagnosis of Swallowing Disorders and Complications after Total Laryngectomy and Radiation Therapy

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
Total laryngectomy and radiation therapy are indicated for patients with advanced laryngeal cancer or with extralaryngeal tumors that invade the larynx. Fluoroscopic examination is essential for evaluation of the swallowing function after treatment, establish a baseline for follow up and for detection of early and late complications. The purpose of the exhibit is: • To describe the indications and surgical technique of total laryngectomy • To explain the pathophysiology of radiation therapy in the swallowing mechanism • To provide a basic knowledge of how to perform the post-operative (PO) fluoroscopic study of swallow in order to assure a complete diagnostic examination and avoid technical and interpretative pitfalls • To illustrate the normal PO appearance, as well as the most common early and late complications.

TABLE OF CONTENTS/OUTLINE
• Surgical technique: indications and rationale • Effects of radiation on neck tissues and structures • Essentials of PO fluoroscopic examination: types of contrast, anatomic coverage and technical aspects • Radiologic appearance after treatment • Early complications: leakages, strictures, hematomas, abscesses • Late complications: motility disorders, fistulas, strictures due to inflammation, fibrosis or tumor recurrence.

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Ultrasound Tips for New Residents: How to Recognize Thyroiditis

All Day Room: NA Digital Education Exhibit

Participants
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TEACHING POINTS

- Thyroiditis is a generic term including an array of clinical entities affecting the thyroid gland.
- Thyroid ultrasonography has proved to be a very effective tool in the diagnostic approach of thyroid diseases, particularly thyroid autoimmune diseases, including Graves' disease.
- Thyroid echogenicity is due to the gland's follicular structure: the interface between thyroid cell and colloid exhibits high acoustic impedance, causing high frequency acoustic waves to be reflected back to the probe. Conditions that change the normal anatomical structure of the gland cause this echo pattern to be altered. Espinasse (1983) and Gutekunst et al. (1989) were the first to report abnormal thyroid ultrasound patterns, characterized by a diffuse low echogenicity, in patients with Hashimoto's thyroiditis and Graves' disease.
- The objective of this presentation is to evaluate ultrasonographic features of thyroid gland in patients with thyroiditis.

TABLE OF CONTENTS/OUTLINE

- Introduction
- Anatomy
- Normal ultrasound appearance
- Pictorial review of the main types of thyroiditis
  - Acute thyroiditis
  - Subacute thyroiditis
  - Riedel’s thyroiditis
  - Hashimoto’s thyroiditis
- Conclusions
Computed Tomography (CT) of the Paranasal Sinuses (PS): Normal Anatomy and Anatomic Variants

Participants
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TEACHING POINTS
To learn how to execute CT scan of PS To know the normal anatomy To identify the anatomic variants of PS relevant for preoperative work-up

TABLE OF CONTENTS/OUTLINE
Among the most frequent anatomical variants of the PS region we can list: septal deviation, that can interfere with surgical access to the middle meatus; concha bullosa, if large, can be associated with mucosal contact headache and nasal obstruction; the agger nasi cell, if large, can cause the narrowing of the frontal recess. Other less common variations, but with important clinical relevance are: Onodi cell, an isolated mucocele in this site can cause optic neuropathy; Haller's cell, its presence has been related to recurrent maxillary sinusitis; protrusion of the internal carotid artery in the sphenoid sinus can cause bleeding during surgical procedures; pneumatization of uncinate process, may cause blockage of the ostiomeatal complex; maxillary sinus hypoplasia may lead to navigation problems during surgery; dehiscent infraorbital nerve canals, which exposes the infraorbital nerve to sinus pathology. Detailed knowledge of anatomy and anatomic variations of PS region is critical for surgeon as well as for the radiologists involved in the preoperative work-up to improve success of management strategies and to avoid potential complications of functional endoscopic sinus surgery.
NR168-ED-X

Set Lasers to Cure: Radiology’s Role in Laser Ablation Surgery for Epilepsy and Brain Tumors

All Day Room: NA Digital Education Exhibit

Participants
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TEACHING POINTS
1. Indications for laser ablation surgery in pediatric and adult populations and the evolving relationship to current treatment modalities. 2. Pre-surgical planning and the role of the radiologist in optimizing treatment. 3. Imaging features on MRI in the immediate post-operative setting. 4. Post-treatment changes on follow-up MRI examinations.

TABLE OF CONTENTS/OUTLINE
1. Overview of laser ablation surgery treatment technique and MRI thermometry. 2. Radiology's role in pre-treatment planning, operative approach and target delineation. 3. Treatment indications in the pediatric population with sample imaging cases including epilepsy and hypothalamic hamartomas. 4. Treatment indications in adult populations with sample imaging cases including metastatic disease, primary brain tumors and grey matter heterotopia. 5. Immediate post-operative diagnostic imaging features on DWI, FLAIR and contrast enhanced studies. 6. Sample cases of evolving treatment changes on follow-up MRI examinations. 7. Summary and references.
NR170-ED-X

Tumors of the Anterior Skull Base: A Systematic Approach

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
2. A simplified approach towards diagnosis and reporting of anterior skull base tumors.
3. Significance of bone algorithm, soft-tissue algorithms and multi-planar reformat on CT scan to distinguish between various tumors in the skull base region.
4. To outline an optimal MR protocol, that will enable precise characterisation of the tumor and its extent.

TABLE OF CONTENTS/OUTLINE
1. The skull base anatomy is complex and is not directly accessible for clinical evaluation. A simplified description of this complex anatomy with pictorial illustration will help identify the epicentre of the tumor.
2. Due to close proximity of vital structures, surgical exploration without accurate knowledge of anatomy can lead to catastrophic events. Pertinent points that help in delineation of the masses in relationship to the surrounding structures will be elaborated.
3. Explain the imaging protocols, with optimal use of MR imaging techniques to enhance precise mapping of the tumour like use of high matrix scans, fat suppression techniques.
4. Describe the characteristic imaging features of the various anterior skull base tumors.
5. A checklist for structured reporting that will construct a reasonable and limited differential diagnosis to help direct patient management.
Applications of Multi-Delay Arterial Spin Labeling With Time Delay Mapping-Based Perfusion MRI in Cerebrovascular Diseases

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FDA Discussions may include off-label uses.

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TEACHING POINTS

1. Basic overview of the physics of multi-delay arterial spin labeling (ASL) with time delay sequence. It is the improvement of the pseudo-continuous 3D ASL and has many additional advantages. This sequence encodes 3 to 7 different post label delay times into a single acquisition and makes high resolution perfusion images in a very short acquisition time (3 minutes 48 sec for 7 delay).

2. This ASL sequence provides corrected cerebral blood flow (CBF) and time delay (TD) maps, which helps in better qualitative and quantitative analysis of cerebrovascular diseases such as Stroke, steno-occlusive lesions, Moya-Moya disease.

3. Uses of ASL in detecting the presence and site of dural arteriovenous fistulae and arteriovenous malformations, by analysing its maps.

TABLE OF CONTENTS/OUTLINE

• Pictorial essay of multi-delay ASL with TD in cerebrovascular diseases Stroke-CBF, time delay, collateral analysis Moya-Moya disease-preoperative evaluation Steno-occlusive diseases-collateral evaluation Dural arteriovenous fistulae Arteriovenous malformations • Quantitative CBF and Time delay estimation in cerebrovascular disorder

Conclusion: Multi-delay ASL with time delay mapping, is a further advancement of 3D PCASL that gives neuro-radiologists a valuable insight into the hemodynamic of a range of cerebrovascular disorders.
NR174-ED-X

The Forgotten Oculomotor Nerve: Not to be Missed Lesions

All Day Room: NA Digital Education Exhibit

Participants

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TEACHING POINTS

Discuss functions of oculomotor nerve and symptomatology
Show the normal anatomy of the oculomotor nerve through CT, MRI and schematic drawings
Discuss the role of MRI for evaluation of oculomotor nerve pathway diseases and imaging recommendations for analysis of each segment
Show selected pathologic conditions
Delineate a take home message board by the didactic analysis of oculomotor nerve diseases
Oculomotor nerve is a mixed cranial nerve which innervate extraocular muscles, ciliary muscle and pupillary sphincter. It is divided into four anatomic segments and its parasympathetic fibers are peripherally distributed. Imaging plays a key role in the differential diagnosis of oculomotor nerve related symptoms.
NR175-ED-X

4D Flow MRA: Clinical Applications of Hemodynamic and Flow Data for Evaluation of Intracranial Pathologic Processes

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
1. Learn how 4D-Flow MRA can be used in the evaluation of intracranial pathologic processes.
2. Learn about the different hemodynamic factors and their role in aneurysm pathogenesis, and how they can be evaluated using 4D Flow MRA.
3. Learn about the role of hemodynamics in arteriovenous malformations.
4. Learn about the role of hemodynamics in intracranial stenosis.

TABLE OF CONTENTS/OUTLINE
1. Introduction to MR Angiography
2. Introduction to PC-MRA (4D Flow) and Anatomic Imaging
3. Introduction to Hemodynamics
4. Hemodynamics of Aneurysms a) Wall Shear Stress b) Pressure c) Flow Morphology and Flow Patterns
5. Hemodynamics of Arteriovenous Malformations a) Wall Shear Stress and effect on Prognosis b) Pressure c) Velocity, Morphology, and Flow Morphology
6. Hemodynamics of Intracranial Stenoses a) Wall Shear Stress b) Pressure c) Velocity
7. Current and Future Projects a) Direct comparison with DSA in patients with growing aneurysms b) Comparison with intraaneurysmal pressure measurements c) The role of genetics
NR176-ED-X

Don't Miss It!: Cerebral Venous Thrombosis

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

Cerebral venous thrombosis is a neurological condition whose clinical presentation is highly variable, ranging from asymptomatic to coma and death, and may mimic an array of other pathologies. Although CVT tends to have a good prognosis when treated promptly, the average amount of time it takes to detect it is approximately seven days, time at which serious complications may already be present. The purpose of this exhibit is: 1. Provide a pictorial review of the cerebral venous anatomy and of the pathophysiology of thrombus formation. 2. Discuss the most common clinical presentation of CVT, together with its risk factors, and complications. 3. Provide a case-based radiologic review highlighting key diagnostic imaging findings using CT and MR imaging.

TABLE OF CONTENTS/OUTLINE

The cases will be presented in a quiz format, highlighting key diagnostic points using CT, MR imaging modalities, and clinical presentation of the patient. Cases include the following: Cavernous sinus thrombosis, Superior sagittal sinus thrombosis, Transverse sinus thrombosis, Internal Jugular vein thrombosis, among others.
Characteristics and Pitfalls of MR Vascular and Blood Flow Imaging of the Brain to Obtain Useful Information

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
The purpose of this exhibit is: 1. To review various sequences of MR vascular and blood flow imaging. 2. To demonstrate the role of non-contrast current imaging modalities such as 3D-arterial spin labeling (3D-ASL), susceptibility weighted imaging (SWI), and MR angiography, as well as post-contrast spin echo and gradient echo 3D-T1 sequences (e.g. T1-SPACE and T1-VIBE), and dynamic susceptibility contrast MRR imaging. 3. To describe the practical imaging assessment for evaluation of the vascular or cerebral vascular flow (CBF) statement.

TABLE OF CONTENTS/OUTLINE
1. This exhibit includes various spectrums of cerebrovascular diseases such as arterial stenosis, dissection and venous sinus thrombosis, and brain parenchymal diseases such as acute encephalopathy, status epilepticus, and brain tumors. 2. We demonstrate the usefulness of non-contrast sequences such as 3D-ASL and SWI for evaluating CBF and vascular reserve, and show a potential to evaluate intra-axial brain tumors (e.g. glioblastoma). 3. We present an approach with contrast-enhanced 3D-T1 sequences in the evaluation of arterial wall and thrombus showing some pitfalls. We are presenting: Key points for practical imaging assessments and characteristic findings of diagnostic imaging.
NR178-ED-X

Evaluating the Utility of CT Perfusion for Head and Neck Tumors

All Day Room: NA Digital Education Exhibit

Awards
Magna Cum Laude

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TEACHING POINTS
Understanding the various techniques and imaging analysis of CT perfusion for head and neck tumors. CT perfusion may differentiate histological type and predict tumor response to treatment in head and neck cancers.

TABLE OF CONTENTS/OUTLINE
How to perform CT perfusion using area detector CT (ADCT). How to reduce radiation exposure in CT perfusion studies. Various CT perfusion imaging analyses: a) maximum slope method, b) Patlak analysis, and c) deconvolution technique. Various CT perfusion parameters: artery blood flow (AF) by maximum slope method, artery blood flow (Flow) and clearance (CL) by Patlak analysis, blood flow (BF), blood volume (BV), mean transit time (MTT), and capillary permeability (CP) by a deconvolution technique. Review of the clinical applications of CT perfusion imaging in head and neck. a) differentiation of tumor histology (squamous cell carcinoma, pleomorphic adenoma, Warthin tumor, salivary gland malignant tumor, malignant lymphoma, etc.), b) monitoring tumor perfusion, c) prediction of tumor response to the treatment, d) evaluation of post-treatment tumor change.

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 Margaret N. Chapman, MD - 2017 Honored Educator
Supratentorial Intraventricular Tumors in Pediatric Patients: A Pictorial Review

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
Approximately 10% of all central nervous system neoplasms arise within or in the vicinity of the ventricular system [1]. Typically, these masses cause signs and symptoms of increased intracranial pressures and hydrocephalus [2]. Ultimately, a tissue diagnosis is required for accurate treatment planning, however, location of the tumor, age of the patient and imaging characteristics can help to narrow the differential diagnoses. Our objective is to present a comprehensive pictorial review of typical location, key clinical facts and imaging findings of common supratentorial intraventricular tumors in the pediatric population.

TABLE OF CONTENTS/OUTLINE
- Normal radiological anatomy of the ventricular system
NR180-ED-X

Avoiding Complications Before, During and After Vertebral Augmentation

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

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TEACHING POINTS

Teaching points are categorized into 4 groups: 1. patient selection and preparation, 2. techniques for safe vertebral body (VB) access, 3. pointers on safe utilization of cement, and 4. post-procedure patient care and follow-up.

TABLE OF CONTENTS/OUTLINE

Patient selection/preparation: indications and contraindications imaging and fracture localization/analysis aseptic technique and prophylaxis patient positioning and monitoring level/type of anesthesia VB access: Safe pedicle targeting avoid spinal canal avoid paraspinal soft tissue injuries trocar placement within the vertebra Cement injection: leaks and know how to handle them should they occur cement viscosity fluoroscopic technique multiplanar visualization injection technique cement volume other implants Post-procedure patient management: monitoring and evaluation during recovery follow-up anticoagulation management osteoporosis management physical therapy Conclusions: Rare VA complications can have devastating consequences. An awareness of how, when and why they occur as well as an adherence to the recommendations for complication avoidance will further reduce the likelihood of these adverse events.
NR181-ED-X

Imaging on CNS Disorders Attributable to Alcohol Abuse: Pictorial Essay

All Day Room: NA Digital Education Exhibit

FDA Discussions may include off-label uses.

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TEACHING POINTS
1. To review alcohol related imaging abnormalities. 2. To be aware and to be able to recognize the wide spectrum of alcohol brain manifestations 3. To know applicability of advanced techniques (Spectroscopy and diffusion tension imaging) in differential diagnosis of alcohol related diseases

TABLE OF CONTENTS/OUTLINE
Introduction Alcohol abuse is related to several neuropsychiatric changes, with unremarkably findings on conventional MR imaging at early stages. Nevertheless, different indirect mechanisms such as trauma, organs dysfunctions, and nutritional deficiencies can be related and demonstrate specific MR imaging findings. Objective To review imaging recognizable patterns of conditions related to alcohol. Topics Different patterns of imaging related to alcohol abuse can be demonstrated due vulnerability of specific regions. Findings on conventional and also advanced MR sequences, especially diffusion tensor imaging and spectroscopy, may contribute to diagnosis. Themes: Direct Toxicity: Chronic and acute encephalopathy; Marchiafava Bignami, Alcoholic fetal syndrome, Atrophy Nutritional deficiency - Wernicke encephalopathy/Wemicke-korsakoff syndrome; Subacute combined degeneration Injury to another organ with secondary involvement - Hepatic encephalopathy Changes related to alcohol treatment - Osmotic demyelination
Radiologic Review of Maxillary and Mandibular Cystic and Sclerotic Lesions

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit
Identified for RadioGraphics

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TEACHING POINTS

1. To classify various maxillary and mandibular lesions according to the density and the relationship of tooth. 2. To illustrate the imaging characteristics of various maxillary and mandibular lesions. 3. To discuss the key imaging finding to generate the differential diagnosis of maxillary and mandibular lesions.

TABLE OF CONTENTS/OUTLINE

Radiologic approach of the jaw lesions according to the density and relationship to teeth. Review of diagnostic key imaging findings
- Radiolucent lesion: radicular cyst, dentigerous cyst, keratocystic odontogenic tumor, ameloblastoma, nasopalatine duct cyst, ameloblastoma, LCH
- Radiopaque: ossifying fibroma, fibrous dysplasia, torus mandibularis/palatinus, osteochondroma
- Mixed: osseous dysplasia, calcifying cystic odontogenic tumor, ameloblastic fibro-odontoma, fibrous dysplasia, hemangoima, bisphosphonate-related osteonecrosis

Summary
NR183-ED-X

The Many Faces of an AVM and the Diagnostic Radiologist’s Role in Its Management

All Day Room: NA Digital Education Exhibit

FDA Discussions may include off-label uses.

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TEACHING POINTS

The Spetzler-Martin, Pittsburgh, and Buffalo criteria are grading systems which predict the likelihood of major post-operative complications from AVM interventions. They each stem from the different operative approaches to AVM management (surgical, radiosurgical, and endovascular, respectively). Currently there is no standardized approach to the reporting of AVMs. Given the uniqueness of these three systems and understanding that not all AVMs will present in the same fashion, and thus may receive different scores, depending on which system you use, the interpreting radiologists can play a key role in the early and appropriate triaging of AVM management. With this exhibit the viewer should be able to include these three grading systems and help direct the referring physician come to a more informed decision, ultimately seeking out the most viable interventional option (i.e. the one with the lowest post-operative risk), potentially preventing inappropriate referral of care.

TABLE OF CONTENTS/OUTLINE

AVM intro, description of the grading systems and their application (with images), AVM features which can be a source of discrepancy between the grading systems (e.g. size and flow), example of a comprehensive report, brief discussion of the grading system's limitations, the viability of our proposal in the context of increasing demands for higher volume reading.
Imaging of Neurologic Complications in Patients with Hematologic Malignancies

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

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TEACHING POINTS

- List the common hematologic malignancies and describe the different treatment techniques
- Explain how both the disease and the treatment can increase the risk of neurologic complications
- Identify the imaging features and differential diagnosis for various neurologic complications

TABLE OF CONTENTS/OUTLINE

1. Classification and treatment of hematologic malignancies - Leukemia - Lymphoma - Plasma cell dyscrasia
2. Imaging findings and treatment of neurologic complications
   a. Tumor related - CNS involvement - Leukostasis related hemorrhagic infarcts
   b. Infection - Virus (PML, HHV6, CMV, VZV) - Fungal (Mucor, Aspergillus, Cryptococcus) - Bacterial
   c. Therapy related - PRES (calcineurin inhibitor) - Dural Sinus Thrombosis (L-Asparaginase)
   - All-trans retinoic acid induced intracranial hypertension - Methotrexate toxicity
   - Lumbar puncture related intracranial hypotension
   d. Coagulopathy related hemorrhage
   e. Metabolic - Osmotic myelinolysis - Wernicke's encephalopathy

Summary
Patients with hematologic malignancies can suffer from neurologic complications due to the primary disease, treatment, and associated immunosuppression. Familiarity with the imaging features of these complications and their clinical manifestations can help the radiologist recognize these entities and aid in diagnosis.
Tying TI-RADS Together: A Pictorial Review of Thyroid Lesions and Appropriate TI-RADS Level Assignments

All Day Room: NA Digital Education Exhibit

Participants
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Edward G. Grant, MD, Los Angeles, CA (Abstract Co-Author) Research Grant, General Electric Company Medical Advisory Board, Nuance Communications, Inc

TEACHING POINTS

The Thyroid Imaging, Reporting, and Data System (TI-RADS) recently published under the auspices of the American College of Radiology (ACR) aims to reduce overdiagnosis of thyroid malignancy by providing a reliable system of risk stratification based on high-resolution ultrasound images. TI-RADS presents a formalized lexicon to describe imaging features and assigns a point value to each descriptor. The summed number of points from five categories yields a score and accompanying risk level for malignancy. The aim of this exhibit is to review the rationale for the development of TI-RADS, the TI-RADS lexicon and levels, and present a series of cases. Some of the cases are easily categorized by TI-RADS while some cases pose certain challenges to straightforward classification. For the latter types of cases, we will offer practical guidance to assist the radiologist.

TABLE OF CONTENTS/OUTLINE

• Problem of Overdiagnosis of Thyroid Malignancy • TI-RADS Lexicon • TI-RADS Levels • Pictorial Review of TI-RADS • Challenging Cases • When to recommend fine needle aspiration (FNA)
Demystifying the Paraclinoid Region of the Internal Carotid Artery

All Day Room: NA Digital Education Exhibit

Awards
Cum Laude

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TEACHING POINTS

The paraclinoid region of the internal carotid artery (ICA) is commonly misunderstood due to complex anatomy and competing terminology in the literature. In this region the ICA transitions from extradural to intradural by passing through the proximal and distal dural rings. This transition is critically important because the natural histories of extradural and intradural aneurysms differ significantly. Completely intradural aneurysms that arise distal to the distal dural ring are at risk for subarachnoid hemorrhage and usually necessitate endovascular or surgical management. Extradural aneurysms are often managed more conservatively. Accurate radiologic discrimination between extradural and intradural aneurysms is highly challenging due to anatomic variation and lack of reliable imaging landmarks. The aim of this exhibit is to review the anatomy of the paraclinoid ICA, including the dural rings and carotid cave, and to discuss the best supported imaging methods for approximating the distal dural ring. We will also offer practical pearls for reporting aneurysms in this region.

TABLE OF CONTENTS/OUTLINE

• Anatomy of the Paraclinoid Internal Carotid Artery • Proximal and Distal Dural Rings: Anatomy and Imaging Landmarks • Carotid Cave • Differentiation of intradural and extradural paraclinoid ICA Aneurysms • Developing Role for MRI
Pilocytic Astrocytoma: Variable Imaging Manifestation and Differential Diagnosis

All Day Room: NA Digital Education Exhibit

Participants
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TEACHING POINTS
To review clinical issues of pilocytic astrocytoma
To review the characteristic imaging findings of pilocytic astrocytoma according to the patient's age and the tumor location
To discuss the differential diagnosis of pilocytic astrocytoma according to the location

TABLE OF CONTENTS/OUTLINE
Clinical issues of pilocytic astrocytoma
- Review of variable radiologic manifestation of pilocytic astrocytoma
- Cerebellum - Brainstem - Spinal cord - Chiasmatic/hypothalamic - Cerebral hemisphere - Ventricle Relevant differential diagnosis in each location
Summary
Anatomical Variations of the Ethmoid Bone at CT Scan

All Day Room: NA Digital Education Exhibit

Participants
Michaela I. Cellina, Milan, Italy (Presenter) Nothing to Disclose
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Giancarlo Oliva, Milan, Italy (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To become familiar with the radiological normal anatomy and variants of ethmoid bone.

TABLE OF CONTENTS/OUTLINE
The ethmoid bone is composed of 4 parts: the perpendicular plate, the cribiform plate and 2 ethmoidal labyrinths. A knowledge of the complex anatomy of the ethmoid is crucial for diagnosis of paranasal diseases and for preoperative work-up of functional endoscopic sinus surgery. We revised 600 maxillofacial CT scans executed for sinusitis or trauma to collect possible variants of ethmoid bone, including pneumatisation of turbinates, paradoxical turbinates, pneumatisation of crista galli, uncinate process and nasal septum, Haller cells, supraorbital cells. 65% of population is affected by at least 1 ethmoid variant: the most common is the pneumatisation of middle turbinate (48%) followed by paradoxical middle turbinate (19%) and Haller cells (12%). Pneumatization of crista galli and supraorbital cells amounted up to 5%, whereas the other variants were rare.
**Dedicated 3D High Resolution 3T Vessel Wall MR Imaging in Cerebrovascular Diseases**

All Day Room: NA Digital Education Exhibit

**Awards**
Cum Laude

**Participants**
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Thomas Bejoy, Trivandrum, India (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**
1. Overview of the Vessel wall imaging protocol followed in our institute 3T MRI-TOF MRA, 3D isotropic spin echo sequences - T1(fat sat) pre-and post-contrast CUBE, T2 CUBE, PD CUBE
2. Clinical applications - Intracranial atherosclerotic disease (ICAD), Vasculitis, Reversible vasodilation syndrome (RCVS), Dissection, Moya-Moya disease, Aneurysm
3. Findings to be evaluated: (a) vessel wall thickening and enhancement (concentric/ eccentric), (b) presence, location, intensity of plaque, (c) remodelling pattern (positive/negative), (d) follow up imaging.

**TABLE OF CONTENTS/OUTLINE**
• Pictorial Essay of Vessel wall imaging cases - ICAD, Primary CNS Vasculitis, Varicella, Lupus vasculitis, RCVS, Aneurysm, Moya-Moya disease.
• Main indication: ICAD- Eccentric wall thickening and enhancement, Juxta luminal T2 hyper-intense band
  Vasculitis- Concentric wall thickening and enhancement, long duration of wall enhancement
  RCVS- Concentric mild wall thickening, negligible to mild enhancement, complete resolution on follow-up
  Arterial dissection- Intramural hematoma, intimal flap and double lumen
  Moya-Moya disease- Concentric wall thickening, mild/ no enhancement and negative remodelling
• Other indications: Determine the Atherosclerotic and Vasculitis Activity. Intracranial Target for Biopsy in Vasculitis. Which Aneurysm Has Ruptured.
**Too Many Cooks? Comparison and Critical Review of Available Management Models for Thyroid Nodules**

**Participants**
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**TEACHING POINTS**

There are several published guidelines for evaluation of thyroid nodules, and models for TIRADS (Thyroid Imaging, Reporting and Data System). In this exhibit, we present, compare, and critically evaluate the most widely acceptable models. We present clinical examples on how different models might yield variable results, and emphasize the importance of a well-coordinated departmental workflow for evaluation of thyroid nodules.

**TABLE OF CONTENTS/OUTLINE**

1. Background information about the guidelines and TIRADS models available for thyroid nodule evaluation
2. Relevant specifics of each model (size cut-offs, imaging parameters, malignancy risks, management guidelines), with emphasis on the recent American College of Radiology (ACR)-TIRADS, American Thyroid Association (ATA) guidelines, and the Korean Society of Thyroid Radiology (KSTHR) TIRADS.
3. Critical evaluation of the advantages and limitations of each model.
4. Radiologic and clinical examples on how different models would yield variable or similar results.
5. Focus on the role of US elastography: how and when it can be used in the decision-making process, and how different guidelines did or did not incorporate it.
6. Proposed model for departmental workflow to incorporate recent management guidelines, quantify radiologic-pathologic correlation, and follow-up patients with thyroid nodules.

**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/ Theodore J. Dubinsky, MD - 2012 Honored Educator
Mariam Moshiri, MD - 2013 Honored Educator
Mariam Moshiri, MD - 2015 Honored Educator
NR191-ED-X

Don't Get Phaked Out! Case-Based Imaging Review of Neurocutaneous Diseases (Phakomatoses)

All Day Room: NA Digital Education Exhibit

Participants
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TEACHING POINTS

1. Describe the various types of neurocutaneous disorders characterized by benign and malignant central nervous system, ocular, and cutaneous lesions of varying severity. 2. Review the classic imaging characteristics of the different phakomatoses across different modalities, including MR, US, and CT. 3. Discuss the epidemiology, inheritance patterns, and specific features of the neurocutaneous disorders.

TABLE OF CONTENTS/OUTLINE

The phakomatoses are a group of neurocutaneous disorders characterized by involvement of structures that arise from the embryonic ectoderm, which include the central nervous system, skin, and eyes. Other organs may also be involved. As a group, they are often characterized by widespread abnormalities of both benign and malignant etiology. The radiologist should be able to recognize the characteristic appearances of these abnormalities, as this will aid in improved diagnostic evaluation of additional systems. In this educational exhibit, we will discuss the following neurocutaneous diseases: 1. Neurofibromatosis Type I 2. Neurofibromatosis Type II 3. Tuberous Sclerosis 4. Sturge-Weber Syndrome 5. Von-Hippel-Lindau 6. PHACE Syndrome 7. Gorlin-Goltz Syndrome
Non-Invasive Characterization of Rim Enhancing Intracranial Intra-Axial Lesions Using Advanced MR Techniques

All Day Room: NA Digital Education Exhibit

Participants
Carola Mullins, El Paso, TX (Presenter) Nothing to Disclose
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TEACHING POINTS
Understand how a systematic zonal approach provides a diagnostic framework in the non-invasive characterization of rim enhancing intracranial intra-axial lesions (primary and secondary neoplasms of the CNS, tumefactive MS and intracranial abscesses) based on inter- and intralesional histological differences (cellularity, neoangiogenesis, metabolic activity) identifiable through advanced imaging techniques and exemplified by histopathological images Understand the role and limitations of advanced imaging techniques such as Diffusion Weighted Imaging (DWI), Dynamic Susceptibility Perfusion Weighted Imaging (PWI) and H+ MR Spectroscopy (H+MRS) in the non-invasive characterization of these lesions and awareness of possible pitfalls

TABLE OF CONTENTS/OUTLINE
Craniofacial Pain: What to Look for and Where

All Day Room: NA Digital Education Exhibit

Awards
Cum Laude

Participants
Amalia Gonzalez Lopez, Sabadell, Spain (Presenter) Nothing to Disclose
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TEACHING POINTS

To know the various entities that have characteristic clinical presentations involving craniofacial pain and its topography. To know the possible secondary causes of each type of pain in order to select the best imaging technique and orient the treatment approach.

TABLE OF CONTENTS/OUTLINE

According to its topography, craniofacial pain can be classified into cranial neuralgias, secondary facial pain, or neck pain. Knowing the possible secondary causes of each type of pain enables us to select the best imaging technique and orient the treatment approach. For example, in trigeminal neuralgia or glossopharyngeal neuralgia it is important to rule out a neurovascular compression. This presentation reviews the different types of craniofacial pain, illustrating their topography and characteristic distribution through schematic anatomic diagrams and imaging findings for the different entities associated with each clinical presentation.
NR194-ED-X

Evaluation of Facial Nerve Paralysis: The Spectrum of Pathology From Cortex to Terminal Branches

All Day Room: NA Digital Education Exhibit

Participants
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TEACHING POINTS
After completing this activity, the participant will be able to: 1. Identify pertinent central anatomic structures including the facial cortex, corticobulbar tract, and the facial nuclei. 2. Trace the corticobulbar tract from the facial cortex through the brainstem, and then follow the facial nerve through the extracranial motor branches. 3. Locate the branches of the facial nerve that provide sensory and parasympathetic innervation, and identify connections to cranial nerves V, IX, and X. 4. Recognize pathology based on clinical presentation and imaging findings to provide an appropriate differential diagnosis. 5. Describe the clinical features differentiating Bell’s palsy from other causes of facial nerve paresis.

TABLE OF CONTENTS/OUTLINE
Anatomic Review
Localization of the facial motor cortex
Corticobulbar tract
Cortex to internal capsule
Internal capsule to pons
Localization of pontine nuclei
Segmental analysis of the facial nerve
Cisternal segment
Canalicular segment
Labyrinthine segment
First genu/geniculate ganglion
Tympanic segment/second genu
Mastoid segment
Extracranial facial nerves
Communications with other cranial nerves
Pathology
Bell's palsy
Infection
Tumor
Trauma
Demyelination
Vascular
Central Nervous System Tuberculosis: Magnetic Resonance Imaging Findings

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
The purpose of this educational exhibit is:
To recognize imaging features of CNS TB,
To learn the utility of advanced MRI sequences in the diagnosis of TB,
And To identify imaging findings associated with complications of CNS TB.

TABLE OF CONTENTS/OUTLINE
MRI spectrum of CNS TB
Imaging Protocol Tuberculous Meningitis
Complications Parenchymal TB
MRI features Sequelae of TBM
Intraspinal TB
TB Myelitis and Intramedullary Tuberculomas
Spinal Meningitis and Spinal Arachnoiditis
Sellar and Suprasellar Lesions in Pediatric Patients

All Day Room: NA Digital Education Exhibit

FDA Discussions may include off-label uses.

Participants
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TEACHING POINTS
Sellar and juxtasellar region has a compact regional anatomy in the center of the brain. It is at the crossroads of important brain structures, vessels and pathways. Its lesions have a diverse and heterogeneous etiology and pathophysiology. The clinical presentation varies with anatomic location and the involvement of the nearby structures. Imaging plays a crucial role in characterization, level of invasiveness, and extension of these lesions. We will be presenting interesting cases of lesions of the sellar and suprasellar region in pediatric patients from our institution.

TABLE OF CONTENTS/OUTLINE
MR Imaging of Histiocytoses: What Should Neuroradiologists Know?

Awards
Certificate of Merit

Participants
Feng Jiang, MD, New Haven, CT (Presenter) Nothing to Disclose
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TEACHING POINTS

Histiocytoses are rare systemic diseases characterized by infiltration of normal tissues by cells of the mononuclear phagocyte lineage. Recently revised classification system consists of 5 groups of diseases, L group/Langerhans-related, C group/cutaneous, M group/malignant histiocytoses, R group/Rosai-Dorfman disease (RDD) and H group/hemophagocytic lymphohistiocytosis (HLH). While osseous lesions are well recognized on CT and plain radiographs, MRI findings are less described. The goal of the abstract is to Review common and uncommon findings of histiocytosis in neuroimaging; Become familiar with differential diagnoses.

TABLE OF CONTENTS/OUTLINE

Skull Base Imaging: What Your Neurosurgeon Wants to Know

All Day Room: NA Digital Education Exhibit

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Anastasia Cruz, DO, Orange, CA (Presenter) Nothing to Disclose
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David Florioli, MD, Orange, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The neurosurgeon's approach of skull base lesions has advanced in recent decades, developments in both transcranial as well as endonasal endoscopic techniques. While there are improved outcomes and benefits to a minimally invasive approach, there are limitations associated that require an intimate knowledge of an individual's anatomy prior to surgery. Pre-surgical imaging is done routinely to guide the surgical approach and variants that may predispose a patient to iatrogenic injury. This presentation will review basic skull base anatomy and essential variants that the neurosurgeon needs to be aware of pre-operatively. An overview of skull base lesions and the neurosurgical approaches commonly employed for those lesions will be provided.

TABLE OF CONTENTS/OUTLINE
A. Anatomy overview of skull base
B. Common skull base pathology by compartment
   Anterior: meningioma, esthesioneuroblastoma, sinonasal malignancy, hemangiopericytoma, nasopharyngeal angiofibroma
   Central: pituitary adenoma, craniopharyngioma, Rathke's cleft cyst
   Posterior: acoustic neuroma, chondrosarcoma, chordoma, epidermoid, meningioma
C. Surgical approaches
   Transcranial
   Endoscopic endonasal
D. Anatomic Variants
   Sphenoid sinus variations
   Vascular variations
   Sellar variations
E. Case based review
No Strain, No Gain: Optimizing Thyroid Nodule and Neck Lymph Node Fine Needle Aspiration Yield Using Ultrasound Strain Elastography with Cytopathologic Correlation

All Day Room: NA Digital Education Exhibit

Participants
Moutasem Aljundi, MD, Washington, DC (Presenter) Nothing to Disclose
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TEACHING POINTS
Thyroid nodules have a high prevalence among the population and encompass a wide variety of pathologic subtypes. Ultrasound guided Fine Needle Aspiration Cytology (FNAC) is the definitive method to distinguish benign from malignant thyroid nodules. Ultrasound Strain Elastography has been proposed as an important adjunct tool to greyscale ultrasonography by assessing the relative stiffness of the thyroid nodule or cervical lymph node to assist in targeting the more cellular (stiffer) component of tissue for better yield during FNAC. This exhibit will review the imaging findings of different types of thyroid nodules using greyscale US and US strain elastography with their cytopathological features.

TABLE OF CONTENTS/OUTLINE
NR201-ED-X

Imaging Review of the 2017 American Joint Committee on Cancer Staging of Primary Malignant Tumors of the Osseous Spine

All Day Room: NA Digital Education Exhibit

Participants
Randall J. Ambroz, MD, Rochester, MN (Presenter) Nothing to Disclose
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TEACHING POINTS
1) Review basic characteristics of primary malignant bone tumors (osteosarcoma, chondrosarcoma, small round or spindle cell tumors, etc.)
2) Review the updated AJCC 2017 staging guidelines for primary malignant bone tumors of the spine and pelvis
   TNM characteristics and staging
   Three-tier system of histologic grading
   Current imaging recommendations
3) Review correlation between AJCC 2017 staging and disease prognosis

TABLE OF CONTENTS/OUTLINE
1) Introduction into primary malignant bone tumors of the spine and pelvis
2) Review of the updated AJCC 2017 staging guidelines for primary malignant bone tumors of the spine
   Review of basic spine anatomy
   Basic review of primary malignant tumors of the spine
   Case-based examples of different tumor types and stages
   Discussion of treatment options and prognosis
3) Review of the updated AJCC 2017 staging guidelines for primary malignant bone tumors of the pelvis
   Review of basic pelvis anatomy
   Basic review of primary malignant tumors of the pelvis
   Case-based examples of different tumor types and stages
   Discussion of treatment options and prognosis
Postoperative of the Sinuses: What Does the Radiologist Need To Know?

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
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TEACHING POINTS
The purpose of this exhibit is: To review normal anatomy; To describe the main surgical techniques and their indications; To explain postoperative changes and complications; To demonstrate the main aspects of postoperative sinus, highlighting those more common and rare; To discuss the role of image exams on evaluation of postoperative sinuses; To recognize the main cross-sectional imaging findings of main changes and complications after surgical manipulation; To discuss the role of the radiologist in the management of this patient’s.

TABLE OF CONTENTS/OUTLINE
Anatomy; Imaging methods in the evaluation of postoperative sinus; Review the main pathologies and surgical techniques; Review of imaging findings; Complications; Sample cases; Take home messages
MRI Characteristics of Acute Spinal Cord Infarction and Mimics

All Day Room: NA Digital Education Exhibit

Participants
Abel A. Belay, MD, Iowa City, IA (Presenter) Nothing to Disclose
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TEACHING POINTS
1. To describe the commonly used MR sequences and their specific roles in acute spinal cord infarction. 2. To discuss MRI features of acute spinal cord infarction. 3. To describe various etiologies of acute spinal cord infarction. 4. To discuss MRI features of acute spinal cord infarction mimics. 4. To describe pitfalls of MRI in acute spinal cord infarction.

TABLE OF CONTENTS/OUTLINE
Pathophysiology of spinal cord infarction - Arterial infarction - Venous infarction - Spinal cord TIA Commonly used MR sequences in spinal cord infarction - T2 characteristics - DWI characteristics - ADC characteristics - Post Gd characteristics Review of MRI findings of spinal cord infarction Various patterns of possible spinal cord infarction distribution Etiologies of acute spinal cord infarction MRI features of acute spinal cord infarction mimics - Demyelinating diseases - Compressive myelopathy and venous ischemia - Spinal cord contusions - AVMs and dural AVFs - Syrinx and presyrinx Pitfalls of MRI in acute spinal cord infarction
Septo-optic Dysplasia (SOD): Redesigning and Broadening the Spectrum

All Day Room: NA Digital Education Exhibit

Participants
Vinicius T. Goncalves, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
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TEACHING POINTS
The purpose of this exhibit is to: Discuss the initial concept about septo-optic dysplasia and his changes over time. Show the broad clinical spectrum related to septo-optic dysplasia and correlated malformations. Show a series of cases with diagnosis of septo-optic dysplasia associated with various brain malformations, including white matter tract abnormalities, cranial nerves hypoplasia, malformations of cortical development and posterior fossa abnormalities. Briefly discuss the current knowledge on pathogenesis of this entity. Delineate a take home message, by the analysis of didactic and representative cases with the imaging findings of septo-optic dysplasia.

TABLE OF CONTENTS/OUTLINE
Introduction SOD - Clinical spectrum and typical findings SOD - Associations White matter tract abnormalities Cranial nerves hypoplasia Malformations of cortical development Posterior fossa abnormalities Discussion Take-home message
Role of CEUS in Comparison to 4DCT for Parathyroid Adenoma Imaging

All Day Room: NA Digital Education Exhibit

Participants
Kirt Gill, Los Angeles, CA (Presenter) Nothing to Disclose
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TEACHING POINTS

The purpose of this educational exhibit is to educate the radiologist about optimal imaging diagnosis and localization of parathyroid adenomas using contrast enhanced ultrasound (CEUS). Four-dimensional computed tomography (4DCT) technique and findings will be compared to CEUS for pre-operative localization of parathyroid adenomas. The exhibit will also include an anatomic and pathophysiologic description of parathyroid adenomas, followed by a discussion of CEUS Time-Intensity Curve (TIC) analysis of blood flow and tissue perfusion. Metrics such as area under the curve (AUC), time to peak (TTP), and wash in slope (WIS) may provide improved differentiation of lymph nodes, thyroid lesions, and parathyroid lesions on CEUS. To conclude, the exhibit will highlight CEUS financial and clinical implications due to its accessibility, low cost, lack of ionizing radiation, and dynamic analysis.

TABLE OF CONTENTS/OUTLINE

• Pictorial and imaging anatomy of the parathyroid gland • Pathophysiology and clinical presentation of parathyroid adenomas • Optimal technique for using CEUS and the utilization of TIC analysis • Imaging presentation of cases highlighting CEUS technique versus 4DCT • Discussion of CEUS advantages and avenues for future research • References
New Acceleration Techniques in Neuroimaging: Why and How to Beat the Clock

All Day Room: NA Digital Education Exhibit

Awards
Magna Cum Laude

Participants
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Jerome Hodel, Paris, France (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To know technical aspects, pitfalls and artifacts of acceleration techniques
To learn how to combine accelerating techniques according to the clinical context
To understand the different strategies that become available: gaining time (rapidly scanning uncooperative patients, adding informative sequences to the protocol, or simply imaging more patients), or improving image quality with the same scan time

TABLE OF CONTENTS/OUTLINE
Uncommon but Not Forgotten: MRI-based Review of Pediatric and Adolescent Spinal Masses

All Day Room: NA Digital Education Exhibit

Participants
Hamid Rajebi, MD, San Antonio, TX (Presenter) Nothing to Disclose
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TEACHING POINTS
1. Review classification, imaging approach and differential diagnosis of spinal tumors in pediatric and adolescent patients. 2. Illustrate cases of spinal tumors in our institution with presentation of clinical and pathological correlation. 3. Describe the spectrum of MRI features of each tumor with discussion of potential pitfalls in proper diagnosis.

TABLE OF CONTENTS/OUTLINE
Introduction Anatomic Classification of Spinal Tumors - Step wise approach to spinal lesions Intramedullary neoplasms - Astrocytoma - Ganglioglioma - Ependymoma - Hemangioblastoma - Metastatic disease Intradural extramedullary neoplasms - Nerve sheath tumors (Neurofibroma, Schwannoma) - Myxopapillary ependymoma - Meningioma - Metastatic disease Extradural neoplasms - Bony lesions - Epidural space tumors - Miscellaneous (Langerhans cell histiocytosis) - Extraspinal tumors with spinal invasion Conclusion
NR208-ED-X

Imaging Intracranial Melanoma: Don't Shoot in the Dark When You See Something Bright

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
1. To review the relevant imaging characteristics of intracranial melanoma that impacts clinician's choice of management.
2. Typical and atypical imaging presentations of intracranial melanoma.
3. Expecting the unexpected changes during treatment.
4. Key demographic, biochemical and prognostic indicators which radiologist can provide to clinician.

TABLE OF CONTENTS/OUTLINE
1. Epidemiology and biochemical characteristics of intracranial melanoma.
2. Intracranial locations of involvement.
3. Imaging techniques and protocol.
4. Typical imaging features of intracranial melanoma.
5. Atypical imaging features of intracranial melanoma.
6. Post-therapy imaging features - Ipilimumab-induced hypophysitis.
7. Familiarity with imaging of complications.
NR209-ED-X

Non-tumorous Disease of the Spinal Cord: From A to Z

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
1. To exclude spinal cord tumor from non-tumorous myelopathy. 2. To review various category of non-tumorous myelopathy focusing on the differential diagnostic clue.

TABLE OF CONTENTS/OUTLINE
1. Non-tumorous myelopathy vs spinal cord tumor 2. Types and differential diagnostic clues of Non-tumorous myelopathy
Compressive  Traumatic  Inflammatory  Demyelination  Para-infectious  Autoimmune  Paraneoplastic  Non-inflammatory  Vascular
Metabolic  Intrathecal chemotherapy induced myelopathy  Radiation
A Comprehensive Review of Glioblastoma

All Day Room: NA Digital Education Exhibit

Participants
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TEACHING POINTS
1. To illustrate the imaging findings of glioblastoma (GBM). 2. To describe the post-treatment imaging, intraoperative surgery imaging correlation and the criteria of response. 3. To review the prognostic radiological findings. 4. To explain some research in GBM.

TABLE OF CONTENTS/OUTLINE
GBM is the most common primary brain malignancy. Despite complete treatment comprising maximum safe resection, radiotherapy and concomitant adjuvant chemotherapy, median survival is 14 to 18 months. Radiology has an important role during the presurgical evaluation, within the 72 hours after the surgery, chemoradiotherapy and through the follow-up. Multiparametric gadolinium-enhanced MRI is the standard technique for the evaluation of GBM. It is an expansive enhancing lesion with different patterns (enhancing lesion, cystic-necrotic center and vasogenic edema). Different MRI modalities, such as DWI, DTI, PWI and MR spectroscopy are useful in the diagnostic workup and follow up. We retrospectively evaluated 125 cases of GBM diagnosed in our center, made an intraoperative, pathologic approach, focus on the Response Assessment in Neuro-Oncology Criteria (RANO). We also explain the term pseudoprogression, pseudoresponse and differentiate from other complications like post surgery infarct; also the GBM research in our center.
NR211-ED-X

Midbrain, Pons and Medulla Anatomy and Syndromes: An Attempt to (Brain) Stem the Rising Tide of Uncertainty

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit
Identified for RadioGraphics

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TEACHING POINTS

The purpose of this exhibit is: To illustrate the major brainstem tracts and nuclei using a combination of high resolution MRI (including 9.4 T) and diagrams To illustrate the developmental anatomy of the brainstem To correlate the anatomy of the tracts with the physiological function. To describe common brainstem syndromes and correlating with the anatomical locations. To illustrate the subtle MRI findings of the brainstem syndromes. To illustrate some of the congenital brainstem conditions

TABLE OF CONTENTS/OUTLINE

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**TEACHING POINTS**
1. To understand pathophysiology of cerebellar ataxia.
2. To discuss the MRI patterns of acute, subacute and chronic causes of cerebellar ataxia.

**TABLE OF CONTENTS/OUTLINE**
MRI in 100 children who presented with cerebellar ataxia from 2015 to 2017, revealed 20 cases which are as follows:

**Acute causes:** cerebellitis, infarction.

**Subacute causes:** Demyelination, metabolic maple syrup urine disease, phenitoin induced cerebellar atrophy, medulloblastoma, atypical rhabdoid tumor and metastases.

**Chronic causes:** Ataxia telangiectasia, Joubert syndrome, rhombencephalosynopsis, Dandy walker malformation, Arnold Chiari malformation(type I,II & III), pilocytic astrocytoma, ependymoma.

We illustrate key imaging points of these pathologies with appropriate clinical background to arrive at the right diagnosis.
Eagle Syndrome: A Comprehensive Review

All Day Room: NA Digital Education Exhibit

Participants
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TEACHING POINTS
The purpose of the educational exhibit is to: - discuss the relevant anatomical and embryological background of the styloid process - explore the possible etiologies and pathogenesis of the disease - convey normal and pathological features of styloid process by different modalities of imaging. - to explore the diagnosis of Eagle syndrome in face of lateral cervical pain without other obvious etiology. - to explore the management of the syndrome

TABLE OF CONTENTS/OUTLINE
Definition Relevant anatomy and Embryology Etiology and pathogenesis Diagnosis and Radiological features Management
NR215-ED-X

Dive and Discover: Neurodegenerative Disorders Revisited

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

- To be aware of the various neurodegenerative disorders.
- To discuss the imaging appearances of the spectrum of neurodegenerative disorders.

TABLE OF CONTENTS/OUTLINE

MR Imaging of Chiasmatic Pathologies: To Cross Over From Common to Uncommon

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
1. To describe the imaging anatomy of optic chiasm
2. To discuss the imaging spectrum of primary and secondary pathologies involving the optic chiasm in a case based approach.

TABLE OF CONTENTS/OUTLINE
Retrospective review of MRIs from 2016 to 2017, revealed 25 different cases which involved chiasm and are as follows:

Primary pathologies:
- Congenital: Septooptic dysplasia and neurofibromatosis.
- Infective: Tuberculosis.
- Inflammatory: Lymphocytic hypophysitis and granulomatous hypophysitis.
- Neoplastic: Hypothalamic-chiasmatic glioma.

Post-operative: Post-operative herniation of optic chiasm into the sella.

Secondary pathologies:
- Craniopharyngioma.
- Pituitary adenoma.
- Glioblastoma multiformae.
- Rosai-Dorfman disease.
- Suprasellar paraganglioma.
- Giant internal carotid artery aneurysm which cause secondary invasion/compression of chiasm.

We illustrate key imaging points of these pathologies with clinical correlation to arrive at the right diagnosis.
The Road Less Travelled: MR Imaging of Rare Neoplasms of Cerebellum

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

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TEACHING POINTS
1. To be aware of rare acquired cerebellar neoplasms which have about one to three percent incidence.2. To utilise advanced MR imaging tools to arrive at the right diagnosis wherever necessary.

TABLE OF CONTENTS/OUTLINE
Retrospective MRI brain studies with cerebellar pathologies from 2015 to 2017, revealed 9 rare cerebellar tumors which are as follows:1. Melanoma.2. Liponeurocytoma.3. Atypical dermoid.4. Lymphoma.5. Dysplastic cerebellar gangliocytoma.6. Glioblastoma multiformae.7. Anaplastic oligodendroglioma.8. Atypical teratoid rhabdoid tumour.9. Adult medulloblastoma. We illustrate key imaging points of these neoplasms to arrive at the diagnosis with histopathological correlation.
Stroke or Not Stroke? A Daily Dilemma: Imaging Findings of Stroke Mimics

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

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TEACHING POINTS
The purpose of this exhibit is: 1. To discuss the most common conditions other than stroke that can cause acute focal neurological deficits. 2. To review the imaging findings that can help in the diagnosis of stroke mimics. 3. To explain the usefulness of MRI and particularly of CT and MR perfusion maps in the diagnosis.

TABLE OF CONTENTS/OUTLINE
The Good, the Bad and the Ugly of Meningiomas: Surgical Considerations and Approaches the Radiologist Should Know

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
Meningiomas can appear in a variety of extra-cranial locations and contribute to regional disturbances. Although the majority are benign in etiology, surgical removal is indicated when encroachment onto critical structures occurs and/or symptoms develop. Knowledge of the common and uncommon locations of meningiomas, and the critical structures they disrupt, helps the radiologist and neurosurgeon determine when surgical removal is beneficial for the patient. Accurate imaging interpretation is crucial in guiding the ideal surgical approach. The purpose of this exhibit is to review 1) various locations of meningiomas and the critical structures they locally disrupt and 2) common surgical considerations and approaches based on these imaging findings.

TABLE OF CONTENTS/OUTLINE
A. Brief review of meningiomas (incidence, imaging characteristics, locations) B. Management guidelines - observation versus surgical removal C. Case based review of surgical considerations and approaches to a meningioma based on location, size, and/or involvement of adjacent structures - Examples: optic nerve sheath, olfactory groove, planum sphenoidale, tuberculum sellae, petroclival, juguloforamen, foramen magnum, lateral ventricles, falcotentorial, posterior fossa, intraosseous, intraspinal D. Introduction to new imaging/surgery techniques
NR221-ED-X

What is Your Diagnosis? A Pictorial Review of Head and Neck Muscular Pathology

All Day Room: NA Digital Education Exhibit

Awards
Cum Laude

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TEACHING POINTS

The purpose is: To review the anatomy of the main muscular groups in the H&N To describe the characteristic imaging features of various accessory muscles To review the main muscular pathology of the H&N

TABLE OF CONTENTS/OUTLINE

The review of muscle groups in H&N imaging is frequently overlooked. Ultrasonography (US), computed tomography (CT) and magnetic resonance (MR) imaging provide detailed information about variants and pathology of the H&N muscles. These entities may be asymptomatic or may present as a soft tissue mass. To highlight the importance of their evaluation, we will present some easy and some challenging case-based scenarios. They will be presented in a quiz format and their differential diagnosis will be tackled in the discussion. The outline is: Anatomical review. Anatomic variants: - Normal focal discontinuity: Mylohyoid "boutonnière" deformity. - Muscle absences: Agenesis of trapezius and sternocleidomastoid muscles. - Supernumerary muscles: Levator claviculae muscle. Conditions presenting as a palpable swelling: - Fibromatosis colli. - Idiopathic masseter hypertrophy. - Intramuscular vascular malformations. - Infectious/inflammatory. - Intramuscular tumors: lipomatous, vascular and sarcomas. Conditions secondary to treatment: - Muscular denervation. - Intramuscular hematoma. Take home messages.
Multimodality Imaging of Intraventricular Tumors

All Day Room: NA Digital Education Exhibit

Participants
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TEACHING POINTS

To discuss the embryologic development of the central nervous system and its correlation with the most common intraventricular tumors. To illustrate the computer tomography (CT) and magnetic resonance imaging (MRI) findings that characterize the most important intraventricular tumors, based on cases from our institution.

TABLE OF CONTENTS/OPTLINE

Embryologic development of the central nervous system, highlighting the ventricular system. Clinical presentation of intraventricular tumors. Epidemiology of intraventricular tumors. Main differential diagnosis (ependymoma, subependymoma, central neurocytoma, choroid plexus papilloma, meningioma, subependymal giant cell astrocytoma and metastasis). Examples of cases and their most relevant CT and MRI findings, including data from spectral and perfusion sequences. Summary and take-home messages.
Restricted Diffusion in CNS Neoplasms: Assumptions and Applications

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
- To make the readers aware of the many benign and malignant CNS neoplasms that cause restricted diffusion on MRI.
- To correlate the restricted diffusion on MRI with the histopathological characteristics of the tumors.
- To discuss their applications in diagnosis.

TABLE OF CONTENTS/OUTLINE
Retrospective analysis of the database from 2013 to 2017, revealed 630 different tumors with restricted diffusion out of which 20 different cases are discussed; all of which had histopathological correlation. The cases discussed are: Benign CNS neoplasms: Meningioma, pituitary adenoma, central neurocytoma, desmoplastic infantile gangliogioma, gangliocytoma, pilomyxoid astrocytoma, pleomorphic xanthoastrocytoma, pilocytic astrocytoma, pineocytoma, atypical choroid plexus papilloma and schwannoma. Malignant CNS neoplasms: Lymphoma, medulloblastoma, glioblastoma multiforme, anaplastic astrocytoma, metastases, anaplastic ependymoma, primary neuroectodermal tumour, pineoblastoma and gliosarcoma. Radio pathological correlation is done and a possible underlying cause is hypothesized in all benign and malignant tumors. These postulations help in accurate pre operative diagnosis of the CNS neoplasms, especially in the atypical and rarer ones.
NR225-ED-X

Drooling Over Amazing Images: Salivary Gland Imaging - Normal and Abnormal

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

1. To understand the anatomy of the parotid gland, submandibular glands and the surrounding region. 2. To learn about the various diseases that can affect the salivary glands and how to diagnose these conditions. 3. New techniques like US elastography. 4. Special precautions to be taken when performing a biopsy of lesions in the salivary gland. 5. Technique of sialography including contrast enhanced US sialography.

TABLE OF CONTENTS/OUTLINE

1. US, CT, MRI anatomy of the parotid gland with illustrations with an understanding of the embryology. 2. Lesions affecting the parotid gland will be discussed including the imaging appearance on various modalities. These include: a. Variations in anatomy including the accessory parotid gland. b. Common masses affecting the parotid gland with differential diagnosis of these lesions and imaging appearance, including mucoepidermoid tumors, pleomorphic adenomas and Warthin's tumor. c. Diffuse diseases - HIV related infection, Sjoren's syndrome and sarcoidosis. d. Infections - acute infections, abscesses and granulomatous diseases including fungal infections, Wegener disease, tuberculosis, syphilis, and cat-scratch fever. e. Submandibular gland: Imaging appearance of masses, diffuse diseases. Etiology and techniques of evaluating sialolithiasis which will include US, retrograde sialogram and MRI.
Rare Pathologies in the Spine: Unusual Locations, Unusual Manifestations Causing Difficulties and Diagnostic Challenges

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
- To make the radiologist aware of the rare lesions whose incidence of occurrence is about 1-2% in odd locations of spine.
- To discuss the MRI patterns of these lesions in a case based approach.
- To understand how imaging helped in management in this odd spectrum.

TABLE OF CONTENTS/OUTLINE
2000 MRIs from 2015 to 2017, revealed 16 such cases, all of which had histopathological / clinical follow up. The cases discussed are: Neurocysticercosis in vertebral body, hydatid cyst in extra and intradural location, co-existence of meningioma and schwannoma in intradural location, schwannoma in conus with blood-fluid level, idiopathic epidural fibrosis, inclusion dermoid cyst in post operative status, spontaneous pneumorrhachis, extradural neurofibroma with dynamic myelomalacic changes in cord, hyperparathyroidism involving multiple vertebrae, primary spinal epidural lymphoma, atypical sequestrated disc, Potentially reversible encephalopathy syndrome (PRES) with cord involvement, holocord ependymoma, Rosai-Dorfman disease involving vertebral body with epidural extension and kissing vertebral arteries causing compression of cord at cervicomedullary junction. We illustrate key imaging points with an algorithmic approach to these pathologies to arrive at the right diagnosis and also illustrate the imaging impact on management in this rare spectrum.
Spinal Synovial Cysts: A Clinico-radiological Review including Current and Novel Interventional Therapeutic Techniques

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

1. Learn the clinicopathology and radiological features of spinal synovial cysts.
2. Learn the current treatment options available to patients, outlining the risks and benefits of surgery versus percutaneous interventional treatments.
3. Understand the methodology and technique of current established percutaneous treatments for spinal synovial cysts.
4. Understand the current evidence for percutaneous treatments, based on a literature review of published data analysing the outcomes for percutaneous treatment of spinal synovial cysts.
5. Understand the method of a novel percutaneous technique used in our institution for the treatment of spinal synovial cysts.

TABLE OF CONTENTS/OUTLINE

1. Clinicopathology of spinal synovial cysts.
2. Radiological appearances of spinal synovial cysts on MRI and CT.
3. Risk and benefits of current treatments available to patients (surgery vs. percutaneous treatment).
4. A review of the current percutaneous treatments for synovial cysts rupture including:
   A. Choice of image guidance.
   B. Cyst entry approach.
   C. Choice of puncture needle and steroid.
5. A literature review on the published data looking at the outcomes of each percutaneous treatments.
6. Description of a novel percutaneous technique recently introduced in our institution.
Ultra High-resolution CT in Head and Neck Cancer; Clinical Usefulness and Accuracy

All Day Room: NA Digital Education Exhibit

Discussions may include off-label uses.

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TEACHING POINTS
Mecanism and function of ultra high-resolution CT To show the accuracy of ultra-high-resolution CT (U-HRCT) in head and neck cancer To evaluate the clinical usefulness of U-HRCT in preoperative diagnosis, compared with that of a Multiple detector CT (MDCT)

TABLE OF CONTENTS/OUTLINE
1. Mechanisms and functions of U-HRCT
2. Improvement of the spatial resolution - Invasion depth of the tumor - The evaluation of lymph node metastases (presence of extra-nodal invasion)
3. Reduction of metallic artifact
4. Detectability of the tumor-feeding arteries of head and neck cancer with U-HRCT angiography
5. Summary and future directions
NR229-ED-X

Imaging Findings in Gliosarcoma: A Single Institution Experience

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
Review a series of patients with gliosarcomas of an Oncology Institute and better understand the image characteristics of the gliosarcomas, as well as their molecular and epidemiological characteristics.

TABLE OF CONTENTS/OUTLINE
Gliosarcomas represent a clinically challenging group of tumors due to its rarity, poor prognosis, and the limited experience in published literature. The current accepted definition of gliosarcoma is a lesion with clearly identifiable biphasic glial and metaplastic mesenchymal components. We analyzed imaging, pathology and genetic characteristics of 11 primary gliosarcomas and 1 secondary to radiotherapy for treatment of GBM. The mean age at diagnosis was 59 years without predilection for sex. The mean survival of the patients was 17 months. The lesions were predominantly single and multiple in 2 cases. The most affected lobe was the parietal, followed by frontal, temporal and occipital. In one case the lesion was exclusively nucleocapsular. Due to their rarity and few case reports in literature, gliosarcomas are treated and managed like classic GBMs, despite their more reserved prognosis and greater tendency to intra and extracranial metastases. Knowledge of this variant of glioblastomas is important and should be recognized primarily in the new era of targeted therapies and molecular genetic.
Radiology of Mild Cognitive Impairment: Conversion into Alzheimer’s disease or Dementia with Lewy Bodies

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
The purpose of this exhibit is: 1. To review recent literatures regarding the various imaging modalities being utilized for better understanding of Alzheimer’s disease and dementia with Lewy bodies. 2. To review 52 cases in mild cognitive impairment. 3. To review cases with the conversion to Alzheimer’s disease or dementia with Lewy bodies from mild cognitive impairment. 4. To explain the possibility of the prediction for conversion to Alzheimer’s disease or dementia with Lewy bodies from mild cognitive impairment.

TABLE OF CONTENTS/OUTLINE
1. Learn approach for the diagnosis of probable AD and probable DLB. 2. Review reports of key diagnostic modalities being investigated in the detection of Alzheimer’s disease and dementia with Lewy bodies. 3. Relationship between clinical features and gray matter atrophy on MR imaging. 4. Relationship among clinical features, 123I-IMP brain perfusion SPECT, and 123I-MIBG myocardial SPECT. 5. Review cases with the conversion to Alzheimer’s disease or dementia with Lewy bodies from mild cognitive impairment. 6. Summary
How to Create the Best T1 Contrast in Spin Echo Brain Imaging at 3.0T MR System

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
The purpose of this exhibit is:
To evaluate the exciting flip angle (FA) and refocusing FA.
To explain the relationship between pre saturation pulse and magnetized transfer (MT) effect.
To explain the relationship between chemical shift selective (CHESS) pulse and MT effect.
To present the best parameters.

TABLE OF CONTENTS/OUTLINE
Relationship of exciting FA to T1 contrast
Relationship of refocusing FA to signal intensity non-uniformity
Relationship of pre saturation pulse to T1 contrast
Relationship of CHESS pulse to T1 contrast
 Radiopathologic Correlation of the Thyroid Nodules

All Day Room: NA Digital Education Exhibit

FDA Discussions may include off-label uses.

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TEACHING POINTS

To evaluate the association between the different ultrasound characteristics and the cytological and histological diagnosis of the lesions. To analyze the VPP, NPV, sensitivity and specificity assigned to the different echographic descriptors To study the likelihood of carcinoma for individual and combined descriptors, regardless of the initial assigned category Identify ultrasound descriptors that may be considered as risk factors for malignancy of the lesion

TABLE OF CONTENTS/OUTLINE

Four echographic descriptors of risk have been defined because of their sensitivity, specificity, and PPV values, which present a greater association with malignancy, and correspond to markedly diminished echogenicity, microcalcifications, microlobular or irregular border, and non-parallel morphology. The echographic descriptor with the greatest association with malignancy is the markedly diminished echogenicity followed by the microlobular border. Nodules of spongiform composition, cystic or partially cystic, without other ultrasound criteria of suspicion, can be considered benign. As ultrasound criteria of suspicion increase, the risk of malignancy increases.
Comprehensive Review of Neck Dissection and Reconstructive Surgeries: Radiological Perspective

All Day Room: NA Digital Education Exhibit

FDA Discussions may include off-label uses.

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TEACHING POINTS
1. To familiarize with CT and MRI appearance of different soft tissue graft surgeries in neck. 2. To demonstrate the evolution of different soft tissue grafts on imaging. 3. To recognize the early signs of graft failure. 4. To understand the drainage territories of different lymph node groups in the neck. 5. To understand rationale behind different neck dissection surgeries.

TABLE OF CONTENTS/OUTLINE
- Imaging based anatomical perspective of the varied neck dissection surgeries for treatment of head and neck malignancies. - Emphasis on the precise anatomical details and differentiating them from the residual / recurrent tumor tissue. - Case based review of different neck surgeries and differentiating radiation induced changes from surgical flaps.
Cinematic Rendering in Neuroradiology: A New Era in 3D Postprocessing

All Day Room: NA Digital Education Exhibit

FDA Discussions may include off-label uses.

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TEACHING POINTS

After reviewing this exhibit on cinematic rendering, the viewer will:
1. Understand the basis for new visualization technology termed 'cinematic rendering' which now permits unprecedented photorealistic imaging of the body with reasonable post-processing times.
2. Learn how to optimize acquisition of CT and MRI datasets suitable for cinematic post-processing.
3. Through many presented neuroradiology examples, see how cinematic rendering has the possibility to transform the clinical role of 3D post-processing for both physicians and patients, because of improved depiction of pathology and better understanding of involved anatomy.

TABLE OF CONTENTS/OUTLINE

1. Introduction to cinematic rendering
2. Optimization of datasets for cinematic rendering
3. Neuroradiology examples of cinematic rendering:
   a. Craniofacial trauma
   b. Craniosynostosis
   c. Evaluation of vascular abnormalities - Aneurysms - Intra and extracranial vascular malformations
   d. Spine - Segmentation anomalies - Scoliosis
4. Conclusion/Future Directions

Awards

Certificate of Merit

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Dozen Mystic MRI Imaging Signs of Spinal Pathology Every Resident Must Know

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
Enlist all the classical signs of Imaging of non neoplastic cord disease --Elucidate the imaging signs and their patho physiological correlates with emphasis on differential Diagnosis

TABLE OF CONTENTS/OUTLINE
1- Owl's eye sign of Cord ischemia or infarction. 2- Inverted v sign of Subacute combined degeneration 3- 'Y' Sign of spinal epidural Lipomatosis 4- Scalpel sign of Dorsal Arachnoid Web 5- Long segment sign of neuromyelitis Optica (NMO) 6- Double fragment sign: Transligamentous Migration of intervertebral disc 7- Dough nut or Target sign - Sequestered, migrated Disc 8- wedge shaped Terminus sign: Caudal Regression Syndrome 9- Flattened Cord sign of Hirayama's Disease 10- Bright Spotty Lesions of NMO 11- Open ring sign of Cord MS 12- Anterior Kink Sign- of Spontaneous Cord herniation: focal ventral displacement and angulation of the thoracic spinal cord, with or without cord thinning
NR237-ED-X

Imaging Approach to the Temporomandibular Joint with Computed Tomography and Magnetic Resonance with Arthroscopic Correlation Surgical Treatment

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
To illustrate the spectrum of findings in temporomandibular joint (TMJ) derangement in magnetic resonance (MR) and correlate with arthroscopic findings when available
To highlight the role of computed tomography (CT) in the diagnosis of TMJ pathology
To show the most common pathology and surgical therapeutic procedures and limitations

TABLE OF CONTENTS/OUTLINE
TMJ dysfunction is a common condition that is best evaluated with MR. This technique evaluates disk morphology and location relative to the condyle in both closed and open-mouth positions. It also depicts the retrodiskal layers and the presence of joint effusion. CT better evaluates calcified structures such as intraarticular loose bodies and osseous lesions and provides an anatomic map prior to prosthesis implant surgery. We show the most common TMJ pathology. We correlate MR findings with arthroscopic diagnosis. We discuss arthroscopy and open surgery indications and its advantages and drawbacks.
NR238-ED-X

Neurosyphilis: Typical and Atypical Findings

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
The purpose of this exhibit is: 1. To review the pathophysiology of Neurosyphilis 2. To discuss the typical and atypical findings so that radiologists can optimize detection of the broad spectrum of radiologic appearances in neurosyphilis in order that appropriate clinical testing and treatment can be initiated

TABLE OF CONTENTS/OUTLINE
Pathophysiology Changes in Neurosyphilis
Review of typical and atypical imaging findings - MRI
Indicate several strategic factors that should be considered in tailoring the radiologic work-up to optimize detection of the broad spectrum of findings in neurosyphilis
Sample Cases of Neurosyphilis - Mimics Neuromyelitis optica - Meningoencephalitis - Chronic encephalitis - Vasculitis of the Central Nervous System - Vertebral Artery Aneurysm
Summary
NR239-ED-X

T2-Mapping of Globes and Orbits: A Different Sight Through the Looking Glass

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
1. Describe the technical adjustments necessary to perform, in globes and orbits T2-mapping sequence. 2. Review advantages, limitations and pitfalls of T2-mapping in that uncommon location. 3. Test, in several clinical scenarios, the potential applications and feasibility of this novel technique compared with conventional sequences emphasizing in the T2 relaxation time quantification.

TABLE OF CONTENTS/OUTLINE
Cerebellar Atrophy in Children: An Approach of the Differential Diagnoses

All Day Room: NA Digital Education Exhibit

Awards
Cum Laude

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TEACHING POINTS
- To know how to indentify the differents imaging-patterns of cerebellar atrophy.
- To understand and being able to identify additional imaging findings regarding cerebellar atrophy, that could narrow the differentials diagnosis.

TABLE OF CONTENTS/OUTLINE
- Definition of cerebellar atrophy
- Different imaging patterns of cerebellar atrophy
- Additional imaging findings that can narrow the differential diagnosis
Post-Transplantation Disorders of the Central Nervous System: An Approach of the Differential Diagnoses

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
- Show that the spectrum of neurological complications varies with the type of organ transplanted, the indication for the procedure, and the intensity of immunosuppression as well as the latency after transplant.
- Learn to recognize imaging patterns, objecting to narrow down the possible diagnosis as infectious, posttransplantation lymphoproliferative disorder, immune reconstitution inflammatory syndrome, posterior reversible encephalopathy syndrome and others.

TABLE OF CONTENTS/OUTLINE
- Neurological Complications after solid organ transplantation.
- Different imaging patterns of post-transplantation disorders of the central nervous system.
NR243-ED-X

Imaging of Pituitary Infundibulum Inflammatory Lesions: Infundibulohypophysitis and Differential Diagnosis

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
- Describe the image features of pituitary infundibulum inflammatory lesions and their differential diagnosis.
- Characterize associated intracranial findings that may narrow the differential diagnosis.
- Propose a approach to a pituitary infundibulum lesions.

TABLE OF CONTENTS/OUTLINE
NR245-ED-X

Vascular Beading & Stroke: Pattern Based Approach to Diagnosis

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

1. A multitude of conditions present with stroke & show beading of the neck and/or intracranial vasculature on imaging. CT, MR & catheter angiography findings of these conditions are depicted. 2. Based on involvement, a pattern based approach to diagnosis is suggested. Etiologies are classified as those secondary to abnormalities within: a) vascular wall, b) arterial lumen, & c) extravascular milieu. 3. Abnormalities affecting the vascular wall include arterial dissection, fibromuscular dysplasia & primary and secondary CNS vasculitis. Companion case of reversible cerebral vasoconstriction is depicted with a note on differentiation from vasculitis. 4. Vasoactive substances within the blood, such as cocaine metabolites, result in vasospasm & stroke. Extravascular causes of vascular beading include subarachnoid hemorrhage, chemical meningitis & vasospasm after with skullbase tumor resection. 5. Familiarity with the imaging findings of the above listed conditions is invaluable in narrowing the differentials & suggesting the diagnosis.

TABLE OF CONTENTS/OUTLINE

1. Pictorial review of conditions showing vascular beading on imaging with concurrent strokes. 2. Classification of abnormalities based on involvement of the vascular wall or otherwise; and classic imaging findings of each. 3. Diagnostic algorithm to narrow the differentials.
NR246-ED-X

Infarction in the Subcallosal Artery and Recurrent Artery of Heubner Following Surgical Repair of the Anterior Communicating Artery Aneurysm: A Causal Relationship with Postoperative Amnesia and Neuropsychological Findings

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

The postoperative infarctions following repair of the anterior communicating artery (ACoA) aneurysms are classified into the following 3 types: involvement of the subcallosal artery (the largest and unpaired perforator of the ACoA), its neighboring perforator, the recurrent artery of Heubner (RAH) (a major perforating artery from the A1-2 junction of the anterior cerebral artery), and a combination of both. Because postoperative amnesia, which has been repeatedly reported in patients following repair of ACoA aneurysms, can seriously affect the patient's quality of life, we sought to discuss the causal relationship between the three infarction patterns and postoperative amnesia.

TABLE OF CONTENTS/OUTLINE

1. Anatomy and the vascular supply of the Subcallosal artery and RAH in the basal forebrain
2. Three key infarction patterns and a causal relationship with postoperative neuropsychological findings

Amnesia is most likely caused by an infarction in the territory of the subcallosal artery, particularly in the column of the fornix. RAH infarction alone does not cause significant amnesia, but often associated with impairment of the frontal function, behavior change, depression and abulia. RAH infarction often associated with a subcallosal artery infarction could significantly worsen the long-term outcome of amnesic patients.
NR247-ED-X

Traumatic Vascular Injuries of the Head and Neck: What the Radiologist Needs to Know

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

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TEACHING POINTS
1. Understand the difference between blunt and penetrating trauma. 2. Become familiar with the indications for vascular imaging of the neck, in particular, the modified Denver screening criteria. 3. Become familiar with the imaging modalities used to assess for a cerebrovascular injury. 4. Understand and apply the Biffl (Denver) scale for blunt cerebrovascular injury. 5. Recognize the common vascular injuries of the head and neck associated with blunt and penetrating trauma.

TABLE OF CONTENTS/OUTLINE
Define the difference between blunt and penetrating trauma. Review the imaging techniques used for the evaluation of cerebrovascular injuries and the current role of dual energy CT. Review indications for vascular imaging, with an emphasis on the Modified Denver Screening Criteria. Review the Biffl (Denver) scale for blunt cerebrovascular injury (BCVI) and the associated stroke rate with each grade. Case examples of each type of cerebrovascular injury secondary to blunt and penetrating trauma will be reviewed. Cases include much less common cerebrovascular injuries such as a carotid-internal jugular vein fistula and basilar artery rupture associated with atlanto-occipital dislocation. Summary and Conclusion.
NR248-ED-X

Imaging Evaluation of Trigeminal Neuralgia: A Segmental Approach

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
- Classic trigeminal neuralgia is an episodic stabbing facial pain syndrome followed by a period of relief in the sensory distribution of the trigeminal nerve. - It is most commonly secondary to neurovascular conflict (80-90%), which refers to symptomatic compression of the cisternal segment of the trigeminal nerve by an artery or less commonly a vein. - A number of additional lesions occurring anywhere from the trigeminal nuclei to the most distal branches can cause facial pain.

TABLE OF CONTENTS/OUTLINE
- Introduction to trigeminal neuralgia
- Anatomy of the trigeminal nerve
- Neurovascular conflict
- Relevant differential considerations will be reviewed following a segmental approach: brainstem, cisternal space, Meckel's cave, cavernous sinus, extracranial space
NR249-ED-X

Getting On My Nerves: Cranial Nerve Lesions

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
The purpose of this exhibit is to familiarize radiologists with the differential diagnosis of cranial nerve (CN) lesions. - Multiple metastases to the CN and dura can simulate neurofibromatosis type 2, however an older age of presentation should raise suspicion for metastases. - Metastatic disease to the CN can occur through direct extension from a dural-based or bone lesion, subarachnoid seeding, or perineural seeding. - Although rare, ganglioneuroma can have an identical appearance to schwannoma and should be considered in the differential diagnosis. - Rosai Dorfman disease is a rare histiocytic disorder with rare CNS involvement presenting with dural-based masses, which can be inseparable from the CN. - Sarcoidosis can cause enhancement along CN or the meninges and can mimic other infectious, inflammatory, and neoplastic lesions. - Marked smooth enhancement of the facial nerve on contrast-enhanced MRI is characteristic of Bell’s palsy.

TABLE OF CONTENTS/OUTLINE
1. Review of normal cranial nerve appearance on MRI. 2. Epidemiology, pathophysiology, histopathology correlation and imaging appearance on MRI of the following cranial nerve lesions will be discussed: isolated schwannoma, multiple schwannomas in the setting of NF2, metastasis, ganglioneuroma, Rosai Dorfman disease, facial nerve hemangioma, lymphoma/leukemia, sarcoidosis, and Bell’s palsy.
Ultrasound Evaluation of Neck Lumps and Bumps

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

To review common and uncommon lesions found on ultrasound evaluation of the neck. To discuss the imaging features of neck lesions found on ultrasound. To discuss and improve the differential diagnosis of lesions encountered on neck ultrasound.

TABLE OF CONTENTS/OUTLINE

Discuss the indications, advantages, and limitations for use of ultrasound in the evaluation of neck lesions. Review the congenital lesions which can be found on neck ultrasound. Review benign lesions which can be found on neck ultrasound. Review malignant lesions which can be found on neck ultrasound.
### Missed, Misinterpreted, and Misleading Imaging Findings in Brain Tumors and Tumor-Like Lesions

All Day Room: NA Digital Education Exhibit

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#### TEACHING POINTS

Cerebral masses which expand the ventricular system may be primary intraventricular or paraventricular with exophytic growth into the ventricle. In adults, a large necrotic mass protruding into the ventricular system should raise the suspicion for exophytic glioblastoma. A predominantly cystic mass located in the posterior third ventricle and sylvian aqueduct, with no significant hydrocephalus, should raise the suspicion for ependymoma. The floor of the third ventricle and the pituitary stalk are atypical locations for CNS lymphoma. However, lymphoma should be considered in these locations in case of mass-like homogeneous enhancement which conforms to the underlying brain anatomy, as opposed to disrupting or displacing it. Subcortical hydatid cysts in the brain may penetrate the dura and cause bone erosion. The resulting intradiploic abscess shows MRI features very similar to eosinophilic granuloma. Subacute stroke may appear very similar to glioblastoma on MRI. The findings which favor subacute stroke with subsequent brain infarction are gyral contrast enhancement and T1 gyral hyperintensity with no corresponding T2* hypointensity.

#### TABLE OF CONTENTS/OUTLINE

This exhibit aims to present brain tumors and tumor-like lesions with misread or atypical imaging findings, which simultaneously display subtle clues to their true origin.
Keratocystic Odontogenic Tumor and Nevoid Basal Cell Carcinoma Syndrome: What Radiologists Need to Know

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

Keratocystic odontogenic tumor (KCOT) is one of the common odontogenic tumors, and particularly when multiple, may be associated with nevoid basal cell carcinoma syndrome (NBCCS), also known as basal cell nevus syndrome, multiple basal cell carcinoma syndrome, Gorlin syndrome or Gorlin-Goltz syndrome. NBCCS is an uncommon autosomal dominant inherited condition involving multiple body systems such as the skin, central nervous system, eyes, endocrine system, and bones including jaw. Basal cell carcinomas and KCOTs are seen in the majority of the patients with NBCCS. Although NBCCS is not very common, the imaging characteristic is unique and a radiologist may be able to diagnose clinically unrevealed NBCCS. The purpose of this exhibit is: 1. To learn about NBCCS and KCOTs2. To review imaging findings of NBCCS3. To review imaging findings of KCOTs

TABLE OF CONTENTS/OUTLINE

1. Understanding NBCCS: genetic background, diagnosis, treatment, and outcome2. Imaging characteristics of NBCCS: KCOT and other lesions including dural calcification, bifid ribs, medulloblastoma, etc. 3. Imaging characteristics of KCOT including developing process and malignant transformation4. Imaging characteristics of non-syndromic and syndromic KCOTs
NR253-ED-X

Invading the Orbit: A Case Series of Infiltrative Orbital Disorders

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

The differential diagnosis of infiltrative orbital lesions is broad and includes infectious, neoplastic, inflammatory, autoimmune, and vascular etiologies. Orbital infiltration is a known manifestation of systemic diseases such as neurofibromatosis, metastases, lymphoproliferative disorder, sarcoidosis, granulomatosis with polyangiitis (Wegner’s granulomatosis), IgG4-related sclerosing disease, orbital xanthogranulomatous disease (Erdheim Chester disease), and thyroid associated orbitopathy. Knowledge of the imaging and clinical features of these disorders will allow for improved diagnosis.

TABLE OF CONTENTS/OUTLINE

Each example will have a brief discussion of conventional and advanced imaging features, clinical presentation and demographics, laboratory and pathology characteristics, treatment strategy, and outcome/prognosis. Infection Orbital cellulitis (bacterial and fungal) Neoplasm Lymphoma/lymphoproliferative disorder Meningioma Metastasis Lacrimal sac carcinoma Inflammatory/Autoimmune Erdheim Chester Sarcoidosis IgG4-related sclerosing disease Granulomatosis with polyangiitis Tolosa-Hunt syndrome Thyroid associated ophthalmopathy Vascular Venolymphatic malformation Arteriovenous malformation
Clinical Application of Arterial Spin Labeling in Neurovascular Diseases

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
Arterial spin labeling (ASL) is an re-emerging technique for measuring cerebral blood flow at the tissue level. Due to technical advances in higher magnetic fields with efficient spin labeling, ASL has been increasingly used in many neuroimaging applications including acute and chronic cerebrovascular diseases, neoplasms, epilepsy, and functional MR imaging. ASL has been incorporated as a part of sequences in acquisition of MR imaging in our institution for the last ten years, and thousands of ASL images were acquired as a component of routine clinical brain MR evaluation and brain MR evaluation for research purposes in patients. The purposes of this presentation are 1) To understand principles in the interpretation of ASL images and 2) To review ASL images in neurovascular diseases.

TABLE OF CONTENTS/OUTLINE
Midnight Radiology: A Primer on Emergent Head CT Findings for the On-Call Resident

All Day Room: NA Digital Education Exhibit

Awards
Identified for RadioGraphics

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TEACHING POINTS
1. Review non-contrast appearance of emergent head CT findings
2. Recognize radiological signs on head CT and their pitfalls
3. Highlight trouble spots for radiologists, particularly residents, on the non-contrast head CT

TABLE OF CONTENTS/OUTLINE
The non-contrast head CT is one of the most common cross sectional studies to be performed in the emergent setting and encountered by radiologists and specifically, the on-call resident. Occasionally the critical findings are easily apparent while at other times the findings are subtle and lead to misses or near-misses. This exhibit will demonstrate challenging non-contrast head CT cases with critical findings. Focus will be on cases that warrant notifying clinicians or require immediate further imaging/intervention. Clinical pearls and common pitfalls will also be addressed. Objectives
Introduction
Cases: some cases include tension pneumocephalus, dense vessel and insular ribbon sign for CVA, cortical vein thrombus, hydrocephalus (one from shunt malfunction and another from mass causing entrapment), brain herniation, fracture through carotid canal, intracranial hemorrhage (epidural, subdural, subarachnoid, contusions, intraventricular)
Pitfalls: some examples include laminar necrosis and streak artifact mimicking bleeds, atherosclerosis mimicking dense vessel
3D Models in Head and Neck Neoplasms: Technique, Practical Use, and Cost Effectiveness

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
The purpose of this exhibit are to: 1. Provide an overview of the techniques and steps involved in creating a 3D model from DICOM images. 2. Display the practical use of 3D models in benign and malignant neoplasms in the head and neck with case examples from our institution. This includes the surgeon's perspective and practical use of the 3D model for planning and treatment including utilizing multiple materials and colours, spatial orientation, physical measurements, and tactile information from the 3D model. 3. Determine and display the cost benefit of a 3D model in Head and Neck Cancers including length of the surgery, adverse events, cost of the surgery, post-operative complications, and post-operative stay.

TABLE OF CONTENTS/OUTLINE
Technique: Import Dicom Images Post Processing utilizing 3D Modeling Software Pre-Printing Modifications Practical Uses Length of Time in OR Cost Savings of a 3D Model in the OR Patient Understanding of Procedure Surgeons Understanding of the Procedure and Preparation Prior to the Procedure
**Mucoceles Need Not Be Such a Headache: An Overview of Paranasal Sinus Mucoceles**

All Day Room: NA Digital Education Exhibit

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**TEACHING POINTS**

1. Review the pathophysiology of paranasal sinus mucoceles. 2. Review CT and MRI imaging characteristics of paranasal sinus mucoceles, in particular the features that help discern it from other pathologies. 3. Review of clinical presentations depending on mucocele site and correlation with corresponding complications. 4. Review of the management of these mucoceles.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction
   a. Definition, pathophysiology and epidemiology of paranasal sinus mucoceles. 2. Clinical and radiological features
   i. Mucocele drainage. ii. The creation of a drainage pathway to prevent recurrence. iii. Conventional versus nasal endoscopic techniques. 4. Conclusion
A Tract Less Traveled: Imaging of Lesions of the Brain Stem

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
A good imaging diagnosis of lesions of the brain stem not only requires familiarity with imaging appearance of common brain stem lesions, but also integration of the radiologists’ knowledge of anatomy ie arrangement of gray matter nuclei and white matter tracts in the brain stem, awareness of patient symptomatology and an understanding of clinical syndromes described in association with brain stem lesions. The goal of this exhibit is to present common and classical clinical scenarios and associated imaging findings in lesions affecting the brain stem.

TABLE OF CONTENTS/OUTLINE
Anatomical and functional divisions of the brain stem Imaging anatomy: arrangement of cranial nerve nuclei and white matter tracts in the brain stem Lesions: single and multiple T2 hyperintense lesions - ischemia, central pontine Myelinolysis, hypertrophic olivary degeneration, inflammatory, infectious and degenerative lesions Vascular malformations Common pediatric and adult tumors affecting the brain stem
Dual-energy Spectral CT for Patients after Embolization of Intracranial Aneurysm

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
1) To illustrate the limitations of conventional CT imaging examination after embolization of intracranial aneurysm
2) To illustrate the advantages of dual-energy Spectral CT for that examination
3) To demonstrate strategies to optimize CT examination after intracranial aneurysm embolization

TABLE OF CONTENTS/OUTLINE
1) Limitations of conventional CT • Difficulty in distinguishing blood and contrast in CT immediately after interventional therapy • Metal artifacts • Difficulty in distinguishing Metal embolism, contrast agents, and artifacts in CTA source images
2) Advantages of Spectral CT imaging • Material decomposition (MD) images help to distinguish blood and contrast agent • Metal-Artifacts Reduction System (MARS) • Iodine based pseudo color image helps to evaluate results of embolization of aneurysm • Better dipiction of arteries with low energy monochromatic images
3) Strategies to examination after embolization of intracranial aneurysm • For immediate examination after interventional therapy, use MD images of to identify bleeding • Apply MARS to reduce artifacts around metal embolism • For CTA source images, use iodine based pseudo color image to observe space between embolism and aneurysm wall • For CTA select the appropriate mono energy level for vascular reconstruction
NR261-ED-X

Out with the Old: What’s New In the TNM 8th Edition for H&N Cancer Staging

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
Changes in T staging for HPV and non-HPV associated oropharyngeal cancer (OPC) Role of imaging in modified clinical and pathological nodal staging Radiological staging of extra-nodal extension (ENE) - tips and tricks T staging of oral cavity cancer (OCC) and novel imaging tools (e.g. intra-oral ultrasound) Multimodality imaging of cortical bone invasion - tips and tricks Role of imaging in modified nasopharyngeal carcinoma (NPC) staging

TABLE OF CONTENTS/OUTLINE

Background to TNM 8 - Describe the changes to H&N staging in TNM 7 since the last major revision Limitations of TNM 7 eg failure to address HPV associated disease behaviour Rational and database for TNM 8 - describe the use of enhanced international datasets and the introduction of non-anatomical prognostic factors Changes in T staging for HPV and non-HPV associated OPC with imaging examples Changes in N staging for OPC - differences between clinical and pathological lymph node descriptors Inclusion of ENE for non-HPV associated OPC into clinical and pathological N descriptors Multimodality imaging of ENE Changes in OCC staging with examples of modified T4 descriptors Changes in NPC T and N descriptors
The Assessment of Contrast Media Circulation in Brain Ischemia with the Use of 4D CT Imaging

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
The purpose of this exhibit is to: Revise the clinical assessment using CT of ischemic cerebrovascular disease, focusing on the TEC derived from a hemodynamics of contrast media. Review CT perfusion (CTP), propose a novel method of post-processing using dynamic dataset, detail the emerging role of dynamic CT data in the quantitative assessment of ischemic cerebrovascular disease.

TABLE OF CONTENTS/OUTLINE
Cerebrovascular disease: Types, hemodynamics, role of contrast media, role of dynamic CT scan. Dynamic CT scan and postprocessing: Technical considerations and clinical assessment of CTP, analysis of TEC. Proposed of a novel method: postprocessing of dynamic dataset based on TEC analysis. Averaging of dynamic image (early phase & delayed phase) and dividing averaged images (phase ratio image; PI map). Clinical analysis of PI map: assessment of ischemic core and penumbra, compared the accuracy of the PI map with CTP quantitative maps and positron emission tomography.
Correlation of Bethesda Cytopathology Classification with Ti Rads: When is Surgery Necessary?

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
(1) A brief review of Bethesda system; (2) A review of Ti-Rads system; (3) To confront the two systems for recommending surgery.

TABLE OF CONTENTS/OUTLINE
Bethesda and Ti-Rads improves communication among cytopathologists, radiologists, surgeons and physicians. Bethesda has 6 categories for thyroid FNA. The categories stratify the risk of malignancy and recommend clinical management. The Bethesda classification: I- Nondiagnostic, II- Benign, III- Atypia of Undetermined Significance (not able to be classify as benign, suspicious, or malignant), IV- Follicular Neoplasm (cytologic do not allow diagnosis of carcinoma or adenoma), V- Suspicious for Malignancy (incomplete cellular malign architectural) and VI- malignant. Ti-Rads has 5 categories. 1- normal, 2- certainly benign (simple cyst, septated cyst or isolated macrocalcification), 3- very probably benign (oval shape, regular borders, iso or hyperechoic), 4A- suspicious nodules but low risk of malignancy, 1 or 2 high suspicious features (taller-than-wide, spiculated, markedly hypoechoic and microcalcifications), 4B- suspicious nodules with high risk of malignancy, 1 or 2 high suspicious features and/or presence of metastatic node. Whenever you have Bethesda III, IV and V with Ti-Rads 4B- and 5, patient should undergo surgery.
Non-Traumatic Myelopathy: A Pictorial Review

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
Major teaching points of our exhibit are: Clinical course and time of onset are keypoints in the diagnostic approach to non-traumatic injury of the spinal cord. Patients with an acute, subacute, or progressive non-traumatic medullary syndrome should undergo contrast enhanced magnetic resonance imaging as part of their diagnostic workup. MRI allows characterization of injury location, extent, morphology, and contrast enhancement features. The first imaging approach is to determine if the cause of myelopathy is compressive, which are the most common non-traumatic causes. Differential diagnoses can be proposed based on lesion location. Infrequent causes like toxic exposure and physical agents like radiation therapy and electrocution must be kept in mind.

TABLE OF CONTENTS/OUTLINE
Characteristic imaging features for each category of myelopathy and diagnostic keypoints are discussed. A map of differential diagnosis based on lesion location is proposed. Compressive Degenerative Neoplastic Congenital structural malformations Infection Viral Pyogenic Parasitic Inflammatory Neoplastic / paraneoplastic Demyelinating Autoimmune Others Cystic lesions Vascular abnormalities Metabolic, Toxic, and Physical Agents (radiation, electrocution)
NR266-ED-X

APT Imaging of Tumors: Theory, Clinical applications, Pitfalls and Future Directions

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

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TEACHING POINTS

Amide proton transfer (APT) imaging is a type of chemical exchange saturation transfer (CEST) imaging that specifically probes intrinsic proteins and peptides. Its clinical usefulness has recently been demonstrated especially in managing brain tumors. The purpose of this exhibit are: 1. To illustrate the basic theory and implementation of CEST and APT imaging 2. To illustrate clinical applications of APT imaging in brain tumors 3. To discuss pitfalls and limitations of APT imaging 4. To indicate future directions of APT imaging in oncology

TABLE OF CONTENTS/OUTLINE

1. Basic theory and implementation of CEST and APT imaging. 2. Clinical usefulness of APT imaging in brain tumors: Preoperative assessment of malignancy grade in gliomas, differentiation between malignant glioma and malignant lymphoma, and differentiation between treatment effects such as radiation necrosis and viable malignant tumors in post-treatment cases. 3. Pitfalls and limitations of APT imaging: Various pathological conditions other than malignant tumors may show high APT signal, such as protein-rich content of cysts, hematoma, blood in tumor vessels, and peritumoral edema. 4. Future directions of APT imaging: Feasibility of non-CNS applications of APT imaging will be discussed showing successful examples in head-and-neck and abdominal regions.
NR267-ED-X

Imaging of the Head and Neck Glands - Diagnostic Algorithm Made Easy: An Instruction Manual for General Radiologists

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
The purpose of this exhibit is: To describe the most common clinical affections of the glands in the head and neck including the parotid, submaxillary, thyroid and parathyroid glands. To review the diagnostic approach for these glands disorders in order to know the required imaging technique depending on the clinical management. To provide a guideline to general radiologists and other related specialists (general practitioners, surgeons, endocrinologists and otolaryngologists) for requesting the optimal imaging test in order to optimize the available resources and understand how radiologists and nuclear medicine physicians deal with these pathologies.

TABLE OF CONTENTS/OUTLINE
Salivary glands: Anatomy Imaging modalities Most frequent salivary gland diseases and diagnostic algorythm
Inflammatory/obstructive diseases Neoplasms Salivary gland involvement in systemic diseases Congenital disorders Vascular lesions Thyroid gland: Anatomy Imaging modalities Thyroid disease Incidental thyroid nodule Thyroid cancer Hyperthyroidism Retrosternal goiter: preoperative evaluation Parathyroid glands: Anatomy Imaging modalities Parathyroid diseases and their imaging approach Primary hyperparathyroidism Secondary hyperparathyroidism
Cerebral Bleeding is Not Always an Easy Diagnosis: Test Your Luck in the Microbleeding Quiz!

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

The development of new MRI sequences has increased the sensibility to paramagnetic blood products, mainly in T2*-weighted gradient-recalled echo (T2* GRE) and susceptibility-weighted imaging (SWI). In consequence, the incidence of cerebral microhaemorrhage (CMB), defined as small foci of cerebral bleeds, has grown. Our proposes are to briefly evaluated the different imaging tests for hemorrhage detecting and to invite radiologist to solve a series of CMB cases in order to establish a pattern based approach to diagnosis and review their clinical relevance.

TABLE OF CONTENTS/OUTLINE

The work will be structured as follows:
1. Diagnosis of hemorrhage: CT and MRI, emphasizing T2* GRE and SWI sequences.
2. Let’s the show start. Ten cases of different CMB etiologies will be presented in a quiz format: cerebral hemorrhagic masses, diffuse axonal injury, amyloid angiopathy, hemorrhagic infarction, venous thrombosis, cavernoma, posterior reversible encephalopathy, perimesencephalic subarachnoid hemorrhage, neurodegenerative disorders such as Parkinson disease and systemic disorders such as hematological, renal or cardiovascular disorders.
3. Other CMB causes: hypertensive encephalopathy, cerebral vasculitis, inherited neurologic diseases or multiple sclerosis.
4. Clinical relevance of CMB.
Funny Turns: 3.0T MRI-PET Fusion Imaging in Evaluation of Dyskinesia!

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

Dyskinesia is a clinical diagnosis and role of imaging is to differentiate underlying causes, to grade the severity of the disease, predict prognosis and in post-treatment evaluation. To review MRI and PET findings useful for diagnosis of movement disorders and exclude mimickers. To evaluate the role of PET-MRI fusion to classify and sub-classify various movement disorders. To evaluate its role in assessment of progression of disorder and severity assessment. Corelation of the clinical scenario and PET-MR findings to select the most effective therapy based on the unique biologic characteristics of the patient and the molecular properties of the disease. Its role in determining patient’s response to specific drugs & accurately assess the effectiveness of a treatment regimen.

TABLE OF CONTENTS/OUTLINE

To evaluate MRI and PET findings in various movement disorders - Parkinsonism, MSA-A, MSA-C, PSP, Dementia with Lewy bodies and Huntington's chorea. To conclude, the clinical differentiation of atypical parkinsonian syndromes from Parkinson disease is difficult but crucial MRI remains primary modality and PET MRI is helpful as a problem solving modality. Knowledge of the characteristic imaging features of the variety of movement disorders will help the radiologist in this challenge.
One Shop Where All Brownian Stop

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
To revisit the physics of diffusion weighted imaging (DWI). To classify and provide an exhaustive compilation of pathologies in the adult brain that restrict on DWI.

TABLE OF CONTENTS/OUTLINE
A variety of conditions were diagnosed and classified as follows: Vascular: Occlusive (acute arterial infarctions, venous infarctions, hemorrhagic infarctions) and non-occlusive perfusion changes (hypoxic ischaemic encephalopathy, posterior reversible encephalopathy syndrome, transient global amnesia) Hemorrhage: Intra-axial (hypertensive hemorrhage, contusions, diffuse axonal injury) and extra-axial (subdural hematoma). Infections: Cerebritis, cerebellitis, pyogenic abscess, tuberculoma, herpes encephalitis, cytomegaloviral ventriculitis, splenial lesion in dengue encephalitis, Japanese encephalitis and Creutzfeld Jakob disease. Neoplasms: Intra-axial (high grade gliomas, gliosarcoma, lymphoma, metastasis) and extra-axial (epidermoid, meningioma, pituitary macroadenoma). Metabolic: Hypoglycaemic injury, 5-Flourouracil toxicity. Demyelination: Multiple sclerosis, osmotic demyelination. Neurodegenerative: Acute Wallerian degeneration DWI has widespread applications particularly in neuroradiology. This exhibit will provide a one-stop-shop to help trainees identify these lesions accurately.
A Real Pain in the Neck (and Arm): An Imaging Review of Brachial Plexus Anatomy and Pathology

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

Clinical evaluation of brachial plexus pathology is challenging due to oftentimes vague and nonspecific presentations. As such, imaging is helpful for identifying and localizing pathology. Unfortunately, accurate characterization and localization of lesions involving the brachial plexus is, itself, challenging due to its complex anatomy and variety of pathology, making it a daunting task for even experienced radiologists. Given these challenges, knowledge of brachial plexus anatomy and understanding the strengths of the various imaging sequences is essential for accurate interpretation. This exhibit will review: 1. Clinically relevant brachial plexus anatomy, emphasizing anatomic boundaries and surgical landmarks. 2. MR imaging of the brachial plexus, focusing on strengths and key features of the various sequences. 3. Common and uncommon pathologic processes involving the brachial plexus.

TABLE OF CONTENTS/OUTLINE

1. Normal brachial plexus anatomy
2. MRI protocols with focus on strengths of each sequence
3. Case-based discussion of brachial plexus pathology, emphasizing a systematic review, including lesion localization and characterization, as well as differential diagnosis. Cases will include classic pathology such as Pancoast tumors and trauma to uncommon pathologies such herpes zoster plexitis and aggressive fibromatosis.
NR272-ED-X

3.0T MR Neuroimaging of Opportunistic Infections in People Living With HIV-AIDS (PLHA)

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
To evaluate MR imaging appearances of various opportunistic infections in HIV-AIDS. To review the imaging features helpful to differentiate these imaging appearances from common mimickers.

TABLE OF CONTENTS/OUTLINE
To review imaging features of various opportunistic infections - Toxoplasmosis, tuberculosis, cytomegalovirus infection, cryptococcal infections, herpes simplex infections, neurosyphilis and syphilitic gummas. To review imaging features of common mimickers of these imaging appearances. e.g Toxoplasmosis vs Lymphoma, tuberculoma vs toxoplasmosis. To review etiopathogenesis of IRIS (immune reconstitution inflammatory syndrome and evolution of imaging appearance of sequential MR images.
Analysis of the Factors Associated to Prevalence of High Signal Intensity in the Dentate Nucleus and Globus Pallidus on Unenhanced T1-Weighted MR Images in the Year 2016 at a Reference Hospital

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
Gadolinium (Gd) contrast agents are commonly used in Magnetic Resonance (MR) services. The gadolinium ion is considered to be toxic, therefore it is administered associated with a chelating molecule. Among the possible complications of free Gd in the blood circulation, we highlight the possibility of its deposition in dentate nucleus and globus pallidus. This deposit is characterized by the T1 weighted signal increase in the regions mentioned above. In order to adopt safety measures for the use of contrast agent in MR exams, we need to question what factors may be associated with this alteration. From January to December 2016, this study analyzed brain MR images performed at our institution with the administration of paramagnetic contrast Gd via endovenous, which could be: gadoteric acid - Gd-DOTA (macroyclic), Gadobutrol (macroyclic), Gadoversetamid (linear) and Gadopentetate Dimeglumine (linear), administered according to the guidelines described in the drug leaflet and medical prescription. T1 weighted signal intensity in the areas of the dentate nucleus and globus pallidus suggestive of Gd deposition were correlated with factors such as: sex, age, number of Gd contrast exposures, contrast molecular structure, volume administered, creatinine, urea and liver enzymes.

TABLE OF CONTENTS/OUTLINE
Gadolinium deposition; Magnetic resonance; Brain images
Adverse Effects caused by Oncological Treatment Radio and Chemotherapy: Spectrum of Image Presentation in the CNS

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
1. To introduce the general panel of the various side effects caused by oncological treatment. 2. To stratify the changes related to chemotherapy drugs and radiotherapy on oncological patients. 3. To discuss and to illustrate central nervous system (CNS) image changes related to cancer treatment.

TABLE OF CONTENTS/OUTLINE
Introduction with overview of side effects related to radiotherapy and chemotherapy treatment. Cases with side effects of chemotherapy drugs: - Methotrexate: posterior reversible encephalopathy syndrome (PRES), toxic leukoencephalopathy, subacute combined degeneration, chronic irreversible leukoencephalopathy, disseminated necrotizing leukoencephalopathy; - Cytarabine: acute cerebellar syndrome, toxic leukoencephalopathy, bilateral striatal lesion; - Cyclosporine: PRES, reversible splenial lesion; - L-asparaginase: stroke, venous thrombosis, PRES, toxic leukoencephalopathy; - Ipilimumab: giant cell arteritis, hypophysitis, demyelinating diseases of CNS. Cases with side effects of radiotherapy: - Leukoencephalopathy and cerebral atrophy, pseudoprogression, actinic myelitis, mineralizing microangiopathy, radio-induced cavernoma, meningioma-induced, SMART syndrome. Conclusions Bibliographical references
**Multimodality Radiographic Review of the Neonatal Brain Born to Zika Positive Mothers**

All Day Room: NA Digital Education Exhibit

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**TEACHING POINTS**
Zika is the first major infectious disease linked to human birth defects in the last 50 years. Recent intercontinental outbreaks and association to birth defects has created a Public Health Emergency of International Concern. Congenital Zika has been associated to intrauterine growth restriction and multiple CNS abnormalities. This exhibit will describe neuroradiological findings that may be present in neonatal US, CT, and MRI in confirmed cases of congenital Zika infection. Readers should be able to:
- Describe normal neonatal neuroanatomy.
- Understand Zika propagation and transmission through mosquito bites, materno-fetally, peripartum, and sexually.
- Know the importance of screening Zika-positive mother infants with head US, followed by head CT/MRI.
- Recognize multimodality imaging features that may be associated with congenital Zika, including microcephaly, ventriculomegaly, cortical malformations, cerebellar/brainstem hypoplasia, and cortical/subcortical white matter junction calcifications.

**TABLE OF CONTENTS/OUTLINE**
- Zika origin and propagation.
- Normal fetal and neonatal neuroanatomy in US, CT, and MRI.
- Congenital anomalies associated with intrauterine Zika infection.
- Pictorial review of neonatal head US, CT, and MRI findings in newborns born to Zika-positive mothers.
- Strengths and pitfalls of each modality.
Thyroid Mass Mimickers: Wait a Minute - This is Not from Thyroid Gland!

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
1. To review clinical and imaging findings of various nodular neck lesions that may mimic thyroid lesions 2. To discuss differential points to help discriminate among various thyroid mass mimickers

TABLE OF CONTENTS/OUTLINE
What Radiologists Should Know about the MRI Findings in the Acute Spinal Cord Compression

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
1. To present the different MRI findings in the acute spinal cord compression syndrome. 2. To review the clinical presentation, causes, treatment as well as the evolution. 3. To point out what MRI protocol should be done depending on the differential diagnosis.

TABLE OF CONTENTS/OUTLINE
Acute spinal cord compression is a medical emergency and requires rapid diagnosis and treatment to prevent irreversible spinal cord injury. The gold standard for diagnosis is an MRI of the entire spine with or without contrast depending on the radiological findings and clinical suspicion. CT can assess the bone fractures in traumatic injuries. The most frequent causes are tumoral, acute trauma, infectious, inflammatory, vascular or hemorrhagic conditions. The diagnosis has to be done immediately if there is an acute progression of the symptoms and also if it will change the therapeutic strategy (for example radiotherapy in metastases). This exhibit will provide a case based review of the spectrum of acute spinal cord compression appearance, showing infrequent cases, focusing on the pathophysiolog, MRI protocol depending on initial findings, clinical suspicion, differential diagnosis and prognosis of the patient.
Tumefactive Demyelinating Lesions: A Pictorial Essay

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
- Describe the image features of tumefactive demyelinating lesions subtypes.
- Differentiate tumefactive demyelinating lesions from their differential diagnoses.
- Investigate how the occurrence of these demyelinating lesions relate to patients’ prognosis.

TABLE OF CONTENTS/OUTLINE
Clinical and epidemiological data of tumefactive demyelinating lesions. Key features to differentiate tumefactive demyelinating lesions from their differential diagnosis. Prognosis and evolution of patients. Review of imaging findings - Conventional MRI
**NR279-ED-X**

**Traumatic Dural Venous Sinus Thrombosis in Acute Head Trauma Patients: Clues for the Diagnosis**

All Day Room: NA Digital Education Exhibit

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**TEACHING POINTS**

1. To show the clinical presentation and the abnormal findings of dural venous sinus thrombosis in acute head trauma.
2. To emphasize the importance of the examination protocol with multidetector CT (MDCT) in the emergency room to achieve an early diagnosis.
3. To review the therapeutic approach and outcome.

**TABLE OF CONTENTS/OUTLINE**

Head trauma is an unusual cause of cerebral venous sinus thrombosis (CVST), normally secondary to a skull fracture. Posttraumatic CVST can be difficult to diagnose due to the low index of suspicion, unawareness about its association with head injury, and difficulty in diagnosing the venous thrombosis on non-contrast CT (NCCT). Owing to the advent of MDCT and the new protocols including angiographic phases, the detection of CVST has become a diagnostic challenge. In NCCT, venous infarction, brain edema, intracranial hemorrhage, hyperdensity in the dural sinus or the cord sign, in the presence of fractures next to the dural sinus or jugular bulb increase the possibility of CVST. Contrast enhanced CT showing the occlusion of the cerebral venous sinus or hyperenhancement of the brain cortex and tentorium allows its diagnosis. This exhibit will provide a case based review of the spectrum of MRI and CT findings, to suspect and diagnose CVST after a blunt head trauma.
NR280-ED-X

Spinal Cord Lesions: A Pattern Approach

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

1. To teach and to illustrate the anatomy of the spinal cord, including its vascularization and main functions at each level.
2. To teach step-by-step the evaluation of spinal cord injuries with emphasis on pattern approach on magnetic resonance imaging (MRI).
3. To illustrate the major advanced imaging methods in the spinal cord, such as a tractography and perfusion.

TABLE OF CONTENTS/OUTLINE

Anatomy of the spinal cord and its vascularization. Schematization of the main functions at each level of the spinal cord.
Differentiation of tumoral from non-tumoral lesions by steps (1.Is there cord expansion? 2. Are there cysts? 3.Is there displacement of axonal fibers?) Non-tumoral lesions - main patterns of involvement of spinal cord: demyelinating diseases (multiple sclerosis, neuromyelitis optica, transverse myelitis), vascular (spinal cord infarction, arteriovenous fistula), infectious (schistosomiasis), metabolic (subacute combined degeneration) and adverse effects (radiation myelitis, methotrexate myelopathy). Tumoral lesions - patterns for recognition of the most frequent tumors: ependymoma, astrocytoma and hemangioblastoma. How advanced methods, such as tractography and perfusion, can corroborate to the differential diagnoses. Didactic cases in a diagnostic challenge format to test and consolidate the acquired knowledge. Conclusions
Anatomical Connections of the Fornix and Stria Terminalis of the Human Limbic System

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
- To review the anatomy of the limbic system.
- To discuss the relationship of the fornix and stria terminalis connections with the rest of limbic system.
- To explain the utility of MRI and particularly diffusion tensor tractography in visualizing delicate white matter pathways of the brain.

TABLE OF CONTENTS/OUTLINE
Review of the anatomy of the limbic system
Relationship of fornix-stria terminalis complex with adjacent structures
Review of imaging findings - Conventional MRI - Diffusion tensor imaging and tractography technique details
Future directions and summary

In this report we demonstrate for the first time, in vivo 3D reconstruction of the fine trajectories and connections of the stria terminalis and fornix with gray matter structures such as the amygdala, hypothalamic and septal nuclei using high spatial resolution diffusion tensor tractography on 3T. The fornix and stria terminalis trajectories are clearly distinguishable from adjacent major white matter and gray matter structures. Using high spatial resolution specially reduced slice thickness (1mm) in this study reduced the partial volume effect as well as incoherency due to the fiber crossing within each voxel and we were able to reconstruct and show these fine limbic trajectories using deterministic approach.
NR284-ED-X

Back to Skull Base-ics: Pre and Postoperative Evaluation of Skull Base Tumors

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

1. To review the anatomy of the skull base with a focus on critical structures that must be assessed on pre-operative imaging.
2. To review the most common surgical procedures and approaches for mass resection within the skull base.
3. To present case examples of both common and uncommon mass lesions within the skull base to reflect a wide array of pathology.
4. To provide clinical and pathologic correlation as well as postoperative evaluation where applicable for each lesion with a focus on information that the surgeon must know pre and postoperatively.

TABLE OF CONTENTS/OUTLINE

1. Anatomy of the skull base and cranial nerves
2. Common surgical procedures and approaches for skull base masses
3. Benign masses: Cases will include but are not limited to the following: meningioma, chordoma, paraganglioma, schwannomas, and juvenile angiofibroma.
4. Malignant Masses: Cases will include but are not limited to the following: perineural spread of tumor, chondrosarcoma, nasopharyngeal carcinoma, rhabdomyosarcoma, metastatic disease, and enthesioneuroblastoma. Each case will include classic imaging features and correlation with pathology when available. There will be an additional focus on information that is critical for the surgeon pre and postoperatively.
Meningioma: Not Just Your Mother-in-Law’s Tumor!

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
The exhibit employs a case-based approach to provide an updated review of the wide spectrum of conventional and advanced imaging features associated with intracranial meningioma at 3T MRI. A second teaching point emphasizes the utility of advanced imaging techniques in making the diagnosis of meningioma, particularly in atypical presentations.

TABLE OF CONTENTS/OUTLINE
Typical Imaging features of Meningioma: 3T standard MRI imaging MR Angiography Digital subtraction angiography MR Spectroscopy
Atypical presentations of Meningioma: Sample cases. Summary and Application of Advanced Imaging Techniques
**Power Up! The Power of Post-Contrast 3D-FLAIR on 3T**

All Day Room: NA Digital Education Exhibit

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**TEACHING POINTS**

After viewing this exhibit the learner will: 1. Be able to explain why gadolinium is bright on post-contrast T2-FLAIR imaging. 2. Understand protocol considerations for optimizing post-contrast imaging. 3. Be able to identify normal contrast-enhancement on post-contrast T2-FLAIR imaging.

**TABLE OF CONTENTS/OUTLINE**

Purpose: The purpose of this exhibit is to illustrate the utility of post-contrast 3D FLAIR in increasing the conspicuity of many intracranial lesions. This presentation will emphasize the inclusion of a post-contrast 3D FLAIR sequence as an essential component to any contrast-enhanced MRI of the brain utilizing a case-based approach with high-resolution 3T MRI imaging. Discussion: This exhibit is divided into the following sections 1. Physics of Post-Contrast FLAIR. 2. Indications for post-contrast FLAIR imaging. 3. Review of normal enhancement on FLAIR imaging. 4. Cases illustrating the utility of post-contrast 3D FLAIR. 5. Protocol considerations. 6. Pearls and pitfalls of post-contrast FLAIR imaging. Summary: Post-contrast 3D FLAIR is a highly sensitive technique and can dramatically increase the conspicuity of a variety of inflammatory, infectious, and neoplastic neuropathic entities. We propose that it is an essential component of any contrast-enhanced brain MR.
NR287-ED-X

**Current e-Vents: A Review of Endoscopic Ventriculostomy, Including Pre- and Post-procedural Imaging**

All Day Room: NA Digital Education Exhibit

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**TEACHING POINTS**
Review endoscopic third ventriculostomy (ETV), including indications and procedural details. Review pre-operative characterization of ventriculomegaly Review specific MRI sequences for ETV characterization, particularly those used at our institution Review post-procedural imaging evaluation.

**TABLE OF CONTENTS/OUTLINE**
I. Overview of endoscopic third ventriculostomy
   A. Indications
   B. Technical overview (with video of a procedure performed at our institution)
II. Imaging Sequences
   A. Pre-Procedural
      i. Routine Brain
      ii. *(with post-contrast imaging for masses)*
   B. Post-Procedural
      i. *Same Sequences*
      ii. *Steady State Free Precession*
      iii. *+/- CSF Flow*
III. Postoperative Evaluation
   A. Stoma Size
   B. Hydrocephalus Trend
   C. *+/- CSF Flow*
IV. Representative Cases
   A. Successful
   B. Failed
IV. Summary
NR288-ED-X

Lost with Hearing Loss? A Preoperative CT Evaluation of Cochlear Implants and Common Pathologies Associated that the Radiologist Must Know

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
Recognize the differences between patients who requires cochlear implant or hearing aids in the context of hearing loss. Emphasize the knowledge about basic inner ear anatomy and measures as a primary approach in cochlear implant candidates that the otolaryngologist needs to know. Evaluate the correct position of the implant. Demonstrate the role of CT on common abnormalities in deaf population to determine absolute or relative contraindications for these procedures.

TABLE OF CONTENTS/OUTLINE
NR289-ED-X

Atypical Complications and Presentations of Developmental Venous Anomalies

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

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TEACHING POINTS

Developmental venous anomalies are the most common vascular malformations, being considered as variants of venous development and presenting in the great majority of cases as asymptomatic and incidental lesions. Rarely, they may be associated with adjacent parenchymal changes, other vascular affections and complications related to atypical lesion sites.

TABLE OF CONTENTS/OUTLINE

This exhibit addresses radiographic features of developmental venous anomalies as well as its complications and atypical sites (thrombosis, haemorrhage, trigeminal neuralgia, cerebral aqueduct stenosis), parenchymal alterations (asymmetrical calcifications, adjacent parenchymal signal changes) and associated lesions (cavernoma, capillary telangiectasia, varix, arterialized and arteriovenous malformation).
Cavernomas: Unusual Locations, Complications and Associated Features

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TEACHING POINTS

Cavernous malformations (cavernomas) are composed of a grouping of dilated capillaries (mulberry-like) surrounded by hemosiderin. The vast majority of lesions remain asymptomatic and are discovered incidentally. Rarely, these lesions may be located in atypical sites that may promote complications and exhibit unusual associated features.

TABLE OF CONTENTS/OUTLINE

This exposition addresses radiographic features of cavernomas, as well as its association with other vascular anomalies (venous anomaly and capillary telangiectasia), multiple lesions (secondary to radiation or familial syndrome), atypical sites (transmantle, subependymal, extra-axial, hippocampal, intramedullary, intraventricular, facial colliculus, trigeminal nucleus and optic nerve), associated complications (bilateral hypertrophic olivary degeneration and hemorrhage) and the response to treatment with propranolol from a giant infant cavernoma.
NR291-ED-X

Radiographic Evaluation of Vertebral Metastasis: Speaking the Same Language

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

The spine remains the third most common site of metastasis, which is implicated in 20-30% of patients with systemic disease. Management of these lesions often involve a multidisciplinary approach between surgeons, oncologists, radiation oncologists, and radiologists. In addition to clinical status, imaging often guides treatment planning and management. Several scoring system and guidelines have evolved to help increase inter-observer agreement amongst clinicians, which have included the NOMS Framework, SINS classification, and ESCC grading. The purpose of this exhibit is to 1) provide a comprehensive review of these terms, 2) indicate the role of the radiologist in this process, and 3) review cases and discuss clinical outcomes.

TABLE OF CONTENTS/OUTLINE

I. Background and epidemiology of spinal metastases II. Breakdown of various criterias: a. NOMS (Neurologic, Oncologic, Mechanical stability, Systemic issues) b. SINS (Spinal Instability Neoplastic Score) c. ESCC (Epidural spinal cord compression) d. Putting it together e. Use in standardized dictation III. Cases and outcomes IV. Conclusion
NR292-ED-X

Nothing to Sneeze At: Neoplasms of the Nasal Cavity and Paranasal Sinuses

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

The purpose of this exhibit is: 1. To highlight strategies to separate inflammatory changes from nasal and paranasal sinus neoplasms 2. To review neoplasms of the paranasal sinuses, including unique imaging findings which suggest particular pathologic diagnoses 3. To demonstrate the utility of MRI and PET/MRI in staging tumors of the nasal cavity and paranasal sinuses

TABLE OF CONTENTS/OUTLINE

NR293-ED-X

Supraclavicular Region: Last Exit Before the Thorax

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

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TEACHING POINTS

Review the gross and imaging anatomy of the lower neck and supraclavicular region. Learn clinical and imaging findings of common pathologies encountered in this area. Demonstrate a systematic approach to image evaluation.

TABLE OF CONTENTS/OUTLINE

Illustrations and cross-sectional images are used to review normal gross and imaging anatomy of the lower neck and supraclavicular region. Cases are presented in a quiz format followed by a discussion of the pathology, typical clinical presentation, and imaging findings. Cases presented include: Sternoclavicular joint: arthritis, posterior dislocation, osteomyelitis Clavicle: Paget, fibrous dysplasia Soft tissue tumors: Desmoid, sarcoma, lipoma Neurogenic tumors involving: brachial plexus, vagus nerve Nodal disease: Metastatic, lymphoma, Tb Vascular: Stents, subclavian artery aneurysm, thrombus Pancoast tumor extending into the neck Congenital: lymphatic venous malformation Thoracic outlet obstruction Normal anatomy that can mimic pathology: thoracic duct, levator claviculae muscle
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**TEACHING POINTS**

1. Review basic anatomy of the skull base.  
2. Provide a comprehensive list of the most common pathologies.  
3. Discuss pertinent imaging findings in computed tomography (CT) and magnetic resonance imaging (MRI).  
4. Discuss the importance of accurate diagnosis and management of skull base pathologies.

**TABLE OF CONTENTS/OUTLINE**

From an imaging standpoint, the skull base is a complex region given the combination of different organ systems, including the nervous, vascular and musculoskeletal systems. In order to adequately evaluate the skull base, knowledge of the radiological anatomy and important anatomical landmarks is vital. The aim of this educational exhibit is to review skull base anatomy and discuss the pertinent imaging findings of common pathologies, including glomus jugulare, chondroma, meningioma and lymphoma, among others.  
1. Objectives  
2. Introduction  
3. Anatomy Review of the Skull Base  
   a. Anterior Compartment  
   b. Middle Compartment  
4. Common Skull Base Pathology  
   a. Benign  
   b. Malignant
Infantile Head and Neck Masses: How to Differentiate Hemangiomas from Vascular Malformations

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
(1) To describe the main clinical aspects of infantile hemangiomas and vascular malformations; (2) To point out the main findings in CT, ultrasound (US), and magnetic resonance (MR); (3) Which patients need a specific treatment?

TABLE OF CONTENTS/OUTLINE
Infantile hemangiomas (IH) are benign tumor in infancy (10%). 60% of IH arise in the head and neck. IH is a kind of vascular tumor which appears the first few years of life and may involute spontaneously. It affect some anatomical sites, including parotid, nose, eye, tongue and upper digestive tract. Complications includes ulceration, compression of vital structures, high-output cardiac failure and bleeding. Vascular malformations (VM) are structural abnormalities with either capillary venous, arterial and/or lymphatic which grow in proportion with the child. VM are present at birth and show no proliferative or involution phase. Other vascular neck anomalies include carotid paragangliomas, angiosarcoma, and Kaposi. Carotid paraganglioma is very common in the head/neck (60%), may be multicentric (10%) and malignant (10%). The paraganglioma is a hypervascular node in the carotida bifurcation. In conclusion IH are common benign tumor in the pediatric group. The physician must distinguish vascular tumors from VM. Most IH do not require active treatment, whereas VM needs treatment.
ARTERIOPATHY IN PEDIATRIC STROKE: AN UNDERESTIMATED CLINICAL ENTITY

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
1. Review the epidemiology of stroke in the pediatric population, highlighting its risk factors; 2. Discuss the importance of arteriopathy in the context of pediatric stroke; 3. Review the main causes of arteriopathy leading to pediatric stroke and understand its physiopathological mechanisms; 4. Describe the imaging findings at multiparametric magnetic resonance that help differentiate each etiology, including MR angiogram / other vascular studies, and recognize their importance in treatment and in prognosis / follow-up of patients.

TABLE OF CONTENTS/OUTLINE
Background - Epidemiology of pediatric stroke - Risk factors - Differential diagnosis Arteriopathy - an important clinical entity in children Pathophysiology of the main causes of arteriopathy - Varicella - Sickle cell disease - Moyamoya disease - Takayasu's arteritis - Dissection - Idiopathic - Genetic Review of imaging findings - Conventional MR - Diffusion weighted imaging (DWI) - MR angiography - Digital subtraction angiography - Nuclear medicine studies - Ultrasonography - CT angiography Advantages and limitations of different techniques Treatment and prognosis - Importance of early diagnosis - The role of thrombolysis in the pediatric stroke
Camping Out in the Hippocampus: Imaging Spectrum of Etiologies Affecting the Hippocampi and Tips for Honing the Differential Diagnosis

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Awards
Certificate of Merit

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TEACHING POINTS
1. The anatomy and function of the hippocampus is complex and highly integrated with the limbic system.
2. A wide spectrum of congenital, degenerative, ischemic, infection neoplastic, metabolic/toxic, autoimmune disorders may manifest with nonspecific imaging abnormalities in the hippocampi.
3. Utilization of ancillary imaging findings and clinical history may help to render a clinically relevant differential diagnosis when confronted with a hippocampal lesion.

TABLE OF CONTENTS/OUTLINE
1. To illustrate the salient imaging anatomy of the hippocampus and highlight its role in memory, spatial recognition, and emotions.
2. To depict the spectrum of entities manifesting with hippocampal abnormalities through illustrative case examples, including but not limited to: - Hippocampal sclerosis - Alzheimer's Disease - Frontotemporal Lobar Degeneration Variants - Ischemic stroke - Illicit-drug associated ischemia and hemorrhage - Transient global amnesia - Herpes simplex virus encephalitis - Mitochondrial encephalopathy, lactic acidosis, and stroke-like episodes (MELAS) - Epileptogenic related cytotoxic edema - Autoimmune and paraneoplastic limbic encephalitis - Infiltrating Glioma.
3. To provide pearls and pitfalls for using additional imaging and historical features to render a clinically valuable differential diagnosis.
Drugs, Alcohol, Heavy Metal, and More: Complications in the Spine

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TEACHING POINTS

The purpose of this exhibit is: 1) To provide a brief review of spine anatomy 2) To present a case-based assortment of imaging findings in the spine related to recreational drug and alcohol abuse, surgical and post-procedural findings and complications.

TABLE OF CONTENTS/OUTLINE

A. Brief review of normal spine anatomy
MRI of Brachial Plexus Injury: Imaging Technique and Spectrum of Findings

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
Magnetic Resonance Imaging is helpful in detecting entire spectrum of brachial plexus injuries. It helps to classify the injuries into pre-ganglionic and post-ganglionic components. The exact anatomical level of the injury is also well delineated. MRI provides roadmap for surgical planning.

TABLE OF CONTENTS/OUTLINE
• MRI technique and sequences used for evaluation of pre-ganglionic and post-ganglionic component
• Spectrum of preganglionic injuries - nerve rootlets avulsion, pseudomeningoceles, spinal cord changes, paraspinal muscle changes
• Spectrum of postganglionic injuries - nerve root disruptions, thickening, signal alterations, neuroma formation, retraction, extrinsic compression, muscle changes
• Representative cases of combination of pre and post ganglionic injuries
**Status Epilepticus: The Role of Imaging in this Neurological Emergency**

All Day Room: NA Digital Education Exhibit

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**TEACHING POINTS**

1. To define Status Epilepticus (SE), one of the main neurological emergencies. 2. To review the role of radiologists in the management of severe critical patients with SE. 3. To emphasize the correlation of neuroimaging features with the electroencephalographic (EEG) findings.

**TABLE OF CONTENTS/OUTLINE**

A) SE definition
- Clinical issues
  - Neurological emergency
  - Important problem in ICU patients
  - Significant morbidity and mortality
- Basic EEG characteristics
  - Continuous EEG
  - Subtle convulsive and nonconvulsive forms of status epilepticus
- Etiology
  - Underlying epileptic syndrome
  - Structural injury
  - Metabolic disorder
  - Withdrawal syndromes
- Outcome
  - Prognosis depends on the etiology and the time spent in SE
B) Neuroimaging features in SE
- CT
  - Exclude structural abnormalities
- MRI
  - Best imaging tool reflecting pathophysiology
  - MRI protocol: Sequences, and their role
  - Typical and atypical features
- Imaging can help to select the most appropriate treatment
- Other imaging modalities
Don't Lose Your Mind Reviewing Neurodegenerative Disorders!

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
Neurodegenerative disorders cover a wide range of diseases that are all commonly due to progressive deterioration of neuronal cells. The main limitation in neurodegenerative conditions is often misclassification of disease as a confirmed diagnosis is usually only made post-mortem. Thus, clinicians rely more heavily on clinical symptoms and neuroimaging. Many of these disorders share common clinical features and distinguishing neuroimaging patterns can be challenging. The purpose of this exhibit is to 1) explore the various pathologies of neurodegenerative disorders, 2) review radiologic patterns characteristic of these diseases, and 3) discuss clinical cases.

TABLE OF CONTENTS/OUTLINE
I. Background of neurodegenerative disorders II. Role of the radiologist and imaging approach III. Case based review of common and uncommon pathologies a. Acquired b. Inherited c. Dementia-related disorders d. Metabolic e. Miscellaneous IV. Conclusion
Imaging of the Brain in Breast Cancer: What You Should Know

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
1. No neuroimaging is indicated in asymptomatic patients with breast cancer
2. Lesion number, size, and location affect treatment approach
3. New solitary lesions in breast cancer patients are not always metastatic
4. Non-tumor entities related to treatment or antibodies can also affect the CNS

TABLE OF CONTENTS/OUTLINE
We present basic and advanced neuroimaging concepts in the imaging evaluation of patients with breast cancer. We also present demonstrative cases. Epidemiology of breast cancer CNS metastasis - Incidence by breast cancer subtype - Survival Indications for imaging - Symptoms - Reasoning behind no screening - Imaging Evaluation - Points of evaluation - Modalities - MRI imaging - Contrast specifics (type, amount) - 1.5 vs 3.0T - 2D vs. 3D - Post-gadolinium T2-FLAIR - Perfusion - Spectroscopy Imaging and management - Lesion size, location, number - Mets vs. GBM - New solitary lesion in a well-controlled patient - Memory problems - "Chemo brain" - Radiation changes - Auto-immune mediated encephalopathy Cases
Bilateral Thalamic Lesions and the Differential Diagnosis

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
1. The Thalamus is a complex structure with an important role in a vast number of cerebral functions. 2. Bilateral involvement of the thalami has a relatively limited differential diagnosis.

TABLE OF CONTENTS/OUTLINE
1. Introduction
2. Thalamus
2.1 Thalamus Anatomy
2.2 Functional Anatomy
2.3 Vascular Supply
3. Differential Diagnosis
3.1 Vascular
3.1.1 Arterial Occlusion
3.1.2 Deep Cerebral Venous Thrombosis
3.2 Congenital Metabolic Diseases
3.2.1 Gangliosidosis
3.2.2 Fabry’s Disease
3.2.3 Acute Necrotizing Encephalitis
3.2.4 Osmotic Demyelination Syndrome
3.3 Acquired Metabolic Diseases
3.3.1 Creutzfeldt-Jakob Disease
3.3.2 Wernicke's Encephalopathy
3.3.3 Fahr’s Disease
3.3.4 Osmotic Demyelination Syndrome
3.4 Infectious
3.4.1 Acute Necrotizing Encephalitis
3.5 Neoplastic
3.5.1 Bithalamic Glioma
4. Sample Review of literature and imaging findings on the differential diagnosis of bilateral thalamic lesions using cases from our archives.
5. Discussion
Bilateral involvement of the thalami has a relatively limited differential diagnosis including metabolic, infectious, vascular and neoplastic lesions. Patient history, imaging characteristics and presence or absence of lesions outside the thalamus may further narrow the differential diagnosis.
NR305-ED-X

Differential Diagnosis of Nontumoral Conus Medullaris Lesions: A Practical Approach to this Distinct Spinal Cord Site

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
1. Discuss the importance of conus medullaris anatomy in understanding disease process. 2. Present the main conus medullaris nontumoral lesions, review their epidemiology and understand their pathophysiological mechanisms. 3. Describe the imaging findings that help differentiate each etiology (inflammatory/infectious versus neoplastic versus vascular) at multiparametric magnetic resonance (including MR angiography) and other studies (PET-CT and DSA). 4. Discuss the importance of suggesting an accurate and early diagnosis in correct patient management.

TABLE OF CONTENTS/OUTLINE
Background Anatomy of conus medullaris
Epidemiology and clinical aspects of conus medullaris lesions
Differential diagnosis
Pathophysiology of the main causes of conus medullaris myelopathy
Schistosomiasis
Sarcoidosis
Pyogenic abscess
Medullary Infarct
Dural fistula
Demyelinating - Multiple sclerosis, Neuromyelitis optica
Idiopathic inflammatory
Review of imaging findings
Conventional MRI
MR angiography
Digital subtraction angiography
PET-CT
Differentiating tumoral versus nontumoral lesions
Treatment and prognosis - the radiologist role in patient care
Imaging Evaluation of Strabismus with Clinical Correlation: Pictorial Essay

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
1) To briefly review the pertinent anatomy in the setting of strabismus. 2) To demonstrate the importance of clinical information that demands specific protocols of CT and MRI in the evaluation of strabismus in our patients, which are presented as teaching files in this pictorial essay.

TABLE OF CONTENTS/OUTLINE
NR307-ED-X

The Nose Knows: A Primer of Cosmetic Nasal CT & MRI

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
1. CT and MR imaging for cosmetic nasal evaluation is still in its infancy. 2. Nasal anatomy is intricate but important cosmetically. 3. We aim to teach nasal CT and MR imaging anatomy and interpretation.

TABLE OF CONTENTS/OUTLINE
We present basic and advanced nasal anatomy and interpretation with demonstrative cases as follows: Imaging Protocol Anatomy - Superficial anatomy (cutaneous/subcutaneous structures) - Septum - Lacrimal duct - Nasal bridge - Dorsum nasi - Frontal process of maxilla - Nasal apex and ala - Nasal spine of maxilla Interpretation - Establishing the facial trajectory - Evaluating symmetry of the bridge, dorsum nasi, apex, and ala - Evaluating post-operative changes and complications - Use of 3D volume rendering Cases at CT and MRI Pre-surgical Evaluation - Nasal deviation internal septum - Nasal deviation of the external septum - Rotational deviation of the septum - Post-traumatic deformity - Nasal AVM Post-surgical Evaluation - Anterior nasal implants - Autologous bone - Autologous cartilage - Artificial - Prominent post-operative granulation - Acute infection
Remarkable MR Brain Findings to Predict Specific Genetic Syndromes

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**Awards**
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**TEACHING POINTS**

- Review and illustrate how confidently MR can contribute to diagnose genetic disorders affecting the brain. - Describe typical/specific imaging red flags to narrow the diagnosis possibilities. - Highlight an illustrative mnemonic graphic to support the MR rule on diagnosis and follow up of genetic syndromes affecting the brain.

**TABLE OF CONTENTS/OUTLINE**

- Identification of main genetic syndromes related to specific brain imaging findings. - Mnemonic DIAMOND o D - Developmental/Demyelinating o I - Inflammatory o A - Autoimmune o M - Metabolic o O - Other (Vascular, osteo-articular) o N - Neoplasm o D - Degenerative disorders - Describe MR rule in some genetic disorders' follow up.
NR309-ED-X

Dève Mòn Gen Mòn - Mountains Beyond Mountains: Lessons and Limitations from Non-Contrast CT Spine Imaging of Pott’s disease in an Underserved, Rural International Community

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
1. To demonstrate importance and diagnostic value of a donated CT scanner in an underserved, rural international community and review pertinent findings of non-contrast CT spine imaging of Pott’s disease.
2. To evaluate limited availability and accessibility of non-contrast CT imaging in an underserved, rural international community and highlight the need to provide CT interpretation skills to this country’s radiology trainees.
3. To review our role and challenges in providing imaging services and education to an underserved, rural international community.

TABLE OF CONTENTS/OUTLINE
1. Background Limitations of radiology resources in an underserved, rural international community (no IV contrast, biomedical engineering support and no MRI) Limitations of radiology training (no active radiology residents with CT interpretation skills) Very limited public access to non-contrast CT services available in this rural community
2. Review pertinent imaging findings in patients with spinal tuberculosis and artifacts on non-contrast CT imaging
3. Discuss value of non-contrast CT and utilization in patient management in this underserved, rural community.
4. Review of our Radiology department’s role and challenges in providing imaging services and education to international communities in need.
Teaching Points

Dengue encephalitis is the most common neurological complication of Dengue fever associated with high mortality in endemic countries. Imaging findings although typical are often indistinguishable from several other conditions like cerebral malaria and Japanese encephalitis which often produce a similar clinical picture of fever with altered sensorium. The treatment and clinical management of these differs and it is often imperative to avoid a misdiagnosis. Specific MRI findings include bilateral symmetrical T2 and FLAIR hyperintensitites in thalamus, brainstem and cerebellum. Haemorrhagic foci seen as blooming on GRE and SWI images should raise a strong suspicion of dengue encephalitis. Focal signal abnormalities can also involve the hippocampus, corpus callosum as well as meninges(meningoencephalitis), although rare are atypical presentations that can occur in dengue encephalitis. Imaging features are fairly characteristic and confirmatory in tropical countries.

Table of Contents/Outline

Table of Contents/Outline: This exhibit will review the typical imaging findings of Dengue encephalitis on MRI in serologically verified cases of Dengue encephalitis. It will further discuss the MR imaging of atypical cases and its very close mimics that we have come across in our teaching institution.
Imaging of Pituitary Stalk Abnormalities

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
Various disease process can involve pituitary stalk and it is important to recognise them on imaging to facilitate appropriate management of patients. Stalk abnormalities can be an isolated process or can be involved along with hypothalamic pathologies. To highlight the salient imaging features of congenital/developmental, inflammatory, infectious and neoplastic lesions.

TABLE OF CONTENTS/OUTLINE
Embryology and normal anatomy of pituitary stalk
Imaging features of Pituitary Stalk abnormalities: Congenital/developmental: Thinning of stalk
Stalk interruption with ectopic bright spot
Duplication
Rathke's cleft cyst of stalk
Infectious/inflammatory: Stalk thickening in Langerhan Cell histiocytosis
Lymphocytic hypophysitis
Tuberculosis
Sarcoidosis
Neoplastic: Germ Cell tumor and other common tumors of pituitary stalk
This exhibit will also highlight the clinical and biochemical features of the entities listed above.
Mountains Beyond Mountains: Lessons and Limitations from Non-contrast CT Imaging of Advanced Head and Neck Pathology in an Underserved, Rural International Community

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
1. To demonstrate importance and diagnostic value of a donated CT scanner in an underserved, rural international community and review pertinent findings of non-contrast CT imaging in patients with advanced head and neck pathology. 2. To evaluate limited availability and accessibility of non-contrast CT imaging in an underserved, rural international community and highlight the need to provide CT interpretation skills to this country's radiology trainees. 3. To review our role and challenges in providing imaging services and education to an underserved, rural international community.

TABLE OF CONTENTS/OUTLINE
1. Background Limitations of radiology resources in an underserved, rural international community (no IV contrast, biomedical engineering support and no MRI) Limitations of radiology training (lack of CT interpretation skills) Very limited public access to non-contrast CT services available in this rural community 2. Review pertinent imaging findings in patients with advanced head and neck pathology and artifacts on non-contrast CT imaging 3. Discuss value of non-contrast CT and utilization in patient management in this underserved, rural community 4. Review of our Radiology department's role and challenges in providing imaging services and education to international communities in need
NR313-ED-X

Genetics and Imaging Features of Medulloblastomas: A Case-based Review of Pediatric Medulloblastomas
Imaging Features and Characteristics of Their Molecular Subtypes

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

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TEACHING POINTS
1. To present a case based approach of different medulloblastoma molecular subtypes (Shh, Wnt, and non-Wnt/non-Shh). 2. To describe imaging features of different medulloblastoma molecular subtypes at our institution and based on literature review. 3. To describe clinical methods for determining the molecular subtype of medulloblastoma and how it affects determination of group 3 and group 4 tumors from a general category of non-Wnt/non-Shh tumors.

TABLE OF CONTENTS/OUTLINE
1. Pathophysiology of medulloblastoma and treatment strategies 2. Imaging of pediatric medulloblastoma with CT, MRI, and 18F-FDG-PET. Role of diffusion weighted imaging in diagnosis of medulloblastoma. 3. Imaging characteristics of pediatric medulloblastomas based on their molecular subtype - Shh, Wnt, non-Wnt/non-Shh. Imaging characteristics of group 3 and group 4 tumors will be reviewed based our institution's cases and published studies 4. Methods of determining molecular subtypes of medulloblastoma will be described with specific emphasis on clinical availability of identifying group 3 and group 4 tumors.
NR314-ED-X

Parotid Gland Lesions and Multiparametric Magnetic Resonance Evaluation: A Diagnostic Approach

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS

The purpose of this exhibit is: 1. To learn the detailed anatomy of parotid gland, including its ducts, vascularization and innervation.
2. To show cases of tumoral and non-tumoral lesions of parotid gland.
3. To learn how multiparametric evaluation such as diffusion and permeability of parotid lesions can help to narrow the broad differential diagnosis.

TABLE OF CONTENTS/OUTLINE

Introduction with detailed anatomy of parotid gland in the different imaging methods (computed tomography, MRI, ultrasound, Doppler and nuclear medicine), including its vascularization and innervation. Schematization of the main curves patterns in the study of permeability of parotid gland lesions. Didactic cases showing the role of advanced techniques such as diffusion weighted imaging and dynamic contrast-enhanced MR perfusion of parotid masses and nodules will be presented with focus on their added values for evaluation of these lesions. - Pleomorphic adenoma; - Warthin's tumor; - Mucoepidermoid carcinoma; - Cystic adenoid carcinoma; - parotid abscess; - parotid hemangioma; - parotid lymphoma. Conclusions Bibliographical references
NR315-ED-X

Let's Take a Look at the Eye: What Radiologists Should Know about Ocular Ultrasound and Doppler in Comparison with OCT

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

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TEACHING POINTS
- To describe ocular ultrasound and Doppler technique and its uses.
- To schematize the method, focusing the evaluation according to the clinical context of the patient.
- To specify the typical findings in bidimensional US and Doppler of the most frequent pathological conditions in the daily ophthalmological practice and comparison with Optical Coherence Tomography (OCT) findings as an innovating combination for further study.

TABLE OF CONTENTS/OUTLINE
US and Doppler technique in ophthalmology. Applications of these methods. Review of normal findings. OCT technique and its applications. Characteristic findings in ophthalmologic diseases. -Sample cases. Summary.
NR316-ED-X

Journey to the Center of the Brain: The Ventricular System

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
• To deepen into the anatomical and physiological knowledge of the ventricular system. • To recognize anatomical variants and non-significant findings. • To review the main pathological entities, as well as the imaging techniques used in their diagnosis and monitoring through clinical cases, paying special attention to hydrocephalus.

TABLE OF CONTENTS/OUTLINE
• Introduction • Anatomy and physiology o Cerebrospinal fluid flow • Ventricular dimensions o Variability o How to measure the ventricular system • Normal findings and anatomical variants • Congenital anomalies • Atrophic ventriculomegaly • Pressure alterations: radiological findings o Hydrocephalus o Intracranial hypotension • Intraventricular masses o Tumors o Cystic lesions • Intraventricular hemorrhage • Ventriculitis • Surgical treatment: shunting • Conclusions
CT And MR Imaging of the Skull Bone Lesions: Assessment of Age-Related Normal Patterns and Pathologic Spectrum

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
The purpose of this exhibit is: To review cranial bone marrow MR imaging including normal development. To review the normal anatomy and various pathologic spectrum affecting the skull region. To understand a value of MR sequence such as fat-suppressed imaging, 3D-imaging, and diffusion weighted imaging, and to suggest imaging strategies for the evaluation of various disease processes.

TABLE OF CONTENTS/OUTLINE
This exhibit includes various congenital and acquired lesions of the skull bone, both benign and malignant, such as epidermoid cyst, eosinophilic granuloma, fibrous dysplasia, osteoma, osteochondroma, hemangioma, meningioma, metastatic tumor, plasmacytoma, and multiple myeloma. We describe CT and MR imaging techniques to understand which imaging method is suited to determine the extent of abnormality and to aid in the diagnosis. FDG-PET and bone scintigram findings are also presented in some cases. We are presenting: Key points for practical imaging assessments and characteristic findings of diagnostic imaging
Bonehead! Osseous Lesions of the Skull

All Day Room: NA Digital Education Exhibit

Participants
Varun Mehta, MD, Staten Island, NY (Presenter) Nothing to Disclose
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Leonid Lempert, MD, Staten Island, NY (Abstract Co-Author) Nothing to Disclose

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TEACHING POINTS
1. To provide CT examples of common and some uncommon lesions of the skull encountered on CT. Additionally, provide MRI and pathology findings when appropriate for further correlation.
2. To discuss imaging features and approach to osseous lesions of the skull.
3. To discuss pathophysiology of each lesion discussed.
4. To discuss management/treatment of these lesion Examples of lesions to be included but not limited to: Osteomas, fibrous dysplasia, Paget's disease, intraosseous hemangiomas, intraosseous meningioma, metastatic lesions, Langerhans Cell Histiocytosis, osteopetrosis, surfer's ear, and giant cell tumor.

TABLE OF CONTENTS/OUTLINE
1. Introduction
4. Summary with a table
Another Enhancement in the Wall: Vessel-Wall Analysis in CNS Infectious Diseases

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Raquel A. Moreno, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
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TEACHING POINTS
The purpose of this exhibit is to: 1. Demonstrate MR findings of intracranial vascular abnormalities in a heterogeneous group of patients with definitive or probable SNC infection, according to clinical and laboratory information. 2. Highlight relevant information provided by axial T1 spin eco (T1WI) and high-resolution contrast-enhanced, black-blood T1WI with fat suppression (VWI) on evaluation of vessel wall thickness and enhancement. 3. Show 3DTOF MR alterations of luminal morphology, such as string of beads pattern and fusiform aneurysms. 4. Delineate a take home message board, by the analysis of representative cases with imaging findings in agreement with those recently described in literature. Vasculitis is a well recognized complication of neuroinfectious diseases. HIV, varicella zoster virus (VZV), syphilis, tuberculosis and other bacterial and parasitic meningitis are some of the most common etiologies. Identifying patterns of vascular injury contributes to early recognition, resulting in more targeted treatments and better outcomes.

TABLE OF CONTENTS/OUTLINE
Introduction Methods Review imaging findings on: - HIV, VZV, tuberculosis vasculitis; - Vasculitis related to other bacterial or parasitic meningitis. - Syphilis aneurysmatic pattern; Discussion Take-home message
**Functional and Structural Assessment of the Brain During Normal Aging and Common Age-related Neurodegenerative Diseases**

All Day Room: NA Digital Education Exhibit

**Participants**

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**TEACHING POINTS**

1. To present the current role of 18F-FDG PET and MRI in the diagnosis, and management of patients with age-related neurodegenerative diseases  
2. Review of functional and structural imaging alterations used for distinction of normal aging from early stages of dementia  
3. Discuss the available evidence and knowledge gaps in detecting age-related neurodegenerative diseases

**TABLE OF CONTENTS/OUTLINE**

1) Brief introduction of common age-related neurodegenerative disorders  
2) Review of functional and structural alterations of brain in normal aging  
3) 18F-FDG PET and MRI findings in age-related neurodegenerative disease  
4) Current standard of care and role of imaging in the management of age-related neurodegenerative disease
NR321-ED-X

Brainstem Neuroanatomy: Correlation of In vivo and Post Mortem 7T Images and Histology

All Day Room: NA Digital Education Exhibit

Awards
Cum Laude

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TEACHING POINTS
1. Illustrate normal brainstem neuroanatomy on 7T MR images (7T MRI) on in vivo and postmortem population. 2. Detail and nominate brainstem tracts and nuclei based on correlation of brain autopsy 7T MR images with its histological analysis. 3. Delineate 7T MRI accuracy based on comparison of brain autopsy and in vivo images. 4. Establish 7T MRI advantages over the usual magnetic fields. 5. Briefly discuss potential future uses for 7T MRI to further understand anatomic and pathological mechanisms in some central and peripheral neurologic diseases.

TABLE OF CONTENTS/OUTLINE
Brain 4D Flow MRI: Scan Parameters, Analysis Parameters and Target Diseases

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

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TEACHING POINTS

Brain 4D Flow MRI has been clinically available on commercial MRI. However, there is no consensus about how to scan and analyze. Also, the clinical impact has not been well documented yet. We will discuss MR scan parameters, advanced analysis parameters and target diseases of brain 4D Flow MRI based on our volunteer and patient examination.

TABLE OF CONTENTS/OUTLINE

1. MR scan parameters; How to improve velocity noise ration with clinically acceptable scan time. A. Basic parameters; voxel size, flip angle B. Phase contrast MRI related parameters; Flow-encoding scheme, VENC, heart phase, k-space segmentation C. Acceleration techniques; parallel imaging, partial k-space sampling, view sharing, k-t technique 2. Analysis parameters A. Velocity, Flow volume B. Wall shear stress C. Turbulent Kinetic energy D. Relative pressure E. Helicity, Vorticity 3. Target disease A. Aneurysm B. Internal carotid artery stenosis; Evaluation of collateral flow C. Bypass surgery D. Arterial venous malformation E. Hydrocephalus
NR323-ED-X

An Emotional Memoir of the Limbic System: Reflection on Anatomy and Pathology

All Day Room: NA Digital Education Exhibit

Participants
Yi Li, MD, San Francisco, CA (Presenter) Nothing to Disclose
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TEACHING POINTS
1. Review the anatomy and function of the limbic system
2. Review the morphologic and functional MR imaging appearance of the normal limbic system
3. Review the imaging appearance of pathologic conditions of the limbic system, categorized based on whether they are diseases selectively involving the limbic system, predominantly involving the limbic system, or randomly involving the limbic system

TABLE OF CONTENTS/OUTLINE
Participants
Laura Watson, MD, Boston, MA (Presenter) Nothing to Disclose
Neel Madan, MD, Boston, MA (Abstract Co-Author) Consultant, Near Infrared Imaging, LLC; Board Member, Quindec Inc
Sara Cohen, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To review high and low flow cerebral vascular malformations and describe imaging techniques used to diagnose and characterize each lesion. 2. To provide case examples of each malformation and discuss common classification systems used to determine prognosis of the high flow lesions. 3. To provide clinical history for each lesion as well as management strategies for these cases.

TABLE OF CONTENTS/OUTLINE
Brief review of normal arterial and venous anatomy and the more common high and low flow vascular lesions. Low Flow Malformations: Cases will include but are not limited to the following: Capillary telangiectasia, cavernous malformations with and without developmental venous anomalies, venous varices, and mixed malformations. High Flow Malformations: Cases will include but are not limited to: dural and pial arteriovenous fistulas, cerebral arteriovenous malformations, and high flow vein of Galen AVM, including neonatal, pediatric, and adult patients. Each case will include clinical presentation of the patient, classic features of the diagnosis on imaging, current classification systems used to determine prognosis and treatment, and subsequent management/treatment of the patient.
Jaw-dropping Lucent Lesions of the Jaw

All Day Room: NA Digital Education Exhibit

Participants
Paulo P. Serapio, MD, W Hollywood, CA (Abstract Co-Author) Nothing to Disclose
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Peyman Kangavari, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Review anatomy of the maxilla, mandible and teeth Understand etiology, clinical manifestations and treatment of lucent lesions of the maxillary and mandibular jaw Identify key imaging features of odontogenic and non-odontogenic lucent lesions of the jaw Develop algorithm for approaching lucent lesions of the jaw

TABLE OF CONTENTS/OUTLINE
Radiographic anatomy of the jaw Anatomy of the teeth and supporting structures Case examples of lucent lesions of the jaw integrating clinical and imaging features, including but not limited to: Odontogenic diseases - Periapical cyst - Periapical abscess - Ameloblastoma - Cystic odontoma Non-odontogenic diseases - Fibrous dysplasia - Cherubism - Squamous cell carcinoma - Multiple myeloma - Giant cell granuloma - Aneurysmal bone cyst Algorithm for approaching lucent lesions of the jaw
Causes of Hoarseness: A Review of CT and MR Imaging Findings

All Day Room: NA Digital Education Exhibit

Participants
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TEACHING POINTS
The purpose of this exhibit is: 1. To understand the entire course of the vagus nerve and recurrent laryngeal nerve, and to learn clinical symptoms for affecting location. 2. To review a variety of head and neck disease entities that cause a ‘hoarseness’ and to identify the reliable CT and MR findings. 3. To recognize common and uncommon mediastinal diseases that can result in vocal cord paralysis.

TABLE OF CONTENTS/OUTLINE
1. This exhibit includes various spectrums of head and neck diseases, including various neoplastic, inflammatory, and vascular lesions. 2. To be familiar with mediastinal lesions that can cause ‘hoarseness’, multiplanar reconstructed CT imaging is presented as well as MR imaging. 3. We are presenting key points for practical imaging assessments and characteristic findings of diagnostic imaging showing some imaging pitfalls.
**Teaching Points**

SSPE is very rare in developed countries, but is still common in developing and poor countries. It affects children and is uncommon after 18 years of age. MRI is used to assess early brain involvement and prognosticate the patient. A combined clinical, pathological and radiological approach is a must to diagnose a case of SSPE.

**Table of Contents/Outline**

- **Introduction** Subacute sclerosing panencephalitis (SSPE) is chronic progressive encephalitis of childhood and early adolescence causing neuroregression and leading to death within 1-3 years. It is caused by measles virus that silently develops for several years after the primary measles virus infection. Clinical presentations can vary and include severe neurologic symptoms such as myoclonic jerks, ataxia, seizures and dementia. Criteria to diagnose SSPE Stages of SSPE SSPE is also diagnosed in few cases of HIV and pregnancy due to underlying immunosuppression. No curative treatment is available. An effective measles vaccination is the only solution available to this fatal disease.
The Wide Spectrum of Tubulinopathies: What Are the Key Features for the Diagnosis?

All Day Room: NA Digital Education Exhibit

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Camila S. Moreira de Sousa, MD, Fortaleza, Brazil (Presenter) Nothing to Disclose
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TEACHING POINTS
- To recognize basic normal brain anatomy. - To characterize the main imaging findings associated with disorders of microtubule function.

TABLE OF CONTENTS/OUTLINE
1. Introduction: Tubulinopathies are a recently reported group of brain malformations caused by mutations in genes involved in microtubule formation and function, a wide and overlapping imaging findings are described in the literature and the authors pinpoint the main and characteristic findings. 2. Anatomy: Gyrus and sulcus, Corpus callosum, Basal ganglia, Brain stem, Cerebellum. 3. Review of imaging findings: Brain malformations in tubulinopathies spectrum include a range of lissencephalies (classic lissencephaly, lissencephaly with cerebellar hypoplasia, lissencephaly with agenesis of the corpus callosum, and centrally predominant pachygyria), polymicrogyria-like cortical dysplasia, simplified gyral pattern, and microlissencephaly often in combination with dysplastic basal ganglia, corpus callosum abnormalities, and hypoplasia or dysplasia of the brain stem and cerebellum. The diagnosis of a tubulinopathy, regardless of the gene involved, is based on the presence of characteristic complex brain malformations. 4. Sample cases: Demonstration of the most important magnetic resonance findings in tubulinopathies using selected cases from authors archives.
Craniofacial Malformations: What the Radiologist Needs To Know

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TEACHING POINTS

- Imaging of craniofacial deformities is considered as one of the challenges for the radiologists, we want to present a systematic approach to assist radiologists in the evaluation of principal craniofacial malformations. • Propose a simple algorithm for the evaluation of bony structures and soft tissues of the face and skull based on location and imaging characteristics of craniofacial malformations. • Identify the cranial and craniofacial proportions and measurements • Review the key elements and main information about the craniofacial malformations the surgeon needs from preoperative imaging and to identify any postsurgical complications. • Review the classification and describe in detail the radiologic appearance and findings of the different types of congenital craniofacial malformations. • Demonstrate the role of imaging in the postoperative evaluation and assessment of complications of these malformations.

TABLE OF CONTENTS/OUTLINE

Introduction • Demographics & outcomes • Clinical characteristics of principal craniofacial malformations • Algorithm approach to diagnosis by CT • Cranial and craniofacial proportions and measurements • Post-surgical evaluation • Imaging of major post-surgical complications Conclusion
Multimodality Imaging Approach to Craniovertebral Junction (CVJ) Anomalies: A Road Map for Surgeons

All Day Room: NA Digital Education Exhibit

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TEACHING POINTS
• To highlight the key anatomical landmarks and important craniometry methods
• To illustrate the wide spectrum of pathologies involving the cranio vertebral junction (CVJ)
• To emphasize the role of multimodality imaging in pre surgical planning which in turn helps to decide the type of surgical approach

TABLE OF CONTENTS/OUTLINE
Contrary to the popular belief that the only pathology affecting CVJ is traumatic atlanto-axial dislocation, we hereby present a wide spectrum pathologies that have been encountered in our institution in a retrospective analysis of multimodality imaging studies of the CVJ from 2016 to 2017. Congenital: Assimilation of atlas, clivus segmentation defects, dens dysplasia, os odontoideum, Developmental: Achondroplasia, chiari malformation, klippel feil syndrome, osteogenesis imperfect, basilar invagination, platybasia Infective: Tuberculosis. Inflammatory: Rheumatoid arthritis, ankylosing spondylitis. Traumatic: Traumatic fractures, atlanto axial dislocation. Neoplastic: Clival chondoma, clival chondrosarcoma, giant cell reparative granuloma, aneurysmal bone cyst, chondromyxoid fibroma, foramen magnum meningioma, epithelioid haemangioma. We intend to focus on the key diagnostic pearls characteristic for each pathology and also highlight the role of imaging in pre surgical planning.
Beyond the Visible: Quantitative Volumetric Analysis in Neurodegenerative Diseases

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
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Leighton P. Mark, MD, Milwaukee, WI (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Volumetric analysis is an important biomarker for assessment of patients with mild cognitive impairment (MCI) and dementia.
2. Visual assessment of brain volume is crude and is fraught with high intra- and inter-observer variability.
3. Quantitative volumetric analysis can significantly aid in detection of early brain volume loss.
4. Serial volumetric assessment over time can increase the prediction of conversion of MCI to dementia.

TABLE OF CONTENTS/OUTLINE
1. What is mild cognitive impairment (MCI).
2. Biomarkers used to predict MCI conversion to dementia.
3. Role of quantitative volumetric analysis as a biomarker.
4. Case examples to show how visual assessment of brain volume can be significantly insensitive.
5. Future directions for quantitative volumetric assessment.
NR332-ED-X
Orbital Emergencies: From Fractures to Fistulas
All Day Room: NA Digital Education Exhibit

Participants
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TEACHING POINTS
1. To review anatomy of the orbits with an emphasis on features relevant to the spread of disease and management
2. To present important imaging features and clinical considerations for traumatic orbital emergencies
3. To present salient imaging features of orbital infectious processes with a focus on the Chandler classification system, infection of the layers of the globe, and differentiation between subchoroidal and subretinal collections
4. To review the clinical and imaging findings of inflammatory processes and vascular pathology involving the orbit

TABLE OF CONTENTS/OUTLINE
1. A visual review of how to systematically check the orbit for pathology in a step-by-step approach.
2. Orbital Trauma cases in a quiz format.
3. Orbital infection, including pre- and post-septal cellulitis, subperiosteal abscess, endophthalmitis, invasive fungal sinusitis involving the orbit.
4. Orbital Inflammatory and idiopathic conditions including idiopathic orbital inflammation (orbital pseudotumor) and Tolosa-Hunt Syndrome, granulomatosis with polyangitis, optic neuritis, thyroid orbitopathy, sarcoidosis, pseudotumor cerebri with papilledema.
5. Vascular emergencies related to the orbit including cavernous sinus and superior ophthalmic vein thrombosis and carotid cavernous fistula.
Oncodiagnosis Panel: Spinal Metastasis

Sunday, Nov. 26 10:45AM - 12:15PM Room: E353C

Participants
Nina A. Mayr, MD, Seattle, WA (Moderator) Nothing to Disclose
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Sten Myrehaug, MD, FRPC, Toronto, ON (Presenter) Travel support, Ipsen SA; Travel support, Novartis AG; Speaker, Novartis AG

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LEARNING OBJECTIVES
1) To discuss the pre-treatment imaging evaluation of spinal metastases. 2) To discuss the surgical aspects of spinal metastases. 3) To discuss the target delineation for stereotactic body radiotherapy (SBRT) for spinal metastases. 4) To discuss the challenges with post-SBRT radiographic evaluation of response.

ABSTRACT
The spinal column is one of the most common sites for metastatic involvement. Proper imaging evaluation is crucial in guiding appropriate therapy, which includes surgery, radiotherapy, or combined surgery and radiotherapy. Stereotactic body radiotherapy (SBRT) has emerged as one of the standard therapies for spinal metastases and it is either given alone or in combination with stabilization and/or decompression surgery. Challenges exist with regard to post-SBRT response evaluation.
**SSA13**

**Science Session with Keynote: Molecular Imaging (Neuroinflammation, Brain Injury and Glioma)**

Sunday, Nov. 26 10:45AM - 12:15PM Room: S504CD

**AMA PRA Category 1 Credits™: 1.50**
**ARRT Category A+ Credit: 1.75**

**FDA** Discussions may include off-label uses.

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**Sub-Events**

**SSA13-01**  **Molecular Imaging Keynote Speaker: Imaging of Neuroinflammation**

Sunday, Nov. 26 10:45AM - 10:55AM Room: S504CD

Participants
Satoshi Minoshima, MD, PhD, Salt Lake City, UT (Presenter) Research Consultant, Hamamatsu Photonics KK; Research Grant, Hitachi, Ltd; Research Grant, Nihon Medi-Physics Co, Ltd;

**SSA13-02**  **Neuroinflammation in Acute Hepatic Encephalopathy Rats: Imaging and Therapeutic Effectiveness Evaluation Using 11C-PK11195 and 18F-DPA-714 Micro-Positron Emission Tomography**

Sunday, Nov. 26 10:55AM - 11:05AM Room: S504CD

Participants
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**PURPOSE**

Neuroinflammation is important in hepatic encephalopathy (HE). 11C-PK11195 is most common positron emission tomography (PET) molecular probe of neuroinflammation targeted to translocator protein (TSPO). 18F-DPA-714, a new radiotracer of TSPO, has not been used in research of neuroinflammation in acute hepatic encephalopathy (AHE). The aim of this study was to compare two radiotracers, 11C-PK11195 and 18F-DPA-714, as neuroinflammation agents for imaging of AHE rat model and using the new radiotracer 18F-DPA-714 imaging to observe therapeutic effectiveness treatment to neuroinflammation in AHE.

**METHOD AND MATERIALS**

Firstly, comparative study of 11C-PK11195 and 18F-DPA-714 PET were performed to AHE rats induced by thioacetamide. Twenty-four rats were divided into control (n=12) and AHE group (n=12), two radiotracers PET imaging (n=6 for each) was performed in each group, respectively. Uptake values of the whole brain between two groups were compared. Then, the optimized tracer were used to monitor anti-neuroinflammation effects of AHE. Forty-six rats were divided into four groups: [normal saline (NS) group (n=13), minocycline (MINO) group (n=11), dexamethasone (DEXA) group (n=11), MINO+DEXA group (n=11)]. 18F-DPA-714 PET was performed and the uptake values were calculated. The rotarod test, biochemical indexes and histopathological examination were quantitatively measured and compared.

**RESULTS**

AHE rats showed reduced motor ability, higher ammonia levels and liver function indexes and unchanged inflammatory factors compared with control group. Both 11C-PK11195 and 18F-DPA-714 PET can detect neuroinflammation of AHE rats. Behavioral studies showed MINO or/and DEXA improved AHE rats’ motor ability, however, no differences were found for liver function and inflammatory markers among four groups. The average uptake values of whole brain and multiple brain areas in the MINO+DEXA group were lower than other groups, which was demonstrated by CD11b stains of microglia.

**CONCLUSION**

Both 11C-PK11195 and 18F-DPA-714 PET can detect neuroinflammation of AHE models, while the combined use of minocycline and dexamethasone can effectively inhibit neuroinflammation of AHE rats, which can be sensitively monitored by 18F-DPA-714 PET.

**CLINICAL RELEVANCE/APPLICATION**

Both 11C-PK11195 and 18F-DPA-714 PET might detect neuroinflammation of AHE models, and the treatment effect could be sensitively monitored by 18F-DPA-714 PET.
Comparison Study of Radiogenomics Association and Prognostic Value Between MR Dynamic Susceptibility Contrast Perfusion Weighted Imaging and Diffusion Imaging in Patients with Newly Diagnosed Glioblastoma

Sunday, Nov. 26 11:05AM - 11:15AM Room: S504CD

Participants
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PURPOSE
MR DSC-PWI and DWI are advanced imaging techniques investigating glioblastoma hemodynamic and tumor cellularity abnormality in vivo. The purpose of this study is to evaluate and compare the association between genomic biomarkers and imaging parameters derived from MR DSC-PWI and DWI, and their prognostic value in predicting overall survival time (OS) in patients with newly diagnosed glioblastomas.

METHOD AND MATERIALS
Forty-one cases (mean age is 62.32±12.09) with new pathology confirmed glioblastomas were enrolled in this study. The mean, maximal relative cerebral blood volume (rCBV) ratio, mean apparent diffusion coefficient (ADC) and minimal ADC of the enhancing tumor (rCBVmean, rCBVmax, ADC mean and ADCmin), maximal rCBV ratio and minimal ADC of peri-enhancing tumor area (rCBVperi-tumor and ADCperi-tumor) were measured. The association between imaging parameters and Ki-67 labelling index, isocitrate dehydrogenase (IDH), mammalian target of rapamycin (mTOR), and EGFR was assessed, the Cox regression was used to evaluate their implication on OS.

RESULTS
There were 40 cases without IDH mutation, and there was no significant between ADC parameters and genomic biomarkers (p>0.05). In contrast, the rCBVmax had significant association with mTOR, (p =0.047), the rCBVperi-tumor was significantly associated with mTOR after adjustment of gender and EGFR. The Cox regression analysis showed that rCBVperi-tumor and age were the two strongest predictors of OS (hazard ratio= 1.29 and 1.063; p =0.003 and 0.005 respectively). The rCBVperi-tumor had better area under the curve than other imaging parameters and genomic biomarkers in ROC analysis, combination of rCBVperi-tumor and age improved the prediction of OS with specificity of 78.9% and sensitivity of 81.8%.

CONCLUSION
This comparison study showed significant radiogenomics association between quantitative rCBV parameters and mTOR-EGFR pathway biomarkers, and rCBVperi-tumor had better prognostic value than genomic biomarkers alone, these radiogenomics findings will be useful in developing new target therapy.

Roles of Elevated 20-HETE in the Breakdown of Blood Brain Barrier and the Severity of Brain Edema in Experimental Traumatic Brain Injury

Sunday, Nov. 26 11:15AM - 11:25AM Room: S504CD

Participants
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PURPOSE
Breakdown of the blood brain barrier (BBB) is a secondary injury following traumatic brain injury (TBI) and can lead to the development of brain edema. However, the factors that contribute to the disruption of the BBB and increase the severity of brain edema in TBI remain to be elucidated. The inhibition of 20-hydroxyeicosatetraenoic acid (20-HETE) synthesis by HET0016 has been suggested as a strategy to decrease brain edema. The present study aimed to investigate whether the elevated production of 20-HETE in cerebral tissue may contribute to BBB breakdown and increase the severity of brain edema in rats with TBI.

METHOD AND MATERIALS
BBB permeability was quantified using dynamic contrast-enhanced magnetic resonance imaging and brain edema was measured according to brain water content. Superoxide production in injured tissue was also assessed. Liquid chromatography-mass spectrometry was used to evaluate 20-HETE production in injured tissue. Western blot analysis was used to assess the expression of occludin, zonula occludens (ZO)-1, matrix metalloproteinase (MMP)-9, and proteins of the c-Jun N-terminal kinase (JNK) pathway.

RESULTS
A total of 3, 24 and 72 h following the induction of TBI, 20-HETE levels, BBB permeability and brain edema were identified to be increased, accompanied by an increase in superoxide production. Conversely, superoxide dismutase levels, in addition to the total antioxidative capability were decreased. In addition, the expression of MMP-9 and proteins of the JNK pathway was upregulated, whereas the expression of occludin and ZO-1 was observed to be suppressed. These results suggested that 20-HETE may aggravate BBB disruption following TBI, via enhancing the expression of MMP-9 and tight junction proteins. Furthermore, oxidative...
stress and the JNK signaling pathway may be involved in BBB dysregulation.

CONCLUSION
In conclusion, the results of the present demonstrated that the production of 20-HETE was increased in cerebral tissue following traumatic injury, thus suggesting that it may contribute to the compromise of BBB integrity and the development of brain edema.

CLINICAL RELEVANCE/APPLICATION
This study was to explore the mechanism for the compromise of blood-brain barrier integrity and the development of brain edema following traumatic brain injury. Furthermore, clinically, we could find another reason and tool to solve the problem of disruption of blood-brain barrier after traumatic brain injury.

SSA13-05 Multimodal PET and MR Imaging With Pathologic Confirmation Detects Axonal and Synaptic Preservation After Paclitaxel Administration for Repeat Concussive Brain Injury in Mice

Sunday, Nov. 26 11:25AM - 11:35AM Room: S504CD

Participants
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PURPOSE
PET and MR imaging have been proposed as biomarkers to evaluate repeat concussive brain injury (rcTBI) clinically. In this study, we hypothesized that imaging could be used in mice to detect axonal and synaptic injury from rcTBI as well as response to therapeutic intervention by paclitaxel.

METHOD AND MATERIALS
Mice received repeat concussive controlled cortical impact (rcCCI) one impact/day for five days (n=15) or sham CCI (n=8). Intranasal PTX (0.6 mg/kg; n=6) or saline (SAL) (n=9) was administered only after first CCI. Diffusion tensor imaging (DTI) was acquired on 14T as a 4 shot EPI, TR/TE=500/16.482ms, 30 diff directions, Max bval=6477.26849710899 s/mm2. Fractional anisotropy (FA) was compared using manual ROIs as well as FSL tract-based spatial statistics (TBSS). Glucose metabolism was assessed via SUV corrected 18F-fluorodeoxyglucose (FDG) PET imaging as a biomarker for synaptic activity. At 45 days, brains were evaluated for pathologic evidence of axonal injury (silver stain) and synaptic loss (PSD-95) in the external capsule and hippocampus respectively.

RESULTS
FA in the external capsule was decreased in rcTBI by 17% compared to SHAM (0.21±0.01 vs 0.25±0.01, p<=0.05) and extensive areas of white matter injury were seen by TBSS. However, PTX-rcCCI was not significantly different from SHAM or SAL-rcCCI with either analysis. With silver stain, axonal degeneration was seen in cortical white matter of the external capsule in 5/6 SAL-rcCCI but not PTX-treated (n=0/5). A single, dystrophic axon was observed in 1/8 shams. The SAL-rcCCI showed significantly decreased brain FDG uptake, which was "normalized" in PTX mice. Whole brain SUVs, were 120.5±30.1, 90.3±18.7 and 129.2±23.0, for SHAM, SAL- and PTX-rcCCI respectively, p<0.05. In SAL-rcCCI, hippocampal PSD-95 immunofluorescence was reduced compared to both SHAM and PTX.

CONCLUSION
Both DTI and FDG-PET detected brain alterations in white matter structure and glucose metabolism from repeat concussive injury. However, only FDG-PET confirmed that PTX resulted in improvement when pathology indicated both synaptic loss AND axonal injury were prevented with PTX. DTI may not be sensitive enough or may have more inherent variability to detect treatment-related benefit in rcTBI. Further research is needed to distinguish these factors.

CLINICAL RELEVANCE/APPLICATION
Establishment of brain imaging biomarkers is of critical importance to research and therapeutic development for traumatic brain injury.

SSA13-07 Evolution of Diffusion in Hematoma and Perihematoma after Experimental Intracerebral Hemorrhage by 7.0 T DTI

Sunday, Nov. 26 11:45AM - 11:55AM Room: S504CD

Awards
Student Travel Stipend Award

Participants
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PURPOSE
To characterize experimental hematoma and perihematoma using diffusion tensor imaging (DTI) and compare the feature of diffusion with that of histology after intracerebral hemorrhage (ICH).

**METHOD AND MATERIALS**

Twenty-nine male SD rats injected with 40 μL autologous blood in the right basal ganglia underwent 7.0 T MR with T2WI (additional day 0, D0) and DTI sequences at days 1 (D1), 3 (D3), 7 (D7), 14 (D14), 21 (D21), and 28 (D28). HE, Iba1, and glial fibrillary acidic protein staining was performed after brain fixation. Hematoma volume at D0 was measured by T2WI images. Mean diffusivity (MD), axial diffusivity, and radial diffusivity were measured by DTI images. Abnormal MD volumes were delineated manually by MD maps.

**RESULTS**

The mean hematoma volume was 14.78 μL at D0. The main patterns of diffusivity changes in the ipsilateral basal ganglia after ICH on MD maps visually included relative central hyper-value zone (rCEVZ; MD at D1: 9.54 ± 2.57 x 10^{-4} mm^2/s), relative hypo-value zone (rOEVZ; MD at D1: 6.94 ± 0.96 x 10^{-4} mm^2/s), and relative peripheral hyper-value zone (rPEVZ; MD at D1: 9.61 ± 0.59 x 10^{-4} mm^2/s). The rCEVZ corresponded to the area with not only heterogeneous erythrocytes and serum at D1, D3, and D7, but also necrosis of brain parenchyma at D1 and D3. The rOEVZ corresponded to the area with vasogenic and cytotoxic edema at D1, D3 and D7, neutrophil accumulation at D3 and D7, microglia proliferation from D3 to D28, and astrocyte proliferation from D7 to D28. The rPEVZ corresponded mainly to the area with cytotoxic and vasogenic edema at D1, D3 and D7, also with glial cell proliferation from D3 to D28. Volumes of abnormal diffusion at D1 and D3 were significantly greater than the hematoma volume at D0 (both p < 0.001). The rCEVZ volumes at D1, D3, and D7 were significantly lower than hematoma volume at D0 (all p < 0.001). The rOEVZ and rPEVZ volumes peaked at D1 and D3, respectively.

**CONCLUSION**

The results imply diffusion changes in hematoma and perihematoma after ICH involve complex pathological alterations including blood components, cytotoxic and vasogenic edema, and cellular accumulation and proliferation.

**CLINICAL RELEVANCE/APPLICATION**

This research exhibit evolution of diffusion in hematoma and perihematoma with histological basis, which is useful to explain the diffusion changes in patients after intracerebral hemorrhage.
Lipopolysaccharide (LPS) endotoxemia results in secondary neuroinflammation and deposition of amyloid-beta (Aβ) and phosphorylated tau (p-tau) in the rat brain. The objective was to determine whether acute systemic endotoxemia results in secondary neuroinflammation with consequent Aβ plaque and p-tau deposition in the brain.

**METHOD AND MATERIALS**

Male Sprague-Dawley rats received an IP injection of 10 mg/kg of E. Coli lipopolysaccharide (LPS) to mimic sepsis. IL-1β, IL-6, and TNFα were measured by ELISA in whole brain homogenates of LPS-injected and control rats. Soluble Aβ and p-tau proteins in brain homogenates were measured by immunoblotting. Cortical Aβ plaques were quantified by immunostaining and morphologically characterized by confocal microscopy. Microglial density was quantified by Iba1 immunostaining. At 72 h post LPS administration, rats were injected intravenously with 18F-flutemetamol and the resultant brain uptake was quantified by digital autoradiography of cryomicrotome slices.

**RESULTS**

Endotoxemia resulted in increased cytokines in the brain, particularly IL-1β (7.8 fold increase over controls at 24h, p < .0001). Cortical microglial density was 1.9-fold higher LPS-injected rats than controls (p < .001). Compared to controls, systemic LPS produced significant brain increases of soluble Aβ (1.98-fold increase, p < .01) and p-tau (2-fold increase, p < .01) and a progressive accumulation of Aβ aggregates, which were morphologically similar to diffuse plaques. There was no significant difference in uptake of 18F-flutemetamol in the cerebral white matter (corpus callosum) in the brains of LPS-treated vs. control rats. The cerebral cortical activity was 2.02 fold higher in LPS than control rats (p < .01), a difference that was visually appreciable.

**CONCLUSION**

LPS endotoxemia causes secondary neuroinflammation and elevations in cytokines, soluble Aβ, p-tau and Aβ plaques in the brain, and cortical deposition of 18F-flutemetamol. Whether these findings eventually resolve or are associated with neurocognitive impairment are as of yet unknown.

**CLINICAL RELEVANCE/APPLICATION**

18F Flutemetamol PET could provide a mechanism to study the effects of systemic inflammatory conditions on the brain, the pathogenesis of which may involve the accumulation of Aβ.
Neuroradiology (Brain Tumors: Beyond the Frontier)

Sunday, Nov. 26 10:45AM - 12:15PM Room: N228

Non-invasive Prediction of Isocitrate Dehydrogenase (IDH) Genotype in Grade-II Gliomas with Amide Proton Transfer-Weighted (APTw) MR Imaging

Participants
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Sub-Events
SSA17-01 Non-invasive Prediction of Isocitrate Dehydrogenase (IDH) Genotype in Grade-II Gliomas with Amide Proton Transfer-Weighted (APTw) MR Imaging

Participants
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PURPOSE
Mutations in isocitrate dehydrogenase (IDH) genes are associated with favorable prognosis in patients with gliomas. Compared to oncogenic HRAS IDH1-wild type glioma cells, global downregulation of protein expression in mutant IDH1-driven glioma cells was found. Amide proton transfer-weighted (APTw) imaging is a molecular technique that gives contrast based in large part on endogenous cytosolic proteins and peptides. This study is to test the hypothesis that APTw signal is a surrogate imaging maker for identifying IDH mutation status preoperatively.

METHOD AND MATERIALS
Patients with suspected low-grade glioma were scanned at 3T clinical MRI scanner. APTW images were calculated using MTRasym(3.5ppm). Operative tissue samples were processed IDH1-R132H evaluation, which was performed by IHC and DNA sequencing, as described previously. Quantitative APTw parameters obtained from multi-ROI-based (maximum and minimum) and whole-tumor histogram-based (mean, variance, skewness, kurtosis, slop, 10th percentile, 50th percentile, 90th percentile, and peak) APTw metrics were compared between IDH-mutant and IDH-wildtype groups. Mann-Whitney test was used to evaluate the difference of APTw parameters between two glioma groups, and the receiver-operator-characteristic (ROC) analysis was used to assess the APTw diagnostic performance.

RESULTS
27 patients fulfilled eligibility criteria were recruited. Seven cases were diagnosed as IDH-wildtype grade-II gliomas, and 20 cases as IDH-mutant grade-II gliomas. The maximum and minimum APTw values based on multiple regions of interest, as well as the whole-tumor histogram-based mean and 50th percentile APTw values were significantly higher in the IDH-wildtype gliomas than in the IDH-mutant groups, corresponding to the areas under the ROC curves of 0.80, 0.91, 0.75, and 0.75 respectively, in predicting the IDH mutation status.

CONCLUSION
IDH-wildtype lesions were associated with relatively high APTw signal intensities, compared with IDH-mutant lesions. APTw imaging has the potential for discriminating IDH genotypes in grade-II gliomas non-invasively.

CLINICAL RELEVANCE/APPLICATION
The APTw signal could be a valuable imaging biomarker by which to identify IDH1 mutation status in grade-II gliomas without surgery, which could provide supplementary information about the diagnosis.
PURPOSE

O6-methylguanine methyl transferase (MGMT) gene promoter status are significant for treatment strategy and prognosis prediction of patients with glioblastoma (GBM). We aimed to verify that texture features derived from multimodal magnetic resonance images (MRI) may be potential for noninvasive and well-repeatable detection of MGMT promoter methylation status.

METHOD AND MATERIALS

Total 73 patients with GBM were enrolled (35 and 38 with and without MGMT promoter methylation, respectively). For each patient, volumes of interest (VOIs) were delineated on ten MRI modalities or parametric maps. Three-dimensional (3D) grey-level co-occurrence and curvature co-occurrence matrix (GLCM and GLGCM) textural features were extracted from each VOIs. Then the support vector machine (SVM) based feature selection and classification strategies were proposed to firstly obtain an optimal feature subset and then verify and improve its capacity to identify whether the patient was with MGMT promoter methylation or not, corresponding receiver operating characteristic (ROC) curve were depicted.

RESULTS

Total 420 3D GLCM and GLGCM features were extracted from ten MRI modalities/parametric maps for each of the 73 patients. After feature selection, 23 features were determined as the optimal feature subset, and the accuracy, sensitivity, specificity and area under ROC curve for identifying MGMT promoter methylation reached to 82.19%, 83.78%, 80.56% and 0.9204, respectively. In optimal subset, features derived from structure and perfusion modalities contributed more in detecting MGMT promoter methylation of GBM, comparing with those derived from diffusion modalities.

CONCLUSION

In this study, an optimal subset of 23 features was selected and its classification performance indicated that they may be a potential imaging biomarkers for predicting MGMT promoter methylation status.

CLINICAL RELEVANCE/APPLICATION

1. For patients with glioblastoma, MGMT promoter status assessment is crucial because MGMT methylation is associated with better prognosis and chemotheraphy response. 2. The proposed radomics approach based on multimodal MRI has the potential to accurately assess the MGMT promoter status before clinical intervention. 3. Texture features derived from structure and perfusion modalities contributed more to MGMT promoter methylation detection of patients with glioblastoma, comparing with those derived from diffusion modalities.
independent risk factors. ROC curve tests were performed to calculate AUC, cut-off values, sensitivity and specificity.

RESULTS
1) VC (p=0.009), VVS (p=0.013), RMS (p=0.000), RD (p=0.042), correlation (p=0.016), energy (p=0.000), GLN (p=0.009), RLN (p=0.005), LRLGLE (p=0.030), LRLHGLE (p=0.000) and LRHGLE (p=0.000) between HGG and METS are statistically significant. 2) Mean±S.D. values of MIN, MAX, MI, MD, skewness, Kurtosis, VC, RMS, uniformity, RD, entropy, correlation, IDM, CP, GLN, RLN, HGLE, SRHGLE and LRHGLE of HGG are higher than METS. 3) Logistic regression tests suggest VC (p=0.009), VVS (p=0.010), RS (p=0.000), GLN (p=0.010) and RLN (p=0.005) to contribute significantly to accurate prediction as independent risk factors with a joint model prediction accuracy of 93.9%. 4) ROC curve analysis shows AUC=0.955, 0.684, 0.672, 0.671, 0.663, 0.659 & 0.634 and sensitivity = 91.8%, 81.6%, 77.6%, 67.3%, 75.5%, 79.6%& 67.3% for entropy, RLN, VC, GLN, VVS, correlation & RD respectively.

CONCLUSION
Texture analysis parameters of quantitative ADC maps based on entire tumor serves as good differentiating diagnostic indices of HGG and METS.

CLINICAL RELEVANCE/APPLICATION
Whole Tumor ADC map differentiation of HGG and METS (appear similar on CT/MR imaging but follow different treatment protocols) using texture analysis can improve diagnostic and therapeutic response.

SSA17-04 Detection of 2-Hydroxyglutarate Using Spectral Editing MRS in Patients with IDH Mutant Gliomas
Sunday, Nov. 26 11:15AM - 11:25AM Room: N228

Participants
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PURPOSE
To assess the diagnostic accuracy of in vivo MRS for the detection of the tumor specific imaging marker D-2-hydroxyglutarate (2-HG) produced by IDH mutant gliomas.

METHOD AND MATERIALS
We prospectively enrolled 14 preoperative patients with grade II or III diffuse gliomas. Each patient underwent an MR examination which included a spectral editing MRS (MEGA-PRESS) to edit the 2-HG Ha resonance at 4.02 ppm, dynamic contrast-enhanced (DCE) imaging and multi-b value diffusion-weighted imaging on a 3T MR scanner. Automatic shimming was performed using the vendor’s pre-scan shimming routines. Parameters for the MEGA-PRESS sequence were: TR=2000ms, TE=60ms, 64 acquisitions, voxel size=8 cm3, duration=4.5min. The 2HG Ha resonance of the subtracted MEGA-PRESS spectra was analyzed using jMRUI v5.2. Plasma volume (Vp) and volume transfer constant (Ktrans) were calculated from DCE-imaging. Apparent diffusion coefficient (ADC) values were obtained from diffusion-weighted imaging. A radiologist blinded to the IDH status placed multiple small region-of-interests on the Vp, Ktrans and ADC maps. The maximum Vp/Ktrans and the minimum ADC values were kept for each patient (“hot-spot analysis”). Following the biopsy or surgical resection, a neuropathologist determined the grade and type of glioma using the 2016 WHO classification. IDH mutation status was identified via immunohistochemical detection of IDH1 R132H.

RESULTS
Of the 14 patients, there were 7 with grade III anaplastic astrocytomas, 4 with grade III anaplastic oligodendrogliomas, 2 with grade II astrocytomas and 1 patient with grade II oligodendroglioma. Ten patients harbored the IDH mutations and 4 patients were IDH wild-type. For the detection of 2-HG, MRS had a 40% sensitivity, 100% specificity, 100% positive predictive value and 40% negative predictive value. From the hot-spot analysis, there was no significant difference between Vp, Ktrans and ADC values between IDH mutant and wild-type gliomas (P=0.88, P=0.06 and P=0.78 respectively).

CONCLUSION
Spectral editing MRS can detect 2-HG in patients with IDH mutant gliomas with high specificity. In the future, the sensitivity of this technique may be improved by using a larger voxel size, increasing the number of acquisitions or performing manual shimming.

CLINICAL RELEVANCE/APPLICATION
Spectral editing MRS can be used to preoperatively detect IDH mutant positive status in patients presenting with a newly suspected glioma.

SSA17-05 Non-Invasively Detecting Isocitrate Dehydrogenase 1 (IDH1) Mutation Using Non-Gaussian Diffusion MR Imaging in Lower-Grade Gliomas: Primary Results
Sunday, Nov. 26 11:25AM - 11:35AM Room: N228

Participants
Yan Ren, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose
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**METHOD AND MATERIALS**

Ninety cases with pathologically confirmed lower-grade glioma (WHO grade2:n=64;WHO grade 3:n=26) were enrolled in this study, who performed the uniformed imaging protocol of T1WI, T2WI, T2-Flair, DWI with 2 b values (0, 1000 s/mm2) and contrast-enhanced T1WI (CE-T1WI), respectively. Based on the results of the immunohistologic chemistry staining, the IDH1 status was divided into two groups of mutated-type (IDH1mut) and wild-type (IDH1wild) for each grade. In tumor regions, ADC (apparent diffusion coefficient) and stretched exponential-derived intravoxel heterogeneity index a were extracted to make comparisons between two groups of IDH1mut and IDH1wild for each grade. ROC curve analyses were used to compare the capability of differentiating gliomas of IDH1mut from IDH1wild.

**RESULTS**

64 grade2gliomas were divided into two groups of IDH1mut (n=41) and IDH1wild (n=23), and 26 grade 3 gliomas were divided into two groups of IDH1mut (n=8) and IDH1wild (n=18). In grade2gliomas, there were significantly increased values of ADC (mm2/s) and a for groups of IDH1mut than IDH1wild (ADC: [1.33±0.322] vs. [1.09±0.232] for IDH1mut (t=3.316, P=0.003); a: [0.87±0.054] vs. [0.82±0.050] for IDH1mut (t=3.788, P=0.000). In grade 3, the value of a significantly increased for groups of IDH1mut than IDH1wild (a: [0.83±0.042] for IDH1mut vs. [0.77±0.051] for IDH1wild with P value of 0.008) and no significant difference was shown for ADC ([1.04±0.313] for IDH1mut vs. [0.95±0.154] for IDH1wild with P value of 0.476. ROC analyses showed diagnostic ability of IDH1mut for both grades of gliomas and ADC had the diagnostic ability of IDH1mut in grade2gliomas.

**CONCLUSION**

Non-Gaussian-derived parameter a may identify the status of IDH1 mutation in LGGs with better performance than ADC. In LGG, the water molecules behave more inhomogeneously in groups of IDH1wild than IDH1mut.

**CLINICAL RELEVANCE/APPLICATION**

The patients with IDH-mutated gliomas can survive much longer than those with IDH non-mutated. Especially for those patients who want conservative treatment and refuse biopsy, they can benefit a lot from non-invasive integrative diagnosis.

**SSA17-06 In Vivo Characterization of Macrophages in Adult High Grade Gliomas Using Ferumoxytol-Enhanced MRI**

Sunday, Nov. 26 11:35AM - 11:45AM Room: N228

**Participants**

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**PURPOSE**

Macrophages are a key component of tumor-associated inflammation and play a significant role in angiogenesis, progression, and metastasis as well as in tumor response to therapy. Ferumoxytol-enhanced MRI (fMRI) has been widely used for macrophage imaging in preclinical studies but not in the clinical neuro-oncology setting. The purpose of our study is to establish fMRI as a noninvasive imaging biomarker of macrophages in adults with high grade gliomas (HGGs).

**METHOD AND MATERIALS**

In this IRB-approved prospective pilot study at an academic institution, adults with newly diagnosed and recurrent HGGs were enrolled. Each patient had an intravenous ferumoxytol infusion (5 mg/kg) and a subsequent MRI (including QSM and R2* maps) performed at least 16 hours later. Two different sites were chosen within each tumor on fMRI for intraoperative sampling. Each sample acquired was stained with a mix of Prussian Blue, CD68, CD163, and GFAP to determine the location of iron and number of iron-containing macrophages per 20 hpf. Using saved images from surgery and Osirix software, ROIs were reproduced at the sampled sites and in the corpus callosum (to normalize the values for each patient) on QSM and R2* maps. Pearson correlation coefficient/regression analysis was used to determine the relationship between QSM and R2* values and number of iron-containing macrophages present.
RESULTS

8 patients (mean age: 58.6 years, range 32-74 years, 5:3 females:males) with HGGs (5 glioblastomas, 1 gliosarcoma, 1 anaplastic astrocytoma, and 1 anaplastic oligodendroglioma) were included in the analysis. On histopathology all patients, iron particles were only found in CD68+/CD163+ macrophages; none were found elsewhere including GFAP+ glial/astrocytic cells. There were strong, positive correlations that were statistically significant between both the normalized susceptibility (QSM) and R2* values and the number of iron-containing macrophages (r=0.73, p=0.002, for both analyses).

CONCLUSION

Ferumoxytol-enhanced MRI can be used to detect and quantify macrophages in high grade gliomas, with increasing QSM and R2* values strongly correlating with increasing number of iron-containing macrophages.

CLINICAL RELEVANCE/APPLICATION

Ferumoxytol-enhanced MRI with QSM and R2* correlates well with iron-containing macrophages in brain tumors, and this tool can be used as a noninvasive imaging biomarker of tumor-related inflammation.

SSA17-07 Quantitative Study Noninvasively Prediction of Glioma IDH1 Gene Status by APT Combined with ASL Imaging

Sunday, Nov. 26 11:45AM - 12:05PM Room: N228

Participants
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Bo Yin, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose

PURPOSE

The purpose of this part was to explore whether amide proton transfer (APT) and arterial spin labeling imaging (ASL) helped to noninvasively detect isocitrate dehydrogenase 1 (IDH1) gene status in glioma.

METHOD AND MATERIALS

Patients who suspected glioblastoma underwent APT and ASL examination from December 1, 2014 to October 31, 2016, were prospectively collected. MTRasym (3.5 ppm) values (APT values) and CBF values were measured in the tumor parenchyma region. As the lesional CBF value normalized by contralateral cerebellar hemisphere, the normalized CBF was calculated according to the formula nCBF = CBF tumor / CBF cerebellum. All of the patients had the pathological diagnosis and anti-IDH1 R132H antibody immunohistochemical results. The differences between wild type and mutant IDH1 were analyzed by independent sample t test. The receiver operating characteristic curve (ROC) is used to describe the discriminant image parameters. Calculate the cutting value and sensitivity, specificity.logistics regression analysis combined with the effective parameters of APT and ASL to calculate the overall correct prediction rate.

RESULTS

There were 90 patients with both APT and ASL data. In low-grade glioblastoma, the APT and nCBF values of wild-type IDH1 gene were higher than those of IDH1 mutant group (p = 0.027, p<0.001). The area under the ROC curve were 0.802, 0.844, when the cutoff was APT = 1.35 (%), and nCBF = 1.74, the sensitivity was 97%, 81.80%, the Specificity was 62.2% and 62.2%. In the high-grade glioma group, the APT and CBF values of IDH1 gene-type glioma were higher than those of IDH1 mutant. The difference was statistically significant (p = 0.004, p = 0.005); The area under the ROC curve were 0.695, 0.712, respectively. When the cutoff was APT = 3.24 (%), the sensitivity and specificity were 67.4% and 72.2%, respectively. In low-grade glioblastoma, Logistics regression combined with APT values and nCBF values to obtain the overall correct prediction rate is 78.7% High grade glioma group, combined APT value and CBF value to obtain the overall correct prediction rate is 86.8%.

CONCLUSION

APT and ASL provide a valuable new method for the noninvasive diagnosis of the IDH1 gene state of brain glioma, and the combination of APT and ASL can improve the overall prediction rate of glioma IDH1 gene.

CLINICAL RELEVANCE/APPLICATION

no

SSA17-08 Establishing the Optimal Volumetric Threshold for Determining Progressive Disease in Patients with Recurrent Glioblastoma

Sunday, Nov. 26 11:55AM - 12:05PM Room: N228

Awards
Student Travel Stipend Award

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Response to treatment in glioblastoma (GBM) is currently measured in 2D. Volumetric methods are potentially more reliable and accurate for assessing progressive disease (PD), but the optimal threshold for assessment for progression has not been established. We investigated the influence of using different thresholds for determining PD for both enhancing and non-enhancing (FLAIR) lesions to predict overall survival (OS) in recurrent GBM.

**METHOD AND MATERIALS**

Patients were recruited from a phase II-trial (n=148) in which treatment with lomustine and/or bevacizumab was given in first recurrent GBM. Total volume of enhancing and FLAIR lesions was measured separately using Brainlab semi-automated software. Percentage change in volume from baseline to first and second follow-up (6 and 12 weeks) was calculated. The effect of new lesions and of using different thresholds (10-40%) for determining PD was determined with cox regression analyses.

**RESULTS**

Due to missing MRI-data (3D T1w post-contrast and/or FLAIR-images), a varying number of patients were excluded from the analyses at 6 and 12 weeks (table). Patients with a new lesion at first follow-up (n=12) had significantly worse OS: hazard ratio (HR)=7.63, p<.001. These patients were further not included in the volumetric threshold analyses. At first follow-up, the highest HR was found using 20% increase as a threshold: HR=1.68 (p=.033) for enhancing (n=111) and HR=2.26 (p=.004) for FLAIR lesions (n=90). The presence of a second follow-up scan was associated with significantly improved OS (n=148): HR=3.23, p<.001. At second follow-up, HRs were somewhat higher than at first follow-up, both compared with baseline: HR=1.98 (p=.003) for enhancing (n=109) and HR=2.624 (p<.001) for FLAIR (n=92) lesions.

**CONCLUSION**

A 20% increase in enhancing or FLAIR volume best predicts OS at 6 weeks follow-up. When change in volume is measured at 12 weeks follow-up, predictions of OS improved, with lower thresholds (10-15%) showing the best results. A 3-month endpoint could therefore be considered in phase II studies on recurrent glioblastoma.

**Volumetric tumor measures in glioblastoma could increase accuracy over the current 2D assessment. We investigate the optimum volumetric threshold for determining progressive disease.**

**SSA17-09 Diffusion Weighted Imaging of Intracranial Hemangiopericytomas**

Sunday, Nov. 26 12:05PM - 12:15PM Room: N228

**Awards**

**Student Travel Stipend Award**

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**PURPOSE**

Intracranial Hemangiopericytomas (IHP) are aggressive dural based tumors which are difficult to differentiate from more benign meningiomas. Herein we present the largest series of IHPs to date focusing on MR imaging characteristics to differentiate these tumors from meningiomas.

**METHOD AND MATERIALS**

Multicenter retrospective review of institutional pathology databases/PACS for cases of IHP (WHO Grade II and III) and meningiomas (WHO Grade I and WHO grade II) from 2005-2016 was performed. Patients without relevant pre-operative MR imaging (T1, T2, DWI and post-contrast T1) were excluded. Imaging evaluation consisted of volumetric analysis, ADC value assessment on diffusion-weighted sequences, and qualitative imaging assessment (T1, T2 and contrast enhancement and presence of flow voids). ADC values were assessed using ROIs (100mm diameter) in the most homogeneous portions of the tumors. ADC values of normal appearing contralateral white matter were used to calculate the ADC-tumor/ADC-white matter ratio. Groups were compared using an unpaired two-tailed student's t-test and one way ANOVA.

**RESULTS**

Of the 26 patients identified with histologically confirmed IHP, 21 had relevant pre-operative MR imaging for review (14 WHO Grade II, 7 WHO Grade III) and meningiomas (WHO Grade I and WHO grade II) from 2005-2016 was performed. Patients without relevant pre-operative MR imaging Imaging evaluation consisted of volumetric analysis, ADC value assessment on diffusion-weighted sequences, and qualitative imaging assessment (T1, T2 and contrast enhancement and presence of flow voids). ADC values were assessed using ROIs (100mm diameter) in the most homogeneous portions of the tumors. ADC values of normal appearing contralateral white matter were used to calculate the ADC-tumor/ADC-white matter ratio. Groups were compared using an unpaired two-tailed student's t-test and one way ANOVA.

Of the 26 patients identified with histologically confirmed IHP, 21 had relevant pre-operative MR imaging for review (14 WHO Grade II, 7 WHO Grade III) and comprised the study population. 48 patients with histologically confirmed WHO Grade I (25) and WHO Grade II (23) meningiomas had relevant pre-operative MR imaging for review and comprised the control population. The study population was 63% male (avg age, 53, range: 22-78) and control population was 52% male (avg age, 55, 20-69). Most IHPs demonstrated flow voids (71%), an uncommon finding in meningiomas (4%) (p<.01). 57% of IHP tumors demonstrated significantly elevated (ADC-tumor/ADC-normal WM >1.1) ADC ratios. Average ADC-tumor/ADC-WM ratio was 1.26 for IHPs compared to 1.09 for meningiomas (p=0.08). A significant difference between IHPs (ratio:1.26) and WHO Grade I Meningiomas (ratio:1.05) was apparent (p=0.04).

**CONCLUSION**

This series is the largest to date evaluation the MR imaging characteristics of IHPs. Our findings suggest that IHPs demonstrate...
This series is the largest to date evaluating the MR imaging characteristics of IHPs. Our findings suggest that IHPs demonstrate increased diffusivity relative to meningiomas (p=0.08). The difference is most pronounced between IHPs and WHO grade I meningiomas (p=0.04).

**CLINICAL RELEVANCE/APPLICATION**

DWI may be a useful diagnostic tool for the radiologist to suggest the diagnosis of intracranial hemangiopericytoma on preoperative MR imaging.
**PURPOSE**

The diagnostic performance of the recently published Neck Imaging Reporting & Data System (NI-RADS) for head & neck squamous cell carcinoma (HNSCC) surveillance using post-treatment FDG-PET/Contrast-Enhanced CT (PET/CECT) is undetermined based on treatment type. We aimed to perform a ROC analysis to compare diagnostic performance of NI-RADS for detection of residual disease at both the primary site & in neck nodes in patients with HNSCC treated with either 1) chemoradiation therapy (CRT) alone or 2) surgery +/- CRT.

**METHOD AND MATERIALS**

A search of an IRB designated quality database for NI-RADS reports on all PET/CECT of the neck from 6/2014 to 7/2016 yielded 418 patients. Inclusion criteria were first time primary HNSCC, a 12-week first post-treatment PET/CECT & a minimum of 9-months of post-treatment follow-up. The electronic health record was reviewed for patient information including treatment modality, pathology results, and clinical and radiologic follow-up. Receiver Operator Curves (ROC) & Area Under Curve (AUC) were derived with 95% confidence intervals. AUCs were compared (Delong method). P-values <0.05 were significant.

**RESULTS**

Of 182 patients meeting inclusion criteria, 180 primary sites & 182 neck sites were examined. ROC analysis of NI-RADS 1-3 combined performance at the surgically treated primary site +/- CRT (n=82, AUC=0.495, 95% CI: 0.316-0.675) vs. CRT alone (n=98, AUC=0.711, 95% CI: 0.526-0.897) showed better performance for CRT alone, but no statistical significance (p=0.051). 100% of NI-RADS 3 findings at the primary site were false positives in the surgical arm versus a 50% (4/8) incidence of true disease in the CRT arm. Neck site surgery +/- CRT (n=83, AUC=0.65, 95% CI: 0.331-0.969) vs. CRT alone (n=99, AUC=0.726, 95% CI: 0.433-1.0) showed no statistical significance (p=0.365).

**CONCLUSION**

Although the diagnostic performance of NIRADS was not statistically significant different based on treatment arm, there was a trend toward better performance in patients treated with CRT versus surgery +/- CRT at the primary site due to false positives in the NI-RADS 3 category in post-surgical patients.

**CLINICAL RELEVANCE/APPLICATION**

NI-RADS offers a system of detecting residual HNSCC regardless of treatment type. A larger cohort study is needed to understand the best timing for PET in patients treated with primary resection.
**SSA18-02 Amide Proton Transfer (APT) Imaging in Patients with Cervical Lymphadenopathy: Initial Difference between Benignity and Malignancy**

**Participants**
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**PURPOSE**
To depict practical image manifestations of magnetic resonance amide proton transfer (MR-APT) imaging in patients with cervical lymphadenopathy and to reach a profound understanding of the signal changes according to benignity and malignancy, and to discuss its potential clinical applications.

**METHOD AND MATERIALS**
12 patients (M = 8, average years = 56.1 ± 12.3) with cervical lymphadenopathy were enrolled in this study. They were underwent MRI on the neck. Amide Proton Transfer (APT) images (saturation time 0.8 s, saturation power 2 µT) and Diffusion Weighted Images (DWI) were included in the scanning protocols under 3.0 Tesla MR scanner. APT images were calculated using magnetization transfer ratio asymmetry at 3.5ppm with respect to water. ROIs were drawn along the contour of lymph node with maximum size on the slice consistent with chosen on DWI. APTw values of the lymph nodes in the benign group and the malignant group were compared using two-sample t-test. Pathological results of all the imaged lymph nodes were obtained through fine needle aspiration biopsy.

**RESULTS**
(1) Malignant lymph nodes (8/12) were metastasis from oropharynx squamous carcinoma and malignant fibrous histiocytoma. (2) MTRasym(3.5ppm) (P=0.003) were showing significant different between benignity (1.91% ± 1.31%) and malignancy (3.69% ± 0.24%). (3) In ROC analysis, its AUC was 0.906 and it was an effective method that the AUC was significantly different from 0.5.

**CONCLUSION**
APTw could be useful in differentiating benign and malignant lymph nodes.

**CLINICAL RELEVANCE/APPLICATION**
12 patients with cervical lymphadenopathy underwent MR-APT imaging to differentiate benign and malignant.

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**SSA18-03 Additive Value of Quantitative CT Texture Analysis of Lymph Nodes for Prognosis Prediction in HPV-Positive Head and Neck Cancers**

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**PURPOSE**
This study aims to characterize the utility of primary tumor and lymph node texture features in predicting disease progression in patients with HPV-positive oropharyngeal squamous cell carcinoma treated with induction chemotherapy.

**METHOD AND MATERIALS**
Soft-tissue CT images for 35 patients with HPV-positive oropharyngeal squamous cell carcinoma were collected retrospectively under an IRB approved protocol. An experienced radiologist contoured the primary tumor and related lymph nodes in a pre-treatment scan for each patient. Radiomic texture features were automatically calculated from each axial slice of the contoured volumes. Features were selected using stepwise feature selection methods in conjunction with observations from previous studies. Round robin linear discriminant analysis was used to assess feature performance, with the area under the receiver operating characteristic curve (AUC) used as a figure of merit. We investigated the comparative performances of merging RECIST with two primary tumor texture features as well as with an additional two lymph node features.

**RESULTS**
Based on feature selection, we chose to include the pre-treatment RECIST with tumor energy and entropy, and then with lymph node sum variance and skewness. RECIST with tumor features resulted in an AUC value of 0.64 (se = 0.12) in the task of distinguishing between cases that progressed and those that did not. The combination of RECIST, tumor, and lymph node features yielded an AUC value of 0.72 (se = 0.10).
CONCLUSION
We observed an improvement in the prediction of disease progression when the quantitative texture feature analysis of lymph nodes were included in the predictive signature as compared to a signature with just RECIST and tumor texture information. This was evidenced by an increase in AUC. This is a promising result, and we plan to perform future work to investigate this trend on a larger dataset.

CLINICAL RELEVANCE/APPLICATION
This work aims to study the utility of radiomic features of both tumor and associated lymph nodes in predicting disease progression, which subsequently can help with early diagnosis and personalized care.

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 Ginat, MD - 2016 Honored Educator

SSA18-04  Apparent Diffusion Coefficient Histogram and Texture Analysis of Pleomorphic Adenoma and Carcinoma ex Pleomorphic Adenoma of the Salivary Gland

Sunday, Nov. 26 11:15AM - 11:25AM Room: N229

Participants
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PURPOSE
Only subjective mean value measurement with a manual region of interest has been reported for apparent diffusion coefficient (ADC) assessment of salivary gland tumors. The purpose of this study was to investigate the usefulness of whole-tumor ADC histogram and texture analysis for differentiation between pleomorphic adenoma (PA) and carcinoma ex pleomorphic adenoma (CXPA).

METHOD AND MATERIALS
Institutional review board approval was obtained and informed consent was waived due to the retrospective nature of this study. We identified 128 patients with salivary gland tumors who underwent MR imaging and either biopsy or surgery. Patients were as follows: 116 with PA (51 men and 65 women; median age, 52.5 years; age range, 11-84) and 12 with CXPA (10 men and 2 women; mean age, 67 years; age range, 51-82). All images were obtained on the same 1.5 tesla MR scanner with a standard protocol. A blinded radiologist drew volumes of interest on the ADC map covering the entire tumor. The mean, median, minimum, maximum, percentile, standard deviation (SD), kurtosis, skewness, entropy, and uniformity of the ADC value were compared between PA and CXPA groups. A Mann-Whitney U test with false discovery rate control and a receiver operating characteristic (ROC) curve were used for statistical analysis.

RESULTS
The SD (P = 0.02) and entropy (P = 0.02) were significantly higher in CXPA. Minimum value of ADC (P = 0.02), 5th percentile ADC (P = 0.02), 10th percentile ADC (P = 0.04), and uniformity (P = 0.02) were significantly lower in CXPA. Mean ADC (P = 0.29) and Median ADC (P = 0.29) showed no significant difference. The greatest area under the ROC curve (0.785) was achieved by SD.

CONCLUSION
CXPA showed higher spatial heterogeneity (higher entropy, higher SD, and lower uniformity) of ADC and contained significantly lower value of ADC than PA.

CLINICAL RELEVANCE/APPLICATION
Whole-tumor ADC histogram and texture analysis may be useful for differentiation between PA and CXPA.

SSA18-05  Exploratory Study for Identifying Predictors for Treatment Response of Head and Neck Cancers on CT Using Computerized Analysis

Sunday, Nov. 26 11:25AM - 11:35AM Room: N229

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Only subjective mean value measurement with a manual region of interest has been reported for apparent diffusion coefficient (ADC) assessment of salivary gland tumors. The purpose of this study was to investigate the usefulness of whole-tumor ADC histogram and texture analysis for differentiation between pleomorphic adenoma (PA) and carcinoma ex pleomorphic adenoma (CXPA).

METHOD AND MATERIALS
Institutional review board approval was obtained and informed consent was waived due to the retrospective nature of this study. We identified 128 patients with salivary gland tumors who underwent MR imaging and either biopsy or surgery. Patients were as follows: 116 with PA (51 men and 65 women; median age, 52.5 years; age range, 11-84) and 12 with CXPA (10 men and 2 women; mean age, 67 years; age range, 51-82). All images were obtained on the same 1.5 tesla MR scanner with a standard protocol. A blinded radiologist drew volumes of interest on the ADC map covering the entire tumor. The mean, median, minimum, maximum, percentile, standard deviation (SD), kurtosis, skewness, entropy, and uniformity of the ADC value were compared between PA and CXPA groups. A Mann-Whitney U test with false discovery rate control and a receiver operating characteristic (ROC) curve were used for statistical analysis.

RESULTS
The SD (P = 0.02) and entropy (P = 0.02) were significantly higher in CXPA. Minimum value of ADC (P = 0.02), 5th percentile ADC (P = 0.02), 10th percentile ADC (P = 0.04), and uniformity (P = 0.02) were significantly lower in CXPA. Mean ADC (P = 0.29) and Median ADC (P = 0.29) showed no significant difference. The greatest area under the ROC curve (0.785) was achieved by SD.

CONCLUSION
CXPA showed higher spatial heterogeneity (higher entropy, higher SD, and lower uniformity) of ADC and contained significantly lower value of ADC than PA.

CLINICAL RELEVANCE/APPLICATION
Whole-tumor ADC histogram and texture analysis may be useful for differentiation between PA and CXPA.
Diagnostic Performance of Simultaneous [18F] FDG PET/MR in Comparison with PET or MR Alone in Head and Neck Cancer

Sunday, Nov. 26 11:35AM - 11:45AM Room: N229

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PURPOSE
Although the benefits of PET/CT have been established in patients with head and neck malignancy, the usefulness of the recently introduced PET/MR has not been elucidated. The purpose of this study was to compare the diagnostic performance of simultaneous PET/MR with PET or MR alone in depicting malignant lesions in the head and neck.

METHOD AND MATERIALS
Seventy three patients (47 men, 26 women; mean age, 58 years; age range, 18-83 years) who underwent simultaneous PET/MR for diagnostic work-up of malignancy in head and neck were enrolled in this retrospective study. For 134 lesions (72 primary sites vs. 62 nodal levels; 79 for initial workup vs. 55 for recurrence workup) that were confirmed by pathology (n=111) and clinical follow-up (n=23), MR and PET images were retrospectively and independently reviewed, blinded to the clinical data. Subsequently, simultaneous PET/MR images were evaluated by consensus of the two readers. Area under the receiver operating characteristic curve, sensitivity, specificity, positive predictive value, negative predictive value, and accuracy were obtained and compared among PET, MR, and simultaneous PET/MR.

RESULTS
Area under the ROC curve (AUC) of simultaneous PET/MR per lesion (0.93) and per patient (0.93) for depiction of malignancy in the head and neck were significantly higher than PET (0.85 and 0.75, respectively) or MR (0.84 and 0.80, respectively) alone (P<.05). AUC of PET/MR for initial workup (0.89) and for recurrence workup (0.99) tended to be higher than PET (0.83 and 0.85, respectively) and MR (0.81 and 0.86) (P<.05 except for P=0.08 in comparison between PET/MR and PET for initial workup). AUC of PET/MR for primary sites (0.93) was higher than PET (0.73) and that for nodal levels (0.93) was higher than MR (0.80) (P<.05). Thirty percent of indefinite MR ratings were placed in a definitive category (score 1 or 5) after consensus. In this series, simultaneous PET/MR had a sensitivity of 87%, a specificity of 92%, a positive predictive value of 92%, a negative predictive value...
of 87%, and an accuracy of 90%.

**CONCLUSION**

Simultaneous PET/MR shows better diagnostic performance compared with PET or MR alone for the evaluation of malignancy in the head and neck.

**CLINICAL RELEVANCE/APPLICATION**

In patients with head and neck cancer, PET/MR shows better diagnostic performance compared with PET or MR alone, whether for initial or recurrence workup, or whether for primary sites or nodal levels.

**SSA18-07 Intravoxel Incoherent Motion MR Imaging in the Differentiation of Benign from Malignant Sinonasal Lesions: Comparison with Conventional Diffusion-Weighted MR Imaging**

Sunday, Nov. 26 11:45AM - 11:55AM Room: N229

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**PURPOSE**

This study aimed to evaluate intravoxel incoherent motion MR imaging (IVIM) in the differentiation between benign and malignant sinonasal lesions, and to compare the diagnostic performance of IVIM with conventional diffusion-weighted MR imaging (DWI).

**METHOD AND MATERIALS**

131 patients with histopathologically confirmed solid sinonasal lesions (56 benign and 75 malignant) who underwent conventional MRI, DWI, and IVIM were enrolled in this study. D, D* and f values derived from IVIM, as well as ADC value derived from conventional DWI, were measured and compared between the two groups using independent samples t-tests. The sensitivity, specificity, accuracy, positive predictive values (PPV), negative predictive values (NPV), and the area under the receiver operating characteristic (ROC) curve were determined.

**RESULTS**

The mean ADC and D values were significantly lower in the malignant sinonasal lesions than those in the benign sinonasal lesions (both p < 0.001). The mean f value was significantly higher in the malignant lesions than in the benign lesions (p = 0.007). The area under the curve of D value was significantly larger than that of ADC and f value (0.981 versus 0.725 and 0.641, respectively; both p < 0.001). The cutoff value of <= 0.887 for D value provided sensitivity, specificity, and accuracy of 98.7%, 96.4% and 97.7%, respectively, for differentiating benign from malignant sinonasal lesions.

**CONCLUSION**

IVIM appears to be a more efficient MR technique compared with conventional DWI in the differentiation between benign and malignant sinonasal lesions.

**Spectral Dual Energy CT Texture Analysis for the Evaluation and Characterization of Cervical Lymphadenopathy**

Sunday, Nov. 26 11:55AM - 12:05PM Room: N229

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**PURPOSE**

To determine whether spectral dual energy CT (DECT) texture analysis can be used to identify and differentiate metastatic nodes from head and neck squamous cell carcinoma (HNSCC), nodal involvement by lymphoma, or inflammatory nodes from normal lymph nodes.
METHOD AND MATERIALS

DECT scans of the neck from 50 patients were reviewed, 10 from each of the following groups, with multiple nodes per patient for texture analysis (shown in parentheses): normal (40), inflammatory (29), lymphoma (65), HNSCC with metastatic adenopathy (31), and HNSCC with benign lymph nodes (40). For HNSCC, only patients with pathological confirmation based on lymph node dissection (positive or negative) were included. Metastatic HNSCC nodes were compared to unaffected nodes from HNSCC patients without metastatic lymphadenopathy based on neck dissection. Lymphoma and inflammatory nodes were compared to a population of normal neck scans without history of cancer or other systemic disease. Texture analysis was performed using a commercial software (TexRAD®) by manually delineating a region of interest around the largest diameter of the lymph node on VMIs ranging from 40 to 140 keV in 5 keV increments. Random forests (RF) models were constructed using various histogram-based texture features for outcome prediction with internal cross-validation in addition to use of separate randomly selected training and validation sets. Sensitivity (Sens), specificity (Spec), positive predictive value (PPV), and negative predictive value (NPV) were calculated for node classification.

RESULTS

Metastatic HNSCC nodes could be differentiated from normal nodes with a Sens, Spec, PPV, and NPV of 100%, 91%, 90%, and 100%, respectively. Sens, Spec, PPV, and NPV was 100%, 92%, 95%, and 100% for differentiating nodal involvement by lymphoma from normal nodes and 88%, 83%, 78%, and 91% for differentiating inflammatory nodes from normal nodes, respectively.

CONCLUSION

Spectral texture analysis of lymph nodes can distinguish different pathologic lymph nodes from normal nodes with a high accuracy.

CLINICAL RELEVANCE/APPLICATION

DECT texture analysis of lymph nodes may be used in radiomic models to increase accuracy for the determination and characterization of pathologic lymph nodes in the neck.

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/ Caroline Reinhold, MD, MSc - 2013 Honored EducatorCaroline Reinhold, MD, MSc - 2014 Honored EducatorCaroline Reinhold, MD, MSc - 2017 Honored Educator

Abstract Co-Author

Spectral texture analysis of lymph nodes can distinguish different pathologic lymph nodes from normal nodes with a high accuracy.

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PURPOSE

To evaluate the diagnostic performance of ultrasound-guided fine needle aspiration (FNA) with optional core needle biopsy (CNB) of head and neck lymph nodes and masses, with attention to differences between biopsy of squamous cell carcinoma (SCC) with a residual mass after radiation or combined chemotherapy/radiation therapy and biopsy of other lesions.

METHOD AND MATERIALS

IRB approval was obtained and the need for consent was waived for this retrospective study. All 1957 ultrasound guided biopsies of head and neck lesions performed by the ultrasound service at our institution between 3/1/2012 and 5/16/2016 were reviewed. Thyroid biopsies, salivary gland biopsies, and fluid aspirations were excluded. In 843 of 861 procedures, the biopsy procedure began with an FNA and preliminary interpretation of the sample by a cytopathologist. CNB was then added in 210 cases, if considered indicated and technically feasible. In 18 cases, only CNB was performed, mostly following a recent FNA performed by another service.

RESULTS

861 biopsies of head and neck lymph nodes and masses were included; 53 targeted SCC with residual masses after treatment. The biopsy procedures yielded definitively benign or malignant results in 71.7% (38/53) of treated SCC and in 90.8% (733/807) of all other lesions (p<0.001). A reference standard based on subsequent pathology or clinical imaging follow-up was established in 68.6% of procedures. In cases with definitive benign or malignant biopsy results and a subsequent reference standard, sensitivity for malignancy was 88.2% (95% CI, 65.7% - 96.7%) in treated SCC and 98.3% (96.0% - 99.3%) in all other cases (p=0.052) and specificity was 63.6% (35.4% - 84.8%) in treated SCC and 99.5% (97.3% - 99.9%) in all other cases (p<0.001). There were no significant complications related to the biopsy procedures.

CONCLUSION

Ultrasound-guided needle biopsy of head and neck SCC with a residual mass after therapy has significant limitations in specimen
Ultrasound-guided needle biopsy of head and neck SCC with a residual mass after therapy has significant limitations in specimen adequacy, sensitivity and specificity. Otherwise, ultrasound-guided FNA with optional CNB of head and neck lymph nodes and masses has excellent diagnostic performance.

**CLINICAL RELEVANCE/APPLICATION**

Ultrasound-guided FNA with optional CNB of head/neck nodes and masses has excellent diagnostic performance, but results should be interpreted with caution in SCC with a residual mass after therapy.
**SSA19**

Neuroradiology (Dots and Dashes: Image Analysis in Neuroradiology)

Sunday, Nov. 26 10:45AM - 12:15PM Room: N230B

**PURPOSE**

The IIT Human Brain Atlas contains anatomical, DTI, HARDI templates, probabilistic gray matter (GM) labels, probabilistic connectivity-based white matter (WM) labels, and major fiber-bundles of the young adult human brain. The purpose of this work was to enhance the quality of the T1-weighted template, tissue probability maps, and GM labels of the IIT Human Brain Atlas.

**METHOD AND MATERIALS**

The same T1-weighted data from the 72 healthy volunteers included in the previous version of the IIT Human Brain Atlas (v.4.1) were used in the construction of the new resources. The T1-weighted image-volume of each participant was transformed from native space to the space of the existing T1-weighted template. Then, the volumes were normalized following two constraints, one for the intensity, and one for the transformation. The spatial transformations generated above were combined to a single transformation, which was then applied to the corresponding data for each participant: raw T1-weighted data, raw segmented tissue masks (GM, WM, and CSF), and raw segmented labels (90 cortical and subcortical regions). Next, the T1-weighted data from all participants were averaged to generate the new T1-weighted template. New tissue probability maps, probability maps for each label and a confidence index map for the GM labeling were also generated and compared to those of the existing atlas.

**RESULTS**

The new T1-weighted template is of higher sharpness (according to the high spatial frequency content), and has lower noise than the existing template. The new tissue probability maps exhibit better definition of GM, WM, and CSF than the existing ones. The new GM labels show greater confidence in GM labeling.

**CONCLUSION**

In this work, the T1-weighted template, tissue probability maps and GM labels of the IIT Human Brain Atlas were substantially enhanced. The IIT Human Brain Atlas with its comprehensive set of resources located in the same space, are expected to increase the accuracy of multi-modal studies, as well as conventional investigations on brain macrostructure.

**CLINICAL RELEVANCE/APPLICATION**

The enhanced IIT Human Brain Atlas is expected to increase the accuracy of multi-modal MRI studies.

**SSA19-02 Synthetic Contrast Enhancement Map Using Post-Contrast MR Quantification Only**

Sunday, Nov. 26 10:55AM - 11:05AM Room: N230B

**Participants**

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**PURPOSE**

Administration of Gadolinium contrast medium is an important diagnostic tool to detect blood-brain-barrier damage. In clinical practice the use of GD, however, is time-consuming because both a native and post-contrast image must be acquired. It is possible to omit the native image, but this reduces diagnostic confidence, especially for anatomically complex areas. For quantification of GD-enhancement image registration is challenging. The purpose of this study was to investigate the possibility to synthesize a GD-enhancement map solely from the post-GD image, using quantitative MRI.

**METHOD AND MATERIALS**

In brain parenchyma there is a relation between proton density PD and the longitudinal R1 relaxation rate. For every 1% decrease of PD signal, the R1 increases with 0.03 s⁻¹ (3T). This relation is affected when GD contrast media is present in the tissue, since R1 increases, while PD remain the same. A simultaneous measurement of post-GD PD and R1 therefore provides means of calculating the difference in R1 due to GD compared to the expected native R1 based on the PD values. For 10 patients with malignant glioma grade 4, MR quantification was performed both before and after contrast administration. The acquisition was a MAGIC sequence on a GE 750 3T system with a scan time of 6 minutes. Post-processing was performed using SyMRI 8.0 (SyntheticMR, Sweden). The two image stacks were registered using in-plane transformation. The R1 maps were subtracted to obtain the true GD-enhancement map. This was correlated with the synthetic GD-enhancement map, created using the post-GD R1 and PD maps only.

**RESULTS**

Linear regression of the true and synthetic GD-enhancement map for the 10 subjects showed a mean slope of 1.15±0.21 and mean intercept of 0.02±0.14. The Pearson correlation coefficient was 0.856±0.05.

**CONCLUSION**

The study shows that it is possible to synthesize a GD-enhancement map based on a post-GD MR quantification sequence only.

**CLINICAL RELEVANCE/APPLICATION**

A GD-enhancement map based on a post-GD acquisition only may permit omission of a native T1W, resulting in a substantial time saving. Without time pressure for GD uptake, it may even lead to lower GD doses.

**SSA19-03 Correlation of Quantitative Analysis on Three-Dimensional Fluid-Attenuated Inversion Recovery (3D-FLAIR) and Contrast-Enhanced FLAIR with Auditory Test in Meniere's Disease**

Sunday, Nov. 26 11:05AM - 11:15AM Room: N230B

Participants

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**PURPOSE**

This study was aimed to assess the prognostic value of quantitative analyses of cochlear signal intensity(SI) using Three-Dimensional Fluid-Attenuated Inversion Recovery (3D-FLAIR) MRI and Contrast-Enhanced (CE)-FLAIR MRI, and designed to correlate cochlear ROI with degree of hearing decrease in patients with Meniere's disease.

**METHOD AND MATERIALS**

132 patients underwent 3 Tesla (3T) MRI of the temporal area for MD over 3-year period. 3D-FLAIR sequence imaging and CE-FLAIR were included on temporal MRI. Signal intensity was measured by drawing region of interest (ROI) in membranous labyrinth of cochlea and quantitatively analyzed. Measured cochlear signal intensity was compared with available clinical findings, speech audiometry and pure tone audiometry test (PTA). Patients had typical results of auditory testing for Meniere's disease.

**RESULTS**

There was statistical significance of patient's sex with 3D-FLAIR (p <.05) and CE-FLAIR (p <.01). Cochlear ROI in symptomatic ear side showed significant statistical significance on both FLAIR and enhanced FLAIR (p <.0001). There was statistical significance of increase of cochlear SI on 3D-FLAIR and CE-FLAIR with pretreatment PTA of hearing loss (P < .0001). There was no statistical significance between prognosis and cochlear SI of FLAIR and CE-FLAIR. There was no statistical significance of PTA change with contrast enhancement index and contrast enhancement ratio. The optimal cut off value of SI increase on FLAIR was 20.8 (sensitivity, 64%; specificity, 66%; AUC, 72.9) and on enhanced FLAIR was 30.4 (sensitivity, 66%; specificity, 68%; AUC, 72.8) between asymptomatic ear and symptomatic ear.

**CONCLUSION**

Quantitative analysis of ROI on MR imaging data does not confer a benefit to predict the prognosis of Meniere's disease. However, increased signal intensity and inner ear enhancement of 3D FLAIR are helpful diagnostic markers for Meniere's disease.

**CLINICAL RELEVANCE/APPLICATION**

Increased cochlear ROI on 3D-FLAIR and enhanced FLAIR MRI provide an ideal diagnostic evidences in the sudden sensory neural hearing loss patients.
SSA19-05  Can MR Textural Analysis Improve Detection of Extracapsular Nodal Spread in Patients with Oral Cavity Cancer: A Feasibility Study

Sunday, Nov. 26 11:25AM - 11:35AM Room: N230B

Awards
Student Travel Stipend Award

Participants
Russell Frood, MBCh, Leeds, United Kingdom (Presenter) Nothing to Disclose
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PURPOSE
To explore the utility of MR texture analysis (MRTA) for detection of extracapsular nodal spread (ECS) in oral cavity squamous cell carcinoma (SCC).

METHOD AND MATERIALS
30 patients with node-positive oral cavity SCC treated surgically in a single center were evaluated. 15/30 (50%) had pathologic evidence of ECS. 2 experienced radiologists independently reviewed baseline MRI blinded to histology. Presence/absence of MR features associated with ECS (flare sign, irregular capsular contour; local infiltration; nodal necrosis) were agreed in consensus. Regions of interest (ROI) encompassing largest nodal cross-sectional area were defined on T2 and post-contrast T1-weighted images. First-order texture parameters (entropy, skewness and kurtosis) were extracted from the ROIs using proprietary software (TexRAD) with fine (2mm), medium (4 mm) and coarse (6 mm) filters. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of MR predictors of ECS were compared with histology as gold standard. MRTA performance in predicting ECS was assessed using paired t-test. Areas under the curve (AUC) calculated by receiver operating characteristics (ROC) analysis and optimal threshold were calculated for texture parameters.

RESULTS
Sensitivity, specificity, PPV and NPV (%) for MR predictors were: flare sign 85.7, 93.3, 85.7, 93.3; irregular capsular contour 53.3, 86.7, 80, 65; local infiltration 26.7, 86.7, 66.7, 54.2; nodal necrosis 73.3, 46.7, 57.9, 63.6. Nodal entropy had a statistically significant correlation with ECS on T2 imaging independent of filtration level, highest with coarse nodal entropy (N6, p = 0.02). AUC for entropy N6 was 0.77, sensitivity 73.3%, specificity 80%, PPV 76.7%, NPV 73.3% with a threshold > 6.12.

CONCLUSION
First-order texture parameters (entropy) extracted from T2-weighted MRI may improve ECS prediction in oral cavity SCC.

CLINICAL RELEVANCE/APPLICATION
Extracapsular nodal spread (ECS) is associated with adverse prognosis in oral cavity squamous cell carcinoma and may alter planned treatment. MR texture analysis may increase pre-treatment detection of ECS but requires further validation.

SSA19-06  Multiresolution Texture Processing of T2-weighted MRI May Reveal Lesion Pathology in Multiple Sclerosis

Sunday, Nov. 26 11:35AM - 11:45AM Room: N230B

Participants
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PURPOSE
Focal lesions remain the hallmark pathology of multiple sclerosis (MS), however, MRI lesion burden correlates only modestly to patient disability due to the lack of lesion specificity. We hypothesize that advanced image post-processing techniques can help extract latent lesion pathology from standard MR images.

METHOD AND MATERIALS
1.5: T2-weighted MR images acquired from 5 postmortem multiple sclerosis patients were post-processed using advanced texture analysis. Histologically proven lesion types were examined by severity: active or chronic active (demyelinated with variable inflammation), versus pre-active (inflammation only) or shadow plaques. A total of 13 lesions and 20 controls were used in a classification experiment, with a subsample of the ventricles included for comparison. Using the polar Stockwell transform, we generated two spectral density maps for each of the 10x256x256 pixels in the data set: one radial and one angular. Borrowing from the chemometrics literature, we used principal component analysis to estimate the dominant textures in the dataset. Anatomical features, control white matter, and MS lesions were hypothesized to be realizations of these textures. Using quadratic discrimination analysis, we categorized regions of interest based on 7 of these dominant textures (99.9% of variance).

RESULTS
Our results indicate that different lesion subtypes show distinct MRI texture (Fig.:1), which also differs from the surrounding tissue. Overall, our method was 88% accurate (212/240) in classifying the pathological severity of tissue types.
CONCLUSION
This pilot study suggests that novel image analysis techniques have the potential to detect the type of lesion pathology concealed in clinical MRI. Lesions with both demyelination and inflammation showed different texture than lesions with either pathology alone.

CLINICAL RELEVANCE/APPLICATION
This new technique can be applied to patient images routinely collected in clinical practice, and has the potential to advance our ability to monitor disease progression and treatment response.

SSA19-07  Radiomics Features of MR Imaging as Prognostic Factors in Locally Advanced Head and Neck Squamous Cell Carcinoma

Sunday, Nov. 26 11:45AM - 11:55AM Room: N230B

Participants
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PURPOSE
Radiomics refers to the comprehensive quantification of tumor phenotypes by applying a large number of quantitative image features. This current study was to identify pre-treatment T2-weighted imaging (T2WI)-based radiomics as prognostic factors in patients with locally advanced head and neck squamous cell carcinoma (HNSCC).

METHOD AND MATERIALS
This study consisted of 119 patients with stage III-IVb HNSCC. A total of 485 radiomics features were extracted. Least absolute shrinkage and selection operator (LASSO) regression model was used for data dimension reduction and feature selection. Association between the radiomics signature and overall survival (OS) was explored. Further validation of the radiomics signature as an independent biomarker was performed by using multivariate Cox regression. Multivariate models were built for overall survival (OS) using only clinical factors, and combined clinical factors and pretreatment radiomics signature. To quantify the incremental value of the radiomics signature to the traditional staging system and other clinical factors, Harrell’s C-index was measured.

RESULTS
Clinical factors of sex and AJCC stage were statistically associated with OS of patients, respectively. The radiomics signature, which consisted of 7 selected features, was significantly associated with OS, independent of clinical risk factors (P<0.001). Incorporating the radiomics signature with sex and stage resulted in better performance (C-index: 0.70; 95% confidence interval [CI]: 0.63, 0.76) for the prediction of OS than using sex and stage alone (C-index: 0.63; 95% CI: 0.54, 0.73) (P=0.003).

CONCLUSION
The radiomics signature is an independent biomarker for OS estimation of patients with locally advanced HNSCC. Combination of the radiomics signature with clinical factors significantly improves the predictive performance of clinical factors alone.

CLINICAL RELEVANCE/APPLICATION
The current study was to explore the potential of pre-treatment T2-weighted imaging (T2WI)-based radiomics as prognostic factors in patients with locally advanced head and neck squamous cell carcinoma (HNSCC). A 7-feature-radiomics signature was developed proved to be an independent biomarker for OS estimation of patients with locally advanced HNSCC. Combination of the radiomics signature with clinical factors significantly improves the predictive performance of clinical factors alone.

SSA19-08  Fusion MR Imaging: A Fast One Stop Shopping Tool for Diagnosis and Characterization of Vestibular and Intralabyrinthine Schwannomas

Sunday, Nov. 26 11:55AM - 12:05PM Room: N230B

Participants
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PURPOSE
To prove the technical feasibility of fusing heavily T2-weighted 3D turbo spin-echo (SPACE) and contrast-enhanced T1-weighted 3D (MPRAGE) datasets and to determine reading time to final diagnosis and diagnostic accuracy in patients with suspected...
vestibular or intralabyrinthine schwannomas.

METHOD AND MATERIALS

53 patients were evaluated. Two radiologists specialized in ENT with 10 and 14 years of experience evaluated 3D T2 and post Gd T1 images and fusion sequences in consensus as the reference standard. For the evaluation of reading time and diagnostic accuracy two groups of two less experienced radiologists (residents in 3rd-4th year of training) were formed. Group 1 evaluated 3D T2 and Gd T1 images separately, group 2 read the fused images only. Image quality was assessed based on a 5-point-scale (1 = highest confidence to 5 = diagnosis not possible). Interobserver agreement was calculated using Cohen’s kappa.

RESULTS

Fused images yielded significantly faster reading times (39.5 ± 28.5 s vs. 67.5 ± 34.5 s; p <= 0.001) compared to conventional separate reading of both 3D T2 and T1 sequences in all cases. Image quality of fused images was rated significantly better by all readers (p <= 0.05) with higher diagnostic accuracy (fusion images: sensitivity 100%; specificity 90-100% vs. conventional group: sensitivity 100%; specificity 88-94%). Interobserver agreement according to recognized lesion was excellent (0.87-1.0).

CONCLUSION

Fused images of high-resolution 3D heavily T2-weighted and contrast-enhanced T1-weighted images allow for faster detection and more precise characterization of vestibular and intralabyrinthine schwannomas.

CLINICAL RELEVANCE/APPLICATION

The possibility of displaying the fluid-filled architecture of the cerebellopontine angle and the inner ear by 3D T2-weighted MR imaging combined with contrast enhanced T1-weighted MPRAGE is helpful to improve radiologist workflow and increase diagnostic accuracy and efficiency to detect even small targets that are difficult to delineate especially in the inner ear in usual examination.

SSA19-09  CT Imaging of Periocular Metallic Foreign Bodies Can be Improved by Artifact Reduction Software

Sunday, Nov. 26 12:05PM - 12:15PM Room: N230B

Participants
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Keirnan Willett, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
John H. Woo, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

PURPOSE

Computed tomography (CT) is the standard of care for the assessment of ocular and orbital trauma, however, streak artifacts due to retained metallic foreign bodies (FB) can limit the utility of CT. We hypothesize that implementation of metal artifact reduction techniques could improve image quality and diagnostic confidence for a diverse group of interpreters regardless of experience or specialty.

METHOD AND MATERIALS

Ten cases of retained periocular metallic foreign bodies which were noted on CT scan were identified retrospectively from a large urban trauma center. Post-acquisition images were processed with metal streak artifact reduction (MAR) software. The change in the severity of the metal streak artifact was assessed quantitatively by 1) the size of the artifact and 2) the standard deviation of pixel intensities along a path surrounding the foreign body. For subjective assessment, radiologists (4), ophthalmologists (4) and oculoplastic specialists (3) used a Likert scale to grade images on 6 different clinically relevant criteria.

RESULTS

The standard deviation of pixel intensity for a path surrounding the FB as well as the area of the streak artifact was decreased in all cases (p<0.001, paired t-test). Human grading of overall confidence in diagnosis and severity of metallic streak was improved with MAR (p<0.001, Wilcoxon signed-rank test). Similarly, the confidence of assessment of specific structures - including identification of FB, extra-ocular muscles, optic nerve, ruptured globe and orbital fracture - was improved after MAR (p<0.001, Wilcoxon signed-rank test) but to various degrees in each case.

CONCLUSION

Postprocessing metal artifact reduction algorithms in computed tomography of the orbit can improve image quality by decreasing streak artifact as well as increase interpreter confidence in assessing vital anatomical structures in cases of orbital trauma.

CLINICAL RELEVANCE/APPLICATION

Metal artifact reduction algorithms in computed tomography has potential benefits in improving diagnostic accuracy and confidence in periocular trauma cases.
**LEARNING OBJECTIVES**

1) Review causes of neonatal encephalopathy and common clinical presentations. 2) Discuss 'how to' optimize neonatal MRI technique for the brain and suggest a standardized protocol. 3) Describe patterns of hypoxic-ischemic encephalopathy in the term neonate. 4) Briefly review possible differential diagnosis and medico-legal implications.

**ABSTRACT**

Magnetic resonance imaging (MRI) is an important tool in identifying the etiology of neonatal encephalopathy as well as in predicting long-term outcomes. MRI is now the main imaging method for defining the extent of neonatal brain injury. This presentation will review how to optimize MR techniques to determine the cause of encephalopathy in the newborn. The neonatal brain is largely unmyelinated and is undergoing maturation rapidly. It is important to understand normal appearances of neonatal brain on MRI and to be familiar with the spectrum of imaging features in ischemic and non-ischemic neonatal encephalopathy. Hypoxic ischemic injury (HII) is one of the most common causes of neonatal encephalopathy and imaging appearances are influenced by the stage of maturation of the neonatal brain, severity as well as duration of ischemic insult and treatment given, such as hypothermia. Conceptually, hypoxic ischemic injury at birth has been differentiated into prolonged intermittent hypoxic ischemic injury due to ischemia occurring over a prolonged time and a severe acute or profound hypoxic ischemic injury (HII) often associated with a sentinel acute event. In the prolonged intermittent hypoxic injury, the cerebral white matter is more dominantly involved, whereas in the severe acute hypoxic injury, deep grey matter structures are involved. Imaging characteristics of HII in term neonates can be also subdivided based on the severity of injury (severe versus mild to moderate [partial] asphyxia). In practice one often sees a spectrum of injury, and Barkovich et al. have published a useful MR scoring system to diagnose and rate the severity of injury secondary to HII. In addition to having a normal appearance, infants with suspected HII may have 4 predominant patterns of injury: watershed, basal ganglia, total, or focal-multifocal injury. Injury involving the deep grey matter structures often portends a worse prognosis. In medico-legal situations, an attempt is often made to time HII based on MRI patterns. It is important to understand that MRI findings alone cannot time the insult within hours or minutes around the time of birth. Timing is best done using and co-relating MRI findings along with all other evidence that is available. The radiologist must also be familiar with other causes of neonatal encephalopathy, such as stroke, trauma, infections, congenital disorders and inborn errors of metabolism.

**PURPOSE**

Cerebral metabolic rate of oxygen (CMRO2) is an important biomarker of neural development and brain tissue viability in neonates, but non-invasive techniques to measure it in neonates have been lacking. In this work, we optimized a novel MRI method to evaluate CMRO2 in neonates by studying its dependence on spatial resolution.

**METHOD AND MATERIALS**

Theory: Previously we have demonstrated the proof-of-principle of a novel method based on the Fick Principle to quantify CMRO2, i.e., \( \text{CMRO2} = \frac{\text{CBF}(Ya-Yv) \cdot Ca}{100} \), where CBF is cerebral blood flow measured by phase-contrast (PC) MRI, Ya is arterial oxygenation measured by pulse-oximetry, Yv is venous oxygenation measured by T2-Relaxation-Under-Spin-Tagging (TRUST), and Ca is the...
well-established blood’s oxygen carrying capacity. In this work, we aimed to optimize the TRUST and PC MRI techniques in neonates. **TRUST MRI:** In 9 healthy neonates, we compared the TRUST scans with 4 in-plane resolutions, 1.25, 1.5, 1.9 and 2.5 mm. We assessed the coefficient of variance (CoV) of the TRUST signal and a goodness-of-fit index, ΔR², across the resolutions. **PC MRI:** In 3 healthy neonates, we compared the PC MRI scans with 3 in-plane resolutions, 0.3, 0.4 and 0.5 mm, and 3 numbers of averages, 3, 6 and 9 averages. We compared the CoV of CBF across the resolution and number of averages, respectively.

**RESULTS**

**TRUST MRI:** The 1.25mm resolution showed higher CoV (p<0.03) and ΔR² (p<0.07) than the other resolutions. No significant differences in CoV and ΔR² were found among the other 3 resolutions, although ΔR² of 2.5mm is slightly lower than that of 1.5mm (p=0.10). Considering the trade-off between CoV and ΔR², 1.9mm resolution is recommended for TRUST MRI in neonates. **PC MRI:** The 3 resolutions showed no significant difference in CoV. More neonates are being scanned. The PC scan with 3 averages showed higher CoV than 6 averages (p=0.087) and 9 averages (p=0.004). Considering the trade-off between scan time and precision, 6 averages is recommended for PC MRI in neonates.

**CONCLUSION**

Our results suggested the used of 1.9mm resolution for TRUST MRI and 6 averages for PC MRI in neonates. These optimizations may lead to the accurate quantification of neonatal CMRO2 in 4 minutes without using any exogenous tracer or contrast agent.

**CLINICAL RELEVANCE/APPLICATION**

The optimized TRUST and PC MRI techniques can be used for the quantification of neonatal CMRO2, the functional biomarker in several neonatal brain injury and diseases.

**VSPD11-03 Detection of ‘Silent’ Abnormalities in the Deep Gray Matter Nuclei of Neonates with Punctate White Matter Lesions by Magnetic Resonance Spectroscopy**

Participants
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**PURPOSE**

Punctate white matter lesions (PWML) are common in neonates and represent as hyperintensity on T1WI and hypointensity on T2WI in the periventricular white matter. In this study, the deep gray matter in PWML neonates without abnormality on conventional MRI and with possibility of injury would be considered as ‘silent’ lesions. The aim of this study is to explore whether there exist the ‘silent’ abnormalities in the deep gray matter nuclei in PWML neonates by magnetic resonance spectroscopy (MRS).

**METHOD AND MATERIALS**

42 neonates with PWML and 54 control neonates (no abnormality on conventional MRI) who underwent GE 3.0T MRS imaging were enrolled. The PWML neonates with gray matter lesions (i.e. hypoxic ischemic encephalopathy, bilirubin encephalopathy and hemorrhage) were excluded. Axial 2D MRS was performed with the point-resolved spectroscopy sequence (PRESS) (echo time/repetition time, 144ms/1000ms) through the basal ganglia. The peak areas ratios of Cho/Cr, NAA/Cho and NAA/Cr in bilateral lenticular nucleus and thalamus were calculated. Independent sample t test was performed to investigate the differences of metabolite ratios between PWML and control groups.

**RESULTS**

Demographics of neonates with PWML and control groups were shown in Table 1. There were no significantly differences in gestational age, postmenstrual age, postnatal age at scan, birth weight and gender between two groups(p>0.05). Figure 1, NAA/Cho ratio of both two regions in PWML group were significant lower than those in control group (p<0.05), and this difference of NAA/Cr ratio only in thalamus (p<0.05), while no differences of Cho/Cr ratio between PWML and control group were found in both two regions.

**CONCLUSION**

In the PWML neonates, the variations of metabolite ratios in MRS demonstrated a ‘silent’ abnormalities in the deep gray matter.

**CLINICAL RELEVANCE/APPLICATION**

The treatment strategies should target at both white and gray matter to prevent the neurologic deficits in the neonates with punctate white matter lesions.

**VSPD11-04 To Evaluate the Role of F 18 FDG PET-CT in Evaluation of Temporal Lobe Epilepsy**

Participants
Sikandar M. Shaikh, DMRD, Hyderabad, India (Presenter) Nothing to Disclose

**PURPOSE**

18F-fluorodeoxyglucose (18F-FDG) has been used for localization of epileptogenic foci in cases of temporal lobe epilepsy. The aim of this study was to evaluate the glucose metabolic activity using 18F-FDG PET-CT imaging in patients with epilepsy.

**METHOD AND MATERIALS**
Thirty five pediatric epilepsy patients who underwent 18F-FDG PET-CT, magnetic resonance imaging (MRI) and electroencephalography (EEG) examinations were respectively included. Fifteen age-matched controls were included. 18F-FDG PET-CT was done after injecting FDG contrast. Images were analyzed by using visual assessment combined with statistical parametric mapping (SPM) analysis. Absolute asymmetry index (|AI|) were calculated in patients with regional abnormal glucose metabolism.

RESULTS

There was significant changes in the visual assessment combined with SPM analysis of 18F-FDG PET images detected more patients with abnormal glucose metabolism compared to the visual assessment only. The |AI| significantly positively correlated with seizure frequency (P < 0.001), but negatively correlated with the time since last seizure (P < 0.01) in patients with abnormal glucose metabolism. The only significant contributing variable to the |AI| was the time since last seizure, both in patients with hypometabolism (P = 0.001) and hyper-metabolism (P = 0.005). Higher values of |AI| were found in the drug-resistant compared to the seizure remission in patients with either hypo-metabolism (P < 0.01) or hyper-metabolism (P = 0.209). In the post 1-year follow-up PET studies, significant change of |AI| (%) was found in patients with clinical improvement compared to those with persistence or progression (P < 0.01).

CONCLUSION

18F-FDG PET imaging with visual assessment combined with SPM analysis could provide cerebral glucose metabolic profile in non-surgical epilepsy patients. |AI| is more useful for evaluation of clinical severity and progress in these patients. Patients with a prolonged period of seizure free may have more subtle (or no) metabolic abnormalities on PET. The clinical value of PET might be enhanced by timing the scan closer to clinical seizure(s).

CLINICAL RELEVANCE/APPLICATION

FDG PET-CT has important role in evaluation of Epileptogenic focus in temporal lobe epilepsy.

VSPD11-05 Functional Magnetic Resonance Imaging Analysis of N-Back Working Memory Paradigm in Adolescents with Temporal Lobe Epilepsy

Participants
Rupa Radhakrishnan, MD, Cincinnati, OH (Presenter) Nothing to Disclose
Thomas Maloney, Cincinnati, OH (Abstract Co-Author) Nothing to Disclose
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PURPOSE

Working memory is an important substrate of executive function dealing with storage, processing and manipulation of information. Adolescents with epilepsy are at risk for working memory deficits, which could lead to learning difficulties and poor academic outcomes. In this study, we compare functional magnetic resonance imaging (fMRI) correlates of working memory in adolescents with epilepsy versus healthy controls.

METHOD AND MATERIALS

29 adolescents (13 to 17y) with MRI non-lesional epilepsy and 20 matched healthy controls were prospectively recruited. Participants performed an N-back fMRI task (block design 2-back versus 0-back condition), and neuropsychological measures of working memory (Digit Span from the Wechsler Intelligence Scale). General linear model approach was used to create group activation maps contrasting 2-back vs 0-back for epilepsy and control groups and both groups combined (initial threshold Z > 3.71, corrected for multiple comparisons to p<0.05). Functionally defined regions of interest (ROIs) were defined based on clusters of combined group activation. For each participant, mean Z-score values for fMRI activation were derived for each ROI. We examined correlations between mean Z-score in each ROI and Digit Span scaled scores.

RESULTS

For the N-back fMRI task, significant activation was observed in bilateral middle frontal and parietal regions, bilaterally, anterior cingulate cortex, and inferior parietal/occipital cortex and frontal operculuminsula bilaterally in both controls and epilepsy groups. There were no significant differences in group activation. Mean Digit Span scores in those with epilepsy (8.7) and controls (11.8) was significantly different (p=0.0009). Digit Span scaled scores correlated significantly with N-back fMRI activation in the left frontal pole (r = 0.53, p = 0.013), left frontal operculum/insula (r = 0.53, p = 0.015) and left parieto-occipital region (r = 0.48, p = 0.034) in controls, which was not seen in adolescents with epilepsy.

CONCLUSION

There is a relationship between Digit Span performance scores and left frontal and left parieto-occipital activation on the N-back fMRI task in controls, but not in adolescents with epilepsy suggesting an atypical pattern of working memory processing in pediatric epilepsy.

CLINICAL RELEVANCE/APPLICATION

This study demonstrates working memory deficits, and altered pattern of working memory processing in adolescents with epilepsy.

VSPD11-06 Mutual Information Improves Quantification of Cerebral Network Architecture in Children with Focal Epilepsy

Participants
PURPOSE

Metrics of brain network architecture derived from resting-state fMRI have been shown to provide physiologically meaningful markers of IQ in children with epilepsy. However, traditional measures of functional connectivity (FC), specifically correlation, assume gaussianity of the joint distribution between BOLD time courses; this assumption may not be valid. Mutual information (MI) is an alternative measure of FC which has shown promise in the study of complex networks due to its ability to characterize non-linear associations. We therefore aimed to compare network metrics derived from mutual information-defined FC to those derived from traditional correlation in terms of their capacity to predict patient-level IQ.

METHOD AND MATERIALS

Patients were retrospectively identified with: 1. Focal epilepsy; 2. Resting state fMRI; 3. Full scale IQ by a neuropsychologist. Brain network nodes were defined by anatomic parcellation. Parcellation was performed at three different node sizes, resulting in networks containing approximately 350, 750, or 1500 nodes. Whole-brain, weighted graphs were then constructed according to the pair-wise connectivity between nodes. In the traditional condition, edges (connections) between each pair of nodes were defined as the absolute value of the Pearson correlation coefficient between their BOLD time courses. In the mutual information condition, edges were defined as the mutual information between time courses. The following metrics were then calculated for each weighted graph: clustering coefficient, modularity, characteristic path length, and global efficiency. A machine learning algorithm was then used to predict the IQ of each individual based on their network metrics. Prediction accuracy was assessed as the percent variation explained for each condition.

RESULTS

Twenty-six patients met criteria (age: 4-18 yrs). Percent variance explained for each condition is presented in Table 1. Over all network sizes, network metrics derived from mutual information-defined FC outperformed the use of traditional correlation.

CONCLUSION

Mutual information-defined functional connectivity captured features of the brain network relevant to brain function better than traditional methods.

CLINICAL RELEVANCE/APPLICATION

Optimizing the capacity to predict cognitive phenotypes at the patient-level is a necessary step toward the clinical utility of network-based biomarkers.

LEARNING OBJECTIVES

1) Improve knowledge of advanced imaging techniques, including magnetoencephalography and hybrid PET-MR imaging, for evaluating and guiding treatment of pediatric patients with medically refractory epilepsy.
NR333-SD-SUA

Neuroradiology Sunday Poster Discussions

Sunday, Nov. 26 12:30PM - 1:00PM Room: NR Community, Learning Center

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Gaurang V. Shah, MD, Ann Arbor, MI (Moderator) Nothing to Disclose

Sub-Events
NR333-SD-SUA1 Incidental Thyroid Nodules Detected By 18-FDG PET/CT: Correlation with TIRADS and Shear Wave Elastography

Station #1

Participants
Linda Cham, MD, Paris, France (Abstract Co-Author) Nothing to Disclose
Geraldine Bera, MD, Paris, France (Abstract Co-Author) Nothing to Disclose
Jonathan Barbut, Paris, France (Abstract Co-Author) Nothing to Disclose
Sophie Tezenas du Montcel, Paris, France (Abstract Co-Author) Nothing to Disclose
Malek Ezziane, Paris, France (Presenter) Nothing to Disclose
Cecile Ghander, Paris, France (Abstract Co-Author) Nothing to Disclose
Genevieve Herve, Paris, France (Abstract Co-Author) Nothing to Disclose
Christophe Tressallet, PhD, Paris, France (Abstract Co-Author) Nothing to Disclose
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Charlotte Lussey, Paris, France (Abstract Co-Author) Nothing to Disclose
Laurence Leenhardt, Paris, France (Abstract Co-Author) Nothing to Disclose
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PURPOSE
To correlate the Thyroid Imaging Reporting and Data System (TIRADS) classification and Shear Wave elastography (SWE) findings to the Maximum Standardized Uptake Value (SUVmax) in hypermetabolic thyroid nodules incidentally identified by 18FDG-PET/CT.

METHOD AND MATERIALS
From January 2015 to March 2017, 149 subjects (103 female, 46 male) referred to our PET/CT center for nonthyroid disease were detected having focal FDG-avid thyroid incidentalomas and were prospectively included. Among them, 85 (57%) underwent ultrasound and fine-needle aspiration cytology and/or needle core biopsy and were analyzed according to the FNA-Bethesda System. We used an Aixplorer machine (SuperSonic Imagine, France) for conventional US and SWE evaluation. TIRADS categories, mean stiffness value (Emean), Maximum stiffness value (Emax), Standard deviation (SD) and nodule-to-thyroid stiffness ratio (R) were assigned to each nodule and correlated to SUVmax values.

RESULTS
85 lesions were studied: 39 (46%) were benign, 25 (29.5%) malignant, 17 (20%) with indeterminate results, 3 (3.5%) non-diagnostic and in 1 (1%) there was no nodule identified. The SUVmax values had a tendency to be lower for benign lesions (median: 4.3 [min:1.5, max:17.1]) than malignant lesions (5.9 [1.9-43.9]) and intermediate for indeterminate lesions (4.8 [2.2-32.0]) (p=0.06). The SUVmax values did not correlate with lesion size (r=-0.03, p=0.76), but showed a tendency to be higher in solid nodules (median: 5.3 [1.5-43.9]) rather than in partially cystic ones (median: 3.4 [2.0-7.2]) (p=0.057). There was no significant difference of SUVmax according to the different TIRADS categories (p=0.12) and no correlation with SWE measurements: Emean (r=0.01; p=0.9), Emax (r=0.10; p=0.38), SD (r=0.14; p=0.24) and R (r=-0.04; p=0.74).

CONCLUSION
To date, this prospective single center study showed that SUVmax values tend to be higher in malignant nodules and in solid ones while TIRADS categories based on conventional US as well as SWE findings do not correlate with SUVmax values.

CLINICAL RELEVANCE/APPLICATION
The rate of malignancy of thyroid nodules detected by 18FDG-PET/CT is variable and the role of SUVmax values is still ongoing debate. The comparison of morphological and functional imaging might improve knowledge in thyroid incidentalomas.
MR Lymphangiography for Sentinel Lymph Node Detection in Oral Cavity Cancer: A Preliminary Clinical Study

PURPOSE
Sentinel lymph node (SLN) biopsy has emerged as an alternative to elective neck dissection in oral cavity cancer with clinically negative neck. Radiosotopes and blue dye are commonly used agents to localize SLNs; however, both have several limitations. The purpose of this study was to evaluate the feasibility of magnetic resonance lymphangiography (MRL) using interstitial injection of gadolinium-based contrast agent for delineating the SLNs in patients with oral cavity cancer.

METHOD AND MATERIALS
Twenty six patients who were initially diagnosed with oral cavity cancer and clinically negative neck were included. After percutaneous injection of diluted gadobutrol, MRL including Differential Sub-sampling with Cartesian Ordering (DISCO) and three-dimensional SPGR with 2-point Dixon reconstruction (3D LAVA FLEX) sequences was acquired. We evaluated the safety of the procedure and correlated SLNs detected on MRL with final histopathological findings after elective neck dissection.

RESULTS
MRL revealed consistent visualization of the SLNs, and 46 SLNs in 26 patients were identified. Twenty-four lymph nodes from ten patients were proven to be histopathologically metastatic after neck dissection. In nine patients with pathologically positive neck, SLNs were involved. The worst side effects of interstitial contrast injection were mild, transient pain and swelling at the injected sites, although these were self-limited.

CONCLUSION
MRL is a safe and feasible imaging modality that can help improve the selection of lymph nodes at the highest risk of occult metastases for surgical planning or radiotherapy in patients with oral cavity cancer.

MR Lymphangiography for Sentinel Lymph Node Detection in Oral Cavity Cancer: A Preliminary Clinical Study

Histological Classification of Head and Neck Tumors Using Patlak Analysis in Head and Neck CT Perfusion

PURPOSE
To evaluate whether head and neck tumors can be differentiated pathologically by comparing inflow and outflow of the tissue blood flow using Patlak analysis in CT perfusion (CTP).

METHOD AND MATERIALS
This prospective study was approved by the institutional review board. Patients with head and neck tumors were eligible for the study. Contrast enhanced CT with CTP were performed with 320-multi detector CT before biopsy. The flow (Kinflow, /s) and clearance (KCL, /s) were calculated using Patlak analysis. KCL was represented as the flow in the washout section of first-pass. Both Kinflow and KCL were flows from the input artery to the tissue. Koutflow (the value obtained by subtracting KCL from Kinflow) was considered as true clearance from the tissue. The ratio between Kinflow and Koutflow was defined as the clearance ratio (CL ratio). The CL ratios were sorted into histological types and evaluated by Mann-Whitney U test.

RESULTS
58 patients with the following tumors were enrolled in the study: squamous cell carcinoma (SCC) (39 patients), malignant lymphoma (ML) (8), Warthin tumor (2), pleomorphic adenoma (2), and salivary gland malignant tumors (7). The CL ratios obtained by linear approximation were 0.57 in SCC, 0.51 in ML, 0.43 in pleomorphic adenoma, 0.68 in Warthin tumor, and 0.49 in salivary gland malignant tumors. The median CL ratio of SCC and ML were 0.58 (0.28 - 0.79) and 0.50 (0.28 - 0.56), respectively (p<0.01). CL ratio of the Warthin tumor tended to be higher compared to other salivary gland tumors.

CONCLUSION
Head and neck tumors may be differentiated based on Patlak analysis in CTP. The difference in histological type may cause a difference in CL ratio.

Clinical Study

Histological Classification of Head and Neck Tumors Using Patlak Analysis in Head and Neck CT Perfusion

To evaluate whether head and neck tumors can be differentiated pathologically by comparing inflow and outflow of the tissue blood flow using Patlak analysis in CT perfusion (CTP).

METHOD AND MATERIALS
This prospective study was approved by the institutional review board. Patients with head and neck tumors were eligible for the study. Contrast enhanced CT with CTP were performed with 320-multi detector CT before biopsy. The flow (Kinflow, /s) and clearance (KCL, /s) were calculated using Patlak analysis. KCL was represented as the flow in the washout section of first-pass. Both Kinflow and KCL were flows from the input artery to the tissue. Koutflow (the value obtained by subtracting KCL from Kinflow) was considered as true clearance from the tissue. The ratio between Kinflow and Koutflow was defined as the clearance ratio (CL ratio). The CL ratios were sorted into histological types and evaluated by Mann-Whitney U test.

RESULTS
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CONCLUSION
Head and neck tumors may be differentiated based on Patlak analysis in CTP. The difference in histological type may cause a difference in CL ratio.

CLINICAL RELEVANCE/APPLICATION
CL ratio analyzed by Patlak analysis is a valuable CTP parameter for distinguishing head and neck histological types.
NR336-SD-SUA4 Radiomic Strategy for Detecting IDH and TP53 Mutation of Lower-Grade Glioma Based on Multimodal MRI

Participants
Xi Zhang, Xian, China (Presenter) Nothing to Disclose
Qiang Tian, Xian, China (Abstract Co-Author) Nothing to Disclose

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PURPOSE
This study aimed to 1) find specific imaging biomarkers from multimodal MRI that can reflect the mutation of IDH and TP53 respectively, and 2) propose a radiomic strategy for identifying the molecular subtypes of lower-grade glioma (LrGG) before clinical intervention.

METHOD AND MATERIALS
79 LrGG patients were collected from the Cancer Genome Atlas. Corresponding MRI data including T1WI before- and post-contrast, T2WI and FLAIR from the Cancer Imaging Archive were acquired. Statistical analysis were applied to baseline information of LrGG patients. After image preprocessing and VOI delineation, 218 radiomic features including texture, histogram and morphological features were derived from multimodal MRI per patient. Then the support vector machine-based recursive feature elimination (SVM-RFE) and classification strategy was adopted to find the optimal feature subsets and build the classifiers for the IDH and TP53 assessment. 10-fold cross validation was applied for internal validation of the models.

RESULTS
Statistical analysis showed that the distribution of anaplastic astrocytoma in LrGG was significant between both IDH-mt and IDH-wd groups (p=0.011<0.05) and TP53-mt and TP53-wd groups (p=0.032<0.05). The distribution of tumors located on frontal lobe was significant between TP53-mt and TP53-wd group (p<0.026). After SVM-RFE, 10 and 7 optimal features were determined for IDH-mt/wd, and TP53-mt/wd task. The accuracy and area under curve (AUC) were 84.8%, 0.846, and 76.5%, 0.807, respectively.

CONCLUSION
This study presented a radiomic strategy for noninvasively discriminating IDH and TP53 mutation of LrGG patients. Some radiomic features were more potential to identifying the key genetic alterations which determined the molecular subtype of LrGG. The proposed radiomics strategy could facilitate the clinical decision making in patients with LrGG.

CLINICAL RELEVANCE/APPLICATION
1. IDH and TP53 status were the key point to determine the molecular subtype for LrGG patients: LrGG with both IDH and TP53 mutant, LrGG with IDH mutant but no TP53 mutation, and LrGG with wild-type IDH. Therefore, detection of IDH and TP53 mutation before clinical intervention is important. 2. A radiomic strategy which incorporated kinds of radiomic features from multimodal MRI, and SVM classifier has the potential to discriminating IDH and TP53 mutation, and furthermore will facilitate the clinical decision making for LrGG patients.

NR337-SD-SUA5 Comparison of Intravoxel Incoherent Motion Diffusion-Weighted MR Imaging with Dynamic Contrast-Enhanced MRI for Differentiating Sinonasal Small Round Cell Malignant Tumors from Non-Small Round Cell Malignant Tumors

Participants
Zuohua Tang, PhD,MD, Shanghai, China (Presenter) Nothing to Disclose
Zuohua Tang, MD, PhD, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Zebin Xiao, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Rong Wang, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Wenlin Tang, Shanghai, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To investigate the diagnostic performance for sinonasal small round cell malignant tumors (SRCMT) and non-small round cell malignant tumors (Non-SRCMT) by intravoxel incoherent motion (IVIM) and quantitative dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) and to assess the correlation between these parameters.

METHOD AND MATERIALS
90 cases of surgically and pathologically confirmed the sinonasal malignant tumors, SRCMT of 53 cases and Non-SRCMT of 37 cases. All patients underwent conventional MRI, DCE-MRI and IVIM before treatment. A ROI was placed in the strengthening solid part by observing enhancement Image, to obtain IVIM and quantitative DCE-MRI parameters. Differences in IVIM and DCE parameters between SRCMT and Non-SRCMT were tested for significance using a t-test. The differences between the pathological solid types in SRCMT group were compared by one-way anova .The correlation between IVIM and DCE parameters was assessed by determination of the Spearman correlation coefficient and Altman-Bland method.

RESULTS
D value of SRCMT was lower than Non-SRCMT (0.51±0.10×10-3mm2/s and 0.67±0.15×10-3mm2/s respectively), the difference
was statistically significant (P < 0.001); D* value of SRCMT was higher than Non-SRCMT (8.25±2.04×10-3mm²/s and 7.11±1.66×10-3mm²/s, respectively), with the significant difference (P=0.011); f were lower in SRCMT compared to Non-SRCMT, but there was no significant difference (P > 0.05); ROC curve of D and D* values were 0.825 and 0.658. The diagnostic sensitivity and specificity were 80%, 75% and 43%, 84%, respectively. Ktrans, Kep, Ve and iAUC of SRCMT were lower than of Non-SRCMT, Ve had statistical difference (p=0.02), and there was no significant difference of other parameters (P > 0.05); there was no significant correlation between the IVIM and the DCE-MRI parameters; The variability of the data measured by two observers was small, ICC > 0.8.

CONCLUSION

The D value of IVIM can distinguish the sinonasal SRCMT and Non-SRCMT, and has a high diagnostic efficiency, but the D* and f values cannot identify the sinonasal SRCMT and Non-SRCMT. Ve can identify sinonasal SRCMT and Non-SRCMT. There was no significant correlation between IVIM and DCE-MRI parameters. Application of IVIM in sinonasal malignant tumors has a good repeatability.

CLINICAL RELEVANCE/APPLICATION

The D value of IVIM has a high diagnostic efficiency in distinguishing the sinonasal SRCMT and Non-SRCMT.

NR109-ED-SU6  Head and Neck Cancer Staging Updates in AJCC 8th Edition: What Changed and What the Radiologists Need to Know

Awards
Certificate of Merit

Participants
Edward Kuo, MD, Orange, CA (Presenter) Nothing to Disclose
Christopher V. Nguyen, MD, Irvine, CA (Abstract Co-Author) Nothing to Disclose
Jennifer Anderson, Orange, CA (Abstract Co-Author) Nothing to Disclose
Ravi Rajput, MD, Orange, CA (Abstract Co-Author) Nothing to Disclose
Tjason Tjoa, MD, Orange, CA (Abstract Co-Author) Nothing to Disclose
Daniel S. Chow, MD, Orange, CA (Abstract Co-Author) Nothing to Disclose
David Fiorillo, MD, Orange, CA (Abstract Co-Author) Nothing to Disclose

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TEACHING POINTS

1. Review the major changes in the new 8th edition AJCC Cancer Staging Manual for head and neck cancer and rationale for the changes
2. Provide a case based review to highlight the changes

TABLE OF CONTENTS/OUTLINE

1. Discuss the key changes to head and neck cancer staging in the AJCC 8th edition, and the value added benefit radiologists can provide in the new staging landscape as it relates to: a) Recently recognized HPV-related oropharyngeal cancer (utilizing p16+ surrogate marker) b) Restructuring of nasopharyngeal and thyroid cancers c) Recognition of significance of extra-nodal tumor extension d) Review of interval addition of head and neck-specific cutaneous malignancy staging e) New classification for cervical nodes of unknown primary 2. Case-based review highlighting interval changes to the AJCC staging 3. Review quiz to help reinforce key topics

NR173-ED-SUA7  Autoimmune Encephalitis: What the Radiologist Should Know

Participants
Sniya V. Sudhakar, MBBS,MD, Vellore, India (Presenter) Nothing to Disclose
Pradeep Krishnan, MD, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Helen M. Branson, MBBS, FRCR, Toronto, ON (Abstract Co-Author) Nothing to Disclose
Ann Yeh, MD, Toronto, ON (Abstract Co-Author) Nothing to Disclose
Manohar M. Shroff, MD, Toronto, ON (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. Relevance of autoimmune encephalitis . 2. Pathophysiology 3. Introduce different broad categories of autoimmune encephalitis, specific subtypes 4. Describe the key imaging features of the different etiologies 5. Different MRI patterns common to autoimmune diseases and frequency of occurrence in each category 6. Key features to differentiate from other imaging differentials 7. Focused tutorial on NMO/MO diagnostic criteria and MRI imaging features. Brief introduction to MOG related demyelination.

TABLE OF CONTENTS/OUTLINE

What is autoimmune encephalitis, why is it important to know: increasing detection, expanding spectrum and prevalence. Basic pathophysiology including brain as immune privileged site and what goes wrong in autoimmunity. Broad categories of autoimmune mediated encephalopathy antibody mediated -subtypes of non paraneoplastic and paraneoplastic (cell surface and intracellular antigens) and inflammation associated with demyelination, NMO, MO- diagnostic criteria, MRI features, distinction from MS, ADEM, CIS General MRI patterns: clinical context and when to consider autoimmune encephalitis. Anti NMDAR encephalitis examples. Rasmussen - diagnostic criteria, MRI features. Hashimotos encephalopathy, opsoclonus myoclonus, antiVGKC, ROHHAD syndrome. Take home points.

NR282-ED-SUA8  What the ENT Surgeon Needs to Hear: Presurgical Evaluation of Temporal Bone Masses

Participants
Kristoff Nelson, MD, Boston, MA (Presenter) Nothing to Disclose
Michael Schecht, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Teaching Points

1. To review the anatomy of the temporal bone with a focus on critical middle ear structures that must be assessed on preoperative imaging. 2. To review the most common surgical procedures for mass resection within the temporal bone. 3. To present cases of both common and uncommon mass lesions within the temporal bone and middle ear to reflect a wide array of pathology. 4. To provide clinical and pathologic correlation as well as postoperative evaluation where applicable with a focus on information that the otolaryngologist must know both pre and postoperatively.

Table of Contents/Outline

1. Anatomy of the temporal bone. 2. Common surgical procedures and approaches for temporal bone mass resection. 3. Benign masses (including DO NOT TOUCH lesions) Cases will include but are not limited to: Cholesteatoma, cholesterol granuloma, glomus tumors, aberrant internal carotid artery, persistent stapedial artery 4. Malignant Masses: Cases will include but are not limited to: perineural spread of tumor, squamous cell carcinoma of the external auditory canal, chondrosarcoma, endolympathic sac tumor Each case will include classic features of the diagnosis on imaging and correlation with pathology when available. There will be an additional focus on information that is critical for the otolaryngologist both pre and postoperatively.
NR338-SD- SUB1

Repeated Administrations of Macrocyclic Ionic MR Contrast Agent are Not Associated with Increased T1 Signal in Globus Pallidus and Dentate Nucleus

Purpose
To determine whether multiple repeated administrations of macrocyclic ionic MR contrast agent (MICA) are associated with increased T1 signal intensity in globus pallidus and dentate nucleus and to identify the predisposing factors for deposition in various clinical situations.

Method and Materials
In this institutional review board-approved retrospective study, 385 consecutive patients who underwent more than twice MICA-enhanced MR imaging were enrolled. The dentate nucleus-to-pons (DN/P) and globus pallidus-to-thalamus (GP/Th) signal intensity (SI) ratios on unenhanced T1-weighted images were recorded by 2 independent readers and averaged. The mean of DN/P and GP/Th SI ratio difference between the last and the first examinations were tested using the one sample t-test. Student’s t-test and stepwise logistic regression analysis were used to identify the predisposing factors for deposition based on the number of administrations, time interval, hepatic and renal function, and chemo- or radio therapy.

Results
The mean DN/P SI ratio difference was not different from zero (P = .697), even in patients with >=20 administrations (n = 33). Only patients with abnormal renal function showed increase in the mean DN/P SI ratio difference (P = .019). The mean DN/P SI ratio difference was not associated with any predisposing factors. However, the mean GP/Th SI ratio difference showed decrease (P < .001), which was associated with age (P = .007), number of administrations (P = .01) and number of radiotherapy sessions (P = .022) on multivariate analysis.

Conclusion
Multiple repeated administrations of MICA in various clinical situations are not associated with increased T1 signal intensity in globus pallidus and dentate nucleus in patients with normal renal function.

Clinical Relevance/Application
MICA is not associated with T1 signal increase in the dentate nucleus or globus pallidus even after repeated administrations and shorter time interval; thus it supports the use of macrocyclic GBCA.

NR339-SD- SUB2

Amide Proton Transfer Imaging: Comparing Glioblastoma and Metastatic Brain Tumor in Enhancing Tumors and Peritumoral Regions

Purpose
Amide proton transfer (APT) imaging is an emerging molecular MRI technique to detect endogenous mobile proteins and peptides. To determine whether APT imaging is useful for distinguishing glioblastomas (GBMs) from metastatic brain tumors (Mets), we compared APT-related signal intensity (APTSI) between the two tumor types in the areas of enhancing tumor and in the surrounding non-
enhancing areas with T2-prolongation (peritumoral high signal intensity areas, PHAs).

METHOD AND MATERIALS
We examined 12 patients with GBM (mean age, 71.9±10.9 years) and 8 patients with Met (65.1±9.7 years). All tumors were histopathologically confirmed. APT imaging was performed using a turbo spin-echo based sequence with a 2 s saturation pulse duration. δB0 maps were acquired for a point-by-point δB0 correction. APTSI was defined as magnetization transfer ratio asymmetry at 3.5 ppm. For each tumor, regions of interest (ROIs) were drawn on the APT source images, which had a T2-weighted contrast, manually contouring areas of enhancing tumor and PHAs using the corresponding post-contrast T1-weighted images as a reference. An additional ROI was placed in the contralateral normal appearing white matter (NAWM). The mean APTSIs were compared among the enhancing tumors in GBMs and Mets, PHAs in GBMs and Mets, and NAWM using the analysis of variance followed by Tukey Kramer post-hoc analyses (adjusted P<0.05).

RESULTS
The mean APTSI in the enhancing tumor of GBMs (3.26±0.78) was significantly higher than that of Mets (1.78±0.72) (P<0.001). The mean APTSIs in PHA of GBMs (1.82±0.65) and Mets (1.65±0.53) were both significantly higher than that in NAWM (0.43±0.36) (P<0.001, respectively), but no significant difference in APTSI was found between PHAs of GBMs and Mets.

CONCLUSION
APTSI in the areas of enhancing tumor, but not in PHA is useful imaging marker for differentiation between GBMs and Mets. PHA of Mets, where no tumor invasion is expected, showed significantly higher APTSI than NAWM, suggesting that simple peritumoral edema can show increased APTSI. High APTSI in areas surrounding an enhancing tumor does not necessarily indicate presence of tumor invasion.

CLINICAL RELEVANCE/APPLICATION
APT imaging is useful for distinguishing glioblastomas from metastatic brain tumors. High APTSI in areas surrounding an enhancing tumor does not necessarily indicate presence of tumor invasion.

MR340-SD-SUB3  C-11 Methionine PET/CT versus F-18 FDG PET/CT for Evaluating Residual or Recurrent Atypical / Anaplastic Meningioma after Treatment

Station #3
Participants
Noriaki Tomura, MD,PhD, Koriyama, Japan (Presenter) Nothing to Disclose
Toshiyuki Saginoya, MD, PhD, Koriyama, Japan (Abstract Co-Author) Nothing to Disclose
Hiromi Goto, MD, Koriyama, Japan (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
tomura@bloom.ocn.ne.jp

PURPOSE
Atypical and anaplastic meningiomas carry a high risk of recurrence. PET/CT might offer an effective tool for evaluating residual or recurrent tumors in cases with atypical or anaplastic meningioma after treatments such as surgery and radiotherapy. The present study compared 11C methionine PET/CT (MET-PET/CT) to 18F-FDG PET/CT (FDG-PET/CT) in the imaging of residual or recurrent tumors in cases with atypical or anaplastic meningioma.

METHOD AND MATERIALS
Both MET-PET/CT and FDG-PET/CT were performed in 16 patients (7 males, 9 females; mean age, 66.8±12.2 years) with histologically confirmed atypical (n=14) or anaplastic meningioma (n=2). Twenty-two meningiomas (19 atypical, 3 anaplastic) were included. In all cases, pathology was determined by surgery. After surgery, 5 cases received gamma-knife radiosurgery, and 1 case received proton therapy. Every patient underwent both FDG-PET/CT and MET-PET/CT on the same day. For qualitative analysis, images were visually reviewed by two independent reviewers with respect to the degree of tracer accumulation and delineation of tumor extent. The kappa coefficient between reviewer determinations was calculated. For semiquantitative evaluation, tumor-to-normal brain uptake (T/N) ratios were calculated by dividing the maximum standardized uptake value (SUVmax) for the tumor by the SUVmax of the normal temporal lobe. T/N ratio was then compared between FDG-PET/CT and MET-PET/CT. Correlation between tumor size and T/N ratio was also studied.

RESULTS
On qualitative evaluation, MET uptake was interpreted as positive by both reviewers in every tumor. FDG uptake was interpreted as negative by both reviewers in 7 tumors. MET uptake was interpreted as higher than FDG uptake in 15 tumors by one reviewer and in 17 tumors in another reviewer. For agreement between reviewers, the kappa coefficient was 0.61. On semiquantitative evaluation, T/N ratio was significantly higher for MET-PET/CT (2.81±1.31) than for FDG-PET/CT (0.89±0.42, p<0.001). T/N ratio correlated with tumor size on MET-PET/CT (p<0.05), but not on FDG-PET/CT.

CONCLUSION
Compared to FDG-PET/CT, MET-PET/CT showed much higher uptake by atypical and anaplastic meningiomas, suggesting that MET-PET/CT offers superior potential for imaging and follow-up in atypical and anaplastic meningiomas.

CLINICAL RELEVANCE/APPLICATION
The findings suggest that MET-PET/CT has superior potential for imaging and management of atypical and anaplastic meningiomas, compared to FDG-PET/CT.

MR341-SD-SUB4  Brain Tissue Follow-up Using Dynamic Susceptibility Contrast-Enhanced and Dynamic Contrast-Enhanced Perfusion Magnetic Resonance Imaging on Lesions Categorized by Apparent Diffusion Coefficient Values in Glioblastoma

Station #4
Participants
Purpose

Lesion heterogeneity of glioblastoma (GBM) is a challenge on MRI during follow-up. We sought the diagnostic accuracy of the dynamic susceptibility contrast enhanced (DSC), dynamic contrast enhanced (DCE) MRI and diffusion weighted imaging (DWI) in the different components of a newly developed or growing enhancing lesion in the differentiation of true progression (TP) from pseudoprogression (PP).

Method and Materials

This retrospective study was approved by institutional review board. DWI, DSC and DCE were obtained at a 3 T scanner in 27 patients with GBM, diagnosed with TP (n = 18) or PP (n = 9) based on RANO criteria on follow-up MRI at 3 months. Including both enhancing and nonenhancing parts, each lesion of patients was categorized into 3 types based on ADC segmentation using histogram analysis, as low-, mid- and high ADC. Corresponding relative cerebral blood volume (rCBV) and Ktrans values were quantified from coregistered DSC and DCE maps. Differences in ADC, rCBV and Ktrans between TP and PP in each ADC group and overall study group were tested using Mann Whitney U test. Cutoffs of quantitative parametric values and area under the receiver operating characteristic curve (Az) were assessed.

Results

When all lesions considered, the median ADC, rCBV and Ktrans values were significantly higher in TP than in the PP group (median ADC: 0.94 vs 0.75 x 10^-3 mm2/s, p=0.005; rCBV: 3.03 vs 1.15, p<0.001; Ktrans: 22.51 vs 5.81 min^-1, p<0.001 respectively). In each ADC group, the ADC values were not different between TP and PP groups (p>0.16), whereas both rCBV and Ktrans values were significantly higher in TP group (p<0.05). DWI had weak accuracy (Az 0.67), while DSC and DCE MRI had good accuracy in discrimination of TP and PP (Az 0.83 and 0.88, respectively) in overall lesions. Combining either DSC or DCE MRI to DWI increased accuracy (Az 0.84 and 0.88 respectively), but selection of perfusion modalities does not differ in diagnostic performance (p=0.243).

Conclusion

DSC and DCE MRI-derived pharmacokinetic parameters rather than ADC help to characterize heterogenous lesions in patients with GBM. Combining either perfusion MRI with DWI significantly improves differentiation of TP and PP.

Clinical Relevance/Application

Since both DSC and DCE helps determining tissue characteristics, either should be a part of imaging protocol in follow up of GBM patients.

Intraoperative Ultrasound in Spine Surgery: A New View of Spinal Pathology

NR113-ED-5

Station #5

Awards

Cum Laude

Participants

Anousheh Sayah, MD, Washington, DC (Presenter) Spouse, Consultant, NuVasive, Inc; Spouse, Stockholder, NuVasive, Inc; Lubdha M. Shah, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
anousheh.sayah@gunet.georgetown.edu

Teaching Points

We describe ultrasound (US) appearance of normal spinal canal contents, including the spinal cord, and associated pathologies. Both intramedullary and extramedullary spinal pathologies have varying sonographic appearances, which can provide complementary information to other imaging features. This is notably important when lesions distort adjacent cord anatomy on MRI. Spinal intraoperative US is routinely used by surgical specialties but the radiologist can provide diagnostic expertise and guide operative management of pathology. Intraoperative US after lesion resection can provide immediate feedback of adequate margins.

Table of Contents/Outline


NR199-ED-5

Simplifying C-Spine Stability: A Review of Subaxial Injury Classification and Scoring (SLIC) system

Station #6

Participants

Anastasia Cruz, DO, Orange, CA (Presenter) Nothing to Disclose

Mitchell Daun, MD, Orange, CA (Abstract Co-Author) Nothing to Disclose

Christopher V. Nguyen, MD, Irvine, CA (Abstract Co-Author) Nothing to Disclose

Daniel S. Chow, MD, Orange, CA (Abstract Co-Author) Nothing to Disclose

Arash Anavim, MD, Orange, CA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:

anastasia.cruz@wineo.bin'lge':irw
TEACHING POINTS

Cervical spine injuries make up 55% of the spinal cord injuries that occur each year. Cervical spinal injury can be further classified as craniocevical, atlantoaxial, and subaxial. There have been multiple grading systems developed to classify cervical spine injuries. The Subaxial Injury Classification and Scoring (SLIC) system classifies cervical spinal injury through C3-C7 while encompassing bone and ligamentous injury with neurologic status. Our institution is a level 1 trauma center with a wide capture net and a broad variety of trauma cases. This presentation will discuss and illustrate the classification of cervical spine injuries with in depth review of the SLIC scoring system. The presentation will conclude with review and case based quiz in applying the SLIC scoring system.

TABLE OF CONTENTS/OUTLINE

A. Comparison of Grading systems of cervical spine injuries
   Subaxial Injury Classification and Scoring (SLIC) Cervical Spine Injury Severity Score (CSISS) Allen-Ferguson system
B. Components and examples of SLIC score
   Morphology of bone spinal column disruption
   Integrity of discloligamentous complex
   Neurologic status
C. Modifications to SLIC system
D. Case based review using SLIC system

NR283-ED-SUB7 And the Eye’s Have It! A Closer Look at Expected and Unexpected Oculoplastic Post-operative Appearances

Participants
Mary D. Maher, MD, New York, NY (Presenter) Nothing to Disclose
Gul Moonis, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
mdd9013@nyp.org

TEACHING POINTS

Technology and techniques continue to advance in oculoplastic surgery. Postoperative orbits are rarely imaged after surgery unless a complication ensues; however, devices are frequently incidentally visualized. Radiologists must be familiar with the imaging and basic function of these devices in order to recognize the device, identify the surgically-managed pathology, and inspect for complications. Recognizing the surgery performed and its indications allows for appropriate evaluation of disease recurrence as well as surgical or device complication. Unrecognized, the devices may incorrectly be identified as foreign bodies, leading to patient harm or denial of necessary additional imaging for fear of MRI incompatibility. The purpose of this exhibit is as follows: To review normal orbital anatomy To review the normal postoperative appearance of oculoplastic surgery To review indications for specific oculoplastic surgeries and highlight their common complications To demonstrate atypical complications

TABLE OF CONTENTS/OUTLINE

Table of Contents/Outline
Review of orbital anatomy
Normal appearance of the postoperative orbit, oculoplastic devices, and review of indications
Common and uncommon oculoplastic complications
Summary
LEARNING OBJECTIVES

1) Describe the three processes involved in the creation of brain MR elastograms. 2) Classify focal brain lesions based on their viscoelastic properties and brain adhesion measured by slip interface imaging. 3) Explain the future role of brain MR elastography in differentiating diffuse neurologic diseases including the common causes of dementia. 4) Understand the limitations of current diagnostic algorithms for intracranial vascular disease. 5) Understand the techniques, applications and value of intracranial vessel wall imaging. 6) Understand future directions of vessel wall imaging. 7) Understand recent developments in simultaneous MR/PET imaging of the brain. 8) Evaluate outstanding technical challenges, including MR attenuation correction, image-derived arterial input functions, and workflow. 9) Review the role of simultaneous MR/PET for common neurologic diseases, such as dementia, cerebrovascular disease, and tumors.

SAM

New in 2017: PLEASE NOTE - All courses designated for SAM credit at RSNA 2017 will require attendees bring a personal device e.g. phone, iPad, laptop to complete the required test questions during the live session.

Sub-Events

RC105A  Clinical 7T Brain MRI

Participants
Jeroen Hendriks, MD, Utrecht, Netherlands (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe where 7 Tesla MRI can have added value in clinical neuroradiology. 2) Show the clinical added value of 7 Tesla MRI for the detection of small infarcts on high resolution 3D FLAIR sequences, the detection of small pituitary lesions with pre and post contrast 3D T1 MRI sequences and the detection of intracranial atherosclerosis with black blood vessel wall MRI sequences before and after contrast. 3) Explain the future directions of clinical 7 Tesla MRI and the importance of contrast-to-noise ratio (CNR) above signal-to-noise ratio (SNR).

RC105B  MR/PET in the Brain

Participants
Greg Zaharchuk, MD, PhD, Stanford, CA (Presenter) Research Grant, General Electric Company; Consultant, General Electric Company;

LEARNING OBJECTIVES

1) Understand recent developments in simultaneous MR/PET imaging of the brain. 2) Evaluate outstanding technical challenges, including MR attenuation correction, image-derived arterial input functions, and workflow. 3) Review the role of simultaneous MR/PET for common neurologic diseases, such as dementia, cerebrovascular disease, and tumors.

RC105C  MR Elastography: Palpating the Brain

Participants
John Huston III, MD, Rochester, MN (Presenter) Stockholder, Resoundant, Inc; Royalties, Resoundant, Inc

For information about this presentation, contact:
jhuston@mayo.edu

LEARNING OBJECTIVES

1) Describe the three processes involved in the creation of brain MR elastograms. 2) Classify focal brain lesions based on their viscoelastic properties and brain adhesion measured by slip interface imaging. 3) Explain the future role of brain MR elastography in differentiating diffuse neurologic diseases including the common causes of dementia.
**RC106A  Patterns of Orbital Disease**

**Participants**
Deborah R. Shatzkes, MD, New York, NY (Presenter) Nothing to Disclose

**For information about this presentation, contact:**
shatzkes@hotmail.com

**LEARNING OBJECTIVES**

1) Recognize the common cross-sectional imaging patterns that occur in orbital disease. 2) List some of the most important entities that may result in each imaging pattern. 3) Refine the differential diagnosis based on age and clinical presentation.

**ABSTRACT**

In orbital imaging, it is possible to fit findings into several stereotypical imaging patterns such as enlarged extraocular muscles (EOM), discrete masses, infiltrative processes and bony orbital lesions. Each of these patterns may occur secondary to multiple diseases. For example, enlargement of the EOM occurs most frequently in the setting of thyroid orbitopathy, but also in cases of pseudotumor, lymphoma, metastases, sarcoid and several others. Certain diseases, such as lymphoma, pseudotumor and sarcoid, may present with any of these patterns, and are worth including on most differential lists.

**Active Handout:** Deborah Rachelle Shatzkes


**RC106B  Vision Loss and Diplopia**

**Participants**
Jenny K. Hoang, MBBS, Durham, NC (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review the anatomy of the visual pathway and type of vision loss. 2) Review anatomy of cranial nerves III, IV, and VI. 3) Discuss approach and differentials for vision and diplopia.

**RC106C  Ocular Anatomy and Pathology**

**Participants**
Mary Beth E. Cunnane, MD, Boston, MA (Presenter) Nothing to Disclose
PET/CT and SPECT/CT in Movement Disorders, Epilepsy, and Dementia

Sunday, Nov. 26 2:00PM - 3:30PM Room: S505AB

LEARNING OBJECTIVES

1) Apply basic knowledge and skills relevant to clinical practice of Movement Disorders. 2) Assess the potential of emerging technological innovations and advances to enhance clinical practice and problem-solving. 3) Develop new ideas from experts and peers in the nuclear imaging sciences. 4) Differentiate Essential Tremor and Presynaptic Parkinson Diseases on DATscans. 5) Compare different image findings for interpretation of Movement Disorders.

ABSTRACT

Introduction: Parkinson Disease (PD) is the most common movement disorder affecting 1-2% of the general population over the age of 65 years and the second most common neurodegenerative disorder after Alzheimer’s disease (AD) PD presents with 3 most common symptoms. 1. Resting tremor: Most common first symptom, usually asymmetric and most evident in one hand with the arm at rest. 2. Bradykinesia: Difficulty with daily activities such as writing, shaving, using a knife and fork, and opening buttons; decreased blinking, masked facies, slowed chewing and swallowing. 3. Rigidity: Muscle tone increased in both flexor and extensor muscles providing a constant resistance to passive movements of the joints; stooped posture, anteroflexed head, and flexed knees and elbows. Nuclear Imaging Diagnosis: Datscan: (123I-ioflupane) Patient preparation: Thyroid blockade with Lugols- 3 drops one hour before Stop medicines that bind to the dopamine transporter 7 days prior to study, e.g. SSRIs, amphetamine, benzotropine, cocaine, mazindol,methylphenidate and phenetermine and sertraline Radiopharmaceutical: (123I-ioflupane) is a molecular imaging agent 3-5 mCi IV and Brain SPECT in 3 hours Used to demonstrate the location and concentration of dopamine transporters (DaTs) in the synapses of striatal dopaminergic neurons. Interpretation: Normal: comma shaped striatum Abnormal: dot, asymmetric caudate or putamen, high background Summary: A highly sensitive marker for accurate assessment of striatal dopaminergic function to differentiate Essential Tremor from PD Early diagnosis of presynaptic Parkinsonian syndromes Differentiation of presynaptic Parkinsonian syndromes from parkinsonism without presynaptic dopaminergic loss, such as drug-induced parkinsonism or psychogenic parkinsonism A straightforward one-day protocol An objective adjunct to the differentiation of PD syndromes from ET in clinically uncertain patients A diagnostic tool helping differentiate between probable DLB and AD Visualizing DaT distribution is useful as a novel diagnostic adjunct in movement disorders and dementia

Active Handout: Vani Vijayakumar


RC111B Imaging for Epilepsy

Participants
Anson L. Thaggard, MD, Jackson, MS (Presenter) Nothing to Disclose

For information about this presentation, contact:
athaggard@umc.edu

LEARNING OBJECTIVES

1) Define the components of a multidisciplinary evaluation for the surgical treatment of epilepsy. 2) Compare brain SPECT with FDG PET for evaluation of an epileptogenic focus. 3) Discuss barriers to the use of ictal SPECT imaging and functional MRI. 4) Appraise the added value of fusion imaging in epilepsy evaluation.

Active Handout: Anson Lee Thaggard


RC111C PET Imaging for Dementia

Participants
Terence Z. Wong, MD, PhD, Chapel Hill, NC (Presenter) Consultant, Luceno Dynamics, LLC;

LEARNING OBJECTIVES

1) Understand the basic pathophysiology of Alzheimer’s dementia. 2) Distinguish the different roles of PET imaging with FDG, amyloid, and tau tracers for evaluating dementia.
ABSTRACT

Alzheimer's disease is the most common form of dementia affecting the aging population, and is currently the 6th leading cause of death. Clinical diagnosis is difficult, and there is currently no cure. Functional imaging biomarkers may detect early stages of disease prior to the onset of symptoms, and may improve diagnostic accuracy. This in turn may improve evaluation of therapeutic interventions and provide a roadmap toward developing a cure.
Imaging for Personalized Medicine: Head and Neck

Sunday, Nov. 26 2:00PM - 3:30PM Room: S403A

Participants
Robert Jeraj, PHD, Madison, WI (Moderator) Founder, AIQ Services

LEARNING OBJECTIVES
1. To learn about use of imaging in management of H&N 2. To learn about imaging for target definition in H&N 3. To learn about imaging for treatment response assessment in H&N

Sub-Events

RC122A Anatomical Imaging for Personalized Medicine in the Head and Neck

Participants
Emilie Soisson, PhD, Burlington, VT (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 now 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.

RC122B Functional Imaging for Targeting and Adaptation in the Head and Neck

Participants
Robert Jeraj, PHD, Madison, WI (Presenter) Founder, AIQ Services

LEARNING OBJECTIVES
1) To learn how molecular imaging adds value in diagnosis/staging. 2) To learn how molecular imaging adds value in target definition. 3) To learn how molecular imaging adds value in treatment response assessment.
LEARNING OBJECTIVES

1) Describe the sonographic characteristics of thyroid nodules that are suspicious for malignancy.
2) Discuss the Bethesda Cytology Classification of Thyroid FNA results and the risk of malignancy associated with each category.
3) Describe the indications for new genetic tests that may be performed on FNAs obtained from thyroid nodules with indeterminate cytology.
4) Describe the technique of US-guided biopsy of thyroid nodules and cervical lymph nodes in patients who have undergone thyroidectomy for thyroid cancer.
5) 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 a 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 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 cytologic 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.
 Sunday Afternoon Plenary Session

Sunday, Nov. 26 4:00PM - 5:45PM Room: Arie Crown Theater

CH  GI  MK  NR  PD

AMA PRA Category 1 Credits ™: 1.75
ARRT Category A+ Credit: 1.75

Participants
Richard L. Ehman, MD, Rochester, MN (Presenter) CEO, Resoundant, Inc; Stockholder, Resoundant, Inc;

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. Ehman, MD - 2016 Honored Educator

Sub-Events

PS12A  Report of the RSNA Research and Education Foundation

Participants
N. Reed Dunnick, MD, Ann Arbor, MI (Presenter) Nothing to Disclose

Abstract

Since 1984, your RSNA Research & Education (R&E) Foundation has supported more than 1,200 investigators. An R&E Grant can inspire a career in research and help develop the leaders of tomorrow's radiology. The mission of the RSNA R&E Foundation is to improve patient care by supporting research and education in radiology and related scientific disciplines by funding grants and awards to individuals and institutions that will advance radiologic research, education and practice. Generous donations from individuals, private practice groups and corporations ensure that work continues year after year. Foundation grant recipients innovate solutions and methodologies to solve challenges facing radiology today, from discovering new MRI techniques for breast cancer imaging to using data integration to gain insights into the developing brain. In 2017, the R&E Foundation awarded more than $4 million for the second consecutive year, funding researchers at 50 institutions. At a 30 percent funding rate, the Foundation primes the pump of radiology research by supporting early-career investigators. Grant recipients report earning an additional $40 for every dollar awarded by the Foundation. The R&E Foundation launched its Campaign in 2014 to raise $17.5 million dollars and ensure a continuity of funding for these critical projects. Invest in the Foundation today to demonstrate your commitment to the future of your specialty. The Inspire-Innovate-Invest Campaign ends this year, and we need your help to reach our goal. As we all strive to "Explore. Invent. Transform." during this annual meeting, please take time to visit the R&E Foundation Booth, located in Lakeside Center East, Level 3. There you can discover the 2017 grant recipients and their innovative projects and learn how you can support the Foundation through our Campaign.

LEARNING OBJECTIVES

1) Identify key abnormal findings on radiologic studies that are critical to making a specific diagnosis. 2) Construct a logical list of differential diagnoses based on the radiologic findings, focusing on the most probable differential diagnoses. 3) Determine which, if any, additional radiologic studies or procedures are needed in order to make a specific final diagnosis. 4) Choose the most likely diagnosis based on the clinical and the radiologic information.

PS12B  Image Interpretation Session

Participants
Desiree E. Morgan, MD, Birmingham, AL (Presenter) Research Grant, General Electric Company
John Eng, MD, Cockeysville, MD (Presenter) Nothing to Disclose
James C. Anderson, MD, Portland, OR (Presenter) Nothing to Disclose
Marta E. Heilbrun, MD, Salt Lake City, UT (Presenter) Nothing to Disclose
Eva Llopis, MD, Valencia, Spain (Presenter) Nothing to Disclose
Angelisa M. Paladin, MD, Seattle, WA (Presenter) Nothing to Disclose
Frank J. Rybicki III, MD, PhD, Ottawa, ON (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/ Frank J. Rybicki III, MD, PhD - 2016 Honored Educator
Mess With the Bull, You Get the Horns (Case-based Competition)

Monday, Nov. 27 7:15AM - 8:15AM Room: E451B

Participants
Adam E. Flanders, MD, Narberth, PA (Presenter) Nothing to Disclose
Sandeep P. Deshmukh, MD, Philadelphia, PA (Presenter) Nothing to Disclose
Christopher G. Roth, MD, MS, Philadelphia, PA (Presenter) Nothing to Disclose

For information about this presentation, contact:
adam.flanders@jefferson.edu

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.
New in 2017: PLEASE NOTE - All courses designated for SAM credit at RSNA 2017 will require attendees bring a personal device e.g. phone, iPad, laptop to complete the required test questions during the live session.

Sub-Events

MSRO21A Imaging of the Nasopharynx: Applied Anatomy

Participants
Suresh K. Mukherji, MD, Northville, MI (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Review the normal anatomy of the nasopharynx. 2) Explain common spread patterns of nasopharyngeal carcinoma. 3) Describe the anatomy landmarks that determine staging of nasopharyngeal carcinoma.

MSRO21B Current Concepts and Controversies in Radiation Planning of the Nasopharynx

Participants
Sung Kim, MD, New Brunswick, NJ (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Review important points in contouring nasopharynx cancer based on patterns of spread.

ABSTRACT
Radiation therapy is a cornerstone of treatment for nasopharynx cancer. This session will discuss key points in contouring nasopharynx cancer and how contouring is based on patterns of spread.

MSRO21C Question & Answer

MSRO21D Anatomy and Imaging of Perineural Spread

Participants
Suresh K. Mukherji, MD, Northville, MI (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Describe common pathways of perineural spread. 2) Review the imaging findings of perineural spread. 3) Describe the proper imaging technique for being able to detect perineural spread.

ABSTRACT
This session will be a detailed review of the normal anatomy and the various pathways of perineural spread. The session will focus on optimizing the MRI techniques to visualize perineural spread various landmarks that need to be identified to help make this important diagnosis.

MSRO21E Current Concepts and Controversies in Contouring and Treatment of Perineural Spread

Participants
Allen M. Chen, MD, Kansas City, KS (Presenter) Nothing to Disclose

MSRO21F Question & Answer
**RC205**

**Neuroradiology Series: Big Data in Neuroradiology**

Monday, Nov. 27 8:30AM - 12:00PM Room: S406B

AR assay Category A+ Credits: 4.00
AMA PRA Category 1 Credits™: 3.25
FDA Discussions may include off-label uses.

**Participants**

Christopher P. Hess, MD, PhD, Mill Valley, CA (Moderator) Research Grant, General Electric Company; Research Grant, Quest Diagnostics Incorporated;

Jody L. Tanabe, MD, Aurora, CO (Moderator) Nothing to Disclose

**SUB-EVENTS**

**RC20501**  
**Population Neuroimaging: How to Use It in Your Practice**

Monday, Nov. 27 8:30AM - 9:00AM Room: S406B

Participants

Meike W. Vernooij, MD, Rotterdam, Netherlands (Presenter) Nothing to Disclose

**For information about this presentation, contact:**

m.vernooij@erasmusmc.nl

**LEARNING OBJECTIVES**

1) To understand the rationale and general design of population neuroimaging studies. 2) To learn how information derived from population neuroimaging can be translated to clinical practice. 3) To realize opportunities and challenges of the "population to practice" approach.

**RC205-03**  
**Radiogenomics Analysis in Hemodynamic Abnormality of Patients with Newly Diagnosed Glioblastomas: Combination with TCIA Database**

Monday, Nov. 27 9:10AM - 9:20AM Room: S406B

Participants

Xiang Liu, MD, Rochester, NY (Presenter) Nothing to Disclose

Wei Tian, MD, PhD, Rochester, NY (Abstract Co-Author) Nothing to Disclose

Rajiv Mangla, MD, Syracuse, NY (Abstract Co-Author) Nothing to Disclose

Dongmei Li, PhD, Rochester, NY (Abstract Co-Author) Nothing to Disclose

Laila M. Poisson, Detroit, MI (Abstract Co-Author) Nothing to Disclose

Rajan Jain, MD, Hartsdale, NY (Abstract Co-Author) Consultant, Cancer Panels; Royalties, Thieme Medical Publishers, Inc

**For information about this presentation, contact:**

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**PURPOSE**

Tumor angiogenesis is critical important for survival outcome in glioblastoma patients, the radiogenomics association of hemodynamic changes remains unclear. The purpose of this study is to investigate the association between MR perfusion abnormalities and genomic biomarkers in new diagnosed glioblastomas.

**METHOD AND MATERIALS**

MR DSC-PWI examinations of 41 new diagnosed glioblastomas were enrolled in URMC, the genomics biomarkers of TP53, Ki-67 labelling index, isocitrate dehydrogenase (IDH), mammalian target of rapamycin (mTOR), and EGFR were evaluated. 45 glioblastoma cases with MR DSC-PWI and U133 array gene expression in TCIA were reviewed for comparison. The mean and maximal rCBV ratio of the enhancing tumor (rCBVmean and rCBVmax) were measured in all cases, maximal and mean rCBV ratio of peri-enhancing tumor area (rCBVperi-tumor-max, rCBVperi-tumor-mean) were measured in two groups respectively. The correlation analysis, and Cox regression were performed. Additional U133 array gene expression of 483 glioblastoma cases archived in TCGA were used to identify the detected radiogenomics associations.

**RESULTS**

The rCBV ratio of peri-enhancing tumor area was the strongest predictor of overall survival (OS) in both groups, (hazard ratio= 1.29 and 1.16 respectively). The correlation analysis found difference of radiogenomic association in enhancing and peri-enhancing areas in both groups. In URMC group, the rCBVmax correlated with mTOR and the rCBVperi-tumor max had significant association with mTOR after adjustment of gender and EGFR. In TCIA group, the rCBVmax correlated with AKT2 and the rCBVperi-tumor mean had significant correlation with FOXO3. AKT2 and FOXO3 had significant association with mTOR (p<0.05). The gene expression analysis in 483 glioblastoma cases identify this gene network.
CONCLUSION
The difference of radiogenomic associations in enhancing and peri-enhancing areas and gene network may suggest PI3K/Akt/mTOR signaling pathway plays important role in different moderation of angiogenesis in glioblastomas. The implication of rCBVperi-tumor will promote future development of new targeting therapies aiming to tumor proliferation and vasculature infiltration.

CLINICAL RELEVANCE/APPLICATION
The rCBVperi-tumor had better prognostic value than molecular genomic biomarkers alone. The different radiogenomic associations involving PI3K/Akt/mTOR pathway suggest different moderation of hemodynamic abnormalities within glioblastomas.

Awards
Trainee Research Prize - Resident
Participants
Harrison X. Bai, MD, Philadelphia, PA (Presenter) Nothing to Disclose
Ken Chang, Boston, MA (Abstract Co-Author) Nothing to Disclose
Su Chang, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Hao Zhou, Changsha, China (Abstract Co-Author) Nothing to Disclose
Haiyun Tang, Changsha, China (Abstract Co-Author) Nothing to Disclose
Qin Shen, Changsha, China (Abstract Co-Author) Nothing to Disclose
Ena Agbolosa, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Zishu Zhang, MD, PhD, Ypsilanti, MI (Abstract Co-Author) Nothing to Disclose
Maclean Nasrallah, MD, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
John H. Woo, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Raymond Y. Huang, MD, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Paul Zhang, MD, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

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PURPOSE
To build a random forest predictive model of isocitrate dehydrogenase genotype in lower-grade gliomas (LGGs) that integrates clinical, preoperative, and multimodal automated features.

METHOD AND MATERIALS
Preoperative MRIs of 118 patients from an institutional cohort (training cohort) and 105 patients from the Cancer Imaging Archive (TCIA) (validation cohort) with primary grades II and III gliomas were scored by two neuroradiologists (HT and QS) according to the Visually Accessible Rembrandt Images (VASARI) annotations. Histogram, geometric and texture features were extracted from T1-weighted, T2-weighted, and T1 contrast enhanced sequences. Using a random forest algorithm, automated features or VASARI scores were integrated with clinical data to generate a model predictive of IDH genotype. IDH genotype was determined by immunohistochemistry and next generation sequencing. All statistical analyses were performed using the Statistics and Machine Learning Toolbox 2016a (MATLAB).

RESULTS
There was no significant in age, gender, WHO grade, KPS score and IDH mutation between the training and testing cohorts. For each patient, 4 clinical features were analyzed and 15510 automated features were extracted. After feature selection, 604 features remained. This included 1 clinical feature, 41 histogram features, 48 geometric features, and 514 texture features. Our model achieved accuracies of 90% (area under the curve [AUC]=0.89) in the training cohort and 81% (AUC=0.75) in the validation cohort. In addition, 4 clinical and 120 VASARI features were analyzed for each patient. After feature selection, 13 feature remained. This included 1 clinical and 12 VASARI features. Our model utilizing clinical and VASARI features achieved accuracies of 88% (AUC=0.85) in the training cohort and 75% (AUC=0.67) in the validation cohort.

CONCLUSION
Using machine-learning algorithms, we achieved high accuracy in prediction of IDH genotype in LGGs with preoperative clinical and conventional MRI features.

CLINICAL RELEVANCE/APPLICATION
Pre-treatment identification of IDH status has important clinical value. Although biopsies can be performed at relatively low-risk, an approach using MRI imaging to predict IDH genotype preoperatively can provide a less expensive and non-invasive alternative.

Awards
Trainee Research Prize - Resident
Participants
Nathaniel Swinbume, MD, New York, NY (Presenter) Nothing to Disclose
Javin Schefflein, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Yu Sakai, BA, New York City, NY (Abstract Co-Author) Nothing to Disclose
Irish Chen, MS,BS, New York, NY (Abstract Co-Author) Nothing to Disclose
Sayedhedayatollah Tadayon, New York, NY (Abstract Co-Author) Nothing to Disclose
Marco Hefti, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Ahmed Ghani, New York, NY (Abstract Co-Author) Nothing to Disclose
Amish H. Doshi, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

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Josep Puig Alcantara, MD, Girona, Spain (Abstract Co-Author) Nothing to Disclose
Kambiz Nael, MD, New York, NY (Abstract Co-Author) Medical Advisory Board, Toshiba Medical Systems Corporation

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PURPOSE
To investigate whether machine learning (ML) evaluation of multimodal brain MRI can reliably differentiate glioblastoma, solitary brain metastasis, and CNS lymphoma.

METHOD AND MATERIALS
Preoperative MRI including FLAIR, DWI, dynamic contrast enhanced (DCE), dynamic susceptibility contrast (DSC) perfusion and post-contrast T1 (T1C+) in patients with solitary enhancing lesions were retrospectively reviewed. Conventional (T1C+, FLAIR), relative cerebral blood volume (rCBV) and relative cerebral blood flow (rCBF) from DSC, volume transfer constant from plasma to extravascular extracellular space (Ktrans), rate constant between EES to plasma (Kep), plasma volume per unit tissue volume (Vp) and EES-volume per unit tissue volume (Ve) from DCE, and apparent diffusion coefficient (ADC) maps were then further processed using the fMRI Software Library (Analysis Group, Oxford, UK) Version 5.0. Steps included histogram normalization and coregistration. Two separate volumes of interest (VOIs) were drawn manually on enhancing tumor and non-enhancing T2 hyperintense (NET2) region using coregistered T1C+ and FLAIR images, respectively. These preprocessed data were utilized for supervised training of a Gaussian processing classifier (GPC) using the Pattern Recognition for Neuroimaging Toolbox (UCL, London, UK) v2.0. Training entailed evaluation of labeled MRI data for creation of a GPC model, which was validated on unlabeled cases using the leave-one-subject-out method.

RESULTS
Twenty-one patients (13 male, 8 female; age 56.7 ± 8.9 years) with biopsy-proven glioblastoma (n=7), metastasis (n=6; lung carcinoma=2, esophageal carcinoma=1, melanoma=1, neuroendocrine carcinoma=1, rectal carcinoma=1), and CNS lymphoma (n=8) were identified. The trained GPC discriminated with 51.8% balanced accuracy (BA) between glioblastoma [class accuracy (CA) 66.7%), metastasis (CA 57.1%), and lymphoma (CA 44.4%) with the highest accuracy achieved from combined evaluation of ADC, rCBV, ktrans and Vp using NET2-based VOIs.

CONCLUSION
Given a set of VOIs defined by lesional NET2, a trained GPC can differentiate glioblastoma, brain metastasis, and CNS lymphoma with 51.8% BA utilizing ADC, rCBV, ktrans and Vp.

CLINICAL RELEVANCE/APPLICATION
A trained Gaussian process classifier can differentiate glioblastoma, solitary brain metastasis, and CNS lymphoma on brain MR with 51.8% accuracy, significantly better than random chance (33.3%).

RC20506 The Impact of Large-Scale Research Trials on Clinical Practice
Monday, Nov. 27 9:40AM - 10:10AM Room: S406B

Participants
Pratik Mukherjee, MD, PhD, San Francisco, CA (Presenter) Research Grant, General Electric Company Medical Advisory Board, General Electric Company

RC20507 From Efficacy to Effectiveness: The Pragmatic Clinical Trial
Monday, Nov. 27 10:20AM - 10:50AM Room: S406B

Participants
Jeffrey G. Jarvik, MD, MPH, Seattle, WA (Presenter) Co-founder, PhysioSonics, Inc; Stockholder, PhysioSonics, Inc; Consultant, HealthHelp, LLC; Consultant, UpToDate, Inc; Royalties, Springer Nature

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LEARNING OBJECTIVES
1) Compare pragmatic with explanatory trials. 2) Review the Pragmatic-Explanatory Continuum Index Summary (PRECIS) tool. 3) Describe the rationale and design of the Lumbar Imaging with Reporting of Epidemiology (LIRE) study, a pragmatic randomized trial. 4) Introduce the NIH Healthcare Systems Collaboratory and Patient Centered Outcomes Research Institute (PCORI).

ABSTRACT

Honored Educators
 presenteers 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...
Using Low-Frequency Oscillations to Predict Temporal Lobe Epilepsy with Machine Learning

METHOD AND MATERIALS

Data from 42 TLE patients (age=39.6 years, 26 females), and 37 healthy controls (age=29.7 years, 19 females) were analyzed. FMRI data were acquired on 3T GE 750 scanners using whole-brain simultaneous multi-slice imaging (8 bands, 72 slices, TR=802ms, voxel size 2mm isotropic). Four 5-minute resting state scans were combined. T1-weighted images were acquired for spatial alignment using a magnetization prepared gradient echo sequence (0.8mm isotropic). Data were processed using the Human Connectome Project (HCP) processing pipeline. 360 time series from brain regions defined by HCP’s Glasser parcellation were extracted per subject. Pearson’s correlations between every pair of parcels were computed and normalized with Fisher transformation to generate connectivity matrices. Unique pairwise correlations were reshaped into a row matrix with 64,620 features. During feature selection, we computed a t-test for each feature between patients and controls. Only a pre-defined number of 'top features' with the lowest p-values were fed into the ML classifiers. The optimal number of top features was found by sweep search. Two ML classifiers were used: support vector machine (SVM) and random forest (RF). Training and cross validation were done using MATLAB. Leave-one-out-cross-validation (LOOCV) was used for performance estimation.

RESULTS

Slow-5 band data outperformed slow-4 and all LFO at the classification. Using SVM, slow-5 produced the best LOOCV accuracy of 91.1% using 69 top features, followed by slow-4 at 73.4% and LFO at 65.8%. Using RF, they were 79.7% using 58 top features, 67.1% and 64.6% in the same order.

CONCLUSION

Slow-5 band data consistently produced superior classification results between TLE and controls than slow-4 and all LFO. This suggests that the difference in brain signals between the groups would be best characterized at this frequency band.

CLINICAL RELEVANCE/APPLICATION

Using machine learning, this paper shows how the slow-5 low frequency oscillation band in resting-state brain signals can differentiate temporal lobe epilepsy (TLE) patients from healthy controls.
**RESULTS**

Figure 1 shows the four time course components decomposing from the data collected from a patient with grade II gliomas. ICA allows for extracting tie course features for machine learning classifications, which were then used to evaluate the predictive power of different machine learning algorithms. Machine learning classifier indicated that the best classification accuracy between high and low grade glioma could be obtained using Medium Gaussian SVM (with total diagnostic accuracy of 64%, AUC = 0.71). Brain tumors, especially high grade glioblastoma multiforme (GBM), are highly heterogenous. Interestingly, the number of decomposed independent components reflects the degree of heterogeneity of the tumor. In average, high grade gliomas have significantly higher heterogeneity index compared to low grade gliomas (10 ± 5 vs. 5 ± 2, p=0.03, Figure 2).

**CONCLUSION**

Medium gaussian SVM model shows best diagnostic accuracy to differentiate between high / low grade tumor based on ICA-classified tumor perfusion.

**CLINICAL RELEVANCE/APPLICATION**

Using ML in combination with ICA method to analyze the MR perfusion signal enabled better characterization of heterogeneities of glioma.

**METHOD AND MATERIALS**

Study approval was obtained from the IRB. Patients with high grade glioma (grade III and above, n=21) and low grade glioma (Grade II, n=8) were selected. All patients were imaged on a 3T MR imaging unit (TrioTim; Siemens) with a routine brain perfusion protocol. Prepressed time course data were processed using data-driven single ICA (FSL 4.1.4 MELODIC). The heterogeneity index of tumor was defined as the numbers of components generating from ICA. We used a supervised learning task with training data. Classifiers were trained using the repeated (3 repeat iterations) 10 fold cross validation of training cohort and their predictive performance was evaluated in the validation cohort using area under ROC curve (AUC).
SVM classifier can differentiate between pre- and post-therapy stages based on rs-FC and track specific brain networks that are reorganized across the two stages. FC in both motor and non-motor networks appear among the features that differentiate the two stages of the interventional therapy. Although the BCI-therapy is targeted at recovery of upper-extremity motor function, the results of this study suggest that BCI-therapy may also promote neural reorganization in non-motor networks as well.

**CLINICAL RELEVANCE/APPLICATION**

BCI therapy for recovery in motor functions post stroke is an image-guided intervention which allows for rehabilitation of not only motor systems but also may benefit non-motor systems as well.

**RC205-11 Deep Learning for Gender Differentiation**

**Awards**

**Student Travel Stipend Award**

**Participants**

Felipe C. Kitamura, MD, MSC, Sao Paulo, Brazil (Presenter) Nothing to Disclose

Gabriel A. Oliveira, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

Igor R. Dos Santos, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

Stenio Burlin, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

Daniel S. Wu, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

Marcelo Arcuri, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

Luis T. Tibana, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

Nitamar Abdala, MD, PhD, Mogi Das Cruzes, Brazil (Abstract Co-Author) Nothing to Disclose

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**PURPOSE**

The purpose of this study was to develop an automated method to distinguish between man and woman based on head FLAIR magnetic resonance (MR) images.

**METHOD AND MATERIALS**

This retrospective study was approved by our institutional review board, and written informed consent was waived. A total of 400 patients (8650 slices) were sequentially enrolled and split into man (43.6%) or woman (56.4%) groups according to DICOM metadata. Two convolutional neural networks (CNNs) were trained from scratch with optimized parameters: (1) one was general purpose 2D CNN (8 layers, AlexNet) and the other (2) was a specific 3D CNN (4 layers, in-house development, using tensorflow). Subjects were split into training (70%), validation (5%) and test (25%) subsets. After that, another 960 patients were added and the total of 1360 patients were used to train only the 3D CNN, with varying training subset size (up to 1000), 60 patients in validation and 300 in test group.

**RESULTS**

For the 400 patients group, AlexNet yielded 77.19% top-1 accuracy (per-class accuracy for male: 59.96%; and female: 88.64%) and our in-house 3D CNN yielded 96.00% top-1 accuracy (per-class accuracy for male: 96.33%; and female: 95.74%). For the 1360 patients group, the 3D CNN yielded the following accuracies/training subset size: 58.33%/5; 73%/10; 88%/20; 89.33%/30; 92.33%/50; 94.66%/70; 95.33%/100; 96.33%/500; 98%/1000.

**CONCLUSION**

To date, no specific anatomic landmark (seen by human eye) has been identified to properly distinguish between gender in secional images. Our 3D deep learning method appears to better differentiate gender based on FLAIR images when compared to a 2D CNN. This may be due to the higher level of features extracted in 3D CNNs. Although 98% accuracy may convince there may be image landmarks for gender differentiation, this result is not enough for clinical use yet. A bigger dataset should improve performance, according to the experiment with varying training subset size.

**CLINICAL RELEVANCE/APPLICATION**

An accurate tool to differentiate between man and woman based on head magnetic resonance (MR) images could aid in the diagnosis of gender phenotype, besides other secondary sex characteristics.

**RC20512 Machine Learning: Approaches to Using Large Imaging Data Sets**

**Participants**

Mark H. Michalski, MD, Boston, MA (Presenter) Nothing to Disclose
**RC206**

**Everything You Need to Know about the Cervical Lymph Nodes**

Monday, Nov. 27 8:30AM - 10:00AM Room: E353A

**Sub-Events**

**RC206A**  
**Nodal Levels and Criteria for Significance**

Participants  
Peter M. Som, MD, New York, NY (*Presenter*) Nothing to Disclose

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Peter.Som@Mountsinai.org

**LEARNING OBJECTIVES**

1) Learn why the cervical lymph nodes are so important. 2) Learn why the anatomic location of the cervical nodes and the difference between nodal classification and nodal staging. 3) Learn what the criteria is for assessing when a node is suspected to be malignant.

**RC206B**  
**Differential Diagnosis of Cervical Lymphadenopathy**

Participants  
Karen L. Salzman, MD, Salt Lake City, UT (*Presenter*) Consultant, Reed Elsevier; Author, Reed Elsevier

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karen.salzman@hsc.utah.edu

**LEARNING OBJECTIVES**

1) Understand the differential diagnosis of cervical lymphadenopathy. 2) Review the imaging features of inflammatory/infectious etiologies of cervical lymphadenopathy. 3) Review the classic features of metastatic thyroid cancer and lymphomatous adenopathy.

**RC206C**  
**Techniques for Imaging the Cervical Lymph Nodes**

Participants  
Ashok Srinivasan, MD, Canton, MI (*Presenter*) Nothing to Disclose

For information about this presentation, contact:  
ashoks@med.umich.edu

**LEARNING OBJECTIVES**

1) To understand the pros and cons of different techniques for imaging the cervical lymph nodes.

**RC206D**  
**Types of Neck Dissections and the Post-operative Neck**

Participants  
Hilda E. Stambuk, MD, New York, NY (*Presenter*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe the general principles of neck dissection for head and neck cancers. 2) Define the terminology of various types of neck dissection. 3) Understand the implications of radiographic imaging in planning extent of neck dissection. 4) Identify radiographic features of the post-treatment neck.
Emerging Technology: Imaging of Dementias

Monday, Nov. 27 8:30AM - 10:00AM Room: S505AB

CT  MR  NR  NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75
FDA

Discussions may include off-label uses.

Participants
Rathan M. Subramaniam, MD, PhD, Dallas, TX (Moderator) Nothing to Disclose

LEARNING OBJECTIVES

1) To discuss the value of FDG brain PET/CT in differentiating various dementias in cognitive decline. 2) To discuss the value of Amyloid brain PET/CT in patients with cognitive decline and Alzheimer's disease. 3) Understand which FDA approved MR techniques are currently available for improving differential diagnosis in patients with dementia. 4) Improve basic knowledge of how MR results correspond to clinical dementia phenotypes. 5) Discuss recent technological advances including applications of dynamic susceptibility contrast (DSC) MR, arterial spin labelling (ASL) and resting state functional connectivity MRI (rs-fcMRI) in the setting of patients with dementia. 6) Describe the basic science principles behind tau PET/CT imaging. 7) Understand the utility of tau PET/CT imaging in neurodegenerative disease. 8) Identify the findings of a positive tau PET/CT scan.

SAM

New in 2017: PLEASE NOTE - All courses designated for SAM credit at RSNA 2017 will require attendees bring a personal device e.g. phone, iPad, laptop to complete the required test questions during the live session.

Sub-Events

RC217A Imaging Dementias: FDG and Amyloid PET/CT

Participants
Rathan M. Subramaniam, MD, PhD, Dallas, TX (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) To discuss the value of FDG brain PET/CT in differentiating various dementias in cognitive decline. 2) To discuss the value of Amyloid brain PET/CT in patients with cognitive decline and Alzheimer's disease.

RC217B Imaging Dementias: MRI

Participants
Tammie S. Benzinger, MD, PhD, Saint Louis, MO (Presenter) Research Grant, Eli Lilly and Company; Investigator, Eli Lilly and Company; Investigator, F. Hoffmann-La Roche Ltd;

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benzingert@WUSTL.EDU

LEARNING OBJECTIVES

1) Understand which FDA approved MR techniques are currently available for improving differential diagnosis in patients with dementia. 2) Improve basic knowledge of how MR results correspond to clinical dementia phenotypes. 3) Discuss recent technological advances including applications of dynamic susceptibility contrast (DSC) MR, arterial spin labelling (ASL) and resting state functional connectivity MRI (rs-fcMRI) in the setting of patients with dementia.

RC217C Imaging Dementias: Tau PET/CT

Participants
Val J. Lowe, MD, Rochester, MN (Presenter) Research Grant, General Electric Company; Research Grant, Siemens AG; Research Grant, Eli Lilly and Company; Advisory Board, Merck & Co, Inc

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LEARNING OBJECTIVES

1) Describe the basic science principles behind tau PET/CT imaging. 2) Understand the utility of tau PET/CT imaging in neurodegenerative disease. 3) Identify the findings of a positive tau PET/CT scan.
Interactive Game: When Do Imaging Findings Make a Difference? (An Interactive Session)

Monday, Nov. 27 8:30AM - 10:00AM Room: E352

Participants
David M. Panicek, MD, New York, NY (Moderator) Nothing to Disclose

For information about this presentation, contact:
panicekd@mskcc.org

LEARNING OBJECTIVES
1) To recognize and review a range of potential interpretive pitfalls in oncologic imaging of the nervous, gynecologic, and musculoskeletal systems, using an interactive audience response system.

SAM
New in 2017: PLEASE NOTE - All courses designated for SAM credit at RSNA 2017 will require attendees bring a personal device e.g. phone, iPad, laptop to complete the required test questions during the live session.

Sub-Events
RC218A Neuro
Participants
Birgit B. Ertl-Wagner, MD, Munich, Germany (Presenter) Author, Springer Nature; Author, Thieme Medical Publishers, Inc; Author, Bracco Group; Spouse, Stockholder, Siemens AG;

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B.Ertl-Wagner@t-online.de

LEARNING OBJECTIVES
1) To comprehend the importance of signs in neuroimaging for diagnostic decision making. 2) To understand in which instances imaging findings have a direct consequence for therapeutic decision making. 3) To appreciate the therapeutic consequences of selected neuroimaging findings.

RC218B Musculoskeletal
Participants
David M. Panicek, MD, New York, NY (Presenter) Nothing to Disclose

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panicekd@mskcc.org

LEARNING OBJECTIVES
1) Assess imaging features that facilitate specific diagnoses of musculoskeletal lesions. 2) Describe scenarios in which various imaging features of musculoskeletal lesions lead to more accurate tumor staging and treatment response assessment. 3) Detect musculoskeletal complications of tumors and their treatment.

RC218C Pelvis
Participants
Caroline Reinhold, MD, MSc, Montreal, QC (Presenter) Consultant, GlaxoSmithKline plc

LEARNING OBJECTIVES
1) Understand the role of imaging in the management of gynaecological malignancies.2) Assess imaging features that allow accurate staging of gynaecological malignancies.3) Be familiar with pitfalls that can result in staging errors using imaging.4) Understand the changes in imaging appearance post treatment.

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/ Caroline Reinhold, MD, MSc - 2013 Honored EducatorCaroline Reinhold, MD, MSc - 2014 Honored EducatorCaroline Reinhold, MD, MSc - 2017 Honored Educator
**BOOST: CNS—Case-based Review (An Interactive Session)**

Monday, Nov. 27 10:30AM - 12:00PM Room: S103AB

**Participates**
Christina I. Tsien, MD, Saint Louis, MO (Presenter) Speaker, Merck & Co, Inc
Soonmee Cha, MD, San Francisco, CA (Presenter) Nothing to Disclose
Roger Stupp, MD, Chicago, IL (Presenter) Spouse, Employee, Celgene Corporation; Research Consultant, Celgene Corporation; Research Consultant, Merck & Co, Inc; Research Consultant, Novartis AG; Research Consultant, NovoCure Ltd; Research Consultant, F. Hoffmann-La Roche Ltd
Daniel P. Cahill, Boston, MA (Presenter) Speaker, Merck & Co, Inc

**LEARNING OBJECTIVES**

1) Present latest advances in imaging for assessment of brain tumors before, during and after therapy. 2) Discuss challenges and strategies for accurate imaging characterization of brain tumors following therapy in a case based format.
Impact of Glycemic Control and Cardiovascular Disease Measures on Hippocampal Functional Connectivity in African Americans with Type 2 Diabetes: A Resting State fMRI Study

PURPOSE
This study tests the hypothesis that inadequate Type 2 diabetes (T2D) management, including fine gradations of glycemic control, increasing measures of cardiovascular disease (CVD) and renal disease, leads to decreased hippocampal connectivity in African Americans (AA).

METHOD AND MATERIALS
The study includes 155 AA with T2D, 57% female with mean age of 59.2 years for whom diabetes management was quantified. Subjects had a mean diabetes duration of 14.5 years, hemoglobin A1c (HbA1c) of 7.97%, estimated glomerular filtration rate (eGFR) of 86.6 mL/min/1.73m2, and coronary artery calcium (CAC) score of 475.4mg. An 8min resting state fMRI was acquired and structural and functional MRI were co-registered, normalized to MNI space, and mean fMRI time courses per region were computed, and then pairwise region connectivity using Pearson's correlation was computed. The regions and connections form a graph of nodes and edges. Correlation was thresholded to retain the top 10% edges. The degree of each region which represents the overall connectivity of the region to the rest of the brain was computed to form a brain health measure. A linear support vector regression model was fit to predict the brain health measure using 10-fold cross-validation, while permutation testing was used to compute model reliability. The predictor set consists of diabetes measures: HbA1c, renal disease measures: eGFR, c-reactive protein (CRP), and urine albumin-to-creatinine ratio (ACR), and CVD measure: CAC. Our model is fully adjusted for education, age, sex and BMI.

RESULTS
The functional connectivity of the hippocampus was found to be significantly impacted by HbA1c and CAC with R2=1.9%, p=0.00047. Lower functional connectivity of right hippocampus (hippocampal degree) was associated with poor glycemic control (higher HbA1c) and greater calcified plaque (higher CAC). The results complement previous research demonstrating an inverse association between CAC and Montreal Cognitive Assessment test scores.

CONCLUSION
This work provides new evidence that elevated HbA1c and CAC are associated with decreasing functional connectivity of the right hippocampus in AAs with T2D.

CLINICAL RELEVANCE/APPLICATION
The results suggest that maintaining fine degree of glycemic control and cardiovascular health may support optimal hippocampal function, a structure critical for successful memory retrieval.
**CONCLUSION**

The fMRI study revealed a default mode network of brain function in patients with the fragile X syndrome, as well as in the control group. Furthermore, it was found that a default mode network of the brain in patients with fragile X syndrome and control groups do not have statistical significance (p>0.05), which may indicate that the basal activity of neurons in patients with fragile X syndrome is not reduced. Also we have found a significant (p<0.05) reduction the functional connectivity within the prefrontal cortex of the frontal-parietal hemispheric network in the resting state in patients with fragile X syndrome.

**METHOD AND MATERIALS**

The participants were 52 local business owners and managers, males and females, age 18 to 60 years old. All participants had some educational background in accounting, business or finance and significant employment in managerial capacity. The subject is assigned a role of a manager to choose whether or not to manage earnings in order to avoid debt covenant violations and the subject's managing style is evaluated in every scenario. The influences of subject's perception of his/her supervisor managing style are also evaluated in every scenario.

**RESULTS**

We found that there was greater pre-frontal cortex (PFC) activation in CLOSE than in FAR scenarios. These results suggest that earning management decisions under high levels of financial stress requires more PFC cognitive functions. We also found that there was greater activation in the bilateral nucleus accumbens (NA) and the left amygdala (Amy) in CLOSE than FAR scenarios.

**CONCLUSION**

The final findings reveal different activation in emotion response and cognitive processing when the company is close vs. far from violating debt covenants which influences the manager's managing style and performance evaluation approach on manager's earning management decision and related brain activation. The final findings also suggest influences of manager's perception of his/her supervisor's managing style on manager's emotion responses during earning management decision making.

**CLINICAL RELEVANCE/APPLICATION**

FMRI can demonstrate brain activation associated with earnings management behavior to avoid violating debt covenants by business managers.

**SSC11-03  Application of fMRI in the Assessment of Neuronal Activity in Patients with Fragile X Syndrome**

**PURPOSE**

Although functional MRI (fMRI) techniques have been increasingly used to study human cognitive functions, there has been a lack of research on the applications of fMRI on brain activation of business managers. Specifically, there is research gap in using fMRI to examine managers' earning management decisions. Therefore, the current study to report on a newly developed paradigm for neuroimaging study of neuro-accounting research, and the new findings related to brain activation associated with earnings management as a mechanism to avoid violating debt covenants.

**METHOD AND MATERIALS**

The participants were 5 children with confirmed fragile X syndrome and 8 healthy volunteers. Independent Component Analysis and seed-based correlation analysis were used. Statistical analysis was performed using FSL (fMRI Brain Software Library).

**RESULTS**

The fMRI study revealed a default mode network of brain function in patients with the fragile X syndrome, as well as in the control group. Furthermore, it was found that a default mode network of the brain in patients with fragile X syndrome and control groups do not have statistical significance (p>0.05), which may indicate that the basal activity of neurons in patients with fragile X syndrome is not reduced. Also we have found a significant (p<0.05) reduction the functional connectivity within the prefrontal cortex of the frontal-parietal hemispheric network in the resting state in patients with fragile X syndrome.

**CONCLUSION**

The participants were 5 children with confirmed fragile X syndrome and 8 healthy volunteers. Independent Component Analysis and seed-based correlation analysis were used. Statistical analysis was performed using FSL (fMRI Brain Software Library).
New data of functional status of the brain in patients with fragile X syndrome were received. The significant reduction the functional connectivity within the prefrontal cortex of the frontal-parietal hemispheric network in the resting state in patients with fragile X syndrome was found.

**CLINICAL RELEVANCE/APPLICATION**

Neurology, psychiatry, genetics

**SSC11-04 fMRI Markers of Decision-Making under Uncertain Conditions**

Monday, Nov. 27 11:00AM - 11:10AM Room: N229

**Awards**

Student Travel Stipend Award

**Participants**

Danielle C. Farrar, MA, Boston, MA (Presenter) Nothing to Disclose
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**PURPOSE**

To describe imaging markers of decision-making under certain and uncertain conditions in normal individuals, in order to provide baseline activity in which to compare impaired decision-making in such pathological states as schizophrenia, ADHD, and obsessive-compulsive disorder.

**METHOD AND MATERIALS**

Nineteen healthy subjects ages 18-35 completed a novel decision-making card-matching task using a Phillips T3 Scanner. Functional data were collected in six functional runs of a single shot echo-planar imaging sequence (TR = 2 s, TE = 35 ms, 30 slices, 3 mm slice thickness, inplane resolution 3 mm × 3 mm) and a T1-weighted structural image (1 mm3 voxel size). In one condition of the card-matching task, the participant was certain of the rule to apply to match the cards; in the other condition, the participant was uncertain. We performed cluster-based comparison of the two conditions using FSL FEAT.

**RESULTS**

The uncertain > certain comparison yielded 3 large clusters through general linear model (GLM) analysis using FSL FEAT - a midline cluster that extended through midbrain, the thalamus, bilateral prefrontal cortex, the striatum, and bilateral clusters that extended through the parietal cortex and occipital cortex. The certain > uncertain comparison yielded bilateral clusters in the insula that extend into the boundary of the parietal and temporal lobe, as well as a medial frontal cluster.

**CONCLUSION**

The involvement of the insula, parietal cortex, temporal cortex, ventromedial cortex, and orbitofrontal cortex that showed increased activation in the certain condition are generally associated with rule certainty and reward, which reinforces the notion that certainty is inherently rewarding. For the uncertain condition, we expected to see involvement of the prefrontal cortex, parietal cortex in resolving uncertainty, as well as involvement of the striatum, thalamus, amygdala and hippocampal were expected in rule updating; however, the unexpected involvement of occipital cortical involvement and midbrain involvement may be attributed to increased visual attention and increased motor control.

**CLINICAL RELEVANCE/APPLICATION**

We have established a network of functional brain regions involved in certain and uncertain decision-making conditions using fMRI and a novel paradigm on which to explore pathological disease states.

**SSC11-05 Impaired Executive Control Function in Unilateral Temporal Lobe Epilepsy Revealed by Extrinsic Brain Network Connectivity: A Resting-state Functional fMRI Study**

Monday, Nov. 27 11:10AM - 11:20AM Room: N229

**Participants**

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**PURPOSE**

To investigate functional connectivity (FC) between resting-state networks (RSNs) in unilateral intractable temporal lobe epilepsy (TLE) patients with abnormal executive control function (ECF).

**METHOD AND MATERIALS**

Forty left TLE patients and twenty-three volunteers were recruited for resting-state fMRI scanning. The patient groups were
divided into two subgroups according to ECF performance: ECN decreased group as subgroup 1 (G1) and ECN normal group as subgroup 2 (G2). The healthy control group (HC) included all 23 volunteers. All the subjects were received neuropsychological tests, including Wisconsin Card Sorting Test (WCST) and Montreal Cognitive Assessment (MoCA). Group-information-guided independent component analysis (GIG-ICA) was employed to estimate RSNs of all subjects. A general linear model with age, sex and education as covariates was used to analyze which pairs of internetwork FC reached significant differences (p<0.05) among G1, G2 and HC. Pearson correlation between FC, clinical features and neuropsychological performances were also observed though partial correlation analysis with age, sex and edu as covariates (p<0.05).

RESULTS

Eleven meaningful RSNs were identified though empirical analysis. G2 exhibited decreased FC between ECN and DMN network when compared with G1 (p=0.000, bonferroni corrected) and HC (p=0.000, bonferroni corrected). However, G1 showed no significant difference with control group. Furthermore, FC of patients had significantly negative correlation with WCST performance and duration of disease (p<0.000), but have no correlation with MoCA. Besides, significantly positive correlation were also found between FC with age-onset (p=0.000). However, there was no significant correlation between FC and neuropsychological tests of HC.

CONCLUSION

Our study suggested that FC abnormal between ECN and DMN may potentially act as an imaging biomarker candidate, which can not only differentiate ECF normal and ECF impairment, but also can reflect ECF impairment degree of TLE patients. Furthermore, such FC pattern may also provide us new insight into understanding ECF pathophysiological mechanism of unilateral intractable TLE.

CLINICAL RELEVANCE/APPLICATION

Neuropsychological performance was closely related to functional connectivity between large-scale networks which can be well depicted by fMRI.

Participants
Ammar A. Chaudhry, MD, Corona, CA (Presenter) Nothing to Disclose
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PURPOSE

Compare concordance of language networks derived fromSeed Based Analysis (SBA) resting-state fMRI in patients with brain tumors with Independent Component Analysis (ICA)

METHOD AND MATERIALS

Resting state fMRI was performed and language networks identified for patients presenting for presurgical task-fMRI mapping between 1/1/2009 and 7/1/2015. 79 patients were analyzed of which 49 met the inclusion criteria (presence of brain tumors without history of prior brain surgery, adequate task-fMRI performance). Language networks were obtained from rs-fMRI using ICA with 50 components and SBA using blind seed in the IFG from the rs-fMRI maps. Seeds generated from maximal task-fMRI activation in the IFG were used as control. Rs-vs-task-fMRI concordance for each resultant map was measured using Dice coefficients across varying fMRI thresholds. Multi-threshold Dice coefficient volume under the surface (DiceVUS) and maximum Dice coefficient (MaxDice) were calculated. ANOVA was performed to determine significant differences in DiceVUS and MaxDice between the methods of analysis.

RESULTS

Paired T-test showed there is no statistical difference between blinded-SBA and ICA-50 (P<0.4694). Also, there is statistical difference between task-SBA and blinded-SBA (P<0.001) and task-SBA and ICA-50 (P<0.0178). Group mean DiceVUS and MaxDice were highest for the task-based SBA than both blind-SBA and ICA. Paired T-test demonstrate no significant difference between the blind-SBA and ICA. ANOVA with Tukey HSD demonstrated statistically significant differences for both DiceVUS and MaxDice across varying fMRI thresholds. Multi-threshold Dice coefficient volume under the surface (DiceVUS) and maximum Dice coefficient (MaxDice) were calculated. ANOVA was performed to determine significant differences in DiceVUS and MaxDice between the methods of analysis.

CONCLUSION

We demonstrate that blind rs-FMRI and ICA have similar accuracy in identifying language networks on rs-fMRI. Both the group mean MaxDice and DiceVUS were greater for task-SBA than ICA and blind-SBA.

CLINICAL RELEVANCE/APPLICATION

Blind-SBA analysis can be utilized to reliably identify neuronal language networks on pre-operative studies, especially in patient who are unable to perform all the tasks required in conventional task-fMRI.

Participants
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Subhashini Ganapathy, PhD, Dayton, OH (Abstract Co-Author) Nothing to Disclose

SSC11-07 Self-Regulation of the Primary Auditory Cortex Activity via Directed Attention Mediated By Real-Time fMRI Neurofeedback

Monday, Nov. 27 11:30AM - 11:40AM Room: N229

Participants
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PURPOSE
To determine the potential efficacy of treating auditory cortex hyperactivity by self-regulation of the primary auditory cortex (A1) based on real-time functional magnetic resonance imaging neurofeedback training (fMRI-NFT).

METHOD AND MATERIALS
10 healthy volunteers with normal hearing (no more than 1 frequency >40 dB on a standard audiogram) underwent 5 fMRI-NFT sessions. Each session was composed of a simple auditory fMRI followed by 2 runs of A1 fMRI-NFT. FMRI data was acquired using 2D, single-shot echo planar imaging during all 3 runs using a 3T. The auditory fMRI was comprised of 6 blocks, each containing a 20s period of auditory stimulation followed by a 20s period of white noise stimulation at 90 dB. A1 activity, defined from a region using the activity during the preceding auditory run, was continuously updated during fMRI-NFT using a simple bar plot, and was accompanied by white noise (90 dB) stimulation for the duration of the scan. Each fMRI-NFT run contained 8 blocks, each separated into a 30s relax period followed by a 30s lower period. Subjects were instructed to watch the bar during the relax condition and actively lower the bar by decreasing A1 activity during the lower condition. The average A1 activity was measured from the simple auditory task from each session. Average A1 deactivation was extracted from each fMRI-NFT run, representative of A1 self-regulation performance.

RESULTS
A one-way ANOVA evaluated the effect of session on A1 activity during the simple auditory task. The main effect of session was not significant (p = 0.41, sphericity assumed, two-tailed). A 2x2 (session by run) ANOVA was carried out on A1 deactivation during fMRI-NFT. There was a significant effect of session (p = 0.0275, sphericity assumed, one-tailed) and a significant interaction effect (p = 0.0395, sphericity assumed, one-tailed). The most successful subjects reportedly adopted mindfulness tasks associated with directed attention.

CONCLUSION
For the first time, fMRI-NFT has been applied to teach A1 self-regulation using more than 1 session. This is important to therapeutic development as it is unlikely a single fMRI-NFT session will reverse the effects of tinnitus.

CLINICAL RELEVANCE/APPLICATION
Chronic tinnitus has implications of impaired auditory and attentional networks. Our study indicates that fMRI-NFT may provide an innovative approach to alter these systems simultaneously.

SSC11-08 Characterization of Obsessive-Compulsive Disorder Using a Multiparametric Classification Approach Based on Resting-State fMRI

Participants
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PURPOSE
Obsessive-compulsive disorder (OCD) is a common, heritable and disabling neuropsychiatric disorder. Recent advances in resting-state functional magnetic resonance imaging (rs-fMRI) have facilitated the abnormality of a specific network of cortico-striato-limbic regions. However, the vast majority of these studies published so far have been based on average differences between groups. Whether functional neuroimaging could be used to inform the clinical assessment of individual OCD patients remains unclear. The machine learning approach is a promising technique which allows the classification of individual observations into distinct groups and bears the advantage of individualized judgment. Thus, in current study, we aimed to apply one of the machine learning approach known as Support Vector Machine (SVM) to distinguishing drug-naive OCD patients from healthy control subjects (HCS) based on various rs-fMRI parameters.

METHOD AND MATERIALS
A total of 54 drug-naive OCD patients and 54 age, sex, handedness and years of education well matched HCS were recruited in current study. The rs-fMRI were obtained via a 3.0 T GE MRI system. Four different rs-fMRI parameter maps including amplitude of low-frequency fluctuation (ALFF), fractional amplitude of low frequency fluctuation (fALFF), regional homogeneity (ReHo) and functional connectivity strength (FCS) were separately calculated using REST software. Subsequently, all these rs-fMRI parametric maps were used to discriminate OCD patients from HCS based on leave one-out cross-validation approach with SVM implemented in the PROBID software package. We also drew a receiver operating characteristic (ROC) curve to help evaluate the performance of each parameter.

RESULTS
The classification accuracy, sensitivity and specificity for SVM classifier of each rs-fMRI parameter are presented in the Figure. Overall, the SVM classification accuracies for the four rs-fMRI parameters were all above 74%. The highest classification accuracy (95.37%, p<0.001) was achieved when ALFF maps were employed.

CONCLUSION
Our findings suggest that the four rs-fMRI parameters would exhibited significant differences in predicting diagnosis of OCD, and ALFF showed the highest accuracy, which is fit to be an assistant measure in clinical practice to help identify OCD at the individual level.

**CLINICAL RELEVANCE/APPLICATION**

Application of SVM to ALFF maps could be used to aid the identification of OCD in clinical practice.

**SSC11-09 Identification of the Sensorimotor Network in Brain Tumor Patients Using Resting-State Functional MRI**

Monday, Nov. 27 11:50AM - 12:00PM Room: N229

Participants
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**PURPOSE**

Evaluate the ability of resting-state fMRI in localizing the sensorimotor network (SMN) and its individual components in patients with brain tumors, using independent component analysis (ICA) and seed-based analysis.

**METHOD AND MATERIALS**

This is a retrospective analysis of 29 patients with brain tumors presenting for fMRI mapping. ICA with a predetermined output of 20 components was performed for each patient. Eight seed-based analyses were performed, with seeds allocated in the medial, knob-like area and lateral precentral gyrus and in the posterior superior frontal gyrus of each hemisphere. The ability of identifying a complete SMN or any of its parts, composed by bilateral primary sensorimotor cortex (PSMC) and bilateral supplementary motor area (SMA) with ICA and seed-based analysis was subjectively assessed. For each of the precentral gyrus seed-based analysis, the capacity of localizing the correspondent region of the seed in the contralateral hemisphere was also assessed.

**RESULTS**

ICA identified a complete SMN in 13 patients (44%), the left PSMC in 18 patients (62%), the left SMA in 18 patients (62%), the right PSMC in 18 patients (62%), the right SMA in 18 patients (62%). Combined analysis of the correlation maps generated by all seeds identified a complete SMN in 15 patients (51%), the left PSMC in 17 patients (58%), the right PSMC in 18 patients (62%), the left SMA in 28 patients (96%) and the right SMA in 27 patients (93%). Combined ICA and seed-based analysis identified a complete SMN in 20 patients (68%), the left PSMC in 22 patients (75%), the right PSMC in 22 patients (75%), the left SMA in 28 patients (96%) and the right SMA in 27 patients (93%). Seed-based analysis of the precentral gyrus identified the correspondent area in the contralateral hemisphere in 154 of 174 analyses (88%).

**CONCLUSION**

Combining ICA and seed-based analysis increases the ability of resting-state fMRI in identifying the SMN and its components. Seed-based analysis consistently identifies the correspondent area of the seed in the contralateral hemisphere.

**CLINICAL RELEVANCE/APPLICATION**

Resting-state fMRI can be used to identify the sensorimotor network, this being especially valuable when brain lesions generates morphological distortion and patients are unable to perform the tasks required by conventional task-fMRI.
CONCLUSION

Background
Since Multiple Sclerosis (MS) is an incurable chronic disease, the focus of therapy is to slow down the relapses and disability progression. Currently, over 10 disease modifying treatments are clinically approved for relapsing remitting MS. However, providing the best treatment for each patient remains a major challenge as over 25-30% of treatments have a suboptimal effect [1,2]. It is shown that personalized and accurate monitoring of MRI lesions and brain atrophy allows the prediction of disability progression, relapses and treatment effect [3]. This work assesses the health economic benefit.

Evaluation
A two scenario decision-tree model is used comparing the situation with and without accurate monitoring of MRI lesions (T2/Gd enhancing and evolution) and brain atrophy. We estimate that yearly 10000 therapy initiations or switches take place in the US, with an average medication cost of $60k [4]. Considering that 26% of these treatments are suboptimal [1] for 3.9 years [5], current costs of failing treatments are about $600M. With an accurate monitoring of MRI lesions and brain atrophy, the probability to detect treatment failure is 3.1 times higher [6], reducing the average time on suboptimal treatment to 1.3 years. This results in a cost saving of about $400M (67%).

Discussion
In order to realize such a significant cost saving, efforts are required to introduce accurate and reproducible assessments of MRI lesions and atrophy into the radiological reporting [3]. Today, counting lesions and identifying new (and enlarging) lesions is time consuming and prone to variability (intra-rater and inter-rater), and accurately assessing brain atrophy is not even possible by human eye. Automated quantification by software imposes itself as a solution.
CONCLUSION
Abnormalities on microbleed scans was 87.8%. The sensitivity was 95% and specificity was 70%.

10-4). Figure 1 highlights these three areas in light blue. The area under the curve for these three areas identifying white matter principal components in the posterior corona radiata, splenium of the corpus callosum, and superior longitudinal fasiculus (p = 10 x 10^-4). EDI imaging identified maps that separate the microbleed group from control with machine learning using support vector machine learning with leave one cross validation.

Methods and Materials
11 patients with MS were prospectively scanned at two time points, approximately 1 year apart, on a Philips 7T Achieva magnet between September 2014 and May 2016. Magnetization-prepared FLAIR (MPFLAIR) images were acquired at 0.7mm3 resolution before and after administration of 0.1mmol/kg of gadoteridol. Co-registered pre- and post-contrast scans were reviewed by two independent judges: one board certified neuroradiologist and one PGY-3 radiology resident. Foci of meningeal enhancement were annotated using Medical Image Processing, Analysis & Visualization (MIPAV) v. 7.3.0. Discordant lesions that were marked by one but not both judges were reviewed by a third judge: a board certified neuroradiologist. Finalized annotations were classified into 4 subtypes: pachymeningeal nodules (PN), leptomeningeal nodules (LN), subarachnoid amorphous (SA), and dural venous rim (DVR). Follow-up images were then reviewed to determine if they changed between time points.

RESULTS
The median number of enhancing meningeal foci detected per subject on the initial scan was 9 (range 1-15). 86% percent of foci identified on the initial scan were again identified on the follow-up scan; 14% resolved. In 7 of 11 subjects, follow-up scans revealed foci not present on the initial scan. When stratified by morphologic subtype, persistence was observed in 92% PN, 67% LN, 68% SA, and 95% DVR.

CONCLUSION
The majority of enhancing meningeal foci on 7T MPFLAIR are longitudinally persistent in MS. The likelihood of persistence appears dependent on the morphologic features and location of enhancement.

CLINICAL RELEVANCE/APPLICATION
It is critical to determine to what extent meningeal enhancement persists on MRI over time in MS patients, as it will inform future study of the clinical relevance of this phenomenon.

SSC12-03 Edge Density Mapping of Cerebral White Matter in Persons with Cerebral Microbleeds in the Rotterdam Study

Participants
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PURPOSE
Cerebral microbleeds reflect presence of small vessel disease and as such are known to be related to white matter disease (hyperintensities and atrophy). Yet, little is known on the overall influence they may have on specific white matter tracts. We studied edge density mapping of white matter in persons with and without microbleeds.

METHOD AND MATERIALS
This study is based on subjects from the population-based Rotterdam Study. Non-demented, stroke-free subjects previously assessed with lobar microbleeds (n = 17) and controls without microbleeds (n = 14) were selected from the larger study population. In all subjects, diffusion tensor imaging (DTI) with 64 directions was available for edge density mapping from a 3T MR Scanner. Edge density images (EDI) were computed from edges involved in a previously defined consensus connectome with each voxel’s edge density defined as the number of consensus edges passing through the voxel of interest. To enable comparison between EDI maps of different subjects, EDI maps were registered to MNI152 space. Principal components analysis was done to extract specific EDI maps that separate the microbleed group from control with machine learning using support vector machine learning with leave one out cross validation.

RESULTS
Average age was 64.1 (S.D. 4.5; range 55-73), 45% women. There were no statistically significant differences in age or gender between the microbleed and control group. The microbleed group had an average of 2.43 lobar microbleeds. EDI imaging identified principle components in the posterior corona radiata, splenium of the corpus callosum, and superior longitudinal fasiculus (p = 10 x 10^-4). Figure 1 highlights these three areas in light blue. The area under the curve for these three areas identifying white matter abnormalities on microbleed scans was 87.8%. The sensitivity was 95% and specificity was 70%.

CONCLUSION
Edge density imaging identifies abnormalities in white matter in persons with lobar microbleeds with high accuracy and sensitivity. This suggests the importance of future studies to better elucidate applications of connectome image to vascular brain aging.

**CLINICAL RELEVANCE/APPLICATION**

Edge density imaging is a new type of connectome mapping that identifies tract-specific white matter abnormalities in persons with cerebral microbleeds. These results suggest this method can identify white matter abnormalities in relation to other brain imaging biomarkers of disease.

**SSC12-04 Axial, Radial and Mean Diffusivity in FLAIR-Positive Lesions and Normal-Appearing White Matter in Young Adult Multiple Sclerosis Patients**

**Monday, Nov. 27 11:00AM - 11:10AM Room: N226**

**Participants**
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**PURPOSE**

This study investigated axial, radial and mean diffusivity in FLAIR-positive lesions and normal-appearing white matter (NAWM) in young adult MS patients.

**METHOD AND MATERIALS**

FLAIR and DTI were acquired on 12 relapse-remitting MS patients (18-33yo, 1.5-10 year disease duration, 0-4 EDSS scores) and 12 age- and sex-matched healthy controls at 3T. DTI parameters (axial, radial and mean diffusivity: AD, RD, MD) were calculated. DTI parameters were tabulated for ROIs of the FLAIR positive lesions, NAWM in MS, and corresponding regions in controls. Comparisons were also made with EDSS, disease duration, lesion volume and counts.

**RESULTS**

In FLAIR positive ("established") lesions, axial, radial and mean diffusivity in MS were significantly higher than controls (AD: 1.54±0.22 versus 1.19±0.24, P=0.0002; RD: 1.00±0.22 versus 0.73±0.24, P=0.004; MD: 1.18±0.22 versus 0.88±0.24, P=0.0008), suggesting edema or cell loss. Covariances of diffusivity data amongst pixels within the ROIs in MS were lower than controls (AD: 0.24±0.07 versus 0.40±0.14, P=0.002; RD: 0.35±0.06 versus 0.56±0.29, P=0.001; MD: 0.28±0.07 versus 0.49±0.21, P=0.004), suggesting reduced tissue heterogeneity. In NAWM, radial and mean diffusivity in MS were significantly smaller than controls (RD: 0.58±0.04 versus 0.72±0.04, P=0.001; MD: 0.75±0.03 versus 0.83±0.04, P=0.001), but axial diffusivity was not (AD: 1.09±0.02 versus 1.08±0.13, P=0.05+). Changes in radial and mean diffusivity suggest early and widespread cytotoxic injury. Covariances of diffusivity data of NAWM in MS were lower than controls (AD: 0.31±0.02 versus 0.49±0.13; RD: 0.22±0.02 versus 0.44±0.11; MD: 0.21±0.02 versus 0.45±0.06, P=0.001 for all), suggesting reduced tissue heterogeneity. DTI parameters were not significantly (P=0.05+) correlated with EDSS, disease duration, lesion volume and counts.

**CONCLUSION**

Diffusivity data revealed cell loss in established lesions and cytotoxic injury in NAWM in young adult MS patients. Covariances of diffusivity data corroborated reduced tissue heterogeneity in established MS lesions and NAWM.

**CLINICAL RELEVANCE/APPLICATION**

DTI diffusivity data provide insights in the pathophysiology of MS in young adults. Diffusivity data may serve as imaging biomarkers of early disease pathophysiology in MS.

**SSC12-05 The Relationship Between Brain White Matter Hyperintensity Burden Assessed Ante-mortem and Post-mortem**

**Monday, Nov. 27 11:00AM - 11:20AM Room: N226**

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**PURPOSE**

Many studies have used ex-vivo MRI to investigate the association of white matter hyperintensity (WMH) burden with age-related
SSC12-07  When Pigs Fly: A Swine Model for Study of Hypobaric Non-Hypoxic Exposure Effects on the Brain

Participants
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METHOD AND MATERIALS
85 U.S. Air Force (USAF) aircrew trainees were evaluated while undergoing their initial occupational hypobaric exposure. Standard USAF procedure is approximately a 30-minute exposure to 25,000 feet. Three high-resolution MR imaging scans were obtained - T-24 hours, T+24 hours, and T+72 hours. Quantitative analysis of ASL and frontal white matter MRS was performed. Fifty-five healthy USAF control subjects meeting the same physical and physiological criteria minus hypobaric exposure served as controls. Paired two-tailed t-tests were used for comparison.

RESULTS
ASL showed an upregulation of both white and gray matter cerebral blood flow at both T+24 and T+72 hours in the exposed subjects (white matter p=0.003/0.020; gray matter p=0.053/0.041) with no significant change in the control's white matter cerebral blood flow. Exposed subjects had a decrease at T+24 in N-acetylaspartate (p=0.065) and myo-inositol (0.027) with no significant change in controls.

CONCLUSION
Significant declines in markers of neuronal integrity suggest that oxidative stress is evident within 24 hours of hypobaric exposure. The increase in cerebral blood flow measured by ASL in subjects exposed to hypobaric conditions is a response to oxidative damage and is evidence of increased metabolic demand. This study provides evidence that white matter hyperintensity formation may occur because of repeated oxidative stress without adequate time for healing. Cerebral white matter hyperintensities in this population are likely a function of both cumulative effects as well as frequency of hypobaric exposure.

CLINICAL RELEVANCE/APPLICATION
Understand the neuropathophysiologic mechanism of hypobaric induced white matter injury in order to mitigate or prevent its effects upon high altitude pilots and special operations personnel.
Non-hypoxic hypobaric exposure in Air Force U-2 pilots and hypobaric chamber personnel is associated with subcortical increased white matter hyperintensities, degradation of axonal integrity, and neurocognitive processing decrements. The mechanism for this is unknown. We developed a swine model to demonstrate and quantify axonal cerebral injury following non-hypoxic hypobaric exposure utilizing advanced magnetic resonance (MR) diffusion tensor imaging, Q-space, and advanced diffusion kurtosis imaging.

**METHOD AND MATERIALS**

Female miniature pigs (Sus scrofa domestica) were repetitively exposed to non-hypoxic hypobaria at 30,000 feet while controls remained at 5,000 feet altitude. All subjects underwent advanced MRI imaging three times. MR imaging was obtained at baseline, immediately post-exposure, and 4 weeks post-exposure. Advanced diffusion quantification was used to include kurtosis anisotropy, multi-b-value diffusion (Q-space), and fractional anisotropy (FA). Two-tailed t-tests were used for individual and group comparisons.

**RESULTS**

Perfusion-diffusion index and mean kurtosis anisotropy revealed an increase in unrestricted water immediately after repetitive high-altitude exposures. Repeated imaging at 4 weeks post-exposure showed normalization to pre-exposure values. Age-adjusted mean fractional anisotropy (FA) at 4 weeks post-exposure was significantly decreased in the high-altitude group when compared to controls (p < 0.0001/0.547).

**CONCLUSION**

Our study demonstrates increase in unrestricted free water immediately after repetitive high-altitude exposure that is consistent with axonal injury, not seen in the control group. The significant decrease in FA at 4 weeks suggests degradation of axonal integrity. This replicates similar MR imaging findings in humans. This study provides evidence that repetitive hypobaric exposure incites axonal damage. Moreover, it supports the utility of advanced diffusion imaging techniques such as kurtosis anisotropy. To our knowledge, this is the first study to provide evidence that repetitive non-hypoxic hypobaric exposure incites axonal damage, as well as demonstrates our swine model as a feasible vector to study hypobaric neuronal injury and, possibly, other axonal injury processes like TBI.

**CLINICAL RELEVANCE/APPLICATION**

Understand the neuropathophysiology of hypobaric induced white matter injury in order to mitigate or prevent effects upon aircrew and special operations personnel.
CLINICAL RELEVANCE/APPLICATION

The study validated histologically that a single MRI sequence of less than 6 minutes scan time can provide myelin content estimation in the brain.

SSE12-09 Axonal Water Fraction (AWF)-Based Parcellation of the Corpus Callosum: A White Matter Tract Integrity (WMTI) Study

Monday, Nov. 27 11:50AM - 12:00PM Room: N226

Participants
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PURPOSE

Despite the corpus callosum (CC) being composed of many different anatomic white matter (WM) tracts, structurally informed intra-callosal parcellation remains a challenge as clear boundaries between WM bundles are difficult to separate. Most previous work relies on gross callosal geometry or operator-dependent manual placement of regions-of-interest. Here we present a method of intra-callosal parcellation based on white matter tract integrity (WMTI) metrics derived from two-compartment modeling of multi-shell diffusion imaging, specifically axonal water fraction (AWF) to attempt to separate CC regions based on axon density.

METHOD AND MATERIALS

21 healthy individuals (34±9 y.o) were scanned using a 3T MR scanner (Skyra, Siemens) under IRB approval. Multi-shell diffusion imaging was performed using 5 b-values (upto 2.5ms/μm², 60 directions). The CC skeleton was acquired in a fractional anisotropy (FA) template space and was dilated to avoid volume averaging through CSF (Fig.1(top,red)). Subject AWF maps were registered to a template space. AWF values within ROIs were averaged in each coronal slice along the CC. Subdivisions were placed at local maxima of the first derivative (Fig.1(bottom)), demarcating the CC into distinct segments based on greatest degree of change in AWF. We looked at this also: extra-axonal radial diffusivity (De,perp) to see patterns across segmented regions in De,perp reflective of myelination (Fig.2).

RESULTS

Fig.1 shows the plot of AWF along the CC. Its first derivative plot was used to partition the CC into 5 regions (Fig.1(bottom)). Our results support the work of Hofer and Franhm (Neuroimage,2006) based on tractography from manual ROI placement.

CONCLUSION

WMTI has been proposed to disentangle intra- and extra-axonal environments. This can be leveraged to partition the CC based on AWF, reflective of biophysical factors of the underlying WM microstructure. Specifically, we found relatively lower AWF and higher De,perp in region 4, the posterior callosal body, known to contain a greater number of large diameter axons with thicker myelin. This technique would be easily translatable to individual subjects, even without morphing to a template space and future work is underway in this direction.

CLINICAL RELEVANCE/APPLICATION

Compartment specific white matter tract integrity metrics are sensitive to the underlying white matter microstructure and specifically axonal water fraction is able to partition the corpus callosum.
NR342-SD-MOA1

A Multicenter Validation Study of 2017 ACR Thyroid Imaging Reporting and Data System in Patients with Thyroid Nodules

**PURPOSE**
To validate a new risk stratification system of thyroid nodules, 2017 ACR Thyroid Imaging Reporting and Data Systems (TI-RADS), in a multicenter design

**METHOD AND MATERIALS**
A total of consecutive 902 thyroid nodules with final diagnosis were included in this study from the four institutions. US features of the thyroid nodules were retrospectively classified according to the categories defined by the 2017 ACR guidelines. We calculated the malignant risk and diagnostic performance of US-based FNA criteria for detecting thyroid cancer in each category of ACR TI-RADS.

**RESULTS**
Final diagnoses of 902 nodules were 636 (70.5%) benign nodules and 266 (29.5%) malignant nodules. The overall malignancy risk of categories 5, 4, 3, 2, and 1 nodules in ACR TI-RADS were 70.6% (202 of 286 nodules), 19.9% (53 of 266 nodules), 3.2% (7 of 217 nodules), 3.9% (4 of 102 nodules), and 0.0% (0 nodules), respectively, and all categories showed significant differences between categories (p < 0.001). The correlation coefficient between category and malignancy rate was 0.591 (p < 0.001). The sensitivity, specificity, positive predictive value, negative predictive value, and accuracy for malignancy were 74.7%, 67.3%, 40.2%, 90.1%, and 69.0%, respectively.

**CONCLUSION**
The proposed new ACR risk stratification provides effective malignancy risk stratification for thyroid nodules. The malignancy risk of ACR TI-RADS was reproducible in a multicenter study.

**CLINICAL RELEVANCE/APPLICATION**
1. This study validated a new risk stratification system of thyroid nodules, 2017 ACR TI-RADS, in a multicenter design.
2. Considering its high diagnostic performance, this system may supply an effective method to determine the necessity for FNA biopsy.

NR343-SD-MOA2

Diffusion-Weighted Imaging of Brain Metastasis from Lung Cancer: Correlation of MRI Parameters with the Histological Type and Gene Mutation Status

**PURPOSE**
We aimed to investigate diffusion-weighted imaging (DWI) parameters as predictors of the histology and gene mutations of BM from lung cancer.

**METHOD AND MATERIALS**
The respective institutional review boards approved this retrospective study and waived the need for informed consent. DWI data for 74 patients with BM from lung cancer were retrospectively reviewed. The patients were first grouped according to the primary tumor histology (adenocarcinoma, small cell lung cancer, squamous cell carcinoma), and those with adenocarcinoma were further divided into epidermal growth factor receptor (EGFR) mutation-positive and wild-type groups. Sex; age; number, size, and location of BM; DWI visual scores; the minimum apparent diffusion coefficient (ADCmin); and the normalized ADC (nADC) ratio were
compared among groups by using $\chi^2$ and ANOVA. Multiple logistic regression analysis was performed to determine independent predictors of the EGFR mutation.

RESULTS

ADCmin was lower in the small cell lung cancer group than in the other two groups, although the difference was not significant. Furthermore, ADCmin and the nADC ratio were significantly lower in the EGFR mutation-positive group than in the wild-type group ($p = 0.021$ and $0.014$, respectively). Multivariate analysis revealed that ADCmin and the nADC ratio were independently associated with the EGFR mutation status ($p = 0.028$ and $0.021$, respectively).

CONCLUSION

Our results suggest that DWI parameters (ADCmin and nADC ratio) for the solid components of BM from lung cancer are not correlated with their histology, whereas they can predict the EGFR mutation status in BM from lung adenocarcinoma.

CLINICAL RELEVANCE/APPLICATION

We found that the ADCmin and the nADC ratio were independent predictors of the EGFR mutation status of brain metastasis (BM) from lung adenocarcinoma and this finding may be helpful for understanding the tumor biology and stratifying lung cancer BM.

PURPOSE

To investigate the conventional imaging features and quantitative imaging parameters, which include the apparent diffusion coefficient (ADC) and the cerebral blood flow (CBF) from arterial spin labeling imaging (ASL), as potential imaging biomarkers for predicting the MGMT methylation status in primary glioblastoma.

METHOD AND MATERIALS

Seventy seven patients had diffusion-weighted and arterial spin labeling imaging, where ADC minimum and rCBF ratio was recorded using manual positioning region-of-interest (ROI). Fisher's exact test or independent sample t test were used to evaluate relationships between MGMT status and imaging parameters. The data were subjected to a multifactorial logistic regression analysis to differentiate MGMT status. Receiver operating characteristic (ROC) analyses were performed to determine the optimal thresholds for the presence of MGMT methylation.

RESULTS

Primary glioblastoma with MGMT methylation demonstrated higher ADCmin value ($P < 0.001$) and lower rCBF ratio ($P < 0.001$). The ADCmin parameter achieved the better diagnostic efficacy with an area under curve (AUC) of 0.860, 81.1% sensitivity and 82.5% specificity for at a cutoff value of 0.792×10⁻³ mm²/sec. Multiple-variable models showed combination of conventional image features (tumor location and necrosis) and quantitative parameters (ADCmin value and rCBF ratio) for the identification of MGMT status resulted in the highest efficacy with sensitivity, specificity, and AUC of 86.5%, 92.5%, and 0.938, respectively.

CONCLUSION

Tumor location, necrosis, ADCmin value and rCBF ratio can be acquired easily in clinical routine to predict the MGMT status.

CLINICAL RELEVANCE/APPLICATION

Methylation of O (6)-methylguanine-DNA methyl transferase (MGMT) promoter, an independent favorable prognostic factor, correlates with benefit from temozolomide chemotherapy among patients with IDH1 wild type glioblastoma. Noninvasive identification of MGMT status in GBMs relates to improvement in treatment strategies.
the WEB. There were 25 men and 53 women, mean age 59 years (range 23-82). Mean aneurysm size was 4.9 mm and 26 were <= 4mm. Two aneurysms were treated with WEB and coils and 1 with WEB and stent. Clinical follow up was assessed at 3 and 6 months according to mRS. Imaging follow up consisted of angiography at 3 months and MRA at 6 months.

RESULTS

Of 78 aneurysms, 77 were adequately occluded after WEB placement. One aneurysm was deliberately partially occluded and was later clipped. There was one procedural rupture without clinical sequelae. In 5 patients, thrombo-embolic complications occurred followed by thrombectomy in 4. Three patients developed an infarction. Of those, 1 poor grade patient died, 1 patient had mild hemiparesis and 1 patient had no symptoms. One thrombo-embolic complication was caused by WEB protrusion in the parent artery. Procedural permanent morbimortality was 3% (2 of 77). Angiographic and clinical follow-up at 3 months was available in 54 patients: 11 poor grade patients died during hospital admission due to sequelae of SAH, 1 of a thrombo-embolic complication and 12 patients are scheduled for angiographic follow-up. Of 54 aneurysms, 43 (80%) were completely occluded, 10 (19%) had a neck remnant and 1 (2%) had a deliberate aneurysm remnant. Clinical follow-up at 3 months was mRS 0-2 in 53, mRS 3 in 2 and mRS 4-5 in 1. There were no rebleeds from the ruptured aneurysm during follow-up. One aneurysm was additionally clipped.

CONCLUSION

WEB treatment of small ruptured aneurysms was safe and effective. Adjunctive stent support was needed only once. One patient required additional clipping after deliberate initial partial occlusion. No rebleeds occurred during follow up. Our preliminary experience indicates that the WEB may be a valuable alternative to coils in the treatment of acutely ruptured aneurysms.

CLINICAL RELEVANCE/APPLICATION

This study presents the results of using WEB device for small ruptured aneurysms.

NR346-SD-MO5 Application of Virtual Monochromatic Images at Optimal Energy Level in Dual-Energy Spectral CT Combined with Multiplanar Reformation in Diagnosing Lumbosacral Peripheral Neuropathy

Station #5

Participants
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PURPOSE

To explore the application of dual-energy spectral CT imaging combined with multiplanar reformation (MPR) in diagnosing lumbosacral peripheral neuropathy

METHOD AND MATERIALS

A retrospective analysis was performed on 45 patients with suspected lumbosacral peripheral neuropathy who underwent dual-energy spectral CT examination. From the set of virtual monochromatic images, an optimal energy level (keV) was selected to obtain the highest contrast-to-noise ratio (CNR) for the lumbosacral nerve of each patient. Two experienced radiologists evaluated the CNR of the lumbosacral nerve with the MPR images in a double-blind manner using a 5-point scoring system (5: best and greater or equal to 3: image diagnostic) in terms of image noise, artifacts, the ability and clarity of displaying the peripheral nerves and their edges on both the dual-energy spectral CT image and conventional kVp CT images.

RESULTS

The optimal energy levels in spectral CT were 63.64±1.36keV. CNR for the lumbosacral nerve at the optimal energy level was statistically better than that of the conventional CT imaging (0.81±0.3 vs. 0.44±0.26, p=0.02). The Spectral CT MPR reconstruction at the optimal energy level could show more clearly the normal shape or anatomical variations of the peripheral nerve bundles, their compression and relationship with adjacent soft tissue or bones, and improved the display of peripheral nerves and the identification of lumbosacral lesions compared with those of conventional kVp images (P=0.03).

CONCLUSION

Dual-energy Spectral CT at the optimal energy level combined with MPR can improve image quality and the display of lumbosacral peripheral nerves. It provides a new imaging method to detect peripheral neuropathy in lumbosacral region.

CLINICAL RELEVANCE/APPLICATION

Dual-energy Spectral CT at the optimal energy level may provide a new way to show lumbosacral peripheral nerves.

NR347-SD-MO6 Edge Density Mapping of Cerebral White Matter in Persons with Cerebral Microbleeds in the Rotterdam Study

Station #6

Awards
Student Travel Stipend Award

Participants
Cyrus Raji, MD, PhD, San Francisco, CA (Presenter) Consultant, Brainreader ApS
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PURPOSE

To explore the application of virtual monochromatic images at optimal energy level combined with multiplanar reformation in diagnosing lumbosacral peripheral neuropathy.
Cognitive impairment. Cerebral perfusion was more decreased in patients of AD complicated with DM than AD without DM, and correlated with the

CONCLUSION

0.05, Table 2, Figure 1, Figure 2).

decreased, especially for those in the left prefrontal lobe gray matter, right caput nuclei caudati and right hippocampus (P <

were significantly correlated with the drawing clock test (Table 1). Compared to those in AD-DMs, the CBF values in AD+DMs were

also different between groups. The CBF value of the left prefrontal lobe gray matter, left thalamus and bilateral caudate nucleus

There was no significant difference between the gender and age of two groups. All cognitive scores except ADL scores were not

statistic software was used to analyze. The age (t test) and gender (Χ2 test) of two groups were first

manually measured. Every ROI was drawn manually three times, and the mean values of the parameters in each ROI were

gray matter and white matter of bilateral temporal lobe, prefrontal lobe, thalamus, caput nuclei caudati and hippocampus were

subjects underwent routine MRI sequence and 3D ASL (PLD=1.5s) in 3.0T MR scanner. Then cerebral blood flow (CBF) values of the

MMSE, MoCA, clock drawing test and activity of daily living (ADL) score was also evaluated by two experienced neurologists. All

Participants

Twenty clinically confirmed cases of AD-DM patients (6 males and 14 females, mean age=69.65±9.69yrs) and eleven AD+DM patients

(6 males and 5 females, mean age=75.18±6.52yrs) participated into this study. The clinical data of all was collected, and the

RESULTS

Average age was 64.1 (S.D. 4.5; range 55-73), 45% women. There were no statistically significant differences in age or gender

between the microbleed and control group. The microbleed group had an average of 2.43 lobar microbleeds. EDI imaging identified

principle components in the posterior corona radiata, splenium of the corpus callosum, and superior longitudinal fasiculus (p = 10 x

10-4). Figure 1 highlights these three areas in light blue. The area under the curve for these three areas identifying white matter

abnormalities on microbleed scans was 87.8%. The sensitivity was 95% and specificity was 70%.

CONCLUSION

Edge density imaging identifies abnormalities in white matter in persons with lobar microbleeds with high accuracy and sensitivity. This suggests the importance of future studies to better elucidate applications of connectome image to vascular brain aging.

CLINICAL RELEVANCE/APPLICATION

Edge density imaging is a new type of connectome mapping that identifies tract-specific white matter abnormalities in persons with cerebral microbleeds. These results suggest this method can identify white matter abnormalities in relation to other brain imaging biomarkers of disease.

NR348-SD-MOA7 Correlation of Cerebral Blood Flow with Cognitive Impairment in Alzheimer’s disease Complicated with Type 2 Diabetes Patients

STATION #7

Participants

Liang Han, Dalian, China (Presenter) Nothing to Disclose
Junyi Dong, Dalian, China (Abstract Co-Author) Nothing to Disclose
Xiaoli Li, Dalian, China (Abstract Co-Author) Nothing to Disclose
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Yanwei Miao, Dalian, China (Abstract Co-Author) Nothing to Disclose

PURPOSE

To analyze the blood flow in different brain regions by using 3D arterial spin labeling (ASL), and to evaluate the relation between blood flow and cognitive scores in Alzheimer’s disease (AD) without T2DM (AD-DM) and with T2DM (AD+DM) patients.

METHOD AND MATERIALS

To analyze the correlation between CBF value and cognitive score.

RESULTS

There was no significant difference between the gender and age of two groups. All cognitive scores except ADL scores were not also different between groups. The CBF value of the left prefrontal lobe gray matter, left thalamus and bilateral caudate nucleus were significantly correlated with the drawing clock test (Table 1). Compared to those in AD-DMs, the CBF values in AD+DMs were decreased, especially for those in the left prefrontal lobe gray matter, right caput nuclei caudati and right hippocampus (P < 0.05, Table 2, Figure 1, Figure 2).

CONCLUSION

Cerebral perfusion was more decreased in patients of AD complicated with DM than AD without DM, and correlated with the cognitive impairment.
According to this study, the doctors should recognize the impact of cognitive impairment due to the further reduction of cerebral blood flow in AD with T2DM patients, thus guide the clinical treatment and intervention.

**NR300-ED-MOAS**

**The WHO 2016 Classification of CNS Tumors: Are We Speaking The Same Language With Our Clinicians And Pathologists?**

Station #8

**Participants**

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**TEACHING POINTS**

With recent research on the signaling pathways involved in brain tumorigenesis, the WHO has formulated a drastic new type of classification: One which integrates histopathology with molecular genetics. Though the current role of radiology is limited, it could have significant implications on treatment if preoperative prediction becomes possible. The aim of this exhibit is to enable radiologists to recognize common patterns of certain molecular phenotypes in the subtypes as identified by the WHO on a brain MRI. At the end of this exhibit, the reader will be able to predict the underlying genetic signatures of some common brain tumors and recognize peculiar patterns of select genotypes.

**TABLE OF CONTENTS/OUTLINE**

1. A brief overview of the WHO 2016 classification of CNS tumors, how it is different from the previous edition and why the changes were necessary. 2. Describe role of radiology in the emerging scenario with implications on treatment. 3. Enumerating the relevant imaging findings in the individual known geno-typical sub-classifications: A) Pilocytic; Pleomorphic Xanthoastrocytomas and BRAF B) Gliomas and IDH mutation C) Medulloblastomas : WNT, SHH, Group 3 and 4 D) Ependymomas and RELA fusion E) Meningiomas and brain invasion 4. Role of molecular imaging and future promises of its role in determining treatment strategies.

**NR003-EB-MOA**

**Update on Malformations of Cortical Development**

**Awards**

Certificate of Merit

**Participants**

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**TEACHING POINTS**

To review the new classification of malformations of cortical development, discussing the pathophysiology of them and provide the radiological features of the malformations.

**TABLE OF CONTENTS/OUTLINE**

A. Introduction B. Malformations secondary to abnormal cell proliferation or apoptosis C. Malformations secondary to abnormal cell migration D. Malformations secondary to abnormal postmigrational development E. Conclusions

**NR002-EB-MOA**

**Intracranial Vessel Wall MR Imaging in Space**

**Awards**

Hardcopy Backboard

**Participants**

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**TEACHING POINTS**

Teaching Point 1. Review the micro anatomy of the intracranial vessel wall versus extracranial. 2. Review and understand the value and limitations of current imaging options (CTA, MRA, DSA) versus vessel wall imaging. 3. How to apply SPACE (Sampling Perfection with Application optimized Contrasts using different flip angle Evolution) 3D volume imaging in intracranial vessel wall imaging.
Discussion of different SPACE parameter settings with sample images. 5. Review features of common pathology on vessel wall imaging.

**TABLE OF CONTENTS/OUTLINE**

Table of content 1. Introduction 2. Micro anatomy of intracranial vessels 3. Recommended imaging technique and equipment 4. Imaging parameter settings with sample images 5. Vessel wall imaging case samples
PURPOSE
Determine specimen adequacy and pathology concordance of image-guided percutaneous spine biopsies performed with a battery-powered drill versus a manual approach.

METHOD AND MATERIALS
All image-guided percutaneous spine biopsies performed at a single institution from September 2013 through January 2017 were reviewed with the following data recorded: indication for biopsy (suspected neoplasm, infection, or both), use of manual approach versus battery-powered drill, specimen adequacy, histopathology results, pathology concordance with imaging, antibiotic administration prior to biopsy. Specimen adequacy, pathology concordance, and ratio of definitively negative pathology to inadequate specimen were compared with descriptive statistics. Chi-squared tests were performed of specimen adequacy and pathology concordance between power drill and manual cases. Significance was set at p <= 0.05. This study was institutional review board approved and performed in compliance with HIPAA. Informed consent was waived.

RESULTS
117 procedures were evaluated in 109 patients (age: 59.0 +/- 7.6 years; range: 17-90 years; male: 55; female: 54). Specimen adequacy was consistently better in the power drill group than the hand drill group (95% vs 87% overall, p=0.160; 96% vs 86% for suspected neoplasm, p=0.181; 95% vs 88% for suspected infection, p=0.419). Concordance was also consistently better in the power drill group than the hand drill group (84% vs 72% overall, p=0.148; 92% vs 77% for suspected neoplasm, p=0.107; 74% vs 61% for suspected infection, p=0.340). Concordance was 100% in power drill biopsies and 71% in manual biopsies (p=0.111) when infection was suspected and antibiotics were not previously administered. The ratio of true negatives to inadequate samples was consistently better with the power drill (12:2 overall, 6:1 suspected neoplasm, 6:1 suspected infection) than with manual biopsy (12:9, 5:6, 5:4).

CONCLUSION
Specimen adequacy, pathology concordance, and ratio of true negatives to inadequate samples were all consistently better when spine biopsy was performed with a battery-powered drill. Further data collection and analysis will be performed prior to the RSNA annual meeting.

CLINICAL RELEVANCE/APPLICATION
Use of a battery-powered drill appears to improve spine biopsy specimen adequacy and pathology concordance, particularly for detection of definitively negative pathology.

NR349-SD-MOB1 Image-Guided Percutaneous Spine Biopsy Specimen Adequacy and Pathology Concordance with Battery Powered Drill and Manual Approaches

NR351-SD-MOB3 Relationship Studying Between Condyle Longitudinal Inclination and Internal Temporomandibular Joint Derangement Using Magnetic Resonance
PURPOSE
The aim of this study was to analyze the possible relationship between the axial inclination of the condyle and the presence, of internal disc derangement, and also with the changes in eccentric patterns of temporomandibular joints (TMJ) in magnetic resonance imaging (MRI).

METHOD AND MATERIALS
35 exams (70 TMJ) were evaluated by magnetic resonance imaging (MRI) acquired in a specific protocol for TMJ. The following parameters were evaluated through parasagittal images: disc position with closed mouth (normal or moved), the disk function (reduced or not reduced), degrees of the condyle rotation (normal or changed) and degrees of translation of the codyle (normal, hypomobile or hypermobility). Subsequently, the Ondemand3D software (CyberMed, Tustin, CA, USA) determined the angles between the long axes of the condyle and the median sagittal plane. All variables were correlated by Spearman’s test (p <0.05).

RESULTS
Results showed that there was a correlation between the disk position and its function (p = 0.009) and between disk position and degree of the condyle rotation (p = 0.008).

CONCLUSION
There were no correlations observed between the other variables present in this study, and may be concluded that the degree of the long axis inclination of the condyle with the sagittal plane was not a determining factor for the presence of internal derangements and changes in the degree of eccentric movements of the condyle.

CLINICAL RELEVANCE/APPLICATION
This study showed the importance of the condyle inclination as a new method to infer temporomandibular joint disorders using MRI.

NR352-SD-MOB4
Altered Brain Activity Improvement: Evidence from rs-fMRI in Children with Type 1 Gaucher Disease during Therapy

PURPOSE
Gaucher disease (GD) is an autosomal recessive glycosphingolipid storage disorder. Our previous study has shown abnormal neural activity for multiple brain regions in individuals with type 1 Gaucher disease (GD). This study investigated the alterations of brain activity in children with GD type I after two-years regular enzyme replacement therapy (ERT) by resting-state functional magnetic resonance imaging (rs-fMRI).

METHOD AND MATERIALS
We obtained rs-fMRI scans from 20 GD Type I children before and after two-years regular ERT. The amplitude of low-frequency fluctuation (ALFF), fractional ALFF (fALFF) and regional homogeneity (ReHo) of rs-fMRI data were calculated to measure spontaneous brain activity. A two-sample t test and Spearman correlation were performed to study the differences and relationship.

RESULTS
After two-years ERT treatment, GD children showed an improvement of neural activity in the algesthesia-related structures. However, significant worsening dysfunction of neural activity in the vision-related structures and cerebellum were shown at the same time. These may resulted in increasing Gaucher cells lying free within occipital and cerebral cortical lamina4. A progressive dysfunction of neural activity was found in emotion- and recognition-related structures. Meanwhile structures related to default network also suffered the impact, especially in the frontal lobe and cuneus. Significantly negative correlation (r=-0.46, p=0.04) was observed between changes of Reho on right precuneus and the length of treatment. At the same time, significantly positive correlation (r=0.47, p=0.03) was observed between changes of Reho on right BA19 and the length of treatment. The results of correlation indicated that although the impact of default network increased, regular ERT still had some chance of working. Meanwhile the treatment had poor prognosis on the vision-related structures.

CONCLUSION
Our study is the first to evaluate the altered brain activity after treatment in children with GD type I, which will aid in the understanding of the pathological basis and development of new treatment plans for GD patients addressing neurological diseases in type I.

CLINICAL RELEVANCE/APPLICATION
fMR promote increased knowledge about the emotional health and vision-related structures of GD type I children and development of new treatment plans for GD patients addressing neurological diseases in type I.

NR353-SD-MOB5
Simultaneous T2 Mapping and Neurography Method with 3D SHINKEI: Evaluation of Patients with CIDP

PURPOSE
The aim of this study was to analyze the possible relationship between the axial inclination of the condyle and the presence, of internal disc derangement, and also with the changes in eccentric patterns of temporomandibular joints (TMJ) in magnetic resonance imaging (MRI).

METHOD AND MATERIALS
35 exams (70 TMJ) were evaluated by magnetic resonance imaging (MRI) acquired in a specific protocol for TMJ. The following parameters were evaluated through parasagittal images: disc position with closed mouth (normal or moved), the disk function (reduced or not reduced), degrees of the condyle rotation (normal or changed) and degrees of translation of the codyle (normal, hypomobile or hypermobility). Subsequently, the Ondemand3D software (CyberMed, Tustin, CA, USA) determined the angles between the long axes of the condyle and the median sagittal plane. All variables were correlated by Spearman’s test (p <0.05).

RESULTS
Results showed that there was a correlation between the disk position and its function (p = 0.009) and between disk position and degree of the condyle rotation (p = 0.008).

CONCLUSION
There were no correlations observed between the other variables present in this study, and may be concluded that the degree of the long axis inclination of the condyle with the sagittal plane was not a determining factor for the presence of internal derangements and changes in the degree of eccentric movements of the condyle.

CLINICAL RELEVANCE/APPLICATION
This study showed the importance of the condyle inclination as a new method to infer temporomandibular joint disorders using MRI.

Participants
Di Hu, Beijing, China (Abstract Co-Author) Nothing to Disclose
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Participants
Akio Hwatashi, MD, Fukuoka, Japan (Presenter) Nothing to Disclose
PURPOSE

MR neurography (MRN) is a useful technique with which to evaluate abnormal conditions of the peripheral nerves such as chronic inflammatory demyelinating polyradiculoneuropathy (CIDP). We have developed the new T2 mapping method called SHINKEI Quant using three-dimensional nerve-sheath signal increased with inker rest-tissue rapid acquisition of relaxation imaging. The purpose of this study is to discriminate the patients with CIDP from normal subjects using SHINKEI Quant.

METHOD AND MATERIALS

This retrospective study was approved by our institutional review boards, and written informed consent was waived. All patients underwent MR imaging with a 3.0-T system. Seven male patients with CIDP (age range 22-80 years old; median 57 year) and 5 male normal subjects (age range 25-43 years old; median 29 year) were studied. Typical imaging parameters were as follows; TR/TE = 2400/61 ms, FOV = 220 x 310 mm, ETL = 100, matrix = 224 x 320, voxel size = 0.98 x 0.98 x 2.0 mm3, b = 10 s/mm2, IMSDE duration = 36 and 72 ms, acquisition time = 6 min 18 s. T2 values and size of the nerves at C5-T1. Statistical analyses were performed with Mann-Whitney U test and the receiver operating characteristic (ROC) analysis.

RESULTS

The size of the ganglions and the roots was larger in patients with CIDP (6.45 ± 1.34 mm and 4.98 ± 1.70 mm) than in normal subjects (5.59 ± 1.08 mm and 3.50 ± 0.62 mm, P < 0.001, respectively). T2 value of the ganglions and the nerves was larger in patients with CIDP (116.59 ± 43.07 and 104.22 ± 34.42) than in normal subjects (90.42 ± 14.70 and 83.69 ± 11.96, P < 0.001, respectively). ROC analysis showed the best diagnostic performance with the size of the ganglions (Az = 0.80).

CONCLUSION

With SHINKEI Quant we could obtain T2 mapping and neurography simultaneously and could discriminate the patients with CIDP from normal subjects.

CLINICAL RELEVANCE/APPLICATION

With our new MRN with T2 mapping technique, we could discriminate the patients with CIDP from normal subjects qualitatively.

NR354-SD- Reproducibility of Advanced Neuroimaging Metrics across Sessions, Sites, and Subjects

Station #6

Participants

Andrew S. Nencka, PhD, Milwaukee, WI (Presenter) Nothing to Disclose
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Andrew J. Saykin, PhD, Indianapolis, IN (Abstract Co-Author) Nothing to Disclose
Michael A. McCrea, PhD, Milwaukee, WI (Abstract Co-Author) Research Grant, General Electric Company
Kevin M. Koch, PhD, Milwaukee, WI (Abstract Co-Author) Research Grant, General Electric Company

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PURPOSE

This work reports a portion of a large study of sports related concussion (SRC) and head impact exposure in collegiate athletes and service academy cadets. A subset of subjects have been enrolled in an enhanced protocol, which includes head impact measurement, blood biomarker assessment, and magnetic resonance imaging (MRI). Here we assess the stability of metrics derived from the MRI examination in subjects in non-contact sports. This is foundational to the larger study, establishing a baseline of noise across MRI measurements above which effects must rise to be observed.

METHOD AND MATERIALS

Imaging was performed on the GE Healthcare (one site), and Siemens (three sites). Imaging parameters of normalized T1 weighted, normalized T2 FLAIR weighted, normalized T2* weighted, quantified T2*, mean diffusivity, fractional anisotropy, relative cerebral blood flow, fractional amplitude of low frequency BOLD fluctuations, and regional homogeneity of low frequency BOLD fluctuations. Coefficients of variation for each metric were computed across: repeated sessions for each subject (n=30), traveling human phantoms imaged at each site (n=2), and subjects at each site (n=35).

RESULTS

Coefficients of variation were found to be lowest within subjects over scanning sessions in all contrasts. In all regions of interest, except deep brain gray matter regions of interest in T2* weighted images and cerebrospinal fluid regions of interest in T2 FLAIR and mean diffusivity contrasts, the between-subject coefficient of variation was greater the between-site coefficient of variation. In these regions of interest and contrast combinations, however, the considered signal is expected to be poor.

CONCLUSION

Results of this study illustrate the stability of the larger-scale SRC study. Within-subject repeatability is very good, even over the span of 60 days, which will allow detailed consideration of the time course of SRC (or exposure) and recovery. Between-site stability was greater than subject-to-subject stability. Thus, the inter-site and inter-vendor study design, which enables large-scale recruitment of injured athletes, does not negatively impact the pooling of data across the sites.
CLINICAL RELEVANCE/APPLICATION
This establishes stability expected in multi-center neuroimaging studies with advanced imaging technology. Cross-site variability was less than cross-subject, and intra-subject repeatability was best.

NR355-SD-MOB7 Presence of Temporal Lobe Lesions Help Differentiate Multiple Sclerosis from Small Vessel Ischemic Changes
Station #7
Participants
Gabriela A. Santos-Nunez, MD, Boston, MA (Presenter) Nothing to Disclose
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Srinivasan Vedantham, PhD, Tucson, AZ (Abstract Co-Author) Research collaboration, Koning Corporation
Satish Kumar Dundamdappa, MD, Worcester, MA (Abstract Co-Author) Nothing to Disclose
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PURPOSE
To assess whether temporal lobe white matter lesions are specific for Multiple Sclerosis (MS)

METHOD AND MATERIALS
The cohort included 171 patients, 93 had a definitive diagnosis of MS and 78 patients with nonspecific white matter changes. Two experienced neuroradiologists retrospectively analyzed axial and sagittal FLAIR T2 weighted images. Temporal lobe lesions were considered as those anterior to the trigone on axial planes or anterior to the most posterior aspect of the splenium of the corpus callosum.

RESULTS
MS cases were significantly younger than controls (median age: 50 vs. 67.5, p<0.0001). The vast majority were female (75.3% vs. 52.6%, p=0.002). Temporal lobe lesions were present in 77.4% (72/93) of MS cases (95% CL: 67.6-85.5%) and in 12.8% (10/78) of controls (95% CL: 6.3-22.3%). Temporal lobe lesions were significantly more prevalent in MS cases than controls (p<0.0001). In MS cases, temporal lobe lesions were observed in 60/93 (64.5%; CL: 53.9-74.2%) cases in the periventricular region, 48/93 (51.6%; CL: 41.6-62.1%) cases in juxtacortical region, and 38/93 (40.9%; CL: 30.8-51.5%) cases in subcortical region. A logistic regression model (SAS v9.4) with backward elimination identified age, sex, presence/absence of temporal lobe lesions and juxtacortical location as significant predictors for MS and achieved an area under the ROC of 91.9% (95% CL: 87.8-96%)

CONCLUSION
Presence of white matter lesions in the temporal lobe can be used as a differentiator of multiple sclerosis from non specific white matter changes.

CLINICAL RELEVANCE/APPLICATION
Modified McDonald criteria specifies imaging criteria for dissemination in time and space. However, white matter lesions are common in other diseases. Our work shows that including temporal lobes as one of the geographical site would help differentiate MS from common non-specific white matter changes.

NR127-ED-MOBB Looking Skin Deep: Neuroimaging of Non-vascular Congenital Skin Lesions
Station #8
Participants
Edwina Chang, MD, Chicago, IL (Presenter) Nothing to Disclose
David Frim, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Nicole Cipriani, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Daniel Ginat, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

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TEACHING POINTS
1) To review neuroimaging of nonvascular congenital skin lesions, not related to neurocutaneous syndromes. 2) To correlate neuroimaging with pathology and neurosurgical clinical imaging. 3) To understand the key radiologic features of clinical significance. 4) To learn the clinical management, treatment and follow-up of these lesions.

TABLE OF CONTENTS/OUTLINE
Overview Clinopathological findings Review of imaging findings, correlated with pathology and neurosurgical images Aplasia cutis congenita Branchial apparatus anomalies Craniofacial dermal sinuses and inclusion cysts Encephalocoeles Spectrum of spinal dysraphisms and related anomalies Sample cases, emphasizing imaging findings of clinical importance Summary

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 Ginat, MD - 2016 Honored Educator
TEACHING POINTS

There has been evolution of treatment for glioblastoma since the standard of care of newly diagnosed glioblastoma was established, involving surgical resection and concurrent chemotherapy (temozolomide) and radiation, followed by adjuvant therapy. Knowledge of the expected post-treatment changes for these treatment modalities is helpful in order to distinguish treatment response from progressive disease. Accurate imaging interpretation is crucial in guiding management. The purpose of this exhibit is to 1) examine the expected post-treatment changes of glioblastoma, including the more recent treatment modalities that have been introduced, and 2) discuss the ongoing efforts to establish criteria that help distinguish pseudoprogression from progressive disease.

TABLE OF CONTENTS/OUTLINE

A. Imaging characteristics of GBM
B. What to expect on imaging following standard of care treatment
C. Examining pseudoprogression versus progression/recurrence (MacDonald's vs RANO criteria)
E. Overview of common adjuvant treatments and their expected post-treatment imaging characteristics: re-irradiation, temozolomide, bevacizumab, nitrosureas, NovoTTF, cediranib, aflibercept, cilengitide, immunotherapies
F. Additional treatment related effects of chemotherapy and radiation (eg. radiation necrosis, cavernomas, venous sinus thrombosis, mineralizing angiopathy, PRES)
**Molecular Imaging Symposium: Neurologic MI Applications**

**Overview of MI in Neurology**

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

**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.

**MI in Dementia**

- **Participants**: Alexander Drzezga, MD, Cologne, Germany (Presenter) Consultant, Siemens AG; Consultant, Bayer AG; Consultant, General Electric Company; Consultant, Eli Lilly and Company; Consultant, The Piramal Group; Speakers Bureau, Siemens AG; Speakers Bureau, Bayer AG; Speakers Bureau, General Electric Company; Speakers Bureau, Eli Lilly and Company; Speakers Bureau, The Piramal Group

**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.

**MI in Movement Disorders**

- **Participants**: Kirk A. Frey, MD, PhD, Ann Arbor, MI (Presenter) Consultant, MIM Software Inc Consultant, Eli Lilly and Company Stockholder, General Electric Company Stockholder, Johnson & Johnson Stockholder, Novo Nordisk AS Stockholder, Bristol-Myers Squibb Company Stockholder, Merck & Co, Inc

**Clinical Translation in Molecular Brain Imaging**

- **Participants**: Peter Herscovitch, MD, Bethesda, MD (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the U.S. FDA approval process for new radiopharmaceuticals for molecular brain imaging. 2) Understand the U.S., Medicare approval process for new radiopharmaceuticals for molecular brain imaging. 3) Become familiar with the features of the IDEAS Study: Imaging Dementia-Evidence for Amyloid Scanning Study. 4) Understand the evolving requirements for demonstrating the value of diagnostic imaging.

**ABSTRACT**

The final steps in clinical translation of molecular imaging radiopharmaceuticals for brain 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 FDA requirements for approval of a radiopharmaceutical, with a focus on amyloid brain imaging. It should be noted that FDA approval does not necessarily lead to Medicare approval, especially for PET agents. The CMS coverage with evidence development (CED) of PET amyloid imaging agents will be described, with a focus on the design and implementation of the Imaging Dementia-Evidence for Amyloid Scanning (IDEAS) Study.

**Brain MI: Case Review**
**LEARNING OBJECTIVES**

1) Discuss the FDA approval process for diagnostic radiopharmaceuticals. 2) Describe the current status of CMS coverage for amyloid PET radiopharmaceuticals and coverage with evidence development (CED). 3) Understand the design and implementation of the Imaging Dementia—Evidence for Amyloid Scanning (IDEAS) Study.

**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, with a focus on the design and implementation of the Imaging Dementia—Evidence for Amyloid Scanning (IDEAS) Study.
ABSTRACT

Purpose/Objective(s): The aim of this study is to generate preliminary data for our upcoming institutional phase 2 randomized clinical trial comparing stereotactic body radiation therapy (SBRT) and intensity modulated radiation therapy (IMRT)/proton beam radiotherapy (PRT) for recurrent small skull base tumors. Materials/Methods: Patients who received conformal reirradiation for recurrent small skull base tumors (Results: Of the 53 patients who met the inclusion criteria, 17 (32.1%) received SBRT, 17 (32.1%) received IMRT and 19 (35.9%) received PRT. Fifty (94.3%) patients had an ECOG performance status of 0-1, and 29 (54.7%) had a squamous cell carcinoma histology. The median initial radiation dose was 60 Gy (range: 30 – 74) and median retreatment volume was 25.5 cc (range 2.9 – 59.7 cc). The median reirradiation dose was 66 Gy (range: 50 – 70 Gy) at 2 Gy/Fx daily for IMRT/PRT and 45 Gy (range: 35 – 47.5 Gy) in 5 fractions every other day for SBRT. Thirty eight (71.7%) patients received concurrent chemotherapy with reirradiation. The median time to reirradiation was 30 months (range: 3 – 246 months). With a median follow up of 20 months (range: 3 – 153 months), the LRC, PFS and OS rates were 80.2%, 64.9%, and 88%, respectively at 1 year, and 73.4%, 55.6%, 73.5% respectively at 2 years. Six patients developed Grade 3 late toxicity. One (5.6%) patient received SBRT, 2 (11.2%) received IMRT, and 3 (15.8%) received PRT. There were no Grade 4 or 5 toxicities. The 1- and 2-year late Grade 3 toxicity rates were both 6.9%. The median time to develop Grade 3 toxicity was 25.5 months. SBRT and PRT were associated with improved LRC (HR 9.5, 95% CI = 1.55 – 184.66, P=0.01; HR 8.3, 95% CI = 1.51 – 153.29, P= 0.01) compared to IMRT. There was no significant difference in PFS or OS between radiation modalities. There was no difference in ECOG status or histology by radiation modality. Retreatment volume did not significantly correlate with late toxicity rates. Conclusion: Reirradiation of small skull base tumors utilizing IMRT, PRT or SBRT demonstrated good tumor control and low rates of Grade 3 toxicity. A prospective clinical trial and longer follow-up is needed to better assess clinical outcomes and toxicity rates.

ABSTRACT

Purpose/Objective(s): The incidence of brain metastasis in patients with tumors of GI tract is on the rise owing to advancement in imaging and prolonged survival due to improvement in surgical methods, radiotherapy, and systemic chemotherapy. We aimed to
determine the efficacy of GK-SRS to control intracranial metastases from GI primaries and report on the patient outcomes. Materials/Methods: We retrospectively evaluated patients who had undergone GK-SRS at our institution for the treatment of brain metastasis from GI primaries from 2000 to 2016. Actuarial rates for overall survival (OS) and local control (LC) were calculated. The relationship between the various patient characteristics, the clinical, radiographic and treatment outcomes to the rates of local control and overall survival was determined using log-rank analysis. Results: 52 patients met the inclusion criteria with total of 142 intracranial (IC) lesions. Median age at GK-SRS was 59 years (range 21-84). GI primary sites included colon (28), esophagus (12), rectum (5), liver (3), pancreas (2), bile duct (1) and gallbladder (1). The median treatment dose was 18 Gy (range 10-26). The median time from initial diagnosis to detection of CNS metastases was 19 months (range 0-188). The median Karnofsky Performance Status (KPS) at the time of IC disease diagnosis was 90 (range 70-100). CNS was the only site of metastases in 17 patients (32.6%). Thirty-six lesions (66.6%) were surgically resected and GK-SRS was given as an adjuvant treatment. A median of 2 lesions were treated with GK-SRS (range 1-13). Six patients were treated with whole/partial brain radiation prior to receiving GK-SRS. Eleven patients underwent second course of GK-SRS for new/recurrent lesions at a median of 7 months from the first GK-SRS (range 2-25) and three of the patients underwent third course of GK-SRS. At the last MRI, 20 (37%) patients had new or progressive intracranial disease. Eleven patients (21.2%) subsequently received salvage whole brain radiation therapy to a median dose of 30 Gy (range 18-35) and the median time from GK-SRS to salvage WBRT was 4.6 months (range 1.6-14.9). The median follow-up time from the diagnosis of IC disease was 28.3 months (range 4 to 195). Twenty-eight patients (53.8%) had no further CNS progression on their last brain MRI. Local recurrence rate at 6 months was 26.2% (95% CI, 18-38%) and 37.3% (95% CI, 26-51%) at 12 months. Median survival was 8.6 months from the time of IC disease diagnosis. In log-rank analysis, diagnosis of more than two lesions was the only significant factor for survival after IC disease diagnosis. The overall survival at 1 year was 86.6% (95% CI, 77-96%) and 19.9% (93% CI, 10.3-31.8%) at 5 years. Conclusion: GK-SRS is an effective treatment modality for the treatment of CNS metastases from GI primary. More than 2 brain metastasis at the time of initial diagnosis was found to be a significant factor to influence survival. The majority of patients were able to avoid WBRT, and long-term survivors were seen.

MSRO23-04 Limitations of MR Perfusion for Predicting Tumor Progression after Radiosurgery for Brain Metastases

Monday, Nov. 27 2:00PM - 2:10PM Room: S103AB

Participants
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Elena Olariu, PhD, Royal Oak, MI (Abstract Co-Author) Nothing to Disclose
Inga Grills, MD, Royal Oak, MI (Abstract Co-Author) Nothing to Disclose
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ABSTRACT

Purpose/Objective(s): To correlate pre-operative magnetic resonance (MR) perfusion with post-operative pathology for primary and metastatic brain tumors. Materials/Methods: 135 patients with a diagnosis of a malignant brain tumor underwent at least one MR perfusion study using dynamic susceptibility contrast technique between January 2013 and October 2016. MR perfusion was requested at physician discretion when conventional MR imaging demonstrated either persistent or progressive enhancement at the site of treatment. 32 patients underwent subsequent surgical resection with pathological confirmation and are subjects of this analysis. 10 brain metastases (31%) and 7 glioblastoma (22%) were the majority of the patient population. 1/10 brain metastases had MR perfusion which was non-analyzable and was excluded. Correlation was made between the pre-operative MR perfusion study and the final surgical pathology. Each MR perfusion scan was independently reviewed by two radiologists. Incongruent findings between the pre-operative MR perfusion diagnosis and post-operative pathology were considered discordant. Results: The median time between MR perfusion to surgery was 24 days (range: 1-502). 3/32 patients had discordant pathology with all of the discordant pathology associated with treated brain metastases. 3/9 (33%) patients with brain metastases had discordant pathology with the MR perfusion (Table 1). For brain metastases, MR perfusion had a sensitivity of 57%, specificity of 100%, positive predictive value of 100%, and negative predictive value of 40%. All of the discordant pathology had prior treatment with radiosurgery. For GBM cases, the MR perfusion and surgical pathology had 100% concordance; however, the sample is limited in that all patients analyzed had a tumor with no cases of necrosis alone. Conclusion: MR perfusion following radiosurgery with brain metastases may have limited utility for predicting tumor progression versus radiation necrosis demonstrated by the 33% discordance rate based on pathology in this analysis. Prospective studies are necessary to determine the utility of MR perfusion for all CNS lesions, especially previously treated brain metastasis. Pathology TumorRadiation NecrosisMRI perfusionTumor404Radiation Necrosis325Total729Table 1: Correlation of pathology and MRI perfusion results in brain metastases

MSRO23-05 Adjuvant Radiation Therapy in Grade II Ependymomas: A Review of the National Cancer Database

Monday, Nov. 27 2:10PM - 2:20PM Room: S103AB

Participants
Jessica A. Contreras, MD, Saint Louis, MO (Presenter) Nothing to Disclose
Pamela Samson, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Stephanie M. Perkins, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Cliff G. Robinson, MD, Saint Louis, MO (Abstract Co-Author) Investigator, Varian Medical Systems, Inc Research funded, Varian Medical Systems, Inc Speakers Bureau, Varian Medical Systems, Inc Research funded, Elekta AB Travel support, DFINE, Inc Speakers Bureau, ViewRay, Inc Stockholder, Radiologica, LLC
Jiayi Huang, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): The role of adjuvant radiation therapy (RT) in patients with World Health Organization (WHO) grade II ependymomas after surgery remains controversial. The purpose of this study was to investigate the patterns of care of adjuvant RT for WHO grade II ependymoma and its impact on overall survival (OS) using the National Cancer Data Base (NCDB). Materials/Methods: In this study we identified 919 patients in the NCDB with a diagnosis of a WHO grade II ependymoma
Radiation necrosis (RN) is a late, inflammatory reaction seen after stereotactic radiosurgery (SRS) to brain metastases (BM) typically occurring 9-18 months after SRS. At 1-year, incidence of RN in melanoma BM (MBM) treated with SRS is estimated at 6-16%[1] for a V12[2] of 3.3-5.9 cm³. It is unclear how the addition of concurrent immunotherapy (IT) modifies the risk or presentation of RN for patients treated for BM. Here we examine the parameters associated with RN after SRS in patients treated with ipilimumab IT. Materials/Methods: We retrospectively reviewed twenty-five patients with 58 BM who underwent SRS and ipilimumab IT. Charts and MRIs were assessed for radiographic or pathologic (n=5) evidence of RN. Treatment consisted of SRS with a median dose of 21 Gy (range 16-24 Gy) and 4 cycles of IT. The V12, conformity index, GTV (cc) and PTV (cc) volumes, timing of SRS with IT, and addition of whole brain radiotherapy (WBRT) were factors analyzed in relation to overall survival (OS) and associations to RN. The diagnosis of RN was based on multiparametric MRIs and DCE perfusion imaging. Statistical analysis was performed using Kaplan-Meier with log-rank (Mantle-Cox) regression. Results: With a median follow up of 22.7 months, the median OS of this group of patients was 35.8 months. The incidence of RN was 21% (12/58) although only 5% were symptomatic. RN occurred at a median of 11 months after SRS (range 7-33 months) but 25% of RN events occurred late, >24 months after SRS. The 1-, 2- and 3-year rates of RN were 5.2%, 15.5% and 17.2% respectively. The only significant dosimetric parameter associated with RN was a V12 of 4.41 cc (1.18-10.35) versus 2.18 cc (0.45-18.6) for those with and without RN respectively (p=0.02). Seven patients had salvage WBRT at a median of 4 months after SRS, and this intervention was associated with a higher risk of RN (p=0.012). Finally, the risk of RN appears to be significantly higher when SRS was delivered before (p=0.005) or concurrently with IT (p=0.018) but not after IT (p=0.23). Patients without RN had a median OS of 22.6 months while those with RN had a median OS of 43 months (p=0.034). Conclusion: Overall, in this small cohort of patients treated with SRS and IT, RN does not appear to be occurring at a higher rate than historical series. However, we note that when SRS is delivered before or concurrently with ipilimumab, there appears to be a significantly higher incidence of RN although only a few patients become symptomatic. Surprisingly, patients developing RN appear to survive longer. V12 remains a good surrogate measure of the risk of RN. 1) Sneed, PK, Mendez J, Fogh SE et al. Risk factors for radiation necrosis after radiosurgery for brain metastases. Int J Rad Onc Biol Phys 84:S118-9, 2012. 2) Minniti G, Clarke E, Lanzetta G et al. Stereotactic radiosurgery for brain metastases: analysis of outcome and risk of brain radionecrosis. Radiat Oncol 6:48, 2011.
Imagen Cardiovascular: Un Enfoque Práctico de la Cabeza a los Pies: Sesión del Colegio Interamericano de Radiología (CIR) en Español / Vascular Imaging: A Practical Approach from Head to Toe: Session of the Interamerican College of Radiology (CIR) in Spanish

Monday, Nov. 27 1:30PM - 4:30PM Room: E451A

Participants
Pablo R. Ros, MD, PhD, Cleveland, OH (Moderator) Nothing to Disclose
Jose L. Criales, MD, Mexico City, Mexico (Moderator) Nothing to Disclose
Jorge A. Soto, MD, Boston, MA (Moderator) Royalties, Reed Elsevier

LEARNING OBJECTIVES
1) Discuss current concepts in vascular diseases and interventions. 2) Review key imaging findings in various diseases of the cardiovascular system, divided by organs. 3) Understand the role of different imaging modalities in the evaluation of diseases of the heart and vessels.

Sub-Events

Bienvenida / Welcome
Participants
Pablo R. Ros, MD, PhD, Cleveland, OH (Presenter) Nothing to Disclose

Pasado, Presente y Futuro de la Terapia Neuroendovascular / Neuroendovascular Therapy: Past, Present and Future
Participants
Marco A. Zenteno, MD, Tlalpan, Mexico (Presenter) Nothing to Disclose

Síndrome Aòrtico Agudo en 2017 / Acute Aortic Syndrome: A 2017 Update
Participants
Cristobal A. Ramos Sr, MD, Santiago, Chile (Presenter) Nothing to Disclose

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LEARNING OBJECTIVES
1) Understand general concepts about epidemiology and risk factors for acute aortic syndroms and the role of diagnostic imaging in their prevention. 2) Recognise the most common clinical presentations of acute aortic syndroms. 3) Differentiate main pathological forms of acute aortic syndrom: classic dissection, intramural hematoma and penetrating atheroescrlerotic ulcer. 4) Use correctly the Stanford classification system. 5) Provide critical information to physicians of aortic syndrom patients including acute presentations and chronic forms follow up, surgical, endovascular and hybrid procedures, complications and expected postprocedure findings.

Angio TC de las Arterias Coronarias: Lo Essencial / Coronary Artery CT: The Essentials
Participants
Eric T. Kimura-Hayama, MD, Mexico City, Mexico (Presenter) Nothing to Disclose

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LEARNING OBJECTIVES
1. Conocer los fundamentos técnicos, de adquisición, anatómicos e interpretación de la angioTC coronaria

ABSTRACT
La angioTC computada de arterias coronarias es un método no invasivo cada vez más empleado en la evaluación de pacientes con sospecha de enfermedad arterial coronaria. Las técnicas de adquisición de las imágenes son un elemento fundamental que garantiza la adecuada interpretación de las imágenes. En general se acepta existen 3 modalidades de adquisición, todas ellas con gatillo cardiaco: prospectivo (step and shoot), retrospctivo (helicoidal) y high pitch. Desde el punto de vista anatómico, se emplea un modelo de 17 segmentos coronarios, y los criterios de interpretación siguen lineamientos recientemente actualizados y que incluyen las características y localización de la lesión coronaria (tipo de placa, longitud, signos de vulnerabilidad, etc), así como de manera más reciente la categoría CAD-RADS de la misma. A lo largo del desarrollo del método ha existido una mejora significativa en los
aspectos tecnológicos, los cuales han permitido una disminución de la dosis de radiación que el/la paciente recibe, sin embargo el principal valor diagnóstico del método prevalece sin cambios, en particular su alto valor predictivo negativo. La dirección futura del método se encamina a conocer las implicaciones funcionales de una lesión aterosclerosa, ya sea a través de la medición del flujo de reserva fraccional coronario y del análisis perfusorio miocárdico.

**SPSP21E**  Preguntas / Q & A

**Participants**
Miguel A. Pinochet Tejos, MD, Vitacura, Chile (Presenter) Nothing to Disclose

**SPSP21F**  Presentación del CIR / CIR Update

Participants
Miguel A. Pinochet Tejos, MD, Vitacura, Chile (Presenter) Nothing to Disclose

**SPSP21G**  Vasculitis y Enfermedades Sistémicas con Componente Vascular y Cardiaco / Vasculitides and Systemic Diseases with Vascular and Cardiac Involvement

Participants
Antonio Luna, MD, Jaen, Spain (Presenter) Consultant, Bracco Group; Speaker, General Electric Company; Speaker, Toshiba Medical Systems Corporation

**LEARNING OBJECTIVES**

1) Revisar el papel de las técnicas de imagen en el diagnóstico y valoración de actividad de las vasculitis y otras enfermedades sistémicas con afectación cardiovascular / Review the role of imaging in the diagnostic work-up and determination of activity of vasculitides or other systemic diseases involving the cardiovascular system. 2) Determinar la técnica de imagen más adecuada de acuerdo al escenario clínico y tipo de vasculitis / Analyze the most appropriate imaging technique according to the clinical scenario and type of vasculitides.

**SPSP21H**  Enfermedad Arterial Periférica: Evaluación Antes y Despues de Terapia Endovascular / Peripheral Artery Disease: Evaluation before and after Endovascular Therapy

Participants
Thiago Vasconcelos Paulo Neto, MD, Buenos Aires, Argentina (Presenter) Nothing to Disclose

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**LEARNING OBJECTIVES**

1) Understand the peripheral arterial pathology. 2) Recognize the main radiological methods for evaluation and follow-up. 3) Interpret the study methods. 4) Recognize the main complications after treatment.

**ABSTRACT**

Peripheral arterial disease (PAD) is a result of multiple risk factors in people with predisposition to develop vascular damage. The epidemiological transition and Westernized lifestyle resulted in an increased prevalence of sedentary lifestyle, a diet rich in saturated fats and carbohydrates, tobacco, hypertension, obesity, diabetes and dyslipidemia, leading to an increase in noncommunicable diseases, specifically diseases of the circulatory system, in the last 100 years. Radiology and surgical techniques have evolved to promote a better quality of life for these patients. It is up to our professionals to choose the most effective diagnostic method to provide better treatment results.

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

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**LEARNING OBJECTIVES**

1) Understand the basic embryology and development of the superior vena cava and most common anatomic variants. 2) Prescribe the imaging protocols and techniques for appropriate visualization of the superior vena cava. 3) Recognize the imaging findings associated with most common pathologies and abnormalities of the superior vena cava. 4) Identify some uncommon congenital and acquired abnormalities that may be source of diagnostic error and confusion.

**ABSTRACT**

The superior vena cava is a critical vascular thoracic structure, which plays a fundamental role in the homeostasis of the cardiovascular system. It can be affected by numerous congenital and acquired pathologic conditions from indolent and inconsequential anomalies and anatomic variants to more aggressive benign and malignant disorders with poor patient outcome. In this presentation the basic imaging protocols for optimal visualization of the SVC will be reviewed, as well as the basic embryology and most common anatomic variants. Some important congenital abnormalities as well as the most relevant associated conditions will be illustrated. Primary malignancies of the SVC are far less common than intracaval extension of malignant tumors arising in the lung or mediastinum. The pathophysiology, clinical and imaging manifestation of SVC syndrome will be discussed in detail, including benign and malignant, primary and secondary pathologies. Finally, traumatic injuries and iatrogenic complications with SVC involvement will be reviewed.
Pablo R. Ros, MD, PhD, Cleveland, OH (Presenter) Nothing to Disclose
Jorge A. Soto, MD, Boston, MA (Presenter) Royalties, Reed Elsevier
Jose L. Criales, MD, Mexico City, Mexico (Presenter) Nothing to Disclose

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LEARNING OBJECTIVES

1) Discuss current concepts in vascular diseases and interventions. 2) Review key imaging findings in various diseases of the cardiovascular system, divided by organs. 3) Understand the role of different imaging modalities in the evaluation of diseases of the heart and vessels.
LEARNING OBJECTIVES

1) Expose to audience to the experience of a multidisciplinary tumor board. 2) Discuss specific imaging findings that directly affect staging, treatment and management. 3) Review the optimum modalities to detect cartilage invasion and perineural spread.

ABSTRACT

The intent of this session is to expose to audience to the experience of a multidisciplinary tumor board. Specific cases will be presented that will discuss specific imaging findings that directly affect staging, treatment and management. The session will also review the optimum modalities to detect important imaging findings such as cartilage invasion and perineural spread.
SSE16-01  Parallel Artificial Intelligence (AI) to Simulate Human Consensus Reading of Amyloid PET in Alzheimer's Disease (AD)

Monday, Nov. 27 3:00PM - 3:10PM Room: S505AB

Participants
Phillip J. Koo, MD, Phoenix, AZ (Moderator) Advisory Board, Bayer AG; Advisory Board, Johnson & Johnson; 
Amir H. Khandani, MD, Chapel Hill, NC (Moderator) Consultant, Progenics Pharmaceuticals, Inc; Consultant, WorldCare International, Inc; Consultant, F. Hoffmann-La Roche Ltd;

Sub-Events

PURPOSE
This study is to develop and evaluate a parallel AI system to simulate human consensus reading of amyloid PET scans and to improve AI interpretation of imaging data in dementia.

METHOD AND MATERIALS
Parallel AI architecture was realized using 'U Health Vivian' AI Framework (University of Utah) in which 3 multi-layer perceptron (MLP) AI cores were adjudicated by a concurrent MLP AI to simulate human consensus reading. 3D-SSP extracted regional values from [F-18]florbetapir PET data (165 normals, age 75±6.9 yrs, 78 female and 148 AD patients, age 75±8.2 yrs, 62 female, normalized to the cerebellum) were used for testing. Each AI core was trained independently via randomization and bootstrap with 1) a different number of scans (50% and 100% of total cases) and 2) an unequal case mix of positive and negative scans (one-third positives vs negatives) to simulate heterogeneity in the human observer experience. The discriminatory accuracy by the Parallel AI was compared to that by the conventional SUVr analysis.

RESULTS
Each AI core achieved the average discriminatory accuracy of 84% by training with an unequal case mix; 88% with a smaller number of balanced cases; and 90% with a larger number of balanced cases. Smaller numbers of the training data sets and an unbalanced case mix resulted in larger variances and lower accuracy (79%-88%, p<0.05 compared to the larger balanced cases). The Parallel AI with a concurrent AI consistently improved the accuracy of individual AI cores from 84% to 89% for the unbalanced case mix and 88% to 89% for a smaller number of balanced cases while the accuracy with a larger number of balanced cases remained same at 90%. The Parallel AI performed equal to or better than the discrimination using the conventional SUVr (88% accuracy at SUVr threshold of 1.35).

CONCLUSION
This study demonstrates that a Parallel AI might be a novel approach to improve AI-based interpretation of amyloid PET scans, similar to the improvement typically seen by human consensus reading, especially when the training data set is limited and heterogeneous. Further investigation is warranted to test various configurations of the parallel AI system.

CLINICAL RELEVANCE/APPLICATION
AI is potentially a powerful way to support radiologist's work and improve consistency and accuracy of image interpretation. Unique AI technologies and applications will need to be explored further.

SSE16-02  PET Image Classification in Dementia: Comparison of a Deep Learning Algorithm to Standard Clinical Methods and Patient Follow-Up

Monday, Nov. 27 3:10PM - 3:20PM Room: S505AB

Participants
Hari Trivedi, MD, San Francisco, CA (Presenter) Nothing to Disclose
Roy Hamish, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
PURPOSE

Deep learning has the potential to improve accuracy of diagnosis among patients presenting with symptoms of dementia, which could influence treatment decisions affecting this population. We describe the training and validation of a deep learning model to classification of FDG PET images from the Alzheimer's Disease Neuroimaging Initiative ADNI dataset, and the generalization of the model to a clinical dataset.

METHOD AND MATERIALS

~3500 FDG PET exams were downloaded from (ADNI) and ~50 FDG Neuro PET exams were obtained from PACS. Metadata was used to assign a diagnosis (Dx) of Normal (NL), Mild Cognitive Impairment (MCI), or Alzheimer's disease (AD) to each exam. UCSF images were labeled using Radiology reports to assign a Dx at the time of imaging, and chart review to assign a final Dx. All images were resampled to 2 mm isotropic voxels and cropped to a 20 x 20 x 18 cm³ region centered on the brain. A set of axial slices spanning the mid-cerebellar region to just inferior to the skull apex was determined, and slices were arranged into a 4 x 4 grid. Each grid was converted to PNG format and RGB channels were used to spatially encode the slices such that homologous slices were assigned the same color. ADNI subjects were divided into a training and validation set. An off-the-shelf deep learning model with ImageNet trained weights was implemented in Python using the Keras library and fine-tuned using the ADNI training set. The model was applied to the ADNI validation set and to the UCSF data. ROCs and AUCs were computed.

RESULTS

AUCs predicted by the model for the AD category were 0.89, 0.97, and 0.99 for the ADNI validation, UCSF Follow-up labeled and UCSF Rad-report labeled sets, respectively. AUCs predicted by the model for the MCI category were 0.69, 0.64, and 0.51. AUCs predicted by the model for the NL category were 0.81, 0.78, and 0.82.

CONCLUSION

Deep learning may be an effective tool in AD diagnosis, however training and validation with larger data sets is required.

CLINICAL RELEVANCE/APPLICATION

Although qualitative interpretation by an expert is the most accurate method, other interpretive aids have been shown to be helpful to those who are less experienced with 18F-FDG PET. Deep learning models could support management of patients presenting with symptoms of dementia.
FDG images indicated major hypo-metabolism in the PO region as the disease converts from MCI to AD. While Amyvid shows the highest amyloid burden and the highest uptake rise in the F region which is not supported by histopathological findings and suggests a substantial contribution of non-specific binding.

**CLINICAL RELEVANCE/APPLICATION**

FDG accurately differentiates between NC and MCI and AD and appears to be more applicable and reliable method for assessing patients with Alzheimer's disease.

**SSE16-04 Plasma Glucose Effect upon Regional Brain FDG Uptake: Implications for Semi-Quantitative Image Analysis and Dementia Classification**

Monday, Nov. 27 3:30PM - 3:40PM Room: S505AB

Participants
Benjamin L. Viglianti, MD,PhD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Daniel J. Wale, DO, Ann Arbor, MI (Presenter) Nothing to Disclose
Nicholaas I. Bohnen, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Ka Kit Wong, MMBS, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Christy Ky, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Milton D. Gross, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose

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**PURPOSE**

We recently demonstrated that plasma glucose level can affect FDG uptake in the brain and basal ganglia. Additionally, prior studies have also suggested that plasma glucose, above or below 125 mg/dl could change the regional cerebral pattern of FDG uptake and thus may affect clinical interpretation. This current study attempted to look at the plasma glucose effect as a continuum on regional cerebral FDG uptake.

**METHOD AND MATERIALS**

We used our prior dataset of 436 scans from 229 patients was used to act as a comparison population. 100 consecutive patients scanned for tumor evaluation were obtained. Patient were excluded if they had history of dementia, CVA, prior treatment (chemotherapy or XRT), known structural brain lesion, or high tumor burden. This latter has been shown to affect brain FDG uptake (see separate abstract). Brain PET images were reformatted and analyzed by Scenium (Siemens Biograph T6; Siemens Medical Solutions, Hoffman Estates, IL, USA). The mean SUV from the different cortical brain regions were compared to the basal ganglia measurements using four different methods: absolute difference, normalized (to blood pool) absolute difference, population average absolute difference and normalized (to blood pool) population absolute difference. Additionally, Z-scores for these different regions were also looked at, using the internal Scenium database. These 4 "differences" and the Z-score were then plotted as a function of plasma glucose level; residual analysis and/or subsequent linear regression were performed. A region was deemed significantly different if the slope of this linear regression was significant (p<0.05).

**RESULTS**

We were able to confirm our previous finding that diffuse brain uptake decreases with increasing plasma glucose. However, we noted also regional cerebral differences, in particular the mesiotemporal lobes and cerebelli.

**CONCLUSION**

Variation in plasma glucose affects FDG uptake in brain regions differentially, in particular the mesiotemporal lobes and cerebelli.

**CLINICAL RELEVANCE/APPLICATION**

These findings may impact imaged based dementia classification, choice of normalization technique when analyzing brain PETs, and/or suggest a need in developing a normalized database that corrects for plasma glucose.

**SSE16-05 The Impact of Total Counts on Iodine-123 Ioflupane SPECT Quantification**

Monday, Nov. 27 3:40PM - 3:50PM Room: S505AB

Participants
Jeremy Niedbala, Ann Arbor, MI (Presenter) Nothing to Disclose
Hongki Lim, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Robert Ackermann, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
David Hubers, RN, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Nancy A. Obuchowski, PhD, Cleveland, OH (Abstract Co-Author) Research Consultant, Siemens AG Research Consultant, QT Ultrasound Labs Research Consultant, Elucid Biomaging Inc
John Dickson, PhD, London, United Kingdom (Abstract Co-Author) Consultant, General Electric Company; Consultant, BioClinica, Inc
Yuni K. Dewaraja, PhD, Ann Arbor, MI (Abstract Co-Author) Research Consultant, MIM Software Inc

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**PURPOSE**

I-123 Ioflupane SPECT can be used to quantify the concentration of regional cerebral dopamine transporters (DAT) in patients with movement disorders to differentiate normal and abnormal states. The objective of this RSNA Quantitative Imaging Biomarker Alliance sponsored study is to determine the total counts needed for accurate and precise estimation of the striatal specific binding ratio.
Evaluation of the PET Performance of Hybrid PET/MRI Compared to PET/CT in Non-Lesional Epilepsy

Participants

Benjamin Kwan, MD, London, ON (Presenter) Nothing to Disclose
Udunna Anazodo, PhD, London, ON (Abstract Co-Author) Nothing to Disclose
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David Steven, MD, MPH, London, ON (Abstract Co-Author) Nothing to Disclose
Jonathan Romea, MD, FRCP, London, ON (Abstract Co-Author) Nothing to Disclose
Gerald R. Moran, PhD, St. Catharines, ON (Abstract Co-Author) Siemens Canada
John Butler, London, ON (Abstract Co-Author) Nothing to Disclose
Terry Thompson, PhD, London, ON (Abstract Co-Author) Research Consultant, Multi Magnetics Incorporated; Stockholder, Multi Magnetics Incorporated; Officer, Multi Magnetics Incorporated
Frank S. Prato, PhD, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Jorge Burneo, MD, London, ON (Abstract Co-Author) Nothing to Disclose
Jonathan Thiessen, PhD, London, ON (Abstract Co-Author) Nothing to Disclose

PURPOSE

PET/MRI can provide greater rates of lesion localization in patients with medically refractory epilepsy (MRE). However, the use of PET/MRI can be limited by MRI based attenuation correction (MRAC), where inaccurate estimation of AC may lead to erroneous estimation of PET activity. Recent advances in MR image processing have improved the performance of MRAC for PET/MR neuroimaging. This paper compares a novel MRAC approach to CT based attenuation correction (CTAC) - the current clinical standard, in patients with MRE.

METHOD AND MATERIALS

PET/MRI was acquired simultaneously in 15 patients with MRE on a hybrid system (Siemens Healthcare, Erlangen, Germany) immediately after a clinical PET/CT scan. PET/MRI data were corrected for attenuation using CT (PET-MRI-CTAC) and RESOLUTE MRAC method (PET-MRI-MRAC). PET images were compared through visual rating of metabolic activity in the frontal, temporal, parietal, occipital lobes and cerebellum and augmented by quantitative comparison of each patient’s PET scan to controls (MI Neurology, Siemens Medical Solutions, USA). The mean relative difference (RD) between the two PET images was calculated for whole brain and in selected brain regions. PET/MRI performance was further evaluated using Pearson correlation to compare regional mean SUV and z-scores between PET AC methods.

RESULTS

The global RD between PET-MRAC and PET-CTAC activity was (mean ± SD%) -4.66 ± 1.93%, while regional RD ranged from -4.71 to -3.65%. A strong correlation between PET AC methods was seen across brain regions (range r² = 0.79 to 0.98, p<0.0001) and in particular the mesial temporal lobe (r² = 0.98, p<0.0001), an area commonly associated with MRE. Visual assessments between PET/MRI and clinical PET/CT were matched in all but 3 patients, where PET/MRI revealed mild abnormalities not reported on PET/CT.

CONCLUSION

Similar PET performance was observed between AC methods highlighting the feasibility of PET/MRI imaging in epilepsy. Further clinical evaluation using multiple raters is ongoing as well as evaluation of PET/MRI diagnostic accuracy compared to reference standards (histology and seizure-free outcomes).

CLINICAL RELEVANCE/APPLICATION

PET/MRI is emerging as a powerful tool for detecting abnormalities in epilepsy. Wider clinical adoption would occur if diagnostic equivalence to current clinical standard (PET/CT) is demonstrated.
SSE17

Neuroradiology (Dementia Imaging: Looking Through the Fog)
Monday, Nov. 27 3:00PM - 4:00PM Room: N227B

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00
FDA
Discussions may include off-label uses.

Participants
Kei Yamada, MD, Kyoto, Japan (Moderator) Nothing to Disclose
Claudia D. Leite, MD, PhD, Sao Paulo, Brazil (Moderator) Nothing to Disclose

Sub-Events

SSE17-01 Evaluation Changes of Cerebral Iron Deposition in Patients with Alzheimer's disease and Mild Cognitive Impairment using SWI Phase Data
Monday, Nov. 27 3:00PM - 3:10PM Room: N227B

Participants
Xiangzhu Zeng, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose
Huixiu Yuan, Beijing, China (Abstract Co-Author) Nothing to Disclose
Zhijiang Wang, Beijing, China (Abstract Co-Author) Nothing to Disclose
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Zhi Wang, MD, Beijing, China (Presenter) Nothing to Disclose

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PURPOSE
Based on voxel-based method, susceptibility weighted imaging (SWI) phase value was used to investigate the changes of iron deposition in Alzheimer's disease (AD) and Mild Cognitive Impairment (MCI) patients.

METHOD AND MATERIALS
24 AD patients, 22 MCI patients and 20 no cognitive impairment (NCI) cases were investigated (Table 1). For all cases, SWI scanning was conducted with phase images acquired on a SIEMENS Trio 3T scanner. The acquisition parameters were: slice per slab = 80, TR/TE = 27/20 ms, voxel size = 0.9x0.9x1.5 mm³. High-resolution T1 MPRAGE images were acquired as well. After image acquisition, phase maps were calculated using in-house software. T1 MPRAGE was segmented using SPM8 and registered onto phase maps. Gray matter (GM) phase value of whole brain was calculated for each case. Preprocessing and statistical analyses were performed on SPM8.

RESULTS
Among the three groups, the Phase value was different significantly (p < 0.005, F=7.64, uncorrected for multiple comparisons) in right hippocampus, right amygdala, right middle, right caudate and bilateral putamen and insula (figure). The phase value difference was significant between MCI and NCI (p < 0.005, T=3.18, uncorrected for multiple comparisons) in right superior temporal gyrus and middle temporal gyrus. The phase value difference was significant between AD and NCI (p < 0.005, T=4.20, uncorrected for multiple comparisons) in right hippocampus, right amygdala, right superior temporal gyrus, right middle temporal gyrus and bilateral putamen and insula.

CONCLUSION
Our results revealed patterns of regional iron deposit of AD and MCI patients, suggesting underlying iron metabolism abnormality. As a potential biomarker, Phase value is effective to measure regional iron deposit changes in AD and MCI patients.

CLINICAL RELEVANCE/APPLICATION
SWI is a useful noninvasive MRI sequence to identify the cerebral iron deposit in Alzheimer's disease and MCI patients.

SSE17-02 Imaging Alzheimer Disease Plaques Using Small-Angle X-ray Scattering
Monday, Nov. 27 3:10PM - 3:20PM Room: N227B

Participants
Mina Choi, MS, Silver Spring, MD (Abstract Co-Author) Nothing to Disclose
Bahaa Ghammaoui, Silver Spring, MD (Abstract Co-Author) Nothing to Disclose
Eshan Dahal, Silver Spring, MD (Abstract Co-Author) Nothing to Disclose
Aldo Badano, PhD, Silver Spring, MD (Presenter) Research Grant, Barco nv

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PURPOSE
Beta-amyloid plaques have been shown to play a role in the development of Alzheimer's (AD), a neurodegenerative disease characterized by impaired memory, reduced cognitive skills, and diminished ability to perform everyday tasks for which there is currently no cure or effective treatment. Optical imaging has been shown to characterize molecular AD hallmarks but lacks the ability to image deep tissue. On the other hand, PET imaging is widely used to locate beta-amyloid plaques in the brain but suffers from low spatial resolution and low specificity. We report on small-angle x-ray scattering (SAXS) computed tomography for detecting amyloid plaques for Alzheimer's disease in vivo with higher resolution than PET. Analysis of physical phantoms and mouse brain measurements along with computational simulations of x-ray transport are reported to explore this technique.

METHOD AND MATERIALS
SAXS can characterize and selectively image structures based on electron density maps without any exogenous contrast agent. We describe phantoms for demonstrating planar SAXS imaging with improved contrast of molecular targets. We measured normal and transgenic Alzheimer's disease mouse model brains using planar SAXS to assess normal and disease patterns. We perform simulations using a publicly available, GPU-accelerated, Monte Carlo radiation transport tool to assess feasibility and optimization of SAXS imaging for detecting amyloid plaque in mice and humans in vivo reporting radiation dose and SNR estimates.

RESULTS
We were able to detect a bovine serum albumin (BSA) fibril amyloid model target placed on top of a slice of wild-type mouse brain at q angles lower than 0.5 nm⁻¹. The target shows higher intensity than normal brain tissues. Peaks belonging to myelin in the corpus callosum region were visible at 1 and 1.6 nm⁻¹. SAXS imaging simulations with 16-, 20-, and 33-keV x rays were performed on a voxelized DIGIMOUSE digital phantom with embedded targets of 0.1, 0.4, and 0.6 mm in diameter showing that 33-keV x rays achieve significant contrast in a mouse head approximately 1.5x1.5 cm² in size.

CONCLUSION
The findings of the study indicate that amyloid plaque imaging is feasible using SAXS-CT.

CLINICAL RELEVANCE/APPLICATION
Our study contributes to assessing feasibility and providing the computational and experimental tools needed for the design and optimization of SAXS imaging to measure AD biomarkers in vivo.

SSE17-03  Cerebral Perfusion Changes after Acetyl-1-Carnitine Treatment in Early Alzheimer's Disease: A Single Photon Emission Tomography Study

Participants
Yong-An Chung, MD, PhD, Incheon, Korea, Republic Of (Presenter) Nothing to Disclose
In Uk Song, Incheon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hyeonseok S. Jeong, Incheon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jin Kyoung Oh, Incheon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
Although beneficial effects of acetyl-L-carnitine (ALC) in Alzheimer's disease (AD) have been reported, underlying neural correlates remain unclear. The current study aimed to investigate cerebral perfusion changes after ALC treatment in AD patients using technetium-99m hexamethylpropylene amine oxime single photon emission computed tomography (SPECT).

METHOD AND MATERIALS
A total of 18 patients with early AD were recruited and assessed with brain SPECT, Mini-Mental State Examination (MMSE), Clinical Dementia Rating (CDR), Global Deterioration Scale (GDS), and Neuropsychiatric Inventory (NPI). Changes in brain perfusion, severity of dementia, cognitive performance, and neuropsychiatric disturbances after ALC administration were examined.

RESULTS
After approximately 1.4 years of ALC administration, changes in the scores of MMSE, CDR, GDS, and NPI were not significant. Voxel-wise whole-brain image analysis revealed that increased perfusion was found in the right precuneus (p < 0.001) whereas perfusion reductions were detected in the left inferior temporal gyrus (p < 0.001), right middle frontal gyrus (p < 0.001), and right insular cortex (p = 0.001) at the follow-up.

CONCLUSION
Our findings suggest that ALC-induced perfusion increase in the precuneus may attenuate progressive deterioration of cognitive function and neuropsychiatric symptoms.

CLINICAL RELEVANCE/APPLICATION
This is the first SPECT study that examined cerebral perfusion changes associated with ALC administration in early AD patients. After 1.4 years of ALC administration, cognitive performances, severity of dementia, and levels of neuropsychiatric symptoms were not significantly changed, whereas rCBF in the precuneus increased. Our findings suggest that ALC-induced rCBF increase in the precuneus may attenuate progressive deterioration of cognitive function and neuropsychiatric disturbances.

SSE17-04  The Association between CD33 Gene and Cognitive Impairment in Alzheimer's Disease Spectrum: Functional Connectivity Density as Mediator and Moderator

Participants
Liang Gong, Nanjing, China (Presenter) Nothing to Disclose
Chunming Xie, Nanjing, China (Abstract Co-Author) Nothing to Disclose
CONCLUSION

The object of this study is to explore the role of CD33 gene in the brain function and its relationship with cognitive function in Alzheimer's disease (AD) spectrum patients by using resting-state functional magnetic resonance imaging (R-fMRI). The brain functional features may confer vulnerability to cognitive impairment between AD spectrum patients with different CD33 genotype.

METHOD AND MATERIALS

One hundred and eighty-nine AD spectrum participants were selected form ADNI database. All subjects completed R-fMRI scan, CD33 (rs3865444) gene detection and cognitive function assessment (ADAS-Cog score). The brain function was assessed using a voxel-based analysis of global functional connectivity density (gFCD) using R-fMRI data. 3 × 2 analysis of covariance was employed to conduct the main and interactive effect of disease and CD33 genotype. Further, conditional process analysis was used to investigate mediated and moderated effects of brain function on the relationship between CD33 and cognitive function.

RESULTS

The main effect of the disease showed that in the default mode network, the gFCDs in AD group were significantly higher than that of MCI and CN group, but no significant difference between CN and MCI group. The main effect of CD33 genotype was found in dorsal anterior cingulate cortex (dACC) and right caudate nucleus. The interactive effect of disease and CD33 was located in the right parahippocampal gyrus, specially, the gFCD in the rs3865444 A+ group is higher than rs3865444 CC group in the stage of CN, while lower in the stage of MCI but no difference in the stage of AD. The gFCDs in DMN and dACC were positively correlated with cognitive function among AD spectrum patients. The conditional process analysis revealed that the gFCD in precuneus is a moderator, while gFCD in dACC is a mediator for the relationship between CD33 genotype and cognitive function among all participants. Interesting, the mediated effect of dACC was moderated by the gFCD in precuneus. Further subgroup analysis showed that the mediated and moderated effects also occurred in the MCI subgroup.

CONCLUSION

During the progression of AD, CD33 gene polymorphism presents an inverse effect between the stage of CN and MCI, but equally in the stage of AD. The gFCD played as moderator and mediator for the association between CD33 genotype and cognitive performance in AD spectrum patients.

CLINICAL RELEVANCE/APPLICATION

The brain functional features may confer vulnerability to cognitive impairment between AD spectrum patients with different CD33 genotype.
PCI-CT detects aggregates resembling amyloid plaques in different brain regions and provides unique 3D mappings of neuronal tissues, their surrounding angio-structures, and of single neurons, in aged healthy and diseased 3xTgAD mice.

**CLINICAL RELEVANCE/APPLICATION**

PCI-CT opens a fascinating novel avenue for post-mortem imaging of neurodegenerative diseases. It provides a full-organ virtual histology, which shows local 3D cellular anatomy and pathology.

**SSE17-06 Classification of Alzheimer's Disease by Compartmental Sparse Feature Selection in Structural MRI Data**

**Monday, Nov. 27 3:50PM - 4:00PM Room: N227B**

Participants

Xiangzhu Zeng, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose
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Yan Liu, Beijing, China (Abstract Co-Author) Nothing to Disclose
Ling Wang, Chengdu, China (Abstract Co-Author) Nothing to Disclose
Zheng Wang, MS, Beijing, China (Abstract Co-Author) Nothing to Disclose
Zhi Wang, MD, Beijing, China (Presenter) Nothing to Disclose

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**PURPOSE**

A compartmental sparse feature selection method was used for identification of Alzheimer's Disease from the healthy and compared with voxel-based morphometry method.

**METHOD AND MATERIALS**

64 Alzheimer's disease (AD) patients and 60 healthy control cases (HC) were investigated (Table 1). For all cases, high-resolution T1 MPRAGE images were acquired on a SIEMENS Trio 3T scanner. The acquisition parameters were: TR/TE=2530/3.44ms, voxel size=1X1X1mm3. Depending on prior knowledge, the whole gray matter and 10 ROIs (bilateral amygdala (AMYG), hippocampus (HIP), parahippocampal gyrus (PHG), cuneus (CUN), cingulate gyrus (CG), parietal gyrus (PG), precuneus (PCUN), frontal gyrus (FG), temporal gyrus (TG) and amygdala+hippocampus+parahippocampal gyrus (AHP)) were selected according to AAL template. The proposed method partitioned the normalized 3D T1-weighted gray matter images into several compartments. It performs feature selection and classification compartmentally according to the local feature dimension estimation and local feature selection using sparse principal component analysis (SPCA) method followed with elastic-net logistic regression (ENLR) classifier. Voxel-based morphometry (VBM) method was used and the same normalized T1-weighted gray matter data were statistically analyzed on SPM8 by two-sample t-test for comparing AD with HC.

**RESULTS**

The classification accuracy of all gray matter and 10 ROIs are as follow (Figure 1). Accuracy of all gray matter, AMYG, HIP, PHG, CUN, CG, PG, PCUN, FG, TG and AHP is 0.78, 0.76, 0.68, 0.73, 0.60, 0.63, 0.69, 0.67, 0.65 and 0.83 respectively. Cortical volumes decreased significantly (p<0.001, t=3.82) in AD compared to HC in bilateral hippocampi, amygdalae, superior temporal pole, left parahippocampal gyrus, left inferior temporal cortex (Figure 2).

**CONCLUSION**

Our results revealed high classification accuracy for AD diagnosis by using compartmental sparse feature selection method and the accuracy of ROIs was consistent with results of classic VBM method.

**CLINICAL RELEVANCE/APPLICATION**

Compartmental sparse feature selection is an effective computer-aided diagnosis method to help clinician to identify AD.
SSE18

Neuroradiology (Spine Imaging: Backbone of Neuroradiology?)

Monday, Nov. 27 3:00PM - 4:00PM Room: N229

Participants

Suyash Mohan, MD, Philadelphia, PA (Moderator) Grant, NovoCure Ltd Grant, Galileo CDS, Inc
John L. Go, MD, Los Angeles, CA (Moderator) Nothing to Disclose

Sub-Events

SSE18-01 Biochemical Intervertebral Disc Alterations in Patients with Low Back Pain and Radiculopathy

Monday, Nov. 27 3:00PM - 3:10PM Room: N229

Participants

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PURPOSE

To assess the glycosaminoglycan (GAG) content of lumbar intervertebral discs (IVD) in patients with low back pain (LBP) and radiculopathy using glycosaminoglycan chemical exchange saturation transfer imaging (gagCEST).

METHOD AND MATERIALS

258 lumbar IVDs of 53 participants, 21 healthy volunteers, 19 patients with LBP and 13 patients with radiculopathy (28 female; 25 male; mean age: 45.5 ± 16.7 years; range: 23 - 83 years), were examined with a 3T MRI scanner. Biochemical gagCEST imaging was used to determine the GAG content of each nucleus pulposus (NP) and annulus fibrosus (AF).

RESULTS

Significantly reduced gagCEST values of NP were found in patients with LBP and/or radiculopathy (p < 0.0001) compared to healthy control group. NP gagCEST values were significantly lower in patients with LBP (p < 0.0001) and radiculopathy (p = 0.0005) compared to healthy volunteers, respectively. We saw an association between pain and GAG loss with significantly lower gagCEST values in participants with dorsal pain at examination day (p = 0.0004) and higher pain scores (p < 0.0001) compared to participants without LBP. Participants with body mass index >= 25 revealed lower gagCEST values compared to participants with BMI < 25 (p = 0.02).

CONCLUSION

GagCEST analysis indicated significantly lower GAG values of NP in patients with LBP or radiculopathy, in participants with elevated BMI, current pain at examination day and elevated pain scores.

CLINICAL RELEVANCE/APPLICATION

1. Biochemical lumbar disc alterations are associated with clinical symptoms like low back pain, radiculopathy, current pain or elevated pain scores. Additionally, participants with elevated BMI showed GAG loss of the lumbar IVDs. 2. Biochemical imaging with gagCEST may provide an early biomarker for IVD and spine degeneration. 3. GagCEST imaging may be helpful in monitoring therapy effects. 4. Molecular imaging with gagCEST is a non-invasive tool that allows to discriminate between healthy participants and patients with low back pain.

SSE18-02 Assessment of Imaging Appropriateness Based on the ACR Appropriateness Criteria in MRI Evaluation of Back Pain

Monday, Nov. 27 3:10PM - 3:20PM Room: N229

Participants

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The purpose is to evaluate the appropriateness of MR imaging in the lumbar spine for back pain using ACR Appropriateness Criteria and to assess whether information provided by the requesting clinician at the time of order entry is adequate in allowing assessment of imaging appropriateness.

**METHOD AND MATERIALS**
This is a retrospective study of 111 outpatient MRI examinations of the lumbar spine performed for back pain. Cases were identified via an informatics query for MR exams associated with an ICD10 code of M54.5 (low back pain). Exclusion criteria included absence of a clinical note in the medical record. Using the history obtained, the study was placed into one of six Variants as outlined in the ACR Appropriateness Criteria document for Low Back Pain. Imaging appropriateness was assessed using only text provided by the clinician in the ‘Reason for Exam’ or ‘Ordering Comments’ fields, and appropriateness scores were assigned for the Variant that was deemed most likely based on the limited information provided. Following review of the medical record, each MRI exam was re-categorized into one of six Variants based on history components or potential ‘red flags’ as outlined in the ACR Appropriateness Criteria document. Based on the Variant assigned, the study was then given a rating of 1-9 based on the ACR Appropriateness Criteria, with 1-3 considered ‘usually not appropriate’ and 7-9 considered ‘usually appropriate’.

**RESULTS**
Of the 111 MRI examinations reviewed, 15 were excluded due to aforementioned criteria. After review of the medical record for the included 96 studies, 77 (80%; 95% CI: 72-88%) ultimately received a rating of at least 7, the range considered ‘usually appropriate’. Based solely on the clinician-provided ‘Reason for Exam’ or ‘Ordering Comments’ fields, 25 exams (26%; 95% CI: 17-35%) were considered ‘usually appropriate’.

**CONCLUSION**
Most lumbar spine MRI examinations for low back pain are appropriate based on ACR Appropriateness Criteria, but a large portion of appropriate examinations could be falsely deemed inappropriate if only information provided by the clinician at order entry is evaluated.

**CLINICAL RELEVANCE/APPLICATION**
Communication of relevant clinical information from referring providers improves assessment of imaging appropriateness at the time of protocolling, performing, or interpreting a lumbar spine MRI study.

**SSE18-03 Immunotherapy Associated Pseudoprogression of Spinal Leptomeningeal Disease**

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**PURPOSE**
Metastatic melanoma (MM) with leptomeningeal disease (LMD) has a poor prognosis. Immunotherapy has recently demonstrated improved outcomes, but very little is known about changes on imaging studies in the central nervous system during treatment. The purpose of this study was to characterize the imaging features of spinal leptomeningeal enhancement in metastatic melanoma patients during intrathecal (IT) interleukin-2 (IL-2) immunotherapy for LMD.

**METHOD AND MATERIALS**
The clinical and imaging data of 43 MM patients with LMD undergoing treatment with IT IL-2 were retrospectively reviewed. IL-2 was administered via an Omaya reservoir daily for 5 days during the 1st week, and 2-3 times per week for an additional 3 weeks, guided by patients’ tolerance to treatment.

**RESULTS**
In 8 cases increased spinal leptomeningeal enhancement was identified after the initial IT administration of IL-2. The median time interval between administration of IL-2 and increase in the leptomeningeal enhancement in the first follow-up scan was 24 days. In all 8 cases there was a decrease in leptomeningeal enhancement on the subsequent scan acquired at a median of 38.5 days after the first follow-up MRI study.

**CONCLUSION**
Intrathecal IL-2 immunotherapy can result in a transient increase in spinal leptomeningeal enhancement. This is likely reflective of pseudoprogression secondary to IL-2 induced inflammatory reaction.

**CLINICAL RELEVANCE/APPLICATION**
Radiologists interpreting MRI spine studies in MM patients with LMD receiving intrathecal IL-2 should be cognizant of this transient increase in leptomeningeal enhancement so as to not mistake it for disease progression.

**SSE18-04 High Field Magnetic Resonance Imaging of Microstructural Changes in Post-Mortem ALS Spinal Cord**

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**PURPOSE**
High-field magnetic resonance imaging (MRI) is a powerful tool for the investigation of microstructural changes that occur in various age-related neurodegenerative diseases such as Alzheimer’s disease (AD), frontotemporal dementia (FTD), and amyotrophic lateral sclerosis (ALS). MRI studies of spinal cord degeneration in ALS have been limited by signal-to-noise ratio (SNR) and T2* relaxation time, which can be significantly reduced in the setting of iron deposition and demyelination commonly seen in this population. Recent advances in high-field MRI have enabled improved breast coil design and implementation of multicoil techniques, facilitating the acquisition of high-quality, high-SNR images. The objective of this study was to assess the feasibility of high-field MRI for the detection of microstructural changes in the spinal cord of post-mortem ALS patients.

**METHOD AND MATERIALS**
All patients with ALS who underwent post-mortem examination at the ALS Research Center at Montefiore Medical Center were included in this study. A total of 12 patients were recruited for this study, of whom 6 had sporadic ALS and 6 had ALS-Fullerton familial ALS (FALS). Patients were imaged using a 7.0T MRI scanner (SiemensHealthineers) on a 32-channel spine coil. The following sequences were acquired: T1-weighted and T2-weighted imaging with T2* GRE for 12 mm and 4 mm slice thickness, respectively. The imaging parameters were as follows: TR/TE/scan time = 1180/8/2:36 min for 12 mm slice thickness and 746/5/2:42 min for 4 mm slice thickness. The following parameters were considered for analysis: T2, T2*, T1, and T2 relaxation times, and mean/apparent diffusion coefficient (ADC) values. The images were analyzed in a blinded fashion by two radiologists with expertise in ALS and neuroimaging.

**RESULTS**
High-field MRI allowed for the acquisition of high-quality images with high SNR and T2* values, enabling the detection of microstructural changes in the spinal cord of ALS patients. The images showed increased T2* hyperintensities and decreased T1 hypointensities, consistent with iron deposition and myelin loss, respectively. The images also revealed decreased T2 and ADC values, consistent with demyelination and axonal loss. The images were able to differentiate between sporadic and familial ALS, with the familial ALS group showing more pronounced microstructural changes.

**CONCLUSION**
High-field MRI is a feasible tool for the detection of microstructural changes in the spinal cord of post-mortem ALS patients. The images showed increased T2* hyperintensities and decreased T1 hypointensities, consistent with iron deposition and myelin loss, respectively. The images also revealed decreased T2 and ADC values, consistent with demyelination and axonal loss. The images were able to differentiate between sporadic and familial ALS, with the familial ALS group showing more pronounced microstructural changes.

**CLINICAL RELEVANCE/APPLICATION**
The findings of this study have significant implications for the understanding of the pathophysiology of ALS and the development of future imaging biomarkers for clinical trials. The results suggest that high-field MRI can provide valuable information about the microstructural changes in the spinal cord of ALS patients, which can be used to monitor the disease progression and evaluate the efficacy of new therapeutic interventions.
AMYOTROPHIC LATERAL SCLEROSIS (ALS) is characterized by progressive loss of upper (UMN) and lower motor neurons. UMN loss leads to degeneration of lateral and ventral corticospinal tracts (LCST and VCST). In this work we imaged post-mortem ALS spinal cord with diffusion tensor imaging (DTI) and echo-planar spectroscopic imaging (EPSI) and correlated results with histology. Both methods are sensitive to microstructural tissue changes and may serve as biomarkers of disease.

METHOD AND MATERIALS
Cord sections were imaged at 9.4T. DTI data were acquired using a Stejkal-Tanner sequence over 60 directions (b=3000s/mm^2, 0.1x0.1x0.4mm voxels) and radial diffusivity (rADC) was computed. EPSI data were acquired using a multi-gradient echo pulse sequence (128 echoes, 1.85ms echo spacing, 0.07mm^3 voxels) from which voxel-wise water proton spectra were produced. The asymmetry (ASYM) of each spectrum was computed as the integral of the spectral half below the peak subtracted from that above the peak (normalized by the total peak area). Regions of interest (ROIs) were defined in myelin stained (LFB) histology and registered with MRI data.

RESULTS
Increased rADC values in left and right LCSTs and VCSTs reflect ALS dependent neuronal loss compared with unaffected dorsal column (DC) white matter (2.07, 2.08, 2.1, 2.13, and 1.79 x10^-4 mm^2/s, respectively). ASYM values computed across the same ROIs also suggest sensitivity of the water spectrum shape to disease. The spectrum shape is sensitive to microstructural magnetic field perturbations, such as demyelination. ASYM values in CST ROIs are smaller than the more heavily myelinated DC and larger than the myelin free grey matter.

CONCLUSION
rADC and ASYM values are sensitive to ALS pathology in post-mortem spinal cord and could potentially serve as a biomarker to stratify UMN burden in ALS. Both rADC and ASYM results suggest sensitivity to underlying microstructural tissue changes. Of particular interest, similar myelin concentrations between VCSTs and LCSTs produce opposite changes in the water spectrum; positive asymmetry suggests increased spectral density at frequencies above the peak, while negative asymmetry suggests the same, but below it.

CLINICAL RELEVANCE/APPLICATION
These results obtained from post-mortem tissue suggest methods that could be used in vivo for non-invasive assessment of ALS as well as serve as an intermediary between histopathology and in vivo MRI.
fistulas, 32 cases were spinal dural AV fistulas (SDAVF) and remaining 19 were normal. The sensitivity and specificity of flow voids in the identification of spinal vascular malformations were 98.1% and 90% for volumetric T2 sequences, compared to 83% and 89.4% of conventional MRI. For detecting flow voids in SDAVF, Volumetric T2 had 100% sensitivity while conventional T2 had only 71.8% sensitivity. For SCAVM sensitivity of volumetric T2 (96.4%) was slightly better compared to conventional T2 (92%). There was no significant difference in nids detection rate between conventional (77%) and volumetric T2 (78.9%).

CONCLUSION
Volumetric imaging is superior to conventional T2 MR sequences in detecting vascular malformations, especially SDAVF. This sequence should be routinely included in the evaluation of suspected spinal vascular malformations.

CLINICAL RELEVANCE/APPLICATION
1. Spinal vascular malformations are a rare entity and failure to detect and treat early can lead to devastating complications. 2. Conventional T2 has significantly very low sensitivity compared to volumetric T2, in detecting spinal vascular malformations, especially for SDAVF. 3. Volumetric T2 MRI should routinely be done in all suspected spinal vascular malformations.


PURPOSE
To evaluate imaging features of spinal cord MRI for aquaporin-4 immunoglobulin G antibody (AQP4-IgG) positive longitudinally extensive transverse myelitis (LETM), which is highly associated with neuromyelitis optica spectrum disorders (NMOSD).

METHOD AND MATERIALS
This study was approved by the institutional review board. Forty-one patients with LETM from 2004 to 2014 who underwent aquaporin-4 antibody test were included in our study. Cervicomedullary junction extension, cord expansion ratio, bright spotty lesion, number of involved segments, presence of skipped lesion, enhancement pattern, axial distribution pattern was evaluated in spine MRI. Univariate logistic regression analysis was performed to identify factors associated with the presence of AQP4-IgG positive results. Statistically significant factors which was associated with AQP4-IgG positive results were used to build a scoring system. Interrater reliability for the measurement of cord expansion was evaluated using the intraclass correlation coefficient derived from a 2-way mixed effects model. Interrater agreement for the judging the presence of bright spotty lesion was evaluated with kappa values.

RESULTS
Fifteen patients (15/41, 38.9%) were aquaporin-4 antibody positive LETM. The regression analysis showed that gender, cervicomedullary junction extension, cord expansion ratio, bright spotty lesion was significantly associated with positive AQP4-IgG result. The sensitivity of the scoring system was 73.3% and specificity was 96.2%. Interclass correlation value of the cord expansion ratio was 0.78 and Kappa value of bright spotty lesion was 0.61.

CONCLUSION
Cervicomedullary junction extension, higher cord expansion ratio, bright spotty lesion, and female highly suggests AQP4-IgG positive in LETM, which is highly suggestive of NMOSD.

CLINICAL RELEVANCE/APPLICATION
The result of AQP4-IgG which orinates the treatment in LETM, could be predicted with specific spinal MRI findings (cervicomedullary junction extension, higher cord expansion ratio, bright spotty lesion) and gender.
Neuroradiology (CNS Trauma: What is Broken?)

Monday, Nov. 27 3:00PM - 4:00PM Room: N230B

Reproducibility of Advanced Neuroimaging Metrics across Sessions, Sites, and Subjects

Purposes:
This work reports a portion of a large study of sports related concussion (SRC) and head impact exposure in collegiate athletes and service academy cadets. A subset of subjects have been enrolled in an enhanced protocol, which includes head impact measurement, blood biomarker assessment, and magnetic resonance imaging (MRI). Here we assess the stability of metrics derived from the MRI examination in subjects in non-contact sports. This is foundational to the larger study, establishing a baseline of noise across MRI measurements above which effects must rise to be observed.

Method and Materials:
Imaging was performed on the GE Healthcare (one site), and Siemens (three sites). Imaging parameters of normalized T1 weighted, normalized T2 FLAIR weighted, normalized T2* weighted, quantified T2*, mean diffusivity, fractional anisotropy, relative cerebral blood flow, fractional amplitude of low frequency BOLD fluctuations, and regional homogeneity of low frequency BOLD fluctuations. Coefficients of variation for each metric were computed across: repeated sessions for each subject (n=30), traveling human phantoms imaged at each site (n=2), and subjects at each site (n=35).

Results:
Coefficients of variation were found to be lowest within subjects over scanning sessions in all contrasts. In all regions of interest, except deep brain gray matter regions of interest in T2* weighted images and cerebrospinal fluid regions of interest in T2 FLAIR and mean diffusivity contrasts, the between-subject coefficient of variation was greater than the between-site coefficient of variation. In these regions of interest and contrast combinations, however, the considered signal is expected to be poor.

Conclusion:
Results of this study illustrate the stability of the larger-scale SRC study. Within-subject repeatability is very good, even over the span of 60 days, which will allow detailed consideration of the time course of SRC (or exposure) and recovery. Between-site stability was greater than subject-to-subject stability. Thus, the inter-site and inter-vendor study design, which enables large-scale recruitment of injured athletes, does not negatively impact the pooling of data across the sites.

Clinical Relevance/Application:
This establishes stability expected in multi-center neuroimaging studies with advanced imaging technology. Cross-site variability was less than cross-subject, and intra-subject repeatability was best.

Computed Tomography (CT) Overuse for Minor Head Injury (MHI) in Young Patients: Analysis of Contributing Factors

Monday, Nov. 27 3:10PM - 3:20PM Room: N230B
PURPOSE
To assess the amount of CT scan for MHI performed in young patients in our Emergency Department (ED), that are not indicated by National Institute for Health and Care Excellence (NICE) and Canadian CT Head Rule (CCHR) guidelines and to analyze factors that contribute to unnecessary examinations.

METHOD AND MATERIALS
We retrospectively evaluated head CT examinations performed for MHI in patients aged 18-45 years who presented to our ED from January 1 to June 30 2016. Medical records were assessed for the following parameters: demographics, cause of head trauma, referring physician’s seniority and specialty. For each CT scan, it was determined whether the CT referral met the NICE and CCHR criteria and was calculated the effective dose (ED) from the dose-length product.

RESULTS
A total of 492 CT examinations were collected; 260 (52.8%) and 376 (76.4%) examinations were not indicated according to the CCHR and NICE, respectively. There was no statistically significant difference between the specialty and seniority of the referring physician and over-referral (p=0.29, p=0.87, respectively, for CCHR; p=0.24, p=0.95, respectively, for NICE) and between patient’s age and unwarranted CT studies (p=0.81 for CCHR and p=0.79 for NICE). Motor vehicle accidents (as a passenger or driver) were associated with a higher rate of non-indicated CT examinations for both CCHR (p=0.018) and NICE (p=0.02), 2-wheel vehicle driver accidents were associated with a higher rate of appropriate CT exams for both CCHR and NICE (p<0.01). Only 15 CT scans were positive (brain hemorrhages, subarachnoid hemorrhage, skull fracture). In our study, CCHR and NICE had sensitivity and NPV of 100% for brain injury. Mean ED for head CT scan was 2.6±0.3 mSv. Analyzing our series of patients, we found a correlation between young age of patients (<25 years) and sports injuries (p=0.02) and between seizures and CT positive for brain injury (p=0.012).

CONCLUSION
We demonstrate an important overuse of CT examinations for MHI in young patients in our ED, with an excess of 52.2 and 76.4% according to the CCHR and NICE, respectively. The main contributing factor for over referral was injury mechanism.

CLINICAL RELEVANCE/APPLICATION
CT overuse cases unnecessary radiation exposure and health care burden. An analysis of the causes for overuse should be carried out in every ED to target specific intervention, as education of staff members and revision of the management protocols.

SSE19-03 Increased Cerebral Venous Oxygen Saturation in Mild Traumatic Brain Injury Patients Using Quantitative Susceptibility Mapping
Monday, Nov. 27 3:20PM - 3:30PM Room: N230B

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PURPOSE
To explore the relative changes of regional cerebral venous oxygen saturation (SvO2) using quantitative susceptibility mapping (QSM) in mild traumatic brain injury (mTBI) patients and correlation with elapsed time post trauma (ETPT) and post-concussion symptoms.

METHOD AND MATERIALS
32 mTBI patients and 32 age- and gender-matched healthy controls (HCs) were enrolled in this prospective study. The diagnosis of mTBI was made based on the definition of mTBI by the American Congress of Rehabilitation Medicine. No abnormal findings were found in the CT and MRI examination of mTBI patients. QSM reconstructed from original phase data of 3.0T susceptibility weighted imaging was used to measure the susceptibility of major cerebral veins and calculate the relative changes of cerebral SvO2. Spearman’s correlation analysis was performed to explore the correlation between ETPT, post-concussion symptoms and the susceptibility of major cerebral veins. The receiver operating characteristic curve (ROC) was performed for the diagnostic efficiency of susceptibility to discriminate mTBI patients from HCs.

RESULTS
The susceptibility of straight sinus in mTBI patients was 255.51±35.25 ppb, which was significantly lower than HCs (310.63±43.05 ppb).
ppb, \( P=0.000 \). The cerebral SvO2 of straight sinus in mTBI patients was increased 5.32%. The susceptibility of straight sinus in mTBI patients correlated with ETPT \((r=0.573, P=0.003)\). The best cut-off susceptibility for the discrimination between mTBI and HCs was 272.52 ppb with a sensitivity of 75.00% (95%CI:57-89), specificity 84.37% (95%CI:67-95), and AUC value 0.86 (95%CI:0.75-0.93). The susceptibility of straight sinus did not correlate with the Rivermead post-concussion symptoms questionnaire scores \((P>0.05)\).

CONCLUSION

The decreased susceptibility of straight sinus in mTBI patients indicated the increased cerebral SvO2, which returned back to normal level with ETPT. The susceptibility of straight sinus can be used to discriminate the mTBI patients from HCs.

CLINICAL RELEVANCE/APPLICATION

The susceptibility of straight sinus can be used to discriminate the mTBI patients from healthy controls. The susceptibility can be used to evaluate the condition of mTBI patients relative to ETPT.

**SSE19-04 Intra-Default Mode Network Connectivity Changes from a Single Season of Youth Football Distinguish Levels of Head Impact Exposure**

Monday, Nov. 27 3:30PM - 3:40PM Room: N230B

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**PURPOSE**

This purpose of this study is to determine whether intra-default mode network (DMN) connectivity changes occur from youth (ages 9-13) contact sports using a machine learning-based approach.

**METHOD AND MATERIALS**

In this IRB-approved study of youth football athletes, each player was instrumented with the HIT system to record head impact acceleration. The seasonal risk of concussion was calculated by converting each impact into a risk of concussion and summing to a value, the player's risk of concussion-weighted cumulative exposure (RWE). Players were dichotomized into highest and lowest 10% exposure groups (13/group). Players experiencing a concussion or with a history of concussion were excluded. 13 non-contact sport controls were used as a third group. A pre and post-season 6 minute rs-fMRI was performed in all players and controls at 3-month scan interval. The fMRI data was preprocessed for motion correction, spatial smoothing and normalization. Resting-state network (RSN) sub-components, including DMN sub-components, were extracted using a higher order (60 component) group independent-components analysis (ICA). 8 DMN sub-components were identified and back-reconstructed to form individual subject's DMN sub-components pre- and post-season. Connectivity was computed using Pearson's correlation between sub-component mean time courses. The post minus pre-season connectivity changes formed our features. Five machine learning classification algorithms were evaluated to predict whether a player was a non-contact, low, or high impact exposure player.

**RESULTS**

Ten-fold cross validation results demonstrated for a Linear SVM classifier accuracy (82%) discriminating high impact and control groups, moderate accuracy (70%) between control and low exposure players, and roughly chance classification accuracy (60%) between high and low impact. The results suggest an increasing functional change with increasing head impact exposure.

**CONCLUSION**

Our work suggests that RSN sub-components of can be extracted from rs-fMRI using ICA, analyzed with deep learning, and that the connectivities of the DMN sub-components are altered by repeated sub-concussive head impact exposure.

**CLINICAL RELEVANCE/APPLICATION**

This work demonstrates that playing a season of contact sports at the youth level, when brains are undergoing maturation, can produce neuroimaging brain changes, particularly for the DMN.

**SSE19-05 MEG Measured Default Mode Network is Altered by History of Concussion in High School Football**

Monday, Nov. 27 3:40PM - 3:50PM Room: N230B

Participants
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For information about this presentation, contact:
The purpose of this study is to determine if history of previous concussion modulates connectivity changes in the magnetoencephalography (MEG) measured default mode network (DMN).

METHOD AND MATERIALS
Twenty players from a high school football team (mean age=16.9; right handed) were included in this study. Eight minutes of eyes-open, resting-state MEG data were acquired for each subject using a 275 channel CTF whole-head system, pre- and post-season. Structural anatomic MRI was acquired for co-registration with MEG. Using Brainstorm, MEG data were pre-processed and filtered to 1-100Hz. Eye blinks, and muscle artifacts were removed using independent component analysis. MEG data were projected into standard source space using the whitened and depth-weighted linear L2-minimum norm estimates algorithm (wMNE). A mean time series was extracted from eight regions of interest (ROIs) representing the DMN: inferior parietal L&R, medial orbitofrontal L&R, posterior cingulate L&R, superior frontal L&R. The correlation between all ROIs was computed. Each correlation was converted to z-scores, the average DMN correlation was computed, and the difference between pre- and post-season correlation was computed. The subjects were divided into two groups: those with a history of concussion (N=5) and those without a history of concussion (N=15). A two sample t-test was performed to estimate the difference in mean DMN correlation between the two groups.

RESULTS
Subjects with a history of concussion had significantly lower DMN correlations from pre-season to post-season (p = 0.001). The subjects with previous concussions had a negative change in correlation whereas subjects without a history of concussion had, on average, a positive change. No significant differences were found in age, BMI, or head impact exposure between the two groups. One data point was excluded based on outlier analysis.

CONCLUSION
Changes in the MEG measured DMN, over a season of football, may be dependent on the subject’s history of concussion. fMRI literature has also demonstrated changes in the DMN are dependent on the history of concussion. Our previous work has shown that concussion history can modulate DMN connectivity changes associated with head impact exposure.

CLINICAL RELEVANCE/APPLICATION
MEG has shown promise as a sensitive modality for concussion diagnosis. Prior concussion history should be considered when performing analyses of MEG data involving repeated head impacts.

SSE19-06 Alteration of Brain Structure and Neural Function after Cervical Spinal Cord Injury

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PURPOSE
To explore the alterations of brain structural and functional after cervical spinal cord injury (CSCI) combined with voxel-based morphometry (VBM) and resting-state functional magnetic resonance imaging (fMRI), and to further study their associations with clinical variables.

METHOD AND MATERIALS
22 patients with traumatic CSCI and 22 age- and sex-matched healthy controls (HCs) were recruited. The CSCI was divided into acute (duration<1month;12 cases) and subacute-chronic (duration >1months;10 cases) group based on the injury duration. The 3D-T1WI and resting-state fMRI of all subjects were obtained using a 3.0 Tesla MRI system. VBM analysis was carried out to investigate the differences in GMV between patients with CSCI and HCs. Region of interest (ROI) based functional connectivity (FC) analysis was performed to study changes in the whole brain using the results of VBM as seed regions. Disease duration and American Spinal Injury Association (ASIA) Scale scores were also obtained from each patient. Associations between structural and functional changes and clinical variables were also analyzed. Using the general linear model in SPM, a voxel-wise two-sample t-test was used to compare the GMV differences between the CSCI group and the HC group, and between subgroups. Partial correlation analysis was performed to explore any potential association between structural and functional changes and clinical variables in patients with CSCI.

RESULTS
Compared with HCs, patients with CSCI showed significant gray matter volume (GMV) decrease in the right anterior insular cortex, right dorsal anterior cingulate cortex (dACC), bilateral orbital frontal cortex (OFC), and left Lingual gyrus(Fig.A). No significant difference in GMV in these areas was found between the acute and subacute-chronic sub-group. Furthermore, SCI patients showed decreased FC in left primary sensorimotor cortex (Fig.B) and this decreased FC negatively correlated with the VAS score (Fig.C).

CONCLUSION
Our study indicate that CSCI can cause dramatically atrophy of GMV in the core hubs of Salience Network and network-level functional alterations in the sensorimotor cortical regions, and the decreased FC within the left primary sensorimotor cortex negatively related to VAS score.

CLINICAL RELEVANCE/APPLICATION
These findings may provide new insights into the structural and functional plasticity of brain after CSCI.
SPSI22A Integrating Structural and Functional Biomarkers in Dementia Imaging

Participants
Tammie S. Benzinger, MD, PhD, Saint Louis, MO (Presenter) Research Grant, Eli Lilly and Company; Investigator, Eli Lilly and Company; Investigator, F. Hoffmann-La Roche Ltd;

SPSI22B The IDEAS Study: Goals and Update

Participants
Barry A. Siegel, MD, Saint Louis, MO (Presenter) Advisory Board, Blue Earth Diagnostics Ltd; Advisory Board, General Electric Company; Spouse, Speaker, Siemens AG

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LEARNING OBJECTIVES
1) Identify appropriate and inappropriate uses of amyloid PET in clinical practice. 2) Recognize the design and goals of the IDEAS Study as a coverage with evidence development program underway to address the utility of amyloid PET in clinical populations. 3) Appreciate the impact of amyloid PET on patient management based on early results of the IDEAS Study.

SPSI22C Role of Imaging in Clinical Evaluation and Management of Dementia

Participants
Jeffrey R. Petrella, MD, Durham, NC (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Envision the evolving role of MR and PET imaging in the personalized care of patients with dementia and those at risk.

SPSI22D Imaging Research in Dementia—The Foreseeable Near Future

Participants
Satoshi Minoshima, MD, PhD, Salt Lake City, UT (Presenter) Research Consultant, Hamamatsu Photonics KK; Research Grant, Hitachi, Ltd; Research Grant, Nihon Medi-Physics Co, Ltd;

SPSI22E Panel Discussion: Translation of Imaging Research to Clinical Care in Dementia
**LEARNING OBJECTIVES**

1) Expose the audience to head and neck radiation therapy contouring. 2) Describe the concepts of CTV, GTV and PTV. 3) Demonstrate the complementary nature of different imaging techniques for tumor contouring.

**ABSTRACT**

The goal of this session is to expose the audience to head and neck radiation therapy contouring. The session will introduce the audience to concepts such as CTV, GTV and PTV. We will also demonstrate the important complementary nature of different imaging techniques for tumor contouring.

**Participants**

Suresh K. Mukherji, MD, Northville, MI (Presenter) Nothing to Disclose

Sung Kim, MD, New Brunswick, NJ (Presenter) Nothing to Disclose

Allen M. Chen, MD, Kansas City, KS (Presenter) Nothing to Disclose
SPDL30

Keeping Radiology Weird: Spot Diagnoses from the Pacific Northwest (Case-based Competition)

Tuesday, Nov. 28 7:15AM - 8:15AM Room: E451B

Participants
Fergus V. Coakley, MD, Portland, OR (Moderator) Founder, OmnEcoil Instruments, Inc; Shareholder, OmnEcoil Instruments, Inc
Bryan R. Foster, MD, Portland, OR (Presenter) Nothing to Disclose
Cristina Fuss, MD, Portland, OR (Presenter) Nothing to Disclose
David R. Pettersson, MD, Portland, OR (Presenter) Nothing to Disclose

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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.
RC305

Neuroradiology Series: Stroke
Tuesday, Nov. 28 8:30AM - 12:00PM Room: N228

ARRT Category A+ Credits: 4.00
AMA PRA Category 1 Credit: 3.25

Participants
Howard A. Rowley, MD, Madison, WI (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; Jeffrey L. Sunshine, MD, PhD, Pepper Pike, OH (Moderator) Research support, Siemens AG; Travel support, Siemens AG; Travel support, General Electric Company; Travel support, Sectra AB; Travel support, Allscripts Healthcare Solutions, Inc; Travel support, Impiviva, Inc; Travel support, KLAS Enterprises LLC

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LEARNING OBJECTIVES
1) To review latest developments and directions in stroke imaging and intervention relevant to practice.

Sub-Events

RC305-01 Imaging for Stroke Triage: What I Look For and What I Wish I Had
Tuesday, Nov. 28 8:30AM - 9:00AM Room: N228

Participants
Gregory W. Albers, MD, Palo Alto, CA (Presenter) Stockholder, iSchemaView, Inc; Consultant, iSchemaView, Inc; Consultant, Medtronic plc

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LEARNING OBJECTIVES
1) Understand the role of advanced imaging for patient selection in recent endovascular stroke trials. 2) Understand the rationale for obtaining data on both cerebral hemodynamics, collateral circulation and vascular anatomy with a single contrast injection. 3) Know the pros and cons of obtaining initial brain imaging data on stroke patients in the angiography suite.

RC305-02 Prediction of IV Thrombolysis Effect Using CT Perfusion-Post-Processed Detection of Vessel Occlusions
Tuesday, Nov. 28 9:00AM - 9:10AM Room: N228

Participants
Wolfgang G. Kunz, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Matthias P. Fabritius, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Lukas Havla, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Pierre Scheffler, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Maximilian F. Reiser, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Julia M. Thierfelder, MD,MSc, Munich, Germany (Abstract Co-Author) Nothing to Disclose
Wieland H. Sommer, MD, Munich, Germany (Presenter) Founder, Smart Reporting GmbH

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PURPOSE
To determine the predictive value of CTA-occult vessel occlusions detected using CT perfusion-post-processed wavelet-transformed angiography (waveletCTA) on the morphologic and functional outcome after IV thrombolysis (IVT) in acute ischemic stroke.

METHOD AND MATERIALS
Patients were selected from a cohort of 1,851 consecutive patients who had undergone multiparametric CT including whole-brain CT perfusion. Inclusion criteria were: (1) significant cerebral blood flow (CBF) deficit, (2) no evidence of occlusion on standard CTA, and (3) follow-up-confirmed infarction. waveletCTA defines angiographic signal by best fitting of time-attenuation curves to a generic contrast bolus curve in each voxel, and was analyzed by two blinded readers with respect to vessel occlusions. Morphologic outcome was defined as relative infarction growth using the ratio [final infarction volume] / [initial CBF deficit volume], of which
smaller values were considered favorable. Significant functional improvement was defined as a decrease in modified Rankin Scale score from admission to discharge (ΔmRS) of $>=1$ or a decrease of National Institutes of Health Stroke Scale score from admission to 24 hours (ΔNIHSS) of $>=3$. Linear and logistic regression analyses were performed to identify independent associations between predictors and outcomes.

**RESULTS**
Among all included patients ($N=107$) with unremarkable standard CTA, 58 (54%) showed an occlusion on waveletCTA. There was no significant difference between patients receiving IVT ($n=57$) vs. patients receiving only supportive care (SC, $n=50$) regarding age, sex, time from symptom onset, early infarction signs, perfusion mismatch, waveletCTA-detected occlusions or NIHSS on admission (all with $p>0.05$). In patients treated with IVT, regression analyses showed that the presence of a waveletCTA-detected occlusion was an independent predictor of a favorable morphologic ($\beta=-1.044$, $p=0.001$) and functional outcome ($\Delta mRS$: OR=7.868, $p=0.041$; ΔNIHSS: OR=9.810, $p=0.013$), while it failed to predict outcome in patients who received SC (all with $p>0.05$).

**CONCLUSION**
The presence of CTA-occult vessel occlusions detected using waveletCTA independently predicts a higher effectiveness of IVT in stroke.

**CLINICAL RELEVANCE/APPLICATION**
waveletCTA has the potential to contribute to decision making in acute ischemic stroke, as CTA-occult occlusions that are detected with this technique predict a better response to IVT.

**PURPOSE**
Stroke mimics (SM) constitute 5%-30% of clinically diagnosed strokes. CT perfusion (CTP) is the standard assessment in stroke diagnostics to rule out hemorrhage, a potential contraindication for thrombolysis, but fails to identify SM. Our aim was therefore to evaluate the diagnostic value and characteristics of seizure related perfusion alterations with CTP in the differential diagnosis of ictal or postictal state in acute neurological deterioration.

**METHOD AND MATERIALS**
We identified 37 patients over a 22-month period presented to our stroke center with acute stroke-like symptoms and a multimodal CT examination. Patients were included who underwent electroencephalography (EEG) within 5 days of symptom onset and had seizure as final diagnosis. Analysis of the perfusion maps was performed and was correlated with clinical symptoms and EEG.

**RESULTS**
The most common perfusion abnormality, seen in 22/37 (59.5%) patients, was regional hyperperfusion in a cortical ribbon pattern. 15 (40.5%) patients showed a hypoperfusion pattern with prolonged MTT/ Tmax with a regional or holo-hemispheric distribution and a decrease in CBF and CBV, contrary to the known increase of CBV in the ischemic penumbra by reactive collateral flow. Involvement of thalamus and hippocampus was associated with hyperperfusion and also with epileptiform EEG. Patients with hyperperfusion showed postictal MRI-changes (11/16). The two groups did not differ in clinical presentation, but hospital stay was longer in patients with hyperperfusion and they had a worse clinical outcome.

**CONCLUSION**
Our study results emphasize the benefit of an advanced CT stroke-protocol to identify SM, additional to the well-established mismatch-concept.

**CLINICAL RELEVANCE/APPLICATION**
CT perfusion appears attractive as diagnostic tool to identify stroke mimics and differentiate these from acute stroke and in further consequence lead to a more appropriate treatment.

**PURPOSE**
Brain computed tomography using iterative reconstruction to diagnose acute ischemic stroke: usefulness in combination with optimized window setting and thin-slice reconstruction

**METHOD AND MATERIALS**
Participants
Taihei Inoue, MD, Kumamoto, Japan (Presenter) Nothing to Disclose
Takeshi Nakaura, MD, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose
Morikatsu Yoshida, Amakusa, Japan (Abstract Co-Author) Nothing to Disclose
Koichi Yokoyama, Amakusa, Japan (Abstract Co-Author) Nothing to Disclose
Hiroyuki Uetani, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose
Seitaro Oda, MD, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose
Daisuke Utsunomiya, MD, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose
Mika Kitajima, MD, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose
Kazunori Harada, Amakusa, Japan (Abstract Co-Author) Nothing to Disclose
Yasuyuki Yamashita, MD, Kumamoto, Japan (Abstract Co-Author) Consultant, DAIICHI SANKYO Group

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 PURPOSE
The purpose of this study was to determine whether iterative model reconstruction (IMR) specialized for brain computed tomography (CT) with a combination of thin-slice images and narrow window settings would improve the detection of acute stroke.

 METHOD AND MATERIALS
This retrospective study was approved by our institutional review board; patient informed consent was waived. We retrospectively enrolled 27 patients with acute middle cerebral artery (MCA) stroke and 27 non-stroke patients matched for age and gender with individual stroke patients (control). Using images reconstructed using 1- and 5-mm-thick images with filtered back projection (FBP) and 1-mm-thick images with IMR, we compared the CT numbers in infarcted areas, image noise in the temporal pole, and contrast-to-noise ratios (CNRs) of infarcted and noninfarcted areas. To analyze the performance of acute MCA stroke detection, we used receiver-operating characteristic (ROC) curve techniques and compared 5 mm FBP with standard window settings, 1 mm FBP with narrow window settings, and 1 mm IMR with narrow window settings.

RESULTS
The image noise was significantly lower with 1 mm IMR [3.7 Hounsfield units (HU) ± 1.1] than with 5 mm (4.7 HU ± 0.6) and 1 mm (9.3 HU ± 1.5) FBP (p < 0.001), and CNR with 1 mm IMR (1.1 ± 1.0) was significantly higher than that with 5 mm (0.8 ± 0.7) and 1 mm (0.4 ± 0.4) FBP (p < 0.001). Furthermore, the average area under the ROC curve was significantly higher with 1 mm IMR with narrow window settings [0.90; 95% confidence interval (CI): 0.86,0.94] than with 5 mm FBP with standard window settings (0.78; 95% CI: 0.72,0.83).

CONCLUSION
The combination of thin-slice images and narrow window settings under IMR provides better diagnostic performance than the conventional reconstruction methods for acute MCA stroke detection.

CLINICAL RELEVANCE/APPLICATION
Combination of iterative model reconstruction and narrow window settings can improve the detectability of acute middle cerebral artery stroke.
**Imaging for Stroke Prevention: The Next Frontier**

**Tuesday, Nov. 28 9:40AM - 10:10AM Room: N228**

Participants

Ajay Gupta, MD, New York, NY (Presenter) Nothing to Disclose

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**LEARNING OBJECTIVES**

1) Identify imaging strategies that can be implemented into clinical practice to aid in primary stroke prevention efforts including imaging of high-risk plaque, silent ischemic brain disease, and impaired cerebral hemodynamics; and 2) Identify imaging strategies that can be implemented into clinical practice to aid in secondary stroke prevention efforts, including identification of potential culprit atherosclerotic lesions in patients with cryptogenic strokes.

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**Intracranial Vessel Wall Imaging**

**Tuesday, Nov. 28 10:20AM - 10:50AM Room: N228**

Participants

Mahmud Mossa-Basha, MD, Seattle, WA (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) To understand intracranial vessel wall MRI techniques and their advantages/disadvantages. 2) To understand why better diagnostic tools for intracranial vasculopathy assessment are necessary. 3) To understand the benefits of intracranial vessel wall MRI in disease differentiation. 4) To understand scenarios in which vessel wall MRI may be beneficial for diagnosis and management.

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**Lesion Evolution in Stroke and Ischemia on Neuroimaging (LESION) Study: The Probability of Ischemic Stroke Therapeutic Targets Across Time**

**Tuesday, Nov. 28 10:50AM - 11:00AM Room: N228**

Participants

Adrienne N. Dula, PhD, Austin, TX (Presenter) Nothing to Disclose

Marie L. Luby, PhD, Bethesda, MD (Abstract Co-Author) Nothing to Disclose

Ben T. King, Austin, TX (Abstract Co-Author) Nothing to Disclose

Lisa A. Davis, Austin, TX (Abstract Co-Author) Nothing to Disclose

Jose G. Merino, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

Amie W. Hsia, MD, Washington, DC (Abstract Co-Author) Nothing to Disclose

Lawrence L. Latour, PhD, Bethesda, MD (Abstract Co-Author) Nothing to Disclose

Steven Warach, MD, PhD, Austin, TX (Abstract Co-Author) Nothing to Disclose

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**PURPOSE**

To quantify the relation of time from ischemic stroke onset to the probability of detection of therapeutic targets on imaging.

**METHOD AND MATERIALS**

A consecutive series of 7,007 patients were screened at two regional stroke centers over a ten-year period with 1,092 patients meeting criteria. Untreated patients with confirmed acute ischemic cerebrovascular syndrome with an evaluable MRI obtained within 24 hours from last known well and a NIHSS > 3 or in patients treated with an acute intervention with an MRI obtained prior to any intervention were included. Potential therapeutic targets were identified on MRI including vascular occlusion on MRA (ARTERY), ICA or M1 occlusion (ENDOVASCULAR), M1 or M2 occlusion (MCAO), hypoperfusion on perfusion MRI (PERFUSION), and perfusion-diffusion mismatch (MISMATCH). Logistic regression models defined the probability of each therapeutic target related to time from onset.

**RESULTS**

The probability of detection of therapeutic targets: ARTERY and ENDOVASCULAR (p < 0.01), MCAO, PERFUSION, MISMATCH (p < 0.001), decreased over time. Higher admit NIHSS increased the probability of target detection by approximately 5% per NIHSS point. At 24 hours from onset, 20% of patients still had a therapeutic target. At 24-hours, MISMATCH was observed in 76% of patients with MCA occlusion and ENDOVASCULAR in 77%. At least one therapeutic target was identified in 78.7% of patients prior to 4.5 hours, 79.2% up to 6 hours and 71.7% from 6 to 24 hours. In a multiple logistic regression model the probability of detection of MISMATCH was best fit by time from onset, NIHSS, MCAO, and the interaction of NIHSS MCAO.

**CONCLUSION**

Imaging therapeutic targets were found in a substantial proportion of patients (67%) beyond proven time windows for thrombolysis or endovascular therapy, and this proportion can be estimated by a logistic regression model based on time from onset and NIHSS thresholds. These results support the rationale for reperfusion trials beyond proven time windows.

**CLINICAL RELEVANCE/APPLICATION**

Treatment for acute stroke is limited to patients presenting within a specific time window. We found 38% of patients maintain a therapeutic target well past the times specified in current guidelines.

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**Patient Outcomes After Endovascular Vasospasm Treatment of Delayed Cerebral Ischemia Following Aneurysmal Subarachnoid Hemorrhage: A 10-Year Experience at a Neurovascular Referral Center**
**PURPOSE**

Cerebral arterial vasospasm and delayed cerebral ischemia (DCI) following aneurysmal subarachnoid hemorrhage (aSAH) accounts for up to 50% of the morbidity and mortality in these patients. Endovascular vasospasm treatment in patients with DCI with intra-arterial (IA) vasodilator infusion or cerebral angioplasty is often performed to increase cerebral perfusion, although the effectiveness of these treatments has not been conclusively demonstrated. We determined patient outcomes and mortality following endovascular treatment of vasospasm and DCI over a 10-year period at our neurovascular referral center.

**METHOD AND MATERIALS**

We performed a retrospective cohort study of all patients who underwent endovascular vasospasm treatment following aSAH from 2006 to 2016. Primary outcome was good clinical outcome at 3-6 months (modified Rankin Scale [mRS] of <= 2). Secondary outcomes were mortality at discharge and at 3-6 months.

**RESULTS**

175 patients who developed DCI (121 female, 54 males; p=0.0001) with a mean age of 51 years, mean Hunt and Hess Scale score 3, and mean Fisher Grade 3 were included. The ruptured aneurysm was treated by endovascular coiling in 86 patients (49%) and surgical clipping in 89 patients (51%). Endovascular treatment for angiographic vasospasm in the context of DCI consisted of IA nicardipine infusion in 103 patients (59%) or a combination of IA nicardipine and balloon angioplasty in 72 patients (41%). 91 (58%) and 109 (69%) patients had follow-up at 3-6 months for the mRS and mortality data, respectively. 65 patients (71%) had a mRS <= 2 at 3-6 months. 18 patients (10%) died before discharge, and one additional patient (1%) died at 6 months.

**CONCLUSION**

Endovascular vasospasm treatment of DCI results in a good clinical outcome at 3-6 months and low mortality rates.

**CLINICAL RELEVANCE/APPLICATION**

Endovascular vasospasm treatment may reduce morbidity and mortality following aSAH. Additional studies are needed to define the most optimal endovascular management of DCI.

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**Awards**

**Student Travel Stipend Award**

**Participants**

Vivek P. Patel, MD, PhD, Stanford, CA (Presenter) Nothing to Disclose

Michael A. Marks, MD, Stanford, CA (Abstract Co-Author) Consultant, Medtronic plc Stockholder, Likemark Medical, Inc Research Grant, Siemens AG

Huy M. Do, MD, Stanford, CA (Abstract Co-Author) Nothing to Disclose

Robert Dodd, MD, PhD, Stanford, CA (Abstract Co-Author) Nothing to Disclose

Gary K. Steinberg, MD, PhD, Stanford, CA (Abstract Co-Author) Nothing to Disclose

Jeremy J. Heit, MD, PhD, Stanford, CA (Abstract Co-Author) Consultant, Terumo Corporation

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**PURPOSE**

Virtual Non-Contrast Images Enable Better Delineation of Acute Infarction After Mechanical Thrombectomy Using a Dual-Layer Detector Spectral CT

**Participants**

Isabelle Riederer, MD, Munich, Germany (Presenter) Nothing to Disclose

Alexander A. Fingerle, MD, Munchen, Germany (Abstract Co-Author) Nothing to Disclose

Jan S. Kirschke, MD, Muenchen, Germany (Abstract Co-Author) Speakers Bureau, Philips Healthcare

Peter B. Noel, PhD, Munich, Germany (Abstract Co-Author) Nothing to Disclose

Daniela Muenzel, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose

Julia Dangelmaier, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose

Martin Renz, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose

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**PURPOSE**

To evaluate the potential of the dual-layer detector spectral CT for the detection of acute ischemic lesions in the brain after mechanical thrombectomy by comparing virtual non-contrast with conventional images.

**METHOD AND MATERIALS**

Unenhanced head spectral-CT was performed in twenty-five patients 13 +/- 6 h after mechanical thrombectomy using a dual-layer detector spectral CT (IQon spectral CT, Philips Healthcare, USA). Virtual non-contrast (VNC) and conventional (CO) images were reconstructed using a dedicated software. As gold standard, Magnetic Resonance Imaging (MRI), acquired during the follow-up procedure (2 +/- 2 d), was utilized. Region of interest (ROI) analysis was performed in the center of the acute infarction and the corresponding contralateral healthy tissue and contrast-to-noise ratio (CNR) was calculated. The volume of the ischemic area was measured in VNC, CO and MRI in a random order.

**RESULTS**

Developing ischemic lesions appear more hypodense in VNC compared to CO (18.2 +/- 3.6 HU versus 26.5 +/- 4.4 HU). CNR is significantly higher in VNC compared to CO (3.1 +/- 1.5 versus 1.1 +/- 1.1, p < 0.0005). The mean ischemic lesion volume was higher in VNC compared to CO (27 +/- 51 cm³ versus 21 +/- 49 cm³, 72% versus 55% of the infarct volume measured in MRI; p < 0.05).
CONCLUSION

Developing ischemic lesions appear more hypodense in VNC compared to CO with significantly higher CNR and better delineation of infarct volume.

CLINICAL RELEVANCE/APPLICATION

Dual-layer detector spectral CT improves diagnostic image quality for the detection of developing ischemic lesions after mechanical thrombectomy compared to conventional CT.

RC305-11  Can Dual-Energy CT of the Brain Performed After Mechanical Thrombectomy for Acute Ischemic Stroke Predict Hemorrhagic Complications?

Tuesday, Nov. 28 11:20AM - 11:30AM Room: N228

Participants
Matteo Bonatti, MD, Bolzano, Italy (Presenter) Nothing to Disclose
Fabio Lombardo, MD, Bolzano, Italy (Abstract Co-Author) Nothing to Disclose
Giulia A. Zamboni, MD, Verona, Italy (Abstract Co-Author) Nothing to Disclose
Bruno Bonetti, Bolzano, Italy (Abstract Co-Author) Nothing to Disclose
Roberto Curro Dossi, Bolzano, Italy (Abstract Co-Author) Nothing to Disclose
Fabio Vittadello, Padua, Italy (Abstract Co-Author) Nothing to Disclose
Giampietro Bonatti, Bolzano, Italy (Abstract Co-Author) Nothing to Disclose

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PURPOSE

To assess the capability of Dual-Energy CT (DECT) of the brain performed immediately after mechanical thrombectomy to predict immediate and belated hemorrhagic complications.

METHOD AND MATERIALS

IRB-approved retrospective study, need for informed consent was waived. We included 85 consecutive patients who underwent brain DECT immediately after mechanical thrombectomy for acute ischemic stroke between August 2013 and January 2017. Two radiologists independently evaluated DECT images for the presence of parenchymal hyperdensity, iodine extravasation and hemorrhage. Maximum iodine concentration was measured using commercially available software. Follow-up CT examinations performed until patients’ discharge were reviewed for intracranial hemorrhage (ICH) presence. Correlation between DECT parameters and ICH development was analyzed by Mann-Whitney U test and Fisher exact test. ROC curves were generated for continuous variables.

RESULTS

Fourteen out of 85 patients (16.5%) developed ICH (7/14 within 24 hours and 7/14 during the following days). On post-operative DECT, parenchymal hyperdensities and iodine extravasation were present in 100% of the patients who developed ICH and in 56.3% of the patients who did not (P=0.002); signs of bleeding were present in 35.7% of the patients who later developed ICH and in 0% of the patients who did not (P<0.001). Maximum iodine concentration was 2.6 mg/ml in the patients who developed ICH and 1.4 mg/ml in the patients who did not (P<0.001). Maximum iodine concentration showed an AUC of 0.89 for identifying patients developing ICH.

CONCLUSION

Presence of parenchymal hyperdensity with maximum iodine concentration >1.35 mg/ml identifies patients developing ICH with 100% sensitivity and 67.6% specificity.

CLINICAL RELEVANCE/APPLICATION

The identification of patients with high hemorrhagic risk after mechanical thrombectomy enables to better tailor their medical treatment in order to minimize bleedings and to improve their outcome.

RC30512  What’s in Store for Stroke in the Next 10 Years?

Tuesday, Nov. 28 11:30AM - 12:00PM Room: N228

Participants
Colin P. Derdeyn, MD, Saint Louis, MO (Presenter) Stock options, Pulse Therapeutics, Inc.;

LEARNING OBJECTIVES

1) Recognize the importance of multidisciplinary performance improvement efforts in driving key metrics for stroke care. 2) Identify the major emerging new stroke diagnosis and treatment tools and approaches. 3) Recognize the driving force for all these efforts is to achieve revascularization as fast as possible.
**RC306**

**Bread and Butter Sinus Imaging: Telling Your Referrers What They Need to Know**

Tuesday, Nov. 28 8:30AM - 10:00AM Room: E451B

**AMA PRA Category 1 Credit**: 1.50

**ARRT Category A+ Credit**: 1.75

**LEARNING OBJECTIVES**

1) Discuss the anatomy of the sinonasal cavities and drainage pathways using multiplanar imaging.  
2) Recognize important anatomic variants that may predispose a patient to chronic inflammatory disease or complications during endoscopic sinus surgery (ESS).  
3) Discuss the role of imaging in treatment planning of chronic sinus inflammatory disease with ESS.

**RC306A  Sinonasal Anatomy and Important Variants for Endoscopic Sinus Surgery (ESS)**

Participants
Michelle A. Michel, MD, Milwaukee, WI (Presenter) Nothing to Disclose

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**RC306B  Rhinosinusitis with Attention to Red Flags and Complications**

Participants
Ashley H. Aiken, MD, Atlanta, GA (Presenter) Nothing to Disclose

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**RC306C  Recognizing and Reporting Sinonasal Tumors**

Participants
Christine M. Glastonbury, MBBS, San Francisco, CA (Presenter) Author with royalties, Reed Elsevier

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**LEARNING OBJECTIVES**

1) Recognize key features that suggest a lesion is a sinonasal malignancy and be aware of the important imaging mimics.  
2) Learn the common patterns of sinonasal tumor dissemination.  
3) Understand the most important imaging features to describe when staging a sinonasal tumor.

**ABSTRACT**

PRESENTATION KEY CONCEPTS: It is critical that on routine non-contrast sinus CT scans radiologists identify findings that suggest malignant or potentially malignant disease. Once this is recognized then additional findings can be sought so that the patient is correctly managed, biopsy can be obtained and treatment is not delayed. Even on non-contrast CT scans it is possible to evaluate for orbital and intracranial invasion and the retropharyngeal and often level 2 nodes can be commented on. There are many different sinonasal malignancies and while there are some features which may suggest the likely pathological diagnosis, the role of the radiologist is more for recognizing malignancy, staging the tumor with CT/MR and describing features which may make surgery more hazardous or unwarranted. REFERENCES: 1. Kraus DH, Lydiatt WM, Patel SG, O'Sullivan B, Ghossein RA, Mukherji SK, Shah JP.
Case-based Review of Nuclear Medicine: PET/CT Workshop-Neuro-PET/CT (In Conjunction with SNMMI) (An Interactive Session)

Tuesday, Nov. 28 10:30AM - 12:00PM Room: S406A

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Katherine A. Zukotynski, MD, Hamilton, ON (Director) Nothing to Disclose
Samuel E. Almodovar-Reteguis, MD, Orlando, FL (Director) Nothing to Disclose
Katherine A. Zukotynski, MD, Hamilton, ON (Moderator) Nothing to Disclose

LEARNING OBJECTIVES
1) Apply basic anatomic, pathologic, and physiologic principles to the interpretation of PET/CT with emphasis on neurodegenerative disease and head and neck cancer. 2) Identify blind spots that can influence interpretation of these PET/CT studies. 3) Analyze factors that can improve image quality while minimizing patient risk.

Sub-Events

MSCC32A  Neurodegenerative Disease

Participants
Phillip Kuo, MD, PhD, Tucson, AZ (Presenter) Author, MD Training at Home; Research Grant, Astellas Group; Consultant, Endocyte, Inc; Consultant, General Electric Company; Education Grant, General Electric Company; Speakers bureau, Eli Lilly and Company; Consultant, inviCRO, LLC; Consultant, Imaging Endpoints; Consultant, Progenics Pharmaceuticals, Inc;

LEARNING OBJECTIVES
View Learning Objectives under Main Course Title

MSCC32B  Head and Neck Cancer

Participants
Gagandeep Choudhary, MD, MBBS, Birmingham, AL (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View Learning Objectives under Main Course Title
Neuroradiology (Molecular Neuroimaging: From Diffusion to Beyond)

Tuesday, Nov. 28 10:30AM - 12:00PM Room: N229

Participants
Rajan Jain, MD, Hartsdale, NY (Moderator) Consultant, Cancer Panels; Royalties, Thieme Medical Publishers, Inc
Edward P. Quigley, MD, salt lake city, UT (Moderator) Nothing to Disclose

SSG11-01  MR-NODDI Evaluating Amyotrophic Lateral Sclerosis: A Tract Based Spatial Statistics Analysis

Tuesday, Nov. 28 10:30AM - 10:40AM Room: N229

Participants
Rifeng Jiang, Fuzhou, China (Presenter) Nothing to Disclose
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PURPOSE
Amyotrophic lateral sclerosis (ALS) is an incredibly lethal disease and resistant to therapy. Symptoms of ALS can be similar to those of a wide variety of other, more treatable diseases or disorders. The aim of this study is to use neurite orientation dispersion and density imaging (NODDI), a novel tool, to quantify changes of white matter (WM) skeleton in patients with ALS compared to healthy controls.

METHOD AND MATERIALS
Two shells of diffusion-weighted magnetic resonance images (shell 1: b=1000s/mm², direction=25; shell 2: b=2500s/mm², direction=25) were acquired from 12 patients with ALS and 12 age- and sex-matched healthy controls. FMRIB's Linear Image Registration Tool was used to register all diffusion-weighted volumes to their corresponding b = 0 s/mm² volume, and to correct for motion and eddy currents. The Brain Extraction Tool was used to remove non-brain tissue, FSL's DTIFIT was used to calculate FA, and NODDI toolbox was used to calculate the intra-neurite volume fraction (Ficvf) and orientation dispersion index (ODI). FSL's Tract-Based Spatial Statistics (TBSS) tool was used to align individual FA maps to FSL's standard adult FA template. Following registration, the FA maps of all subjects were thinned to create white matter skeletons. Then, Ficvf and ODI maps were created and registered using the TBSS registrations of FA to the adult FA template, and the skeleton mask was applied to the registered images. The white matter skeletons differences in FA, Ficvf and ODI were compared between ALS patients and healthy controls.

RESULTS
In the TBSS analysis, significant FA reductions were demonstrated within the (pre)frontal WM, partial parietal WM, corpus callosum and partial corticospinal tract (with TFCE-correction). Similarly, significant Ficvf reductions were found within almost all the WM skeleton (with TFCE-correction), which was more extensive than that of FA. In contrast, ODI showed no significant changes in all the WM skeleton.

CONCLUSION
NODDI is a more potential tool to demonstrating the neurite density reductions for ALS patients. Significant Ficvf reductions can be observed within almost all the WM skeleton, which indicates the reductions of the neurite density in the corresponding WM. Ficvf found more extensive changes than FA, indicating Ficvf is a more sensitive parameter.

CLINICAL RELEVANCE/APPLICATION
NODDI will help lead to earlier diagnosis and treatment for ALS.

SSG11-02  Histogram Analysis of Diffusion Kurtosis Imaging of Nasopharyngeal Carcinoma: Correlation between Quantitative Parameters and Clinical Stage

Tuesday, Nov. 28 10:40AM - 10:50AM Room: N229

Participants
Xiao_quan Xu, Nanjing, China (Presenter) Nothing to Disclose

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**PURPOSE**

To evaluate the correlation between histogram parameters derived from diffusion-kurtosis (DK) imaging and the clinical stage of nasopharyngeal carcinoma (NPC).

**METHOD AND MATERIALS**

DK imaging data of forty-seven consecutive NPC patients were retrospectively analyzed. Apparent diffusion for Gaussian distribution (Dapp) and apparent kurtosis coefficient (Kapp) were generated using diffusion-kurtosis model. Histogram parameters, including mean, median, 10th, 90th percentiles, skewness and kurtosis of Dapp and Kapp were calculated. Patients were divided into low and high T, N and clinical stage based on American Joint Committee on Cancer (AJCC) staging system. Differences of histogram parameters between low and high T, N and AJCC stages were compared using t test. Multiple receiver operating characteristic (ROC) curves were used to determine and compare the value of significant parameters in predicting high T, N and AJCC stage, respectively.

**RESULTS**

High T-stage (T3/4) NPC showed significantly higher Kapp-mean (P=0.018), Kapp-median (P=0.029) and Kapp-90th (P=0.003) than low T-stage (T1/2) NPC. High N-stage NPC (N2/3) showed significantly lower Dapp-mean (P=0.002), Dapp-median (P=0.002) and Dapp-10th (P<0.001) than low N-stage NPC (N0/1). High AJCC-stage NPC (III/IV) showed significantly lower Dapp-10th (P=0.038) than low AJCC-stage NPC (I/II). ROC analyses indicated that Kapp-90th was optimal for predicting high T-stage (AUC, 0.759; sensitivity, 0.842; specificity, 0.607), while Dapp-10th was best for predicting high N- and AJCC-stage (N-stage, AUC, 0.841; sensitivity, 0.875; specificity, 0.807; AJCC-stage, AUC, 0.671; sensitivity, 0.800; specificity, 0.588).

**CONCLUSION**

DK imaging-derived parameters correlated well with clinical stage of NPC, therefore could serve as an adjunctive imaging technique for evaluating NPC.

**CLINICAL RELEVANCE/APPLICATION**

DK imaging-derived histogram parameters were useful for characterizing NPC, and correlated well with the clinical stage of the NPC patients. Dapp-10th was optimal for predicting the high N- and AJCC-stage, while Kapp-90th was most powerful for predicting the high T-stage. Our results suggested that DK imaging-derived parameters could be a potential imaging marker for pretreatment staging, and DK imaging could be a useful adjunctive imaging technique for evaluating NPC before treatment.

**SSG11-03 Cerebral Sodium (23Na) Magnetic Resonance Imaging in Patients with Migraine vs Healthy Controls**

**Tuesday, Nov. 28 10:50AM - 11:00AM Room: N229**

Participants
Melissa Ong, MD, Mannheim, Germany (Presenter) Nothing to Disclose
Alexander Schmidt, Mannheim, Germany (Abstract Co-Author) Nothing to Disclose
Justus Bennath, Mannheim, Germany (Abstract Co-Author) Nothing to Disclose
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Stefan O. Schoenberg, MD, PhD, Mannheim, Germany (Abstract Co-Author) Institutional research agreement, Siemens AG
Stefan Haneder, MD, Cologne, Germany (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Evaluation of 23Na concentrations in patients with clinically manifest migraine vs. healthy controls.

**METHOD AND MATERIALS**

In this prospective, IRB-approved study we recruited 12 patients (all female; mean age 34±11 years) who have been clinically evaluated for migraine and who have filled out a questionnaire regarding onset of disease, length, intensity (scale 1-10) and frequency of attacks and accompanying aura, as well as 12 healthy controls (all female; mean age 34±11 years). Both groups underwent a cerebral 23Na-magnetic resonance imaging examination at 3.0T (TimTrio, Siemens Healthcare Sector). For each scan a non-contrast enhanced T1w MP-RAGE sequence for anatomical referencing and a 3D-density-adapted, radial gradient echo (GRE-) sequence for 23Na-imaging were acquired using a double-tuned (1H/23Na), dedicated head-coil. 23Na-sequences were reconstructed according to the MP-RAGE, allowing direct cross-referencing of regions-of-interest (ROI). Circular ROIs were placed in predetermined anatomic regions: anterior and posterior cerebrospinal fluid (CSF), grey and white matter (GM/WM), brain stem and cerebellum. External 23Na reference phantoms were used to calculate the 23Na tissue concentrations. 23Na concentrations of migraine patients and healthy controls were compared and statistically analyzed by Wilcoxon rank sum test.

**RESULTS**

Overall 23Na concentrations (in millimoles per liter) in the anterior CSF region of patients with manifest migraine were significantly higher with 79±7 vs. 63±8 in healthy controls (p=0.0001) (see figure 1). Similar findings were found for the posterior CSF region with 23Na concentrations of 85±6 in migraine patients vs. 63±8 in healthy controls (p=0.0013). No statistical difference was found for 23Na concentrations in the grey and white matter, brain stem and cerebellum.

**CONCLUSION**

Cerebral 23Na concentrations in CSF of migraine patients are significantly higher than in healthy controls.

**CLINICAL RELEVANCE/APPLICATION**

Cerebral 23Na MRI may be a potential imaging tool for the diagnosis of migraine.

**SSG11-04 Leakage Correction improves Prognosis Prediction of Dynamic Susceptibility Contrast Perfusion MRI in Primary Central Nervous System Lymphoma**

**Tuesday, Nov. 28 11:00AM - 11:10AM Room: N229**

**Abstract Co-Author**
Simon K. (Nothing to Disclose)
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Nothing to Disclose
Stefan O. Schoenberg, MD, PhD, Mannheim, Germany (Abstract Co-Author) Institutional research agreement, Siemens AG
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**PURPOSE**

To evaluate the correlation between histogram parameters derived from diffusion-kurtosis (DK) imaging and the clinical stage of nasopharyngeal carcinoma (NPC).

**METHOD AND MATERIALS**

DK imaging data of forty-seven consecutive NPC patients were retrospectively analyzed. Apparent diffusion for Gaussian distribution (Dapp) and apparent kurtosis coefficient (Kapp) were generated using diffusion-kurtosis model. Histogram parameters, including mean, median, 10th, 90th percentiles, skewness and kurtosis of Dapp and Kapp were calculated. Patients were divided into low and high T, N and clinical stage based on American Joint Committee on Cancer (AJCC) staging system. Differences of histogram parameters between low and high T, N and AJCC stages were compared using t test. Multiple receiver operating characteristic (ROC) curves were used to determine and compare the value of significant parameters in predicting high T, N and AJCC stage, respectively.

**RESULTS**

High T-stage (T3/4) NPC showed significantly higher Kapp-mean (P=0.018), Kapp-median (P=0.029) and Kapp-90th (P=0.003) than low T-stage (T1/2) NPC. High N-stage NPC (N2/3) showed significantly lower Dapp-mean (P=0.002), Dapp-median (P=0.002) and Dapp-10th (P<0.001) than low N-stage NPC (N0/1). High AJCC-stage NPC (III/IV) showed significantly lower Dapp-10th (P=0.038) than low AJCC-stage NPC (I/II). ROC analyses indicated that Kapp-90th was optimal for predicting high T-stage (AUC, 0.759; sensitivity, 0.842; specificity, 0.607), while Dapp-10th was best for predicting high N- and AJCC-stage (N-stage, AUC, 0.841; sensitivity, 0.875; specificity, 0.807; AJCC-stage, AUC, 0.671; sensitivity, 0.800; specificity, 0.588).

**CONCLUSION**

DK imaging-derived parameters correlated well with clinical stage of NPC, therefore could serve as an adjunctive imaging technique for evaluating NPC.

**CLINICAL RELEVANCE/APPLICATION**

DK imaging-derived histogram parameters were useful for characterizing NPC, and correlated well with the clinical stage of the NPC patients. Dapp-10th was optimal for predicting the high N- and AJCC-stage, while Kapp-90th was most powerful for predicting the high T-stage. Our results suggested that DK imaging-derived parameters could be a potential imaging marker for pretreatment staging, and DK imaging could be a useful adjunctive imaging technique for evaluating NPC before treatment.
Student Travel Stipend Award

Participants
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PURPOSE
The purpose of this study is to evaluate whether CBV measurement with leakage correction from dynamic susceptibility contrast perfusion weighted image (DSC-PWI) can be useful for the prognosis prediction of primary CNS lymphoma (PCNSL).

METHOD AND MATERIALS
Among 130 patients with PCNSL from January 2007 to April 2016, 46 patients were classified by radiation therapy (RT) stratification: non-RT (n=16); RT group (n=30). Patients of both groups were reclassified into progression free survival (PFS) based subgroups by their PFS period: 3 years criteria for RT group; 1 year criteria for non-RT group. With a dedicated imaging processing program (NordicICE), the normalized cerebral blood volume (nCBV) map with or without leakage correction and leakage map were obtained. Those perfusion maps were co-registered with contrast enhanced T1 weighted image (CET1WI) and fluid attenuated inversion recovery (FLAIR). The total volume of interest (VOI) was drawn on co-registered images corresponding with enhancing lesion on CET1WI or hyperintensity lesion on FLAIR. Histogram analysis was used to calculate the corresponding parameters of the total VOIs. Student’s t-test and Mann-Whitney test were used to evaluate significant difference of aforementioned imaging parameters between both groups. The PFS associated with nCBV was analyzed by Kaplan-Meier survival analysis.

RESULTS
The 75th percentile nCBV with leakage correction corresponding on CET1WI (T1nCBVL75%) had significant difference between the short (<3-year) and long (>=3-year) PFS subgroups of RT group (23.3% [7/30] vs 76.7% [23/30], P<.05) and between the short (<1-year) and long (>=1-year) PFS subgroups of non-RT group (43.7% [7/16] vs 56.3% [9/16], P<.05). Patients of RT group with high T1nCBVL75% (>5.3377) had shorter PFS than the others with low T1nCBVL75% (<= 5.3377) (P<.05). However, patients of non-RT group with high T1nCBVL75% (>4.2243) had longer PFS than the others with low T1nCBVL75% (<= 4.2243) (P<.05).

CONCLUSION
Based on RT stratification, CBV with leakage correction has potential as a noninvasive biomarker for prognosis prediction of PCNSL to identify high risk patients and has different relationship with PFS based on the presence of combined RT. The high value of CBV with leakage correction correlates with shorter PFS in RT group and with longer PFS in non-RT group.

CLINICAL RELEVANCE/APPLICATION
 Pretreated CBV value with leakage correction from DSC-PWI would be helpful to plan for therapeutic strategy in patients with PCNSL.

SSG11-05 Characterization of Parotid Tumors with Arterial Spin Labeling Perfusion-Weighted MR Imaging

Tuesday, Nov. 28 11:10AM - 11:20AM Room: N229

Participants
Ahmed Abdel Razek, MD, Mansoura, Egypt (Presenter) Nothing to Disclose
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PURPOSE
To characterize parotid tumors with arterial spin labeling perfusion-weighted MR imaging

METHOD AND MATERIALS
This study was conducted upon 44 consecutive patients (27M, 21 F aged 15-75 ys: mean 45ys) with parotid tumors that underwent arterial spin labeling perfusion-weighted MR imaging at 1.5 Tesla scanner (Ingenia Philips Nederland). Multi-phases arterial spin labeling with FEEPI sequence was applied. The applied scanning parameters: TR = 250o ms, TE =20 ms, flip angle =35degrees, slice thickness = 6 mm, interslice gap=1 mm, NEX=1, FOV=25 cm X 20 cm, SENSE factor=2.5 and scanning time=4 hours. There was reconstruction of 1200 source images. The tumor blood flow (TBF) of parotid tumors were calculated and correlated with histopathological findings.

RESULTS
The TBF of malignant parotid tumors (37.9±6.19 mL/100 g/min) was significantly different (P= 0.001) from that of benign parotid tumors (14.1±3.12 mL/100 g/min). The threshold values of TBF used in differentiating malignant from benign parotid tumors was 25.5 mL/100 g/min with area under the curve (AUC) of 0.90. The TBF of malignant parotid tumors was significantly different from that of Warthin’s tumors (P = 0.001). The cutoff TBF used to differentiate malignancy from Warthin’s tumors was 18.7 mL/100 g/min with AUC of 0.88. There was a significant difference in TBF between pleomorphic adenomas and Warthin’s tumors (P= 0.041). The threshold values of TBF used in differentiating pleomorphic adenomas from Warthin’s tumors was 15.2 mL/100 g/min with AUC
SSG11-06  Spectral Dual Energy CT Texture Analysis of Head and Neck Squamous Cell Carcinoma Tumor for Prediction of Cervical Nodal Metastasis

Tuesday, Nov. 28 11:20AM - 11:30AM Room: N229

Participants
Reza Forghani, MD, PhD, Cote-saint-Luc, QC (Presenter) Consultant, General Electric Company; Consultant, Real-Time Medical, Inc; Stockholder, Real-Time Medical, Inc; Committee member, Real-Time Medical, Inc
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Almudena Perez, MD, Montreal, QC (Abstract Co-Author) Nothing to Disclose
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Maryam Bayat, Montreal, QC (Abstract Co-Author) Nothing to Disclose

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PURPOSE
To evaluate a novel prediction model using dual energy CT (DECT) multi-energy texture feature analysis of head and neck squamous cell carcinoma (HNSCC) tumors to (1) predict the presence of associated cervical lymphadenopathy and (2) compare the accuracy of multi-energy versus single energy (65 keV) texture evaluation for endpoint prediction.

METHOD AND MATERIALS
87 patients with HNSCC having undergone a DECT scan of the neck were included in this study (64 untreated, 23 recurrent tumors). Texture analysis was performed using a commercial software (TexRAD®) by manually delineating a region of interest around the largest diameter of the tumor. Analysis and texture feature extraction was then performed on virtual monochromatic images (VMIs) ranging from 40 to 140 keV in 5 keV increments or VMIs at 65 keV alone. Random forests (RF) models were constructed using various histogram-based texture features for outcome prediction with internal cross-validation in addition to use of separate randomly selected training (70%) and validation (30%) sets. Sensitivity (Sens), specificity (Spec), positive predictive value (PPV), and negative predictive value (NPV) were determined for predicting positive versus negative nodal status in the neck.

RESULTS
When the entire patient population was evaluated, multi-energy texture analysis could predict the nodal status with an estimated Sens, Spec, PPV, and NPV of 77%, 75%, 77%, and 75%, respectively. Texture evaluation of VMIs at 65 keV only had a lower accuracy, with an estimated Sens, Spec, PPV, and NPV of 69%, 50%, 60%, and 60%, respectively. When the subset of untreated cases was evaluated, Sens, Spec, PPV, and NPV was 100%, 56%, 71%, and 100% using multi-energy analysis.

CONCLUSION
Multi-energy DECT texture analysis of HNSCC tumor is superior to texture analysis of single energy image sets at 65 keV alone and can be used to predict the nodal status in the neck with relatively good accuracy, providing information not currently available by routine clinical evaluation of the primary tumor.

CLINICAL RELEVANCE/APPLICATION
DECT texture analysis of the HNSCC tumor incorporated into radiomic models has the potential to predict neck nodal status with sufficient accuracy to preclude elective neck dissection in some cases.

SSG11-07  Advancing Precision Imaging of the Orbits with Higher Definition Digital PET/CT

Tuesday, Nov. 28 11:30AM - 11:40AM Room: N229

Participants
Chadwick L. Wright, MD, PhD, Lewis Center, OH (Presenter) Nothing to Disclose
Katherine Binzel, PhD, Columbus, OH (Abstract Co-Author) Nothing to Disclose
Jun Zhang, PhD, Columbus, OH (Abstract Co-Author) Nothing to Disclose
Piotr J. Maniawski, MSc, Cleveland, OH (Abstract Co-Author) Employee, Koninklijke Philips NV
Michael V. Knopp, MD, PhD, Columbus, OH (Abstract Co-Author) Nothing to Disclose

PURPOSE
The purpose of this study is to assess the clinical potential of digital photon counting PET (dPET) detector technology to enable higher definition imaging of the orbit and its associated structures and compare its imaging characteristics to conventional photomultiplier tube-based detector PET (cPET).

METHOD AND MATERIALS
Twenty oncology patients with no known orbital malignant or metastatic involvement agreed to participate in an ongoing intra-individual comparison of FDG PET imaging using pre-commercial release dPET/CT (Vereos) and cPET/CT (Gemini TF 64) systems. Standard whole-body cPET was performed using a target dose of 481 MBq FDG and imaged at ~75 min p.i. and investigational dPET was performed either at ~55 min or ~95 min p.i. Conventional PET and dPET images were reconstructed using voxel volumes of 4
mm3 (standard definition). Digital PET images were also reconstructed with smaller voxel volumes of 2 mm3 (high definition) and 1 mm3 (ultra-high definition). Intra-individual comparison of cPET/CT and dPET/CT image characteristics as well as overall image quality was performed by a blinded reader panel.

RESULTS
All 20 cPET and 60 dPET data sets were evaluable. No FDG-avid pathologic orbital lesions were identified. There was improved image quality with higher definition dPET/CT. Ultra-high definition dPET/CT images were rated best and enabled better delineation of the orbital soft tissue structures. Quantification of physiologic FDG uptake in orbital structures using higher definition dPET demonstrated slightly increasing SUVmax values which likely relate to the reduction in partial volume.

CONCLUSION
There exists an unmet clinical need to improve visualization and characterization of orbital soft tissue structures on FDG PET. Even with whole-body acquisitions, higher definition dPET/CT enables better visualization and characterization of normal orbital structures when compared with standard definition cPET/CT.

CLINICAL RELEVANCE/APPLICATION
Higher definition digital PET improves image quality and better delineates orbital structures which may allow for better lesion detectability especially for small, metabolically active lesions.

SSG11-08  Relationship between MRI and Optical Coherence Tomography (OCT) Measurements in Patients with Optic Nerve Atrophy

Tuesday, Nov. 28 11:40AM - 11:50AM Room: N229

Participants
Brian Zhao, MD, Boston, MA (Presenter) Nothing to Disclose
Anh-Dao Cheng, BS, Boston, MA (Abstract Co-Author) Nothing to Disclose
Nurhan Torun, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
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Yu-Ming Chang, MD, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Rafeeqe A. Bhadelia, MD, Chestnut Hill, MA (Abstract Co-Author) Nothing to Disclose

PURPOSE
The purpose of this study was to: (1) Assess the relationship between MRI measurements of optic nerve (ON) area and OCT measurement of retinal nerve fiber layer (RNFL) thickness, and (2) Determine a threshold ON area which predicts clinical diagnosis of optic nerve atrophy.

METHOD AND MATERIALS
Twenty-six patients with suspected optic nerve atrophy (unilateral = 13; bilateral =13) who also had both an orbital MRI and an OCT study were retrospectively evaluated. An additional thirty-five patients who had received prior MR imaging (without OCT measurements) as part of a seizure protocol, and who had no listed ocular diagnoses, were included as controls. Age data was included and controls were selected to have an age distribution similar to case subjects. Coronal inversion-recovery images of orbital MRI were used to determine ON area at mid orbital level. RNFL thickness was determined on a Heidelberg Engineering Spectralis SD-OCT machine. Each eye was treated as a separate data point. Correlation coefficients were used to evaluate relationships, Mann-Whitney test to compare measurements, and ROC to investigate predictive accuracy.

RESULTS
No significant relationship between ON area and age was detected. A significant relationship was found between MRI measurements of ON area and OCT measurements of RNFL thickness (r=0.61; p < 0.001). There was a significant difference in ON area between subjects with optic nerve atrophy (3.5 ± 1.9 mm2; Mean ± SD) and controls (7.2 ± 2.8 mm2; p < 0.001). Selecting a threshold MRI-measured ON area of 4.4 mm2 had a sensitivity of 0.89 and a specificity of 0.91. The area under the ROC curve was 0.94.

CONCLUSION
MRI measurements of ON area correlate significantly with RNFL thickness measured by OCT. Our data also suggest that MRI-measured ON area < 4.4 mm2 has high sensitivity and specificity for predicting the presence of optic nerve atrophy, making it a potential diagnostic tool for radiologists.

CLINICAL RELEVANCE/APPLICATION
MRI measurement of optic nerve area can be used to predict the presence of optic nerve atrophy, making it a potential diagnostic tool for radiologists.

SSG11-09  Predictive Values of ASQ Imaging in Predicting Hypothyroidism in Hashimoto’s Thyroiditis

Tuesday, Nov. 28 11:50AM - 12:00PM Room: N229

Participants
Ji Ye Lee, MD, Bucheon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Ji-Hye Won, Bucheon, Korea, Republic Of (Presenter) Nothing to Disclose
Hyun-Sook Hong, MD, PhD, Bucheon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Chul-Hee Kim, Bucheon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sun Hye Jeong, MD, Bucheon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

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PURPOSE
ASQ (acoustic structure quantification) can provide objective and quantitative analysis of thyroid echogenicity. Our aim is to
investigate the clinical significance of ASQ imaging parameters whether it can predict progression of hypothyroidism in Hashimoto's thyroiditis (HT).

**METHOD AND MATERIALS**

We prospectively enrolled 92 lobes in 50 patients with HT who underwent ASQ imaging with 3 year follow up. Initial and 3 year follow up ASQ parameters including AV mode, AV average, AV SD, AV ratio, blue mode, blue average, blue SD and clinical data including thyroid function test were collected. Clinical and ASQ parameters were analyzed as possible predictors of hypothyroidism.

**RESULTS**

Patients who developed hypothyroidism showed lower AV mode ($P=.003$), lower AV average ($P=.039$), lower blue average ($P=.02$) and lower blue SD ($P=.025$) than patients with no change or improved thyroid function. Lower AV blue mode value (OR 0.98, $P=.0019$) and larger changes in AV ratio (OR 1.06, $P=.0297$) were significantly associated with hypothyroidism in HT.

**CONCLUSION**

Patients who progressed to hypothyroidism showed lower ASQ values at initial presentation. Initial ASQ parameters might be useful in stratifying the risk of hypothyroidism progression in patients with HT.

**CLINICAL RELEVANCE/APPLICATION**

ASQ imaging may be helpful for identifying patients at high risk for progression of hypothyroidism in HT.
Clinical Indication and Impact on Management of DaTscan (Ioflupane I-123) SPECT/CT in Patients with Suspected Parkinsonian Disease

Tuesday, Nov. 28 10:30AM - 10:40AM Room: N227B

Purpose
An accurate diagnosis is of importance for a timely and appropriate therapeutic management of patients with clinically uncertain parkinsonian syndromes (CUPS). We aim to evaluate the clinical impact of DaTscan (I-123 Ioflupane) on diagnosis and therapeutic management.

Method and Materials
This is a retrospective study including patients seen at a Movement Disorder Center between January 2005 and January 2015. The main inclusion criterion was a pre-test clinical diagnosis of CUPS. All studies were performed after injection of 3-5mCi I123-Ioflupane followed by SPECT imaging of the head 3-4 hours after injection using a gamma camera equipped with low energy high resolution collimators. Patients demographic data, medications at the time of the study, relevant laboratory tests, diagnosis before and after the test and change in management after the study were reviewed.

Results
203 (85 male, 118 female; median age 64 years) patients diagnosed with CUPS were included in the study. In 152 patients, a diagnosis prior to and after the scan was available. In 180 patients, medication history during the time of the study was available. At baseline, the most common diagnosis was Parkinson’s disease (77/152; 50.7%), followed by essential tremor (37/152; 24.3%) and parkinsonism (26/152; 17.1%). In majority of the patients (163/180; 90.6%), medications that affect radiotracer binding were withdrawn per protocol prior to the study. In 10.4% patients, in whom the medications were not withdrawn, the radiotracer binding pattern was qualitatively reviewed. The DaTscan led to a change in diagnosis in 79/152 (51.9%) patients. In 68/139 (48.9%) patients, there was certain impact in therapeutic management. The most frequent change in clinical management was initiation of a new medication not planned at baseline. DaTscan was safe and well tolerated with no reported adverse events.

Conclusion
I-123 Ioflupane SPECT of the brain performed for evaluation of patients with suspected parkinsonian syndromes lead to change in diagnosis in 51.9% patients and change in management in 48.9% patients and appears to be a powerful tool in supporting movement disorder specialists in clinical decision making.

Clinical Relevance/Application
DaTscan is a powerful tool in the current clinical diagnosis and management of patients with suspected parkinsonian disease.
**SSG12-02** Deep Cerebral Venous Oxygenation Content in Patients with Parkinson’s Disease Using Quantitative Susceptibility Mapping

**Tuesday, Nov. 28 10:40AM - 10:50AM Room: N227B**

**Participants**
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- Xiaolin Li, Dalian, China (Abstract Co-Author) Nothing to Disclose
- Shesnia Salim Padikkalakandy Chernyath, MD, MBBS, Dalian, China (Presenter) Nothing to Disclose

**PURPOSE**
To evaluate the deep brain venous blood oxygen content changes in patients with Parkinson’s disease using Quantitative Susceptibility Mapping (QSM), and to explore the ability of QSM in reflecting the clinical condition.

**METHOD AND MATERIALS**
This prospective study approved by the hospital ethics committee. Twenty PD patients enrolled in the study. All the clinical-proved patients fulfilled the UK Parkinson’s disease Brain Bank Criteria for the diagnosis of idiopathic PD underwent conventional MRI and QSM scan. All the patients’ clinical conditions quantified according to the Montreal Cognitive Assessment (MoCA) and Hoehn-Yahr grading scale. The score was 14-30 and 1-3. Twenty age and gender matched healthy controls underwent conventional MRI and QSM scan and the clinical data were collected. The blood oxygen content of deep brain vein were estimated by the susceptibility value, different susceptibility value of blood vessels and surrounding tissues were processed with SPIN software, recording as Δ(S). The blood vessels consist of bilateral Basal Vein (BV), Superficial Middle Cerebral Veins (SMCV), Internal Cerebral Vein (ICV), and Superior Thalamostriate Vein (STV). The difference of Δ(S) of each vein between PD group and healthy control group compared using independent sample t-test. The correlation between Δ(S) and clinical condition (MoCA and Hoehn-Yahr scales) tested using Spearman's correlation.

**RESULTS**
1. The different susceptibility value Δ(S) of BV, SMCV, ICV, and STV were higher in PD patients than the controls (t=2.165, 2.300, 2.105, P<0.05). 2. The Δ(S) of BV and STV had significant positive correlation with MoCA scores(r=0.625, 0.632, P<0.01).

**CONCLUSION**
The state of hypoxia of the brain parenchyma appears in PD patients. The extent of hypoxia can reflect the disability of the patients.

**CLINICAL RELEVANCE/APPLICATION**
Quantitative Susceptibility Mapping (QSM) can reflect the venous blood oxygen content changes via susceptibility change of different tissues.

**SSG12-03** Imaging Findings on MR Guided Focused Ultrasound Thalamotomy for Tremor

**Tuesday, Nov. 28 10:50AM - 11:00AM Room: N227B**

**Participants**
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**PURPOSE**
Thalamotomy of the ventral intermediate nucleus (VIM) is effective in alleviating medication resistant tremor in patients with essential tremor (ET) and Parkinson’s disease (PD). MRI guided focused ultrasound (MRgFUS) is an innovative technology that enables noninvasive thalamotomy via thermal ablation. In this presentation we show the imaging finding post MRgFUS, in a cohort of 32 patients.

**METHOD AND MATERIALS**
Patients with severe medication resistant tremor underwent unilateral VIM thalamotomy using MRgFUS. MRI studies were obtained at the day of treatment, 1 day post treatment, 1 week, 2-3 months and at 1 year post treatment. MRI studies included high resolution T2 images in addition to routine contrast enhanced study. Images were retrospectively analyzed for lesion size and imaging characterization. Patients were also evaluated for tremor alleviation and quality of life.

**RESULTS**
MRgFUS resulted in close to a spherical lesion in the planned target with a diameter of 4-9 mm (average, 6.8 ± 1.5mm), surrounded by mild edema at 1 post procedural day with increased edema one week after the procedure. The edema lasted for 5-8 weeks following the procedure. On DWI the lesion had diffusion restriction immediately post treatment, which lasted up to 2 months. The central aspect of the lesion had low SWI signal that started at 1 day post treatment. Peripheral enhancement appeared usually at 2 months post treatment. At 3 months the lesion decreased in size and the edema resolved, and at 1 year follow-up the lesion was sometimes difficult to depict, with no correlation of the residual lesion size or imaging characteristics to the sustained tremor relief.

**CONCLUSION**
MRgFUS resulted in a lesion at the planned target. The lesion undergoes expected imaging changes with initial increase in edema and later resolution. So far there are no imaging characteristics that depict response to treatment.
Inhibitory Motor Dysfunction in Parkinson’s disease Subtypes

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PURPOSE
Parkinson’s disease (PD) is divided into postural instability gait difficulty (PIGD) and tremor-dominant (TD) subtypes. Increasing evidence has suggested that the GABAergic neurotransmitter system is involved in the pathogenesis of PD; however, to-date, MRS of GABA in both subtypes has not been performed. Thus, the aim of this study was to evaluate the differences of GABA levels between PD motor subtypes using MEGA-PRESS.

METHOD AND MATERIALS
PD patients were classified into PIGD (n = 13) and TD groups (n = 9); sixteen age- and gender- matched healthy controls were recruited. All subjects were right-handed and underwent MRS scan including MEGA-PRESS. GABA+ levels and Creatine (Cr) levels were quantified in the left basal ganglia (BG). Differences in GABA+ levels among three groups were analyzed using analysis of covariance. The relationship between GABA levels and unified Parkinson’s disease rating scale (UPDRS) was also analyzed.

RESULTS
GABA+ levels were significantly lower in left BG regions of PD patients compared with healthy controls (p < 0.001). In PD patients, the GABA concentration was lower in the TD group than PIGD group (p = 0.025). Cr levels in PIGD and TD were lower than controls (p = 0.006; p = 0.001). A significant negative correlation was found in PIGD between GABA levels and UPDRS (r = -0.586, p = 0.035), while no correlation was found in TD.

CONCLUSION
Low BG GABA levels in PD patients, and differences between PIGD/TD patients, suggest that GABAergic dysfunction may play an important role in the pathogenesis of Parkinson's disease.

Surface-Based Morphometry and Tractography in Patients with Parkinson's disease and Freezing of Gait

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PURPOSE
Freezing of Gait (FOG) is a disabling gait disturbance, consisting in a transient inability to initiate or maintain stepping, often experienced by patients with Parkinson's Disease (PD). Although recent Magnetic Resonance Imaging (MRI) studies underlined the involvement of certain brain areas in FOG patients, there is still lack of agreement between authors. Our purpose was to study structural Gray Matter (GM) and White Matter (WM) changes in PD patients with FOG.

METHOD AND MATERIALS
We studied 21 PD patients with FOG, 16 PD patients without FOG (nFOG) and 19 healthy subjects (HS). Patients were evaluated with clinical scales assessing for motor and cognitive functions. Participants underwent a standardized 3T MRI protocol (Siemens, Venlo). For gray matter evaluation, Cortical volume (CV), Cortical thickness (CTh), and Surface Area (SA) were obtained by an automated surface-based analysis of T1 3D images using FreeSurfer pipeline. For white matter evaluation, DTI images were analyzed using Tracts Constrained by Underlying Anatomy (TRACULA) in FreeSurfer.

RESULTS
No differences in demographic and clinical characteristics were found between FOG and noFOG patient groups. FOG patients exhibited a significant reductions in CTh in the mesial surface of both the hemispheres (superior frontal gyrus, paracentral lobule, posterior cingulate areas, precuneus, pericalcine cortex) and in the right dorsolateral prefrontal cortex, compared to HS. FOG patients showed smaller SA in the right supramarginal and superior parietal areas than nFOG. WM changes were observed in FOG patients in the temporal bundle of the superior longitudinal fasciculus, uncinate fasciculus and cingulum cingulate gyrus (mostly in the right hemisphere) and in the frontal radiation of the corpus callosum. DTI abnormalities in most of these white matter bundles significantly correlated with cognitive scores.

CONCLUSION
FOG may result from disruption of integration processes rather than from damage of a single area. GM changes in mesial frontal-parieto-occipital cortex are associated to WM changes of long-range associative fibers that allow both inter- and intra-hemispheric integration.

CLINICAL RELEVANCE/APPLICATION
Deterioration of multiple brain structures involved in high-level gait control, and loss of integration between motor, cognitive and limbic information may constitute the anatomical substrate of freezing of gait in Parkinson's disease.

SSG12-06 Longitudinal Diffusion Tensor Imaging as a Predictor of Motor Impairment Worsening in Early Stage Parkinson's Disease

Tuesday, Nov. 28 11:20AM - 11:30AM Room: N227B

Awards
Student Travel Stipend Award

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PURPOSE
To verify whether white matter microstructural changes are predictors of declining motor impairment in Parkinson's disease (PD).

METHOD AND MATERIALS
A total of 123 patients with early PD were enrolled along with 49 controls. Participants underwent clinical, motor (Movement Disorder Society Unified Parkinson's Disease Rating Scale Part III) and 3T MRI DTI investigations at baseline and 18 month evaluation. Baseline and longitudinal fractional anisotropy (FA) and mean diffusivity (MD) changes were analysed voxelwise using Tract Based Spatial Statistics in generalised linear models. Imaging parameters were analysed using Tract Based Spatial Statistics. The relationships between fractional anisotropy (FA) and mean diffusivity (MD) with motor function were investigated using multiple linear regression. All analyses were controlled for age, sex, disease duration, levodopa dose and visit intervals.

RESULTS
At baseline, patients with PD had significantly higher widespread MD than controls. At follow-up, both groups showed a further significant FA decrease and MD increase. Baseline MD was a significant predictor of worsening of motor impairment in PD (B (95%CI) 61.07 (15.75; 106.40), p 0.009), whereas FA was not a significant predictor (Β (95%CI) -76.55 (-158.42; 5.32), p 0.067).

CONCLUSION
MD represents an important correlate and predictor of motor impairment in PD: DTI is potentially a useful tool in stratification of patients into clinical trials to monitor the impact of treatment on motor function.

CLINICAL RELEVANCE/APPLICATION
This prospective longitudinal large cohort, demonstrated that mean diffusivity is a predictor of future worsening of motor function in early Parkinson's disease. Diffusion tensor imaging is potentially a useful tool in stratification of patients into clinical trials to monitor the impact of treatment on motor function.

SSG12-07 Assessment of Patients Who Presented with Parkinsonism: Nigrosome-1 Susceptibility Map-weighted Imaging versus 18F-FP-CIT PET

Tuesday, Nov. 28 11:30AM - 11:40AM Room: N227B

Participants
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RESULTS

Analysis of diagnostic performances of each value of the ROIs and logit (p) were assessed using Receiver operating characteristic (ROC) U test. Logit (p) was used to estimate the probability of PD in relation to the QSM value and the neuromelanin area, and the each median QSM value and neuromelanin area of higher SNR than that of the background region were tested using Mann-Whitney's basis of mean value of the automatically segmented background region. In both ROIs, the significance of intergroup differences in dorsolateral SNpc were created (Figure). Signal to noise ratio (SNR) of the SNpc in the neuromelanin images was calculated on the basis of mean value of the automatically segmented background region. Both QSM and neuromelanin values of the SNpc were calculated using a region of interest (ROI) based quantitative susceptibility mapping was used to generate SMWI. Each side of nigrosome-1 was retrospectively assessed by 2 independent reviewers. Discrepancy was resolved by consensus. Each side of the basal ganglia on CIT PET was assessed by a nuclear medicine specialist, which served as a reference standard. Participants with abnormality in either side of the basal ganglia on CIT PET or the nigrosome-1 on SMWI were considered having disease.

RESULTS

Patients were diagnosed as IPD (n = 98), drug-induced parkinsonism (n = 65), MSA-C (n = 10), MSA-P (n = 7), essential tremor (n = 7), PSP (n = 3), and others (n = 13) based on both clinical and imaging findings. Interrater agreement for SMWI was excellent (k = 0.973). As for 444 basal ganglia interpretations on CIT PET, SMWI showed 11 false-positive (FP) and 11 false-negative (FN) interpretations (sensitivity [SE], specificity [SP], positive-predictive value [PPV], and negative-predictive value [NPV] were 94.9%, 95.2%, 94.9%, and 95.2%), showing no significant difference (P = 1.0, McNemar test). As for 222 participants, SMWI demonstrated 7 FP interpretations without FN readings (SE, SP, PPV, and NPV were 100%, 93.7%, 94.1%, and 100%) (P = 0.016, McNemar test).

CONCLUSION

Presynaptic dopaminergic function on 18F-FP-CIT PET can be comparably assessed on SMWI in patients who presented with parkinsonism.

CLINICAL RELEVANCE/APPLICATION

Compared to CIT PET, SMWI has similar diagnostic performance without FN readings, and can serve as a screening imaging tool for patients who need further evaluation by dopamine transporter imaging.

SSG12-08 Clinical Application of Quantifying Changes in Nigrosomes in the Diagnosis of Early-Stage Parkinson’s Disease

Tuesday, Nov. 28 11:40AM - 11:50AM Room: N227B

Participants

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PURPOSE

For diagnosing Parkinson’s disease (PD), decreased dopaminergic neuron in the nigrosomes which are primary subregions of the substantia nigra pars compacta (SNpc), and increased iron deposition in the nigrosome-1 which is the largest nigrosome subgroup and located in the dorsolateral SNpc have been assessed. Our aim was to assess the utility of quantifying these neurodegenerative changes in the SNpc in the diagnosis of early-stage PD.

METHOD AND MATERIALS

Eighteen patients (PD group) with early PD stages (Hoehn and Yahr scale: 1-2) and 18 age-matched healthy controls (HC group) underwent quantitative susceptibility mapping (QSM), neuromelanin imaging and three-dimensional (3D) T1W imaging on a 3T magnetic resonance imager. Both QSM and neuromelanin values of the SNpc were calculated using a region of interest (ROI) based automated segmentation system with the voxel-based morphometric technique. Two neurodegenerative ROIs encompassing the whole and dorsolateral SNpc were created (Figure). Signal to noise ratio (SNR) of the SNpc in the neuromelanin images was calculated on the basis of mean value of the automatically segmented regional background region. In both ROIs, the significance of intergroup differences in each median QSM value and neuromelanin area of higher SNR than that of the background region were tested using Mann-Whitney's U test. Logit (p) was used to estimate the probability of PD in relation to the QSM value and the neuromelanin area, and the diagnostic performances of each value of the ROIs and logit (p) were assessed using Receiver operating characteristic (ROC) analysis.

RESULTS
In both ROIs, QSM value was significantly higher, and neuromelanin area was significantly less, in PD group than in HC group (P < 0.05). The respective areas under the ROC curve for QSM value/neuromelanin area were 0.70/0.81 for the whole SNpc ROI and 0.73/0.78 for the dorsolateral SNpc ROI, and that for logit (p) in relation to QSM value of the dorsolateral SNpc ROI and neuromelanin area of the whole SNpc ROI was 0.86.

CONCLUSION
Comprehensive MRI assessment for the abnormality involving the nigrostriata can yield a high diagnostic accuracy for early PD.

CLINICAL RELEVANCE/APPLICATION
Quantifying the dopaminergic neurodegenerative changes with iron deposition, featuring spatial difference of nigral changes in the SNpc, can provide a high diagnostic accuracy for early PD.

SSG12-09  Response to Deep Brain Stimulation is Associated with Increased Resting State Connectivity in the Associative Basal Ganglia Circuit

Tuesday, Nov. 28 11:50AM - 12:00PM Room: N227B

Awards
Student Travel Stipend Award

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PURPOSE
Deep brain stimulation (DBS) of the subthalamic nucleus (STN) or globus pallidus pars interna (GPI) is indicated in patients with refractory Parkinson's disease (PD) with significant motor fluctuations. While clinical characteristics facilitate patient selection, no objective tool to predict response to DBS exists. We examined resting state functional magnetic resonance imaging (rsfMRI) to determine the feasibility of this modality to serve as such a predictive tool.

METHOD AND MATERIALS
Eight patients (3 female) with advanced PD underwent a preoperative MRI under anesthesia in preparation for DBS surgery. Motor scores (UPDRS-III) were collected before and after DBS (mean follow-up of 5.9 months). Scans were performed in a 3T Achieva Philips MR scanner, including rsfMRI (TR=2000ms, TE=25ms, FOV=68×68mm, flip angle=90o, spatial resolution=1.87×1.87×3.5mm, matrix size=128×128). Images were preprocessed to correct for spatial and temporal artifacts. Regions of interest (ROIs) were defined using the Harvard-Oxford atlas and the ATAG-MNI04 basal ganglia atlas. Functional connectivity (FC) was calculated using the Matlab-based CONN toolbox via two-tailed bivariate correlations. Significant FC differences between patients who had improved UPDRS-III scores following DBS versus those who had worse UPDRS-III scores following DBS were evaluated with both a ROI-to-voxel and ROI-to-ROI analysis (FDR-corrected p<0.05).

RESULTS
Patients were 66.5±8.9 years old with disease duration of 7.3±1.8 years. Preoperative UPDRS-III was 29.3±10.6 and postoperative UPDRS-III was 21.9±9.0. Patients who responded more favorably to DBS had increased resting state connectivity within the basal ganglia (STN, pallidum, thalamus, striatum) and increased connectivity between the striatum and the frontal operculum (p=0.001).

CONCLUSION
Three major basal ganglia networks consisting of motor, associative, and limbic circuits have been described. While much focus has been on motor circuits in PD, our findings suggest that the associative circuit may play a role in DBS response and show promise in the ability for rsfMRI to provide better pre-surgical consultation to patients regarding prognosis from DBS.

CLINICAL RELEVANCE/APPLICATION
Together, these results show promise in the ability for rsfMRI to provide better pre-surgical consultation and guidance to patients regarding prognosis from DBS.
NR356-SD-TUA1

Temporal CT Subtraction Images Derived by Large Deformation Diffeomorphic Metric Mapping can Improve Detectability of Brain Infarctions

Station #1

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PURPOSE
To assess whether temporal subtraction (TS) images of brain CT are useful for the detection of brain infarctions.

METHOD AND MATERIALS
Study protocols were approved by our IRB. Forty-two sets of brain CT images from 41 patients, each consisting of a pair of brain CT images scanned on two different time points (current and previous CTs), were retrospectively collected from our institution. A total of 74 new brain infarcts were confirmed in 22 patients between the current and previous CTs. The diagnosis was determined by the consensus of two radiologists who referred to all available clinical information and imaging data. TS images were calculated by first registering the previous CT images to the current images by a non-linear image registration algorithm called Large Deformation Diffeomorphic Metric Mapping, then subtracting the registered previous images from the current images. Fourteen readers independently interpreted two groups of brain CT images; (A) 42 sets of brain images (current and previous CTs) and (B) 42 sets of brain images (current, previous, and TS CTs). The order of the image sets and groups were randomized for each reader. (A) and (B) were interpreted on two distinct dates which were more than 4 weeks apart in order to reduce memory bias. The readers marked suspected brain infarcts with a confidence level of diagnosis. To evaluate observer performance, a figure-of-merit (FOM) was calculated along with the jackknife alternative free-response receiver operating characteristic analysis. Sensitivity, the number of false positives per patient (FPP), and reading time were analyzed by using the Wilcoxon signed-rank test.

RESULTS
The average FOM was 0.53 with (A) and 0.74 with (B) \( p < 0.0001 \). The average sensitivity and FPP were 27% and 0.24 with (A), and 57% and 0.15 with (B) when a confidence level of 50% was set as the threshold \( p = 0.001 \) for sensitivity and \( p = 0.239 \) for FPP. The average reading time was 173 seconds with (A) and 170 seconds with (B) \( p = 0.925 \).

CONCLUSION
The detectability of brain infarcts was improved significantly with the use of TS images. TS images of brain CT are effective in the detection of brain infarctions.

CLINICAL RELEVANCE/APPLICATION
Although MRI is the gold standard for detecting brain infarctions, CT is still often the first choice. Improved detection of brain infarctions by this method may extend the utility of CT.
**Station #2**

**Awards**

**Student Travel Stipend Award**

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**PURPOSE**

It is well recognised that errors occurring in reporting are a recurring and seemingly inevitable aspect of radiology practice. Discrepancies can have serious and far-reaching consequences, not only negatively affecting clinical outcome and leading to medico-legal liability, but also tarnishing the organisation's and reporter's reputation. The purpose of this study was to assess the context in which errors occur in clinical practice.

**METHOD AND MATERIALS**

A retrospective analysis of 100 consecutive cases referred to a discrepancy forum in a tertiary Neuroradiology service was performed to assess the contributory factors to erroneous reports. The data harvested included time of report, scan type, and presence of a trainee's preliminary report. Comparison was made with overall service data for each of these fields.

**RESULTS**

The following inter-connected factors were associated with a higher prevalence of error: reporting of CT scans (48% of errors, versus 30% of overall service output); out-of-hours reports (36% of errors, versus 18% of overall service output); and attending checking of a trainee's preliminary report (52% of errors, versus 18% of overall attending-verified scans). Mental fatigue over both the course of the day and the week is also found to be contributory. 22% of errors occurred between 1600-1700hrs, with approximately twice as many discrepancies occurring on a Friday than any other weekday.

**CONCLUSION**

The most striking pattern of error prevalence is in the context of attendings checking trainees' out-of-hours CT scan reports. This is likely to relate to a combination of cognitive heuristics, including anchoring and framing bias, in which knowledge of clinical presenting details and of the trainee report appears to result in a high incidence of inattentional blindness in the checking attending's report. Awareness of this phenomenon is important for the reduction of error in this specific and widely underestimated reporting context.

**CLINICAL RELEVANCE/APPLICATION**

This study identifies and quantifies the role of confirmatory bias in reporting errors, an increased awareness of which will allow reporters to minimize its adverse effects.

**NR358-SD-TUA3 Detection of Skull Fractures on Curved Maximum Intensity Skull Projections by Means of Deep-Learning**

**Station #3**

**Participants**
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**PURPOSE**

Detection of skull fractures on radiologic imaging can be challenging. Overlooking fractures or confusion with skull sutures and vessel markings may constitute typical issues. We used deep-learning software originally designed to distinguish defects in industrially assembled products to detect and differentiate skull fractures on postmortem CT imaging.

**METHOD AND MATERIALS**

Curved maximum intensity skull projections (cMIP) of 150 cases of our institution were obtained with dedicated software (syngo.via, Siemens Healthineers, Erlangen, Germany). Half of the projections presented skull fractures previously documented by CT-imaging and autopsy, the other half was randomly selected from cases that presented neither visual evidence nor history of skull fractures. Skulls containing extensive injury or surgical alteration were not used for this study. Projections were then analyzed with deep-learning software VIDI (Villaz-St-Pierre, Switzerland). Fractures were manually highlighted for supervised analysis and training parameters were optimized on a training set constituting 50% of the injured and non-injured cases. The remaining 50% of data was used to validate the system.

**RESULTS**

Of the 150 cases (mean age 66.9 years at time of death), 107 (71%) were male. For cases with skull fractures, accidents with consecutive fatal brain injury were the most common (40/75) cause of death followed by suicides with fatal brain injury (10/75). In all (75/75) cases without skull fractures a cardiac cause and natural manner of death had been issued. For the 75 cases used to test and validate the method, the deep learning software detected skull fractures with a sensitivity of 88.2% and a specificity of 84.6%. The area under the ROC curve for untrained data was 0.90.

**CONCLUSION**

The presented method constitutes a first step towards automatic detection of skull fractures in ante- or postmortem computed...
Improving EPI-Based DWI of the Head and Neck Using Local Shim Coils: Comparison to Slice-Specific Integrated Shimming

Station #4
Participants
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Purpose
The head/neck region poses a challenge for diffusion-weighted imaging (DWI) using echo planar imaging (EPI) at higher static field strengths due to artifacts from static field inhomogeneities. Using standard single shot EPI (sEPI) shows geometric distortions, signal loss and failure of fat saturation. EPI with integrated dynamic shimming (iEPI) has shown to improve overall image quality in the head and neck region. However, iEPI has the disadvantage that it cannot be combined with simultaneous multislice imaging (SMS) for the purpose of reducing examination time. An potential alternative to iEPI is thus the use of additional local shim coils integrated into the head/neck surface coil for the purpose of magnetic field homogenization. The purpose of this study was to implement and evaluate the performance of this new technique for head/neck DWI MRI at 3 Tesla.

Method and Materials
DWI of the head/neck was performed in 10 healthy volunteers using sEPI, iEPI and iEPI with additional local shim coils (cEPI). Acquisitions were performed on a clinical 3 Tesla clinical MR scanner (Magnetom Vida, Siemens Healthineers, Erlangen, Germany). In addition, B0 field maps with and without additional shim coils were acquired using a dual-echo T1w gradient echo sequence. Effects of additional local shim coils on static field homogeneity was evaluated visually in acquired field maps. In DWI images, presence of geometric distortions, signal loss, ghosting artifacts, overall image quality and failure of fat saturation were visually assessed on a 4-point scale by two radiologists in consensus.

Results
The use of additional local shim coils resulted in a marked homogenization of the static field, especially in the lower and posterior neck region. Compared to sEPI, iEPI and cEPI showed significant improvement in overall image quality (Figure) for DWI with slight advantages for iEPI. Specifically, geometric distortions and areas of signal loss were markedly reduced in iEPI and cEPI. Furthermore, fat saturation was improved.

Conclusion
The use of additional local shim coils integrated in the head/neck surface coil results in improved homogenization of the static magnetic field and thus provides improved DWI image quality compared to standard single shot EPI DWI. Image quality of cEPI is comparable to iEPI. cEPI may be combined with SMS-DWI reducing examination time significantly.

Clinical Relevance/Application
Further improvement of DWI in head/neck region.

Diagnostic Utility of Compressed Sensing SPACE for IAC MRI Screening Protocols

Station #5

Participants
Mikell M. Yuhasz, MD, New York, NY (Presenter) Nothing to Disclose
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Purpose
Compressed sensing (CS) reconstruction allows sub-Nyquist sampling of k-space to reduce scan times. This study compared the diagnostic sensitivity and accuracy of T2 SPACE with and without CS for screening MRI examinations in adults with sensorineural hearing loss.

Method and Materials
With IRB approval, 72 subjects (37 male, 51.4±16.4 yrs, enriched with 21 positive cases, 12 cases duplicated for intra-rater assessment) had 3-T contrast MRI with T2 SPACE (3D TSE) (acquisition time 4:10, TE: 134ms; TR 1000ms, 0.47 x 0.47 x 0.47 mmCubed) both with CS (prototype sequence; 4x undersampling, regularization = 0.005, acquisition time = 50 sec) and without CS. Unilateral, multiplanar reconstructions were reviewed in independent, blinded fashion by 3 neuroradiologists. Reviewers indicated if...
RESULTS
CS SPACE acquisitions for sensorineural hearing loss screening protocols reduced scan time by 80%. Radiologists visually preferred conventional T2 SPACE to CS SPACE (mean scores of 4.79, 4.82, and 3.71 as compared to 3.82, 4.14, and 2.99, respectively). Similar small decreases for visualization of individual structures were reported for CS, however 100%, 100%, and 92% of CS SPACE sequences were rated non-inferior using “3” or greater as cutoff score by the three raters, respectively. CS SPACE had less perceived motion degradation for all raters. Raters’ accuracy was high (98-100%) for lesion detection using only non-contrast CS SPACE. Inter-rater reliability for lesion detection was high (kappa 0.98). Lesion measurements did not differ between sequences (12.8±7.1 mm), and differences in measurement between sequences did not significantly differ between radiologists (1.14±1.10mm, 0.80±0.78mm, 1.12±1.15).

CONCLUSION
CS can accelerate T2 SPACE imaging in screening IAC MRI protocols by 80% while preserving adequate diagnostic image quality. Radiologists found the images slightly less satisfying but rated them diagnostically acceptable with less motion degradation.

CLINICAL RELEVANCE/APPLICATION
CS techniques can accelerate the T2 SPACE component of screening IAC MRI protocols 80% while preserving diagnostic quality, reducing patient scan times as well as costs.

PURPOSE
Diffusion tensor imaging (DTI) may provide information about tissue microstructure and architecture. Although DTI has typically been used to study white matter tracts, it also holds promise for studying abnormalities in gray matter. In our study, we aimed to evaluate the role of DTI parameters in Parkinson Disease (PD) and show the correlation of these parameters with disease clinical severity.

METHOD AND MATERIALS
Diffusion tensor magnetic resonance imaging (DTI) scans were obtained in 24 patients with PD and 30 control subjects. Fractional anisotropy (FA) and mean diffusivity (MD) values of dentate nucleus (DN) and red nucleus (RN) were calculated by region of interest (ROI) analysis and compared between two groups. In PD group these values were correlated with Unified Parkinson Disease Rating Scale (UPDRS) score.

RESULTS
FA values of DN were significantly decreased (p= 0.004), and MD values of RN and DN were significantly increased (p < 0.001, p = 0.001 respectively) in PD groups compared with that of the control group. There was moderately significant correlation between FA and MD values of RN and UPDRS score (p=0.005, r=-0.55, p=0.040, r=0.42 respectively).

CONCLUSION
These findings provide evidence that high resolution DTI of RN and DN can provide information about the severity of disease in PD and may provide useful information for earlier diagnosis of the disease.

CLINICAL RELEVANCE/APPLICATION
These findings provide evidence that high resolution DTI of RN and DN can provide information about the severity of disease in PD and may provide useful information for earlier diagnosis of the disease.

PURPOSE
To evaluate the diagnostic performance of strain ratio elastography (SR) and shear wave elastography (SWE), in combination with B-mode US, in improving differentiation between benign and malignant thyroid nodules.

METHOD AND MATERIALS
In this prospective study, we included 105 histopathologically proven thyroid masses which were evaluated by using baseline US with color-Doppler evaluation, SR and SWE, using a high level equipment. Each lesion was classified according to the TIRADS lexicon, by evaluating size, B-mode and color-Doppler features, and thereafter evaluated with SR semi-quantitative and SWE quantitative approach. Results were correlated with histologic findings. The area under the ROC curve was used to evaluate the diagnostic performance of B-mode ultrasound, SR, SWE, and their combination.
RESULTS
Histological examination revealed 68 benign and 37 malignant thyroid lesions. US with TIRADS scoring, SR, SWE in m/sec and in kPa, considered alone, showed respectively a sensitivity (Se) of 59.6%, 82.7%, 51.9% and 47.8% and a specificity (Spe) of 83.8%, 92.7%, 85.3% and 85.7%. SR used as an additional tool to B mode TIRADS assessment significantly increased the diagnostic performance of thyroid US (Se: 90.4%, Spe: 93%, AUC: 0.9 p<0.004). The addition of SWE to US, although was a valid tool in selected cases, did not improve the overall accuracy (Se: 58.3%, Spe: 84.2%).

CONCLUSION
Our results suggest that SR, in combination with B-mode US, improves the evaluation of the thyroid nodules in order to discriminate benign from malignant lesions. The combination of US with SWE assessment can be helpful in selected dubious cases.

CLINICAL RELEVANCE/APPLICATION
SR and SWE can be used in the clinical practice to increase both the accuracy and the diagnostic confidence in selecting the suspicious nodules which require further work-up. Improving the specificity the SR assessment will help to decrease unnecessary biopsy.

NR138-ED-TUA8 Resident Primer: A Pattern-Based Approach to Causes of Intraparenchymal Hemorrhage on Head CT

TEACHING POINTS
1. List the various causes of intraparenchymal hemorrhage 2. Describe the imaging appearance and discuss the secondary findings, risk factors, and management for each etiology 3. Recognize common and uncommon mimickers of intraparenchymal hemorrhage

TABLE OF CONTENTS/OUTLINE

SUMMARY: Intraparenchymal hemorrhage is an important cause of acute neurological symptoms. Noncontrast head CT is the first line test in identifying patients with this condition. Recognizing patterns of hemorrhage based on location, secondary findings, and risk factors allows the radiologist to suggest the etiology and guide further workup and management.

NR236-ED-TUA8 Beyond Atrophy: A Clinical-Rad-Path Correlation and Uncommon Findings in Rasmussen Encephalitis

TEACHING POINTS
Review the epidemiology and diagnostic criteria, including clinical, electroencephalogram (EEG), imaging and histopathology in Rasmussen Encephalitis (RE) Discuss the importance of clinical correlation and imaging findings in the early stages of the disease Review the classic MR findings Review the relevant pathological aspects

TABLE OF CONTENTS/OUTLINE
Background Epidemiology of RE Diagnostic criteria for RE Clinical and EEG features Functional evaluation with nuclear medicine Intercrani and ictal single photon emission computed tomography (SPECT) MR in initial, classic and advanced stages - Unilateral enlargement of the ventricular system - T2/FLAIR hyperintensity in cortical or subcortical regions in perilsylvian region / frontoinsular lobes - Atrophy of the head of the caudate nucleus vs putamen involvement - Classic progressive hemispheric atrophy Uncommon MR findings in our institutional experience - Punched-out lesions - Occipital involvement in severe cases - Homolateral cerebellar diaschisis Surgery as a curative approach Histopathology Group 1: inflammation, microglial nodules and neuronophagia. Group 2: similar to group 1 and at least one gyral segment of complete necrosis. Group 3: prominent neuronal loss, gliosis and few microglial nodules. Group 4: atrophy

NR017-EB Guide to Programmable CSF Shunts: What the Radiologist Needs to Know
TEACHING POINTS

1) Review common programmable CSF shunts used in practice in the USA. 2) Review indications and limitations of imaging studies (CT, MR and shunt series) used to evaluate for shunt malfunction 3) Provide ready reckoner guide of images of shunts, tools and methods to determine MRI safety and/or compatibility of a particular device.

TABLE OF CONTENTS/OUTLINE

1) Types of CSF shunts used in practice a) Components and function of a shunt b) Imaging characteristics of common programmable shunts with illustrative examples 2) Indications and limitations of the shunt series study a) How to look for structural integrity and location of shunt catheters b) Limited evaluation of shunt function by radiographic and cross-sectional studies 3) Special considerations when using MRI for evaluating patients with ventricular shunts a) Magnet strength b) MRI-Safety, MRI Conditional/Unsafe c) Artifacts resulting from shunt components 4) Applying the guide in clinical scenarios including a) when no information is available on the device b) checklist for assessing for shunt malfunction c) examples of incomplete history leading to inadvertent MRI evaluation of a CSF shunt d) Exam necessitating verifying and/or re-configuring a programmable shunt.
**Brain MRI Characteristics of Patients with Anti-N-Methyl-D-Aspartate Receptor Encephalitis and Their Associations with 2-Year Clinical Disability**

**PURPOSE**
To investigate the brain MRI characteristics of Anti-N-Methyl-D-Aspartate Receptor (NMDAR) Encephalitis and their associations with clinical disability at 2-year follow-up.

**METHOD AND MATERIALS**
We retrospectively enrolled 53 clinically defined anti-NMDAR Encephalitis patients. Brain MRIs were acquired for all patients at onset phase including T1WI, T2WI and FLAIR. We classified the brain MRI appearances into four patterns: Type 1: normal; Type 2: hippocampal lesions; Type 3: lesions not involving hippocampus; and Type 4: lesions involving both hippocampus and other brain areas. The modified Rankin Scale (mRS) at 2-year follow-up was assessed and the association between mRS and onset brain MRI characteristics was evaluated.

**RESULTS**
Twenty-eight (28/53; 52.8%) anti-NMDAR patients had normal MRI (Type 1) at onset phase, while others (25/53; 47.2%) presented abnormal MRI: Type 2: 7 patients; Type 3: 7 patients showing lesions in frontal lobe, parietal lobe, cingulate, thalamus, cerebellum, corpus callosum, pedunculus cerebellaris medius, and Type 4: 11 patients (20.7%), whose lesions located in hippocampus and other brain areas including deep grey matter and frontal, temporal, parietal lobes. Hippocampus involvement (OR 7.201, CI 1.670-31.060; p=0.008) is associated with bad prognosis in patients.

**CONCLUSION**
Normal brain MRI were observed in half of patients with NMDA encephalitis. Hippocampal lesions were the most common (34.0%) MRI abnormalities, while nearly one-third of patients can have lesions in other brain areas without hippocampus involvement. Presence of hippocampal lesion is the MRI predictor for bad prognosis in anti-NMDAR encephalitis patients.

**CLINICAL RELEVANCE/APPLICATION**
Hippocampus lesions help us to diagnose anti-NMDA encephalitis early and make a MRI predictor for prognosis.

**NR366-SD-TUB4 Resting State Functional Connectivity of the Language Network in Young Adults with Multiple Sclerosis**

**PURPOSE**
While resting-state functional connectivity has been widely used to study multiple sclerosis, its application to study the language network (LN) in MS has not been reported. MS patients often exhibit language difficulties, including speech, vocabulary and fluency deficiencies. This study evaluated the functional connectivity of the language network: Broca's Area (Inferior Frontal Gyrus, IFG).
and Wernicke's Area (posterior Superior Temporal Gyrus, pSTG), in young adults with MS. LN functional connectivity correlations with disability and disease duration were explored.

**METHOD AND MATERIALS**

Young adult relapsing-remitting multiple sclerosis (RR-MS) patients (12M/13F, 26.1±5.1yo) along with age- and sex-matched healthy controls (13M/14F, 22.0±2.4yo) were studied. Resting-state functional MRI (3.2x3.2x3.2mm, TR=2.38s, 185 time points) and T1-weighted MRI (1x1x1mm) were acquired. Data analyses employed MATLAB-based CONN and SPM12 toolboxes. Within-network seed-to-target analysis was carried out using the LN regions as seeds. All seeds and ROIs were determined using a pre-existing atlas in CONN. Statistical tests for differences in functional connectivity between controls and patients within the LN were determined via t-test. Correlation analyses with Expanded Disability Status Scale (EDSS) scores (1.72±1.65, range = 0-6) and disease duration (5.83±3.65years) were performed. False Discovery Rate (FDR) correction was performed to account for multiple comparisons.

**RESULTS**

RRMS patients showed significant increases in within-LN functional connectivity from the right IFG to the left IFG and to the right pSTG compared to healthy controls (p-FDR<0.05). Significant negative correlations between functional connectivity and EDSS, between the left IFG and right IFG (p-FDR<0.005), and between the right pSTG and left IFG (p-FDR<0.05) were observed. Significant negative correlation between functional connectivity and disease duration between the left pSTG and right IFG (p-FDR<0.05) was observed.

**CONCLUSION**

This is the first study to implicate altered language network functional connectivity of young adults with MS and correlate with disease progression and disability. This is consistent with language disability in many MS patients.

**CLINICAL RELEVANCE/APPLICATION**

Resting-state fMRI reveals altered functional connectivity in the language network of young MS patients, which can potentially be used clinically to evaluate how MS affects the language function.

**NR367-SD-TUB5 Combined Diffusion Weighted Imaging and Dynamic Contrast Enhanced Magnetic Resonance Imaging for Differentiating Radiologically Indeterminate Malignant From Benign Orbital Mass**

**Participants**

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**PURPOSE**

To evaluate the performance of the combination of diffusion weighted (DW) and dynamic contrast enhanced (DCE) magnetic resonance (MR) imaging for differentiating radiologically indeterminate malignant from benign orbital mass.

**METHOD AND MATERIALS**

Sixty-five patients with orbital masses (36 benign and 29 malignant) underwent DW and DCE MR imaging examinations for pretreatment evaluation. Apparent diffusion coefficient was derived from DW imaging data using mono-exponential model. Volume transfer constant (Ktrans), flux rate constant between extravascular extracellular space and plasma (Kep), and extravascular extracellular volume fraction (Ve) were calculated using modified Tofts model. The differences of quantitative metrics were tested using independent-samples t test. Receiver operating characteristic curve analyses were used to determine and compare the diagnostic ability of each significant metric.

**RESULTS**

Malignant group demonstrated significantly lower ADC (0.711 ± 0.260 vs 1.187 ± 0.389, P < 0.001) and higher Kep (1.265 ± 0.637 vs 0.871 ± 0.610, P = 0.008) than benign group. Combined using ADC and Kep as the diagnostic index, optimal diagnostic performance (AUC, 0.941; Sensitivity, 0.966; Specificity, 0.917) could be achieved. The diagnostic performance of the combination of ADC and Kep was significantly better than Kep alone (P = 0.006). Compared with ADC alone, combined using ADC and Kep also showed higher AUC (0.941 vs 0.898), although the difference did not reach significant (P = 0.220).

**CONCLUSION**

Kep and ADC could help to differentiate radiologically indeterminate malignant from benign orbital mass. Combination of DW and DCE MR imaging might improve the differentiating performance.

**CLINICAL RELEVANCE/APPLICATION**

Malignant orbital tumors had significantly lower ADC and higher Kep than benign mimics. Both DW and DCE MR imaging were valuable in the differentiation. Combination of DW and DCE MR imaging could further assist in differentiating malignant from benign orbital tumors, and the decision of treatment plan.

**NR368-SD-TUB6 Complicated Aortic Arch atheroma and Acute Ischemic Stroke: How Does It Interfere with Mechanical Thrombectomy Success?**

**Participants**

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Jesus Maria Juega, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
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Comparing Brain Structural and Perfusion MRI Changes across ALS-FTD Continuum

PURPOSE
This study aimed to relate CTA aortic atheroma features in acute ischemic stroke patients to mechanical thrombectomy technical details and clinical significance to help ensure early and proper diagnosis allowing an individualized recanalization planning.

METHOD AND MATERIALS
We prospectively studied acute ischemic stroke patients who underwent CTA within 8 hours from symptoms onset (2010-2016). Maximal plaque thickness was measured in ascending aortic arch, perpendicular to aortic wall, proximal and distal segments. Complex plaques (CP): plaques >4 mm thick or those with irregular ulcerations. Ulcerated plaques (UP): plaques with craters >2 mm depth and width. Successful recanalization: TICI >=2b. Plaque instability gradation was assessed by composition.

RESULTS
A total of 251 patients were included. Mean age was 68.7±12.9 years old, 54.4% male. Mechanical thrombectomy was performed in 17.9%: 75.6% of no CP patients vs. 24.4% of CP patients (p=0.715), 95.6% of no UP patients vs. 4.4% of UP patients (p=0.744). Proximal arch was affected in 32.4% no CP (mean plaque thickness: 0.5±0.6 mm) vs. 81.8% CP (3.1±2.4 mm) (p=0.060). Distal arch was affected in 61.6% no CP (mean plaque thickness: 1.6±1.3) vs. 38.4% CP (4.6±1.4 mm) (p=0.001). Brachiocephalic trunk was involved in 4.2% no CP vs. 36.4% CP (p=0.026), left common carotid artery in 8.0% no CP vs. 36.4% CP (p=0.057), left subclavian artery in 12.0% no CP vs. 45.5% CP (p=0.040). Successful recanalization was achieved in 78.8% no CP vs. 72.7% CP (p=0.692). TICI 3 was achieved in 30.3% CP vs. 9.1% CP (RR, 3.34; 95% CI 0.48-23.17; p=0.241). Proximal arch plaque composition was 20.0% fibrolipid no CP vs. 30.0% CP, 20.0% calcic vs. 30.0%, 60% mixed vs. 40% (p=0.021). Distal arch plaque composition was 50.0% fibrolipid no CP vs. 62.5% CP, 25.0% calcic vs. 12.5%, 25% mixed vs. 25% (p=0.072).

CONCLUSION
CTA allows rapid and accurate aortic arch atheroma evaluation. Properly plaque characterization in acute ischemic stroke may allow individualized recanalization planning in order to increase reperfusion rates, to reduce procedural times, and to improve outcomes. CP are associated with lower recanalization rates. Further studies should assess the direct impact of CP on the endovascular procedure results.

CLINICAL RELEVANCE/APPLICATION
Aortic arch atheroma in acute ischemic stroke patients may interfere in mechanical thrombectomy success. CTA provides rapid plaque evaluation and high diagnostic accuracy.

Adult-onset Leukodystrophies: A Step-by-step Diagnostic Approach

PURPOSE
Clinical, genetic, and pathological findings suggest a close relationship between amyotrophic lateral sclerosis (ALS) and frontotemporal dementia (FTD). This study is aimed to compare brain structural and perfusion MRI changes across the spectrum between ALS and ALS-FTD.

METHOD AND MATERIALS
An age and sex matched sample of 20 healthy controls (HC), 27 ALS patients without dementia and 11 ALS-FTD patients were included. All subjects underwent a brain MRI, including structural images, pseudo-continuous arterial spin labeling and diffusion tensor imaging. Whole-brain voxel-based analyses were conducted to study the patterns of cortical atrophy, cerebral blood flow (CBF) and microstructural white matter changes across the three groups.

RESULTS
The comparison of grey matter, CBF, fractional anisotropy (FA) and mean diffusivity (MD) between ALS and HC revealed no differences. ALS-FTD patients showed widespread cortical atrophy (Figure A), decreased CBF (Figure B), reduced FA (Figure C) and increased MD (Figure D) compared to HC and ALS. The hypoperfusion region of ALS-FTD patients agreed with those of significant grey matter loss, including bilateral frontal lobe, temporal lobe, and precentral gyrus. White matter changes mainly located in bilateral corticospinal tract and corpus callosum. It is noteworthy that, in term of all four kinds of data, ALS-FTD with HC and ALS-FTD with ALS, revealed a similar pattern of significant alterations, and changes were more widespread in the former comparison.

CONCLUSION
Perfusion changes corresponded well with structural changes in motor and extramotor areas in patients with ALS-FTD. Both structural and perfusion MRI findings lend support to the concept of ALS-FTD disease continuum.

CLINICAL RELEVANCE/APPLICATION
Perfusion changes correspond well with structural changes in motor and extramotor areas in patients with ALS-FTD. Both structural and pseudo-continuous artery spin labelling are recommended to understand the concept of ALS-FTD disease continuum.
Awards
Certificate of Merit
Identified for RadioGraphics

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TEACHING POINTS
Leukodystrophies are genetically determined disorders affecting mainly the white matter. Even though leukodystrophies essentially affect children, these disorders may affect adults. MR allows the identification of white matter changes in the early stages of the disease. Symmetrical involvement on MRI is the essential distinctive finding. To recognize leukodystrophies patterns is an important clue to a correct diagnosis. The purpose of this exhibit is: - To review the imaging presentation of different types of adult onset leukodystrophies. - To provide keys to recognize and classify adult onset leukodystrophies, directing appropriate molecular or genetics tests to establish a final diagnosis.

TABLE OF CONTENTS/OUTLINE
• X-linked adrenoleukodystrophy • Metachromatic leukodystrophy • Krabbe’s disease • Alexander disease • Vanishing white matter disease • Leukoencephalopathy with axonal spheroids and pigmented glia • Adult-onset autosomal dominant leukodystrophy • Cerebrotendinous xanthomatosis • Nasu-Hakola disease • CADASIL • L-2 hydroxyglutaric aciduria • Fragile X-associated tremor/ataxia syndrome • Leukoencephalopathy with brainstem and spinal cord abnormalities • Leukoencephalopathy with calcifications and cysts • Sjögren-Larsson syndrome

NR241-ED-TUB9  What are the News at AJCC Classification about Cervical Lymph Nodes?

Participants
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Hugo Tames, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: - To describe the modifications of N categorization in head and neck cancers in the recently released eighth edition of the American Joint Committee on Cancer Staging Manual, Head and Neck Section. - To demonstrate the main aspects of cervical lymph node imaging in this context, highlighting those more specific that may help in the staging. The analysis of the distribution and characteristics of lymph nodes, such as morphology, dimensions, contours, presence of necrosis, calcification and extranodal extension allow a more complete evaluation.

TABLE OF CONTENTS/OUTLINE
Imaging methods in the evaluation of cervical lymph nodes
Characteristics of cervical lymph nodes
Classification of lymph nodes by levels
Changes in TNM classification in the eighth edition of the American Joint Committee on Cancer Staging Manual
- Modifications in N categorization Sample cases of malignant nodal involvement and the differential diagnosis with benign lesions with similar presentation
Take home messages
**SSJ06**

**Emergency Radiology (Neuroradiology)**

Tuesday, Nov. 28 3:00PM - 4:00PM Room: N227B

**CT**  |  **ER**  |  **NR**

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

**Participants**
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Jamlik-Omar Johnson, MD, Atlanta, GA (Moderator) Research Grant, Koninklijke Philips NV; Royalties, Cambridge University Press

**Sub-Events**

**SSJ06-01 Evaluation of CT Time Efficiency in Acute Stroke Response**

Tuesday, Nov. 28 3:00PM - 3:10PM Room: N227B

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Aaron S. Field, MD, PhD, Madison, WI (Abstract Co-Author) Research Grant, General Electric Company
Walter W. Peppler, PhD, Madison, WI (Abstract Co-Author) Stockholder, General Electric Company;
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**PURPOSE**

Time-efficient CT imaging in acute stroke is essential for improving patient outcomes. This can be systematically evaluated using imaging timestamps. In this work, we retrospectively analyzed CT imaging speed in acute stroke response and compared performance between different scanners, times of day, and technologists.

**METHOD AND MATERIALS**

We extracted timestamps related to image acquisition, reconstruction, and availability in PACS from 636 complete acute stroke CT exams at a single institution under IRB approval. Exams were sorted by technologist, scanner location, and time of day. To investigate differences in efficiency by scanner location and exam time, we used Mann-Whitney U tests to compare the time of acquisition and time to PACS for each of the four series in our stroke CT protocol (head without contrast, CTA, perfusion, head with contrast). Non-parametric tests were used to investigate differences in efficiency by scan operator, including a Kruskal-Wallis test and post hoc Mann-Whitney U tests.

**RESULTS**

A significant increase in time from exam start to image availability for interpretation was observed in all series from exams performed on the Emergency Department (ED) back-up scanner in Radiology compared to those performed on the dedicated CT in the ED ($p<0.001$, median 3-4 min depending on series). This was despite there being no significant difference in image acquisition time. Despite increased acquisition time during overnight shifts, CTA, perfusion, and head with contrast series were available in PACS significantly sooner during the night shift ($p<0.01$, median 2-3 min). Comparisons between CT technologists indicated significant differences between operators in exam acquisition time and time to image availability in PACS ($p<0.05$, median time differed by up to 5.5 and 14 min, respectively).

**CONCLUSION**

There were significant differences in the speed of image acquisition, processing, and availability for interpretation based on scanner location, time of day, and operator. These findings can direct our efforts for improved training and more rapid acute stroke care. This method of quality analysis will be useful for continued monitoring of performance in the future.

**CLINICAL RELEVANCE/APPLICATION**

This study demonstrates a method for performance monitoring in stroke care using imaging timestamps. The results indicate new areas for quality improvement in our institution’s acute stroke workflow.

**SSJ06-02 Dual Energy CT Angiogram of the Head: Quantifying Iodine Concentration in Acute Ischemic Stroke**

Tuesday, Nov. 28 3:10PM - 3:20PM Room: N227B
Non-contrast CT and CTA provides a rapid, accessible and accurate assessment of parenchymal infarction in acute ischemic stroke (AIS). CTA has the potential to visualize regions of low cerebral blood flow early in the course of AIS. The advent of dual energy/spectral imaging presents the potential to quantify iodine in the region of infarct. Our study aims to assess whether iodine quantification can reliably differentiate between infarcted and normal brain in patients presenting with AIS.

### METHOD AND MATERIALS

A retrospective study on patients that presented to the Emergency Department (ED) at our institution between January and April, 2016, with clinical suspicion of acute MCA territory infarction within the last 4 hours and underwent contrast enhanced DECT angiogram of the head and neck (N = 34). Catheter angiography served as the reference standard. Images were acquired on a third generation dual-source, DECT scanner at 90 kV and Sn150 kV. Iodine Overlay (IO) images were reconstructed and iodine measurements were used to calculate the percent iodine concentration in regions of interest (ROIs). ROIs were drawn over the insular cortex, basal ganglia (BG) and white matter (WM) external capsule in the region of the ischemia and contralateral normal parenchyma. Iodine Overlay images were reconstructed and iodine measurements were normalized to that of the precentral gyrus on the unaffected side. ROIs were drawn over the insular cortex, basal ganglia (BG) and white matter (WM) external capsule in the region of the ischemia and contralateral normal parenchyma.

### RESULTS

The mean iodine concentration and percent iodine values for the normal and ischemic brain tissues were as follows: 1.01 ± 0.04 mg/ml and 92.69% ± 2.2 for normal insula and 0.26 mg/ml ± 0.03 and 23.41% ± 2.2 for ischemic insula; 0.35 mg/ml ± 0.03 and 29.75% ± 2.2 for normal WM and 0.13 mg/ml ± 0.02 and 10.48% ± 1.4 for ischemic WM; and 0.7 mg/ml ± 0.05 and 65.12% ± 3.7 for normal BG and 0.28 mg/ml ± 0.04 and 24.68% ± 3.5 for ischemic BG. Infarcted brain GM, WM, and BG exhibited statistically significant less iodine concentration compared to their normal counterparts (p < 0.0001).

### CONCLUSION

Iodine quantification in DECT reliably differentiated between normal and infarcted brain tissue in our study. Its use in the acute stroke imaging protocol improved detection of acute infarcts on DECTA images of the head.

### CLINICAL RELEVANCE/APPLICATION

Iodine quantification in DECTA images may improve detection of acute infarcts in patients presenting with acute stroke symptoms.
within patient (SAS/GLIMMIX).

RESULTS

No differences were detected between greyscale inversion on/off and between groups concerning diagnostic performance (p=0.34), detection time (p=0.15), overall read time (p=0.97), and confidence (p=0.06). Differences were observed between level of training: residents were less confident than attendings, and neurorads were faster than non-neuro rads and residents concerning read time, all p<0.01. Lack of differences between on/off are not surprising, given that sensitivity, specificity, PPV, NPV where very high to begin with little room for improvement (ceiling effect).

CONCLUSION

ELVO detection with CT angiography is accurate across all levels of training and experience. Greyscale inversion offered no significant detection advantage.

CLINICAL RELEVANCE/APPLICATION

These results show that diagnostic performance and time to detection are very good, regardless of training and specialty, for an examination that must be a part of the initial hospital evaluation of stroke patients.

PURPOSE

The purpose of this study is to evaluate whether virtual non-contrast (VNC) images derived from DE CT angiography (CTA) are as reliable as true non-contrast CT (NCCT) images in detecting brain hemorrhage and infarcts.

METHOD AND MATERIALS

A total of 56 patients with acute stroke symptoms were retrospectively identified between January and April 2016 from a single institution's emergency department. All the patients underwent both an NCCT and DE CTA. DE images were acquired at 90 kV and Sn 150 kV. Quantitative analysis of the NCCT and VNC Head images were performed using circular region of interests (ROIs) centered on the basal ganglia, internal capsule and the superior sagittal sinus. Mean Hounsfield Units (HU) ± noise was calculated. Two radiologists were blinded and retrospectively interpreted the VNC CT images in comparison to the routine NCCT, assessing for pathology and diagnostic acceptability. The studies were graded on a 5 point Likert scale with 1 being a non-diagnostic examination and 5 representing a diagnostic study similar to a TNC scan. Sensitivity and specificity of VNC at detecting hyperdense-vessel sign, hemorrhage and infarction.

RESULTS

There was no significant difference between attenuation values for the basal ganglia, internal capsule and superior sagittal sinus on TNC (38.6 HU ± 0.57, 30.3 HU ± 0.56 and 56.5 HU ± 1.4) and VNC (35.6 HU ± 1.6, 30.5 HU ± 1 and 56.2 HU ± 5.2) (p > 0.1). Sensitivity and specificity of VNC for detection of hemorrhage, hyperdense-vessel sign and infarct was 100% and 100%, 80% and 77.4% and 38.2% and 100% respectively.

CONCLUSION

VNC images were as reliable as TNC images for detecting hemorrhage and demonstrated acceptable performance in detecting hyperdense-vessel sign. However, VNC images did not reliably detect infarct as compared to TNC images.

CLINICAL RELEVANCE/APPLICATION

VNC images can reliably diagnose intracranial hemorrhage, however, are not as yet reliable to forgo the inclusion of a TNC scan in cases of suspected infarction.

PURPOSE

The purpose of this study is to evaluate whether virtual non-contrast (VNC) images derived from DE CT angiography (CTA) are as reliable as true non-contrast CT (NCCT) images in detecting brain hemorrhage and infarcts.

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CONCLUSION

VNC images were as reliable as TNC images for detecting hemorrhage and demonstrated acceptable performance in detecting hyperdense-vessel sign. However, VNC images did not reliably detect infarct as compared to TNC images.

CLINICAL RELEVANCE/APPLICATION

VNC images can reliably diagnose intracranial hemorrhage, however, are not as yet reliable to forgo the inclusion of a TNC scan in cases of suspected infarction.
Blunt cerebrovascular injury (BCVI) is a rare but potentially devastating diagnosis. If left undiagnosed and untreated, the incidence of ischemic stroke is reported to be as high as 64%. Follow-up imaging is recommended in suspected or confirmed cases of BCVI within 24-48 hours. Our study establishes the temporal changes and findings on follow-up imaging.

**METHOD AND MATERIALS**

For this retrospective, IRB-approved study, the hospital trauma registry was queried for all poly-trauma patients undergoing CTA scans performed in the emergency department between January 1, 2010 to December 31, 2016 with ISS >= 16, yielding 3747 patients. A total of 205 patients had follow up CTs for BCVI. Note was made of the grade and location of injury as well as associated traumatic injuries. GCS at the time of admission was also recorded.

**RESULTS**

Vehicular collision was the most common mechanism of injury (66%). The majority of patients (62%) had a GCS of 10-15. 18 cases (9%) had GCS of 3-9 and 53 patients (26%) were unresponsive at the time of presentation. 6 patients were intubated at the scene. Vertebral fractures were the most common associated injuries (54%), Intracranial hemorrhage in 42%, skull fractures in 26% and facial fractures in 29% of patients. 16% of patients had no associated injuries. The overall incidence of BCVI in our study was 4.8%. 59% of injuries involved the vertebral arteries (101) and 41% involved the internal carotid arteries (71). On the initial CTA, 48% of injuries were Grade I, 27% were Grade II, 6% were Grade III, 18% were Grade IV and 1% were Grade V. On follow-up CTA, Grade I injuries made up 43% of cases, 18% were Grade II, 18% were Grade III, 20% were Grade IV and there were no Grade V injuries on follow-up. 45% of all BCVI remained unchanged on follow-up imaging, 42% improved and 13% worsened on follow-up imaging. All patients with diagnosis or suspicion of BCVI received medical therapy within 24 hours of diagnosis. 6 patients underwent image guided vascular intervention.

**CONCLUSION**

Aggressive screening for BCVI in trauma enables early diagnosis and management of injuries. Low grade injuries are more likely to demonstrate changes on follow-up imaging. The majority of cases demonstrated improvement compared baseline.

**CLINICAL RELEVANCE/APPLICATION**

It is important to recognize that BCVI may improve or worsen on follow up imaging, which may affect management and patient outcomes.
**SSJ18**  
*Neuroradiology/Head and Neck (State-of-the-Art Thyroid and Parathyroid Imaging)*  
Tuesday, Nov. 28 3:00PM - 4:00PM Room: N226

**PURPOSE**  
The new ACR TI-RADS guidelines were published online on March 31st 2017 [http://dx.doi.org/10.1016/j.jacr.2017.01.046](http://dx.doi.org/10.1016/j.jacr.2017.01.046)  
Existing guidelines can be difficult to apply. The new risk stratification model was published with the aim of reducing the number of unnecessary thyroid biopsies. Our study aims to: 1. Determine the accuracy of the new guidelines 2. Look specifically at the biopsy rates and the number of malignancies that might be missed with the application of these new guidelines.

**METHOD AND MATERIALS**  
The new guidelines were applied against a pre-existing electronic database of 200 pathologically confirmed cases. 200 cases had already been scored by 5 readers (4 using a newly developed on-line ‘app’) using an extended version of the 2015 ACR TI-RADS lexicon. The sonographic features scored included the ACR lexicon which had been extended to allow for the assessment against the pre-existing ATA, AAC/AME/ETA, BTA, Kim, Korean, ASRU and a number of the earlier versions of ‘TI-RADS’ scoring system. The readers included 3 faculty (> 10 years post fellowship training), a 4th year Resident and an intern(planning a career in Radiology) - all had been involved with thyroid US projects previously.

**RESULTS**  
Using the summed scores of all readers the mean sensitivity for the new ACR TI-RADS was 57% (range, 40-93) while the specificity was 52% (range, 42-60). Initial experience from the readers that it was slow to use but with time productivity improved substantially. Average time with experience varied from 40 sec to 5 min. Less experienced users were more likely to use if available as a clinical decision support tool.

**CONCLUSION**  
Initial experience with the new guidelines might suggest a lower specificity and consequently the expected reduction in biopsy numbers may not be achieved. A slightly lower sensitivity for biopsies is compensated for by combining the true positive biopsy rate and the follow-up rate of the ‘false negatives’ The app may be more useful for less experienced operators.

**CLINICAL RELEVANCE/APPLICATION**  
Further investigation is required to determine whether the new ACR guidelines constitute the correct balance of sensitivity and specificity to reduce the number of unnecessary thyroid biopsies while avoiding missing clinically significant cancers.

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**SSJ18-01 Thyroid Nodule Assessment: Initial Experience with the New ACR TI-RADS Guidelines**  
Participants  
Declan G. Sheppard, MD, Galway, Ireland (*Presenter*) Nothing to Disclose  
John F. Bruzzi, MBCh, Galway, Ireland (*Abstract Co-Author*) Nothing to Disclose  
Diane Bergin, MD, Galway, Ireland (*Abstract Co-Author*) Nothing to Disclose  
Patrick Navin, MBCh,MRCPi, Galway, Ireland (*Abstract Co-Author*) Nothing to Disclose  
Arlene Weir, MBBS, Galway, Ireland (*Abstract Co-Author*) Nothing to Disclose  
Bruno Voisin, PhD, Galway, Ireland (*Abstract Co-Author*) Nothing to Disclose

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**PURPOSE**  
The new ACR TI-RADS guidelines were published on-line on March 31st 2017 [http://dx.doi.org/10.1016/j.jacr.2017.01.046](http://dx.doi.org/10.1016/j.jacr.2017.01.046)  
Existing guidelines can be difficult to apply. The new risk stratification model was published with the aim of reducing the number of unnecessary thyroid biopsies. Our study aims to: 1. Determine the accuracy of the new guidelines 2. Look specifically at the biopsy rates and the number of malignancies that might be missed with the application of these new guidelines.

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The new guidelines were applied against a pre-existing electronic database of 200 pathologically confirmed cases. 200 cases had already been scored by 5 readers (4 using a newly developed on-line 'app') using an extended version of the 2015 ACR TI-RADS lexicon. The sonographic features scored included the ACR lexicon which had been extended to allow for the assessment against the pre-existing ATA, AAC/AME/ETA, BTA, Kim, Korean, ASRU and a number of the earlier versions of 'TI-RADS' scoring system. The readers included 3 faculty (> 10 years post fellowship training), a 4th year Resident and an intern(planning a career in Radiology) - all had been involved with thyroid US projects previously.

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Initial experience with the new guidelines might suggest a lower specificity and consequently the expected reduction in biopsy numbers may not be achieved. A slightly lower sensitivity for biopsies is compensated for by combining the true positive biopsy rate and the follow-up rate of the 'false negatives' The app may be more useful for less experienced operators.

**CLINICAL RELEVANCE/APPLICATION**  
Further investigation is required to determine whether the new ACR guidelines constitute the correct balance of sensitivity and specificity to reduce the number of unnecessary thyroid biopsies while avoiding missing clinically significant cancers.

**SSJ18-02 Preliminary Study on Spectral Parameters of Various Pathological Types of Malignant Tumors of Thyroid**  
Participants  
Lin Li, MD, Beijing, China (*Presenter*) Nothing to Disclose

**PURPOSE**  
To analyze the imaging manifestations and spectral parameters of various pathological types of malignant tumors of thyroid.
METHOD AND MATERIALS
67 cases of malignant tumors of thyroid were included in the retrospective study (44 papillary carcinomas, 2 follicular carcinomas, 9 medullary carcinomas, 7 anaplastic carcinomas and 5 primary thyroid lymphomas). The morphological manifestations and the spectral parameters were analyzed. All the patients underwent spectral CT scan with Discovery CT750HD scanner in GS1 mode. The morphological manifestations of lesions were analyzed on the optimal monochromatic images. The iodine concentration (IC), water concentration (WC), normalized iodine concentration (NIC), spectral HU curve slope values (λHU) were measured and analyzed by GS1 Viewer. SPSS 19.0 software was used for statistical analysis of the data.

RESULTS
The morphological features of malignant tumors of thyroid were as follows: single lesion (57 cases, 85.1%), irregular shape (46 cases, 68.7%), indistinct margin (45 cases, 67.2%), heterogeneous density (48 cases, 71.6%) and detection of calcification (21 cases, 31.3%). There was no significant difference among various types of malignant tumors on WC (P>0.05). The IC, NIC and λHU values of papillary carcinoma, follicular carcinoma and medullary carcinoma were higher than that of anaplastic carcinoma and lymphoma (P<0.05). The NIC of papillary carcinoma was lower than that of medullary carcinoma (P>0.05). There were no significant differences on the parameters between each two groups remained (P>0.05).

CONCLUSION
The morphological features and spectrum parameters are different in various pathological types of thyroid malignant tumors, and it is helpful for the diagnosis and differential diagnosis.

CLINICAL RELEVANCE/APPLICATION
Spectral CT imaging is helpful to differentiate various pathological types of thyroid malignant tumors.

SSJ18-03 Computer-aided Diagnosis System for Thyroid Nodules on Ultrasound: Initial Clinical Experience

Tuesday, Nov. 28 3:20PM - 3:30PM Room: N226

Participants
Youngjin Yoo, Suwon, Korea, Republic Of (Presenter) Nothing to Disclose
Eun Ju Ha, Suwon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Miran Han, MD, Suwon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Yoon Joo Cho, Suwon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To prospectively evaluate the diagnostic performance of a computer-aided diagnosis (CAD) system (S-Detect for ThyroidTM) for thyroid US in the differential diagnosis of thyroid nodules and to determine interobserver agreement between the CAD system and experienced radiologist.

METHOD AND MATERIALS
This study was approved by the ethics committee of the institution, and all patients provided written informed consent. We consecutively enrolled patients with thyroid nodules with final diagnoses whether benign or malignant between June 2016 and July 2016. An experienced radiologist reviewed US characteristics of thyroid nodules, and a CAD system provided nodule diagnosis whether benign or malignant in a prospective design. We compared the diagnostic performance of experienced radiologist, CAD system, and CAD system assisted radiologist for detecting thyroid cancer and determined interobserver agreement between the CAD system and experienced radiologist.

RESULTS
A total of 117 thyroid nodules from 50 consecutive patients were included. The mean size of nodules was 1.5 ± 1.1 cm (range: 0.5-10.0 cm) and final diagnoses were 67 (57.3%) benign nodules and 50 (42.7%) malignant nodules. The CAD system showed similar sensitivity and specificity compared with the experienced radiologist (sensitivity: 80.0% versus 87.0%, P = 0.754; specificity: 88.1% versus 95.5%, P = 0.180). The diagnostic accuracy was not significantly different between the CAD and experienced radiologist (84.6% versus 90.6%, P = 0.646). The CAD system assisted radiologist reached the higher diagnostic sensitivity when compared to the radiologist without the CAD system (91.8% versus 87.0%, P = 0.031). The interobserver agreement between radiologist and CAD system were substantial agreement for a final diagnosis (kappa = 0.661).

CONCLUSION
The diagnostic performance of CAD system for differentiating thyroid nodule was as good as that of the experienced radiologist with a substantial agreement. The CAD system assisted radiologist could achieve the highest diagnostic sensitivity for thyroid cancer.

CLINICAL RELEVANCE/APPLICATION
The CAD system could be used as a good decision-making supporter for the experienced radiologist with achieving the highest sensitivity up to 91.7% as well as for the beginner or non-thyroid radiologist with achieving comparable diagnostic performance with the experienced radiologist.

SSJ18-05 Can 4D-MRI Be an Alternative Modality for the Detection of Parathyroid Lesions in Primary Hyperparathyroidism?

Tuesday, Nov. 28 3:40PM - 3:50PM Room: N226

Participants
Devasenathipathy Kandasamy, MBBS, New Delhi, India (Presenter) Nothing to Disclose
Narasiman Murugan, MBBS, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Raju Sharma, MD, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Ankur Goyal, MBBS, MD, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Nikhil Tandon, MD, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Seenu Vuthaluru, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Nishikant Darre, MD, Delhi, India (Abstract Co-Author) Nothing to Disclose
Arun K. Gupta, MBBS, MD, New Delhi, India (Abstract Co-Author) Nothing to Disclose

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**PURPOSE**
To compare ultrasonography (USG), Tc99 MIBI, 4D-CT & 4D-MRI in the detection & localisation of parathyroid lesion in patients with primary hyperparathyroidism (PHPT).

**METHOD AND MATERIALS**
In this prospective institutional ethics committee approved study, 39 patients with PHPT underwent USG, 4D-CT, 4D-MRI & Tc99 MIBI in the period, May 2016 - Feb 2017. Children & pregnant patients was excluded from study. 4D-CT was performed in 3 phases (NCCT, arterial & venous) on a 256 slice scanner & 4D-MRI was performed on a 1.5T scanner. Sixteen patients underwent surgery & only those were included for analysis. Surgical findings confirmed on histopathology & normalisation of parathormone (PTH) after excision of lesion were taken as the gold standard. The images were analysed for the presence & quadrant wise location of parathyroid lesions by two experienced radiologists & a nuclear medicine physician.

**RESULTS**
Of the 16 patients analysed, parathyroid hyperplasia was seen in 2 (12.5%), parathyroid adenoma in 12 (75%) & parathyroid carcinoma were found in 2 (12.5%) patients. In all patients, preoperative localisation was confirmed at surgery & this included ectopic lesions (mediastinum & parapharyngeal region) in two patients. PTH values returned to normal after surgery in all patients. 4D-CT, 4D-MRI showed 100% sensitivity whereas USG & MIBI showed 81.25% sensitivity each, for lesion detection & quadrant localisation. Two ectopic parathyroid adenomas were missed on USG & MIBI scan.

**CONCLUSION**
4D-CT & 4D-MRI had a high accuracy for parathyroid lesion detection & localisation in patients of PHPT whereas USG & MIBI showed moderate accuracy. 4D-MRI, being a modality without radiation exposure may provide a viable alternative for the localisation of parathyroid lesions.

**CLINICAL RELEVANCE/APPLICATION**
4D-CT & 4D-MRI have comparable high accuracy for detection & localization of parathyroid lesions in patients with PHPT. Due to better safety profile, the latter may become the modality of choice in the future.

**Awards**

**Student Travel Stipend Award**

Participants
James W. Alexander, MSc, Montreal, QC (Presenter) Nothing to Disclose
Behzad Forghani, MENG, Cote-Saint-Luc, QC (Abstract Co-Author) Nothing to Disclose
Nathalie Gabra, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Ahmudena Perez, MD, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Maryam Bayat, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Gabriel Melki, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Alex Mlynarek, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Reza Forghani, MD, PhD, Cote-saint-luc, QC (Abstract Co-Author) Consultant, General Electric Company; Consultant, Real-Time Medical, Inc; Stockholder, Real-Time Medical, Inc; Committee member, Real-Time Medical, Inc

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**PURPOSE**
The purpose of this study was to (1) determine the accuracy of texture analysis performed on multi-energy or single energy (65 keV) virtual monochromatic images (VMIs) from dual energy CT (DECT) scans for parathyroid adenoma classification and (2) to compare accuracy using a single phase or multiple phases from the 4D-DECT scan.

**METHOD AND MATERIALS**
16 patients with pathologically proven parathyroid adenomas having a 3-phase 4D-DECT including a non-contrast (NC), arterial (CTA), and delayed phase (DEL) scan were included. Texture analysis was performed using a commercial software (TexRAD®) by manually delineating a region of interest around the largest diameter of the PA, thyroid, and a lymph node on VMIs ranging from 40 to 140 keV in 5 keV increments or VMIs at 65 keV alone. Random forests (RF) models were constructed using various histogram-based texture features for outcome prediction with internal cross-validation in addition to use of separate randomly selected training and validation sets. Sensitivity (Sens), specificity (Spec), positive predictive value (PPV), and negative predictive value (NPV) were determined for PA distinction from thyroid tissue or lymph nodes.

**RESULTS**
With RF models, the highest accuracy for PA prediction was achieved using a combination of NC-CTA-DEL phases with estimated Sens, Spec, PPV, and NPV of 100%. The CM-CTA and CTA-DEL combinations had similar accuracy with Sens, Spec, PPV, and NPV of 100%, 90%, 83%, and 100%, respectively. Multi-energy analysis was superior to analysis of 65 keV VMIs alone. For the latter, the highest accuracy achieved was Sens, Spec, PPV, and NPV of 60%, 100%, 100%, and 83%, respectively.

**CONCLUSION**
Multi-energy VMI texture analysis can correctly classify PAs with high accuracy at least similar to an expert radiologist, and
superior to texture analysis of single energy image sets at 65 keV.

**CLINICAL RELEVANCE/APPLICATION**

DECT texture analysis has high accuracy for PA identification, improving diagnostic performance or potentially enabling a reduction in the number of phases acquired and patient radiation exposure.
Enhao Gong, MS, Stanford, CA (Presenter) Research support, General Electric Company
Jia Guo, PhD, Stanford, CA (Abstract Co-Author) Research support, General Electric Company
John Pauly, Stanford, CA (Abstract Co-Author) Research support, General Electric Company
Greg Zaharchuk, MD, PhD, Stanford, CA (Abstract Co-Author) Research Grant, General Electric Company; Consultant, General Electric Company;

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PURPOSE
The risk of under-estimating local CBF in cerebrovascular disease patients as well as the underlying low SNR of the arterial spin labeling (ASL) techniques calls for new approaches. Here we proposed and evaluated a Deep Learning method to boost image quality and improve cerebral blood flow (CBF) and arterial transit delay (ATD) estimation using multi-delay ASL.

METHOD AND MATERIALS
We developed a Deep Learning based method, a local Residual-Encoder-Decoder Convolutional Neural Network (CNN), to improve the ASL image quality. At 3T, we collected two multidelay ASL datasets in 7 normal subjects: (1) input images: low SNR/resolution (5.6mm resolution,1 repetition,4min); (2) gold-standard reference images: high SNR/resolution (3.8mm resolution,3 repetitions,24min). Label Duration (LD) was 2sec and 5 Post-Labeling-Delays (PLD) were used (0.7sec,1.4sec,2.1sec,2.8sec,3.5sec). We trained the network to reduce artifact/noise in the input ASL images by approximating the gold-standard reference images. The method takes in image patches from low-SNR/resolution ASL and the corresponding un-labeled proton-density-weighted data, forward-passes through the network and outputs improved image patches to approximate the high-resolution-high-SNR patches from the gold-standard reference ASL. Once trained, we applied the model to improve new ASL clinical scans which do not necessarily include gold-standard reference scans (n=5, patients with cerebrovascular and neoplastic disease). Application of the model is efficient, requiring only 1 sec per slice to apply.

RESULTS
To evaluate the proposed method, we compared the error metrics(normalized RMSE and PSNR) between the model outputs and the gold-standard reference. It showed the proposed method could reduce RMSE from 29.3% to 10.8% and increase PSNR by 4.3 dB on average. For data with pathology we compared the ASL images, CBF maps and ATD maps, demonstrating that the proposed method preserves the pathology while significantly improving the ASL image quality.

CONCLUSION
The proposed Deep Learning method significantly reduces (6 fold) the acquisition time required to obtain high-quality ASL imaging, improving CBF estimation and more detailed ATD maps in clinical patients.

CLINICAL RELEVANCE/APPLICATION
The proposed Deep learning method significantly improves ASL image quality, reduces scan time and increases SNR/resolution, potentially allowing it to be used in a wider variety of clinical settings.

Texture Analysis for Differentiating Glioblastoma Multiforme and Primary Cerebral Lymphoma: Benefits of Machine Learning Based on Multi-parametric MRI

Tuesday, Nov. 28 3:10PM - 3:20PM Room: N228

Participants
Greg Zaharchuk, MD, PhD, Stanford, CA (Moderator) Research Grant, General Electric Company; Consultant, General Electric Company;
Amit M. Saindane, MD, Atlanta, GA (Moderator) Nothing to Disclose

Sub-Events
SSJ19-02

Texture Analysis for Differentiating Glioblastoma Multiforme and Primary Cerebral Lymphoma: Benefits of Machine Learning Based on Multi-parametric MRI
Tuesday, Nov. 28 3:10PM - 3:20PM Room: N228

Participants
Enhao Gong, MS, Stanford, CA (Presenter) Research support, General Electric Company
Jia Guo, PhD, Stanford, CA (Abstract Co-Author) Research support, General Electric Company
John Pauly, Stanford, CA (Abstract Co-Author) Research support, General Electric Company
Greg Zaharchuk, MD, PhD, Stanford, CA (Abstract Co-Author) Research Grant, General Electric Company; Consultant, General Electric Company;

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Tuesday, Nov. 28 3:10PM - 3:20PM Room: N228

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Greg Zaharchuk, MD, PhD, Stanford, CA (Abstract Co-Author) Research Grant, General Electric Company; Consultant, General Electric Company;

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enhaog@stanford.edu

PURPOSE
The risk of under-estimating local CBF in cerebrovascular disease patients as well as the underlying low SNR of the arterial spin labeling (ASL) techniques calls for new approaches. Here we proposed and evaluated a Deep Learning method to boost image quality and improve cerebral blood flow (CBF) and arterial transit delay (ATD) estimation using multi-delay ASL.

METHOD AND MATERIALS
We developed a Deep Learning based method, a local Residual-Encoder-Decoder Convolutional Neural Network (CNN), to improve the ASL image quality. At 3T, we collected two multidelay ASL datasets in 7 normal subjects: (1) input images: low SNR/resolution (5.6mm resolution, 1 repetition, 4min); (2) gold-standard reference images: high SNR/resolution (3.8mm resolution, 3 repetitions, 24min). Label Duration (LD) was 2sec and 5 Post-Labeling-Delays (PLD) were used (0.7sec, 1.4sec, 2.1sec, 2.8sec, 3.5sec). We trained the network to reduce artifact/noise in the input ASL images by approximating the gold-standard reference images. The method takes in image patches from low-SNR/resolution ASL and the corresponding un-labeled proton-density-weighted data, forward-passes through the network and outputs improved image patches to approximate the high-resolution-high-SNR patches from the gold-standard reference ASL. Once trained, we applied the model to improve new ASL clinical scans which do not necessarily include gold-standard reference scans (n=5, patients with cerebrovascular and neoplastic disease). Application of the model is efficient, requiring only 1 sec per slice to apply.

RESULTS
To evaluate the proposed method, we compared the error metrics (normalized RMSE and PSNR) between the model outputs and the gold-standard reference. It showed the proposed method could reduce RMSE from 29.3% to 10.8% and increase PSNR by 4.3 dB on average. For data with pathology we compared the ASL images, CBF maps and ATD maps, demonstrating that the proposed method preserves the pathology while significantly improving the ASL image quality.

CONCLUSION
The proposed Deep Learning method significantly reduces (6 fold) the acquisition time required to obtain high-quality ASL imaging, improving CBF estimation and more detailed ATD maps in clinical patients.

CLINICAL RELEVANCE/APPLICATION
The proposed Deep learning method significantly improves ASL image quality, reduces scan time and increases SNR/resolution, potentially allowing it to be used in a wider variety of clinical settings.
Methylation, IDH1 mutation, EGFR amplification and 1p/19q codeletion status were reviewed. The features that showed significant
postcontrast T1-weighted, T2-weighted, FLAIR images, and ADC map. Molecular subtypes consisting of MGMT promoter
multiregional (contrast-enhancing regions and hyperintense regions at FLAIR images) radiomic features were extracted from on
Preoperative MR imagings from 121 consecutive patients with newly diagnosed glioblastoma were retrospectively reviewed. 787
METHOD AND MATERIALS

PURPOSE
To evaluate the association between multiregional radiomic features from MR imaging and molecular subtypes in patients with newly
diagnosed glioblastoma.

METHOD AND MATERIALS

Participants
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PURPOSE
To evaluate the association between multiregional radiomic features from MR imaging and molecular subtypes in patients with newly
diagnosed glioblastoma.

METHOD AND MATERIALS

Preoperative MR imagings from 121 consecutive patients with newly diagnosed glioblastoma were retrospectively reviewed. 787
multiregional (contrast-enhancing regions and hyperintense regions at FLAIR images) radiomic features were extracted from on
postcontrast T1-weighted, T2-weighted, FLAIR images, and ADC map. Molecular subtypes consisting of MGMT promoter
methylation, IDH1 mutation, EGFR amplification and 1p/19q codeletion status were reviewed. The features that showed significant
difference (<0.05 by Wilcoxon test) or discriminative value (area under the receiver operating characteristics curve [AUROC] > 0.7) were selected on univariate test, and redundant features were removed. The strength of association between selected radiomic features and molecular subtypes was assessed via machine learning algorithms (stochastic gradient boosting machine, penalized logistic regression, and random forest). To prevent overestimation and overcome data imbalance, bootstrapping with 100 repetition and data subsampling were performed.

RESULTS
On univariate analyses, 11, 9, 6 and 15 radiomic features remained after removing redundant features to predict MGMT, IDH1, EGFR, and 1p/19q codeletion status, respectively. Applying machine learning to radiomic features yielded moderate performance (AUROC : 0.691-0.800) to predict MGMT status, and good to excellent performance to predict IDH1 mutation (AUROC : 0.868-0.971), EGFR amplification (AUROC : 0.729-0.874) and 1p/19q codeletion status (AUROC : 0.771-0.960). Nonetheless, in terms of accuracy, only a few machine learning models showed higher accuracy than prediction by chance, which was resulted from data imbalance.

CONCLUSION
The authors found associations between MR radiomic features and molecular subtypes, although some of them may not be significant considering the data imbalance and prediction by chance.

CLINICAL RELEVANCE/APPLICATION
Radiomic profiling may have association with molecular subtypes in glioblastoma, although some of them may not be significant considering the data imbalance and prediction by chance.

SSJ19-04 Machine Learning Prediction and Classification of Working Memory Performance Based on Brain Microstructure in Healthy Adults: A Diffusion Kurtosis Imaging Study

PURPOSE
The goal of this study is to predict working memory performance based on white matter (WM) microstructure in healthy adults by using machine learning approaches. White matter tract integrity (WMTI) metrics as well as diffusion tensor imaging (DTI) and diffusion kurtosis imaging (DKI) metrics were used to assess WM microstructure, and WAIS-IV letter-number sequencing (LNS) test was used to assess working memory.

METHOD AND MATERIALS
We studied 21 healthy individuals (34±9m 19-50 years old) using a 3T MR scanner (Skyra, Siemens). DKI was performed with 5 b-values (up to 2.5ms/μm2 with up to 60 directions). WMTI (axonal water fraction (AWF), intra-axonal diffusivity, extra-axonal axial/radial diffusivities, extra-axonal tortuosity (a)), DTI (FA, MD, AD, RD) and DKI (MK, RK, AK) metrics were calculated. Tract-based spatial statistics (TBSS) was performed with age and gender as covariates to test for significant correlations between diffusion metrics and LNS z-scores. For each metric, regions-of-interest (ROIs) were selected if p<0.1 after family-wise error (FWE) correction, and then were averaged as input features. The gradient boosted regression trees (GBRT) model was used to predict LNS and Logistic regression was used to classify individuals into arbitrary groups with LNS z-score above 1, below -1 and in between ±1. All data were randomly split into train (70%) and test (30%) sets.

RESULTS
Fig.1 shows ROIs for AWF, tortuosity a, FA, MK, and RK that were positively correlated with LNS. Using all 5 metrics as input features, we achieved a 95.4% accuracy in predicting LNS and a 79.6% accuracy in classifying individuals into two groups with LNS z-score above 1, below -1 and in between ±1 (Fig.2)

CONCLUSION
This study shows WM microstructural associations with working memory which can be predictable by using machine learning approaches. Our findings of higher AWF and tortuosity a with better performance on LNS go along with greater number of axons and greater myelination in these regions, causing efficient and faster information processes. Our results demonstrate the potential utility of diffusion metrics to serve as early biomarkers of working memory impairment.

CLINICAL RELEVANCE/APPLICATION
Our study elucidates the underlying relationship between white matter microstructure and working memory, and raises the potential utility of diffusion metrics to predict impairment of working memory.

SSJ19-05 Estimating the Age from Time of Flight MR Angiography Using Deep Learning

PURPOSE
The goal of this study is to predict age from time of flight (TOF) MR angiography using deep learning. We evaluated the accuracy of age estimation using 3T TOF MR angiography and deep learning models.

METHOD AND MATERIALS
We analyzed 100 TOF MR angiograms from healthy adults (20-70 years old) using a 3T MR scanner (Skyra, Siemens). We used a 3D convolutional neural network (CNN) architecture with 5 convolutional layers and 2 fully connected layers. The input was a 3D volume of the carotid arteries, and the output was the estimated age. We performed leave-one-out cross-validation and evaluated the accuracy of age estimation using mean absolute error (MAE) and correlation coefficient (R).

RESULTS
The CNN model achieved a mean absolute error of 1.8 years and a correlation coefficient of 0.85. The model was able to accurately estimate age from TOF MR angiograms, with results comparable to human visual assessment.

CONCLUSION
The model achieved 92% accuracy in estimating age from TOF MR angiograms using deep learning. This study demonstrates the potential for deep learning models to accurately estimate age from non-invasive imaging techniques, with potential applications in clinical settings for age-related disease diagnosis and treatment planning.
Learning with PNS X-ray can be used to classify between normal and sinusitis cases. For diagnosis of sinusitis, it is necessary to run the pre-processing steps such as extracted patch and data augmentation. Deep learning diagnosis for sinusitis using PNS X-ray depends on the quantity and quality of data.

**RESULTS**

A deep learning model was built to estimate subjects' age solely using TOF-MRA successfully. For validation set, high correlation coefficient (r=0.847) with good MAE (6.774) was obtained. For test set, performance was slightly decreased (r=0.825, MAE=7.765), but results were acceptable. Using trained network, a subject's age can be estimated from TOF-MRA data within a second.

**CONCLUSION**

We demonstrated the potential of deep learning technology for the assessment of age from the brain MRA. Estimated age from TOF-MRA showed good concordance with subject's biologic age.

**CLINICAL RELEVANCE/APPLICATION**

Estimated age from TOF-MRA can be used as an imaging biomarker for the brain vasculature. For example, a subject with atherosclerosis might have higher estimate age from brain TOF-MRA than subject's biological age.

**SSJ19-06 Convolutional Neural Network based Deep Learning to Diagnosis the Sinusitis with Paranasal Sinus X-Ray**

Participants

Hyung-Gi Kim, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose

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**PURPOSE**

Sinusitis is diagnosed by the opacification of the sinuses and air/fluid level best seen in the maxillary sinus with the paranasal sinus (PNS) X-ray scan. It is hard to represent these features to discriminate sinusitis from normal cases. Deep learning is a branch of machine learning used in acquiring useful representation of features directly from data. The most important factors that determine the performance of deep learning is data quality and quantity. The objective of this study was to investigate the ability of deep learning to improve the diagnosis of sinusitis using the PNS X-ray image.

**METHOD AND MATERIALS**

A total of 954 TOF-MRA images were collected from two public databases of healthy volunteer and our own database of participants without any neurological or neurovascular disease. A deep neural network based on Alexnets was trained using axial MIP images as input data and actual ages as labels to minimize mean absolute errors (MAE) using TensorFlow framework. Spatial normalization and data augmentation were performed before train. For training and validation purpose, 689 subjects (augmented to 22,737) and 93 subjects were used. Remaining 203 subjects were used as test set. To evaluate the model accuracy, correlation coefficients (r) and MAE were calculated.

**RESULTS**

We compared the results of our approaches to optimize classification model. The results of accuracy for training/test data set were 70.3%/60.9%, 75.6%/59.6%, and 75.6%/59.6%, respectively. Fig. 1 shows that representation for the learned hierarchical feature maps with PNS X-ray image. Original data: a (normal) and e (sinusitis), Patched data: b (normal) and f (sinusitis), Feature maps: .c (1st layer), g (2nd layer), d and h (normal and sinusitis in final fully connected layer, respectively). Arrow indicates the characteristic to evaluate the sinusitis in the maxillary sinus.

**CONCLUSION**

The diagnosis for sinusitis using deep learning with PNS X-ray depends on the quantity and quality of data. To improve the accuracy of sinusitis, it is necessary to run the pre-processing steps such as extracted patch and data augmentation. Deep learning with PNS X-ray can be used to classify between normal and sinusitis cases.
CLINICAL RELEVANCE/APPLICATION

Optimized deep learning study with PNS X-ray image can demonstrate to be used to classify normal and sinusitis cases indicating it as a practical method for early diagnosis.
**SSJ20**

**Neuroradiology (Neurointerventional Radiology)**

Tuesday, Nov. 28 3:00PM - 4:00PM Room: N229

**NR**

**IR**

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Michele H. Johnson, MD, New Haven, CT (Moderator) Nothing to Disclose
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Sub-Events

**SSJ20-01**

**Prior IV tPA in Mechanical Thrombectomy for Acute Ischemic Stroke: Technical Details and Clinical Significance**

Tuesday, Nov. 28 3:00PM - 3:10PM Room: N229

Participants
Carmen Parra-Farinas, MD, Barcelona, Spain (Presenter) Nothing to Disclose
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**PURPOSE**

This study aimed to assess the impact of intravenous (IV) tPA treatment before mechanical thrombectomy in acute ischemic stroke patients.

**METHOD AND MATERIALS**

We studied patients prospectively included in SONIIA registry (2011-2015), a mandatory, externally audited registry that monitors the quality of reperfusion therapies in Catalonia. We included the total number of thrombectomy cases from all participant centers to simulate "real-world" clinical practice. Analysis and outcome parameters: any recanalization (TICI >=2a), complete recanalization (TICI >=2b), procedural time, symptomatic intracranial hemorrhage (SICH), neurological improvement (>=4 points decrease in the NIHSS score at 24 hours), independent functional outcome (mRS <=2), mortality at three months.

**RESULTS**

Among the 1640 patients included, 48.1% received IV tPA. Mean age at treatment was 67.5±13.5, 54.4% male. Diabetes mellitus (p=0.024), atrial fibrillation (p<0.001), and ischemic cardiomyopathy (p=0.018) prevalence rates were higher in IV tPA patients. There were no other statistically significant differences in baseline characteristics between treatment groups. Median NIHSS score was 17 (12-21) on arrival and 9 (3-18) at 24 hours. The overall complete recanalization rate was 77.8%. The rate of complete recanalization was not different according to IV tPA administration: TICI >=2b: 79.8% IV tPA patients vs. 75.9% no IV tPA (p=0.065). However, patients who received IV tPA achieved higher any recanalization rate: TICI >=2a: 88.3% vs. 84.2% (RR, 1.0; 95% CI 1.0-1.1; p=0.018). IV tPA was associated with shorter procedural time: 82.4±70.1 min vs. 93.3±74.9 min (p=0.002). There were no differences in SICH: 3.0% vs. 3.2% (p=0.064). No differences were observed in early neurological improvement: 70.1% vs. 71.8% (p=0.491). IV tPA patients achieved higher functional independence: 43.9% vs. 53.3% (RR, 1.2; 95% CI 1.1-1.3; p=0.046), and less mortality: 21.4% vs. 14.7% IVT (RR, 0.7; 95% CI 0.6-0.8; p=0.001).

**CONCLUSION**

IV tPA before mechanical thrombectomy is associated with better recanalization rate, shorter procedural time, better functional independence, and less mortality. In addition, preceding IV tPA does not seem to influence in SICH development.

**CLINICAL RELEVANCE/APPLICATION**

Endovascular stroke therapy has revolutionized the management of patients with acute brain infarction. There is a lack of evidence-based data concerning the impact of including IV tPA before mechanical thrombectomy.
New Detector with Special High Definition (Hi-Def) Zoom Feature for Neuro Interventional Procedures

Tuesday, Nov. 28 3:10PM - 3:20PM Room: N229

Participants
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PURPOSE
Traditional Flat Panel Detectors (FPDs) have increasing difficulty in visualizing improved neuro interventional devices which have more complex finer structures. A new unique single package High Definition detector with a special Hi-Def zoom feature was developed. Initial subjective evaluations of Pipeline Embolization Device (PED) images acquired using the FPD and the Hi-Def zoom of this detector are presented.

METHOD AND MATERIALS
A PED was placed inside a neurovascular phantom with anatomically accurate 3D printed vessel structures embedded in a skull and having PMMA attenuating material. For image quality comparison, PED images were acquired with FPD and Hi-Def zoom in identical Fields of View. Ten Image sets each composed of one FPD and one Hi-Def zoom image acquired under the same x-ray exposure conditions were presented together to two blinded-neuro-interventionists who were asked to select the better image of the two and rate the selection as either Similar, Preferred or Much Preferred. Their annotations about the better images were also recorded.

RESULTS
For all the image sets generally, the Hi-Def zoom images were Much Preferred over FPD images by both the raters. Both the raters commented that the visualization of the stent structures in the Hi-Def zoom images were superior compared to those of the FPD and indicated that such imaging can be very helpful during interventions.

CONCLUSION
A new High Definition detector with high resolution Hi-Def zoom was developed and evaluated in simulated clinical settings by neurovascular interventionists. The Hi-Def zoom images were generally Much Preferred due to their superior image quality. Information regarding delicate movements and structural changes of the devices during deployment, navigation of the microwire through the stent, and stent to vessel wall apposition are critical to an intervention's success. The new high resolution imaging can improve real time visualization of such information and could potentially improve endovascular treatment outcomes.

CLINICAL RELEVANCE/APPLICATION
Superior real time imaging of devices during a neuroendovascular intervention treatment of diseases such as strokes and aneurysms is critical to its success and to ensure good treatment outcomes.

Intraoperative Thermal Imaging During Awake Craniotomy

Tuesday, Nov. 28 3:20PM - 3:30PM Room: N229

Participants
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PURPOSE
Gliomas represent a diverse and deadly class of brain tumors, for which aggressive surgical resection of the tumor is the best treatment. Resection is limited in a majority of patients by tumor invasion into critical functional regions, which are avoided in resection through direct cortical stimulation mapping during awake craniotomy. However, this method has poor spatial resolution (~10 mm), limiting the extent of resection and therefore survival.

METHOD AND MATERIALS
Neural activation creates a downstream compensatory vasodilation, increasing local perfusion. Intraoperatively, this mechanism causes a focal increase in cortical temperature, which can be measured by infrared thermal imaging. This approach captures small temperature deviations (>0.03 °C) at high spatial and temporal resolution (~0.5 mm, 30 Hz). In this study, we examine cortical...
temperature gradients during a behavioral task to construct a neural activation map for guidance of surgical resection.

RESULTS
Cortical temperature changes were measured in two patients undergoing routine direct cortical stimulation during glioma resection surgery. The first patient performed a lip pursing task, which created diffuse temperature elevation (+0.3 °C) throughout facial motor and sensory regions. The region of maximal temperature elevation (+0.5 °C) coincided with the area of positive direct cortical stimulation. A second patient performed a right hand clenching task, which created temperature elevation (+0.5 °C) in the left motor cortex in the areas of positive direct cortical stimulation. This thermal signature was not observed during left hand clenching, which produced an activation pattern similar to the cortical temperature pattern measured at patient baseline.

CONCLUSION
Intraoperative thermal imaging may delineate activated cortical regions during awake craniotomy, and appears grossly consistent with direct cortical stimulation. While further measurements are necessary to conclude efficacy across tasks and patients, the utility of thermal imaging as an intraoperative mapping tool is promising. Future work will parse networks and functional regions by examining the dynamics of small temperature fluctuations within gross activation.

CLINICAL RELEVANCE/APPLICATION
Infrared thermal imaging is a promising approach for intraoperative cortical mapping, permitting increased extents of resection which can prolong patient survival after glioma resection surgery.

SS220-04 Development of Patient-Specific CT/MR "Bio-mimicking" 3D-Printed Phantoms, with Application to Minimally-Invasive Image-Guided Thermal Ablation Planning and Simulation
Tuesday, Nov. 28 3:30PM - 3:40PM Room: N229

PURPOSE
Image-guided percutaneous ablations in the head/neck, spine, chest, and abdomen have a steep learning curve and safety is a concern as new application sites such as the posterior spinal elements are explored. We developed a technique to 3D print "bio-mimicking" phantoms that replicate the patient-specific anatomy in both CT and MRI, and used it to simulate an image-guided cryoablation.

METHOD AND MATERIALS
A model was designed from pre-procedure CT and MRI of a patient w/ LI left lamina osteoblastoma. Cortical and cancellous bone and osteoblastoma were segmented from the CT. Cerebrospinal fluid, spinal nerves and foraminal fat were segmented from the T1- and T2-W MRI. Tissues segmented from each image set were combined in a single model using cancellous bone, aorta, and diaphragmatic crura as landmarks. The combined model was 3D-printed using a different mixture of 2 MRI-visible and 1 non-MRI-visible material for each tissue, and imaged identical to the patient (120 kVp CT, T1/2W FSE MRI). Signal intensity and contrast-to-noise ratio (CNR) of tissues in patient and model images were compared with ANOVA to determine if tissues separable in vivo were also separable with the printed model. Finally, CT-guided power drilling and subsequent MRI-monitored cryoablation was performed on the model identically to the patient procedure.

CONCLUSION
Bio-mimicking 3D-printed models can be produced that replicate patient anatomy in both CT and MRI. These models enable targeting and monitoring key anatomic structures during CT- and MRI-guided procedures such as thermal ablations.

CLINICAL RELEVANCE/APPLICATION
Patient-specific bio-mimicking 3D printed phantoms are now possible for simulating and hands-on teaching of CT/MR image-guided thermal ablations toward enhancing procedure safety and efficacy.

SS220-05 Clinical and Imaging Evaluation of Lumbar Disc Herniation after Different Oxygen-Ozone (O2-O3) Chemiodiscolysis Treatment Sessions: Which is the Best Treatment Protocol Management in Partially-Responder Patients?
Tuesday, Nov. 28 3:40PM - 3:50PM Room: N229

PURPOSE
Participants
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Carlo Masciocchi, MD, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose

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To compare the therapeutic outcome of different treatment sessions of oxygen-ozone (O2-O3) therapy in patients with lumbar disc herniation

**METHOD AND MATERIALS**

We retrospectively evaluated 432 patients (mean age 44.3 years, range 26-69), who underwent multiple treatment sessions of O2-O3 lumbar chemiodiscolysis in the period between January 2014 and January 2017. We excluded patients with multiple level pathology, patients with multiple causes of low back pain, patients who underwent surgery during the follow-up period. For each patient we evaluated the number of treatment sessions and the type of treatment performed. Treatment outcome was assessed using a modified MacNab method to assess the clinical response and performing MRI to evaluate the modifications of the disc herniation area.

**RESULTS**

235 patients were treated with 2 sessions of intradiscal injection associated with periganglionic steroid injection (Group A); 197 patients received an intradiscal-perigangliar injection of O2-O3 and a second periganglionic injection with steroids (Group B). The mean time interval between each treatment was 32.6 days (range 15-62). Treatment was successful in terms of clinical outcome in 82.3% of patients of group A and 78.7% in group B. Statistical analysis showed no statistically significant difference between the two groups in terms of both clinical results and reduction of the disc herniation area (p<=0.001).

**CONCLUSION**

Multiple intradiscal ozone injections are not associated with a superior herniation volume reduction nor better clinical outcome compared to a single intradiscal O2-O3 injection followed by periradicular steroids.

**CLINICAL RELEVANCE/APPLICATION**

According to the results of our follow-up, in partially or non-responder patients after a first O2-O3 intradiscal injection, a better cost-effective protocol should include a second periradicular steroid injection rather than additional intradiscal treatments.

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SSJ20-06  **Efficacy and Safety of Ethanol Ablation for Branchial Cleft Cysts**

Tuesday, Nov. 28 3:50PM - 4:00PM Room: N229

Participants
Eun Ju Ha, Suwon, Korea, Republic Of (Presenter) Nothing to Disclose
Jung Hwan Baek, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Branchial cleft cyst (BCC) is a common congenital lesion of the neck. This study evaluated the efficacy and safety of ethanol ablation (EA) as an alternative treatment to surgery for BCC.

**METHOD AND MATERIALS**

Between September 2006 and October 2016, EA was performed in 22 patients who refused surgery for a second BCC. After the exclusion of two patients who were lost to follow-up, the data of 20 patients were retrospectively evaluated. All index masses were confirmed as benign before treatment. Ultrasound-guided aspiration of the cystic fluid was followed by injection of absolute ethanol (99%) into the lesion. The injected volume of ethanol was 50-80% of the volume of fluid aspirated. Therapeutic outcome, including volume reduction ratio (VRR), therapeutic success rate (VRR > 50% and/or no palpable mass), and complications, were evaluated.

**RESULTS**

The mean index volume of the cysts was 26.4 ± 15.7 mL (range: 3.8-49.9 mL). After ablation, the mean volume of the cysts decreased to 1.2 ± 1.1 mL (range: 0.0-3.5 mL). The mean VRR at last follow-up was 93.9 ± 7.9% (range: 75.5-100.0%, P <0.001). Therapeutic success was achieved in all nodules (20/20; 100%), and the symptomatic (P <0.001) and cosmetic (P <0.001) scores had improved significantly by the last follow-up. In one patient, intracystic hemorrhage was developed during the aspiration; however, no major complications occurred in all patients.

**CONCLUSION**

EA is an effective and safe treatment for patients with BCC who refuse, or are ineligible for, surgery.

**CLINICAL RELEVANCE/APPLICATION**

1. This study evaluated the efficacy and safety of EA for the treatment of BCCs, based on the largest number of cases (drawn from two hospitals) reported thus far. 2. A mean volume reduction in the EA-treated BCCs of 93.0%, as well as improvements in clinical symptoms and cosmetic problems. There were no major complications or procedure-related deaths. 3. After a single session, 55.0% of the patients had incompletely resolved clinical problems but they responded well to additional EA, which was effective and safe and had a therapeutic success rate of 100.0%. These results support the use of EA as a first-line treatment for BCC.
**RC405**

**Traumatic Brain Injury**

Tuesday, Nov. 28 4:30PM - 6:00PM Room: E351

*AMA PRA Category 1 Credits™: 1.50*
*ARRT Category A+ Credit: 1.75*

**Participants**
Roland R. Lee, MD, San Diego, CA (Moderator) Research Grant, General Electric Company

**LEARNING OBJECTIVES**
1) Discuss impact exposure in youth and high school football. 2) Recognize the imaging correlates of head impact exposure. 3) Identify how risks can be reduced. 4) Be able to identify the important findings of acute head trauma on non-contrast CT. 5) Know what the indications are for MRI in the setting of head trauma. 6) Be able to describe new techniques in imaging of concussion. 7) Identify unique characteristics of military TBI compared to civilian TBI. 8) Understand advanced imaging MRI techniques application to military TBI. 9) Recognize the potential uses and limitations of these techniques for chronic mild TBI in the US military.

**SAM**

New in 2017: PLEASE NOTE - All courses designated for SAM credit at RSNA 2017 will require attendees bring a personal device e.g. phone, iPad, laptop to complete the required test questions during the live session.

**Sub-Events**

**RC405A**  **Imaging and Subconcussive Impacts in Youth Sports**

Participants
Joseph A. Maldjian, MD, Dallas, TX (Presenter) Consultant, BioClinica, Inc; Consultant, Koninklijke Philips NV

**LEARNING OBJECTIVES**
1) Discuss impact exposure in youth and high school football. 2) Recognize the imaging correlates of head impact exposure. 3) Identify how risks can be reduced.

**RC405B**  **'Don't Miss' Lesions in Traumatic Brain Injury**

Participants
Yvonne W. Lui, MD, New York, NY (Presenter) Nothing to Disclose

*For information about this presentation, contact: yvonne.lui@nyumc.org*

**LEARNING OBJECTIVES**
1) Be able to identify the important findings of acute head trauma on non-contrast CT. 2) Know what the indications are for MRI in the setting of head trauma. 3) Be able to describe new techniques in imaging of concussion.

**RC405C**  **Neuroimaging of Military TBI**

Participants
Gerard Riedy, MD, PhD, Bethesda, MD (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
1) Identify unique characteristics of military TBI compared to civilian TBI. 2) Understand advanced imaging MRI techniques application to military TBI. 3) Recognize the potential uses and limitations of these techniques for chronic mild TBI in the US military.
**RC406**

**The Head & Neck Spaces: Anatomy & Pathology**

Tuesday, Nov. 28 4:30PM - 6:00PM Room: E451B

**HN**

**NR**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

**SAM**

New in 2017: PLEASE NOTE - All courses designated for SAM credit at RSNA 2017 will require attendees bring a personal device e.g. phone, iPad, laptop to complete the required test questions during the live session.

**Sub-Events**

**RC406A  Parotid and Parapharyngeal Spaces**

Participants
Ilona M. Schmalfuss, MD, Gainesville, FL (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

schmai@radiology.ufl.edu

**LEARNING OBJECTIVES**

1) Describe the boundaries and contents of the parotid and parapharyngeal spaces. 2) Identify the origin of a lesion based on growth pattern and/or displacement of fat planes.

**RC406B  Masticator Space**

Participants
Daniel E. Meltzer, MD, New York, NY (*Presenter*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Become more familiar with the anatomy of the masticator space, especially with regard to its neighboring compartments in the face and neck. 2) Develop ability to generate a concise and relevant differential diagnosis for lesions in the masticator space. 3) Deepen understanding of the patterns of spread of disease from the masticator space to its neighboring compartments in the face and neck (and vice versa). 4) Understand the importance of the mandibular nerve as a potential conduit for perineural spread of tumor to and from the masticator space.

**RC406C  Carotid Space**

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

For information about this presentation, contact:
cornelrs@ucmail.uc.edu

**LEARNING OBJECTIVES**

1) Identify the anatomic structures located in the carotid space. 2) Differentiate pathologic processes that occur within the carotid space.

**ABSTRACT**

The carotid space extends from the skull base to the aortic arch and is surrounded by the carotid sheath, which is composed of all 3 layers of the deep cervical fascia. The suprahypoid carotid space contains the internal carotid artery, the internal jugular vein and cranial nerves IX through XII while the infrahyoid carotid space contains the common carotid artery, internal jugular vein and cranial nerve X. Pathologic processes in the carotid space include vascular abnormalities, neoplasms and infectious/inflammatory processes. The most common benign neoplasms are paragangliomas and schwannomas. When malignant neoplasm involves the carotid space it occurs either from direct extension of primary tumor from an adjacent space or from extranodal extension from nodal metastasis. Vascular pathology can be arterial or venous. The differential diagnosis of carotid space pathology is limited, based on the limited anatomic contents of this space.

**Active Handout:**Rebecca Sue Cornelius


**RC406D  Visceral Space**

Participants
Kristine M. Mosier, DMD, PhD, Indianapolis, IN (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) To be familiar with the anatomical components of the visceral space. 2) To be familiar with common pathology involving the visceral space. 3) To be familiar with the differential diagnoses for common lesions of the visceral space.

RC406E    Retropharyngeal and Danger Spaces

Participants
Keivan Shifteh, MD, Brooklyn, NY (Presenter) Nothing to Disclose

For information about this presentation, contact:
kshifteh@montefiore.org

LEARNING OBJECTIVES

1) Retropharyngeal and danger space: Normal anatomy. 2) The normal contents of the suprathyoid and infrahyoid RPS: Fasciae and terminology, including Alar fascia. 3) Anatomic variants: Retropharyngeal and danger space pathology. 4) RPS and DS: Differential Diagnosis.

Active Handout:Keivan Shifteh

**Emergency Neuroradiology (An Interactive Session)**

**Tuesday, Nov. 28 4:30PM - 6:00PM Room: E451A**

**AMA PRA Category 1 Credits**: 1.50  
**ARRT Category A+ Credit**: 1.75

**Participants**
A. Orlando Ortiz, MD, MBA, Mineola, NY (Moderator) Nothing to Disclose

For information about this presentation, contact: oortiz@winthrop.org

**LEARNING OBJECTIVES**

1) To introduce common spine interventions that are performed for the evaluation of neck and back pain. 2) To learn the indications for these procedures. 3) To understand the role of imaging in patient selection.

**SAM**

New in 2017: PLEASE NOTE - All courses designated for SAM credit at RSNA 2017 will require attendees bring a personal device e.g. phone, iPad, laptop to complete the required test questions during the live session.

**Sub-Events**

**RC408A Cervical Spine Trauma**

**Participants**
Wayne S. Kubal, MD, Tucson, AZ (Presenter) Author, Reed Elsevier; Editor, Reed Elsevier

**LEARNING OBJECTIVES**

1) Understand the concept of stability as described by the "three column model". 2) Identify various cervical spine injuries on CT and MR and discuss their level of stability. 3) Appreciate the advantages of obtaining MR.

**RC408B Compressive Myelopathy**

**Participants**
A. Orlando Ortiz, MD, MBA, Mineola, NY (Presenter) Nothing to Disclose

For information about this presentation, contact: oortiz@winthrop.org

**LEARNING OBJECTIVES**

1) To review the clinical presentation of patients with myelopathy. 2) To distinguish between acute and subacute clinical presentations. 3) To understand the role of imaging in patients presenting with clinical myelopathy.

**RC408C Stroke Imaging: Pathway to IA Therapy**

**Participants**
Gregg H. Zoarski, MD, Newark, DE (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Optimize recommendations for imaging algorithms in patients presenting with acute stroke. 2) Identify imaging findings that characterize patients who are likely to benefit from stroke intervention. 3) Determine if a patient is a patient is a candidate for intraarterial stroke treatment based upon imaging findings.
Interventional Stroke Treatment: Practical Techniques and Protocols

Tuesday, Nov. 28 4:30PM - 6:00PM Room: S404CD

Participants
Joshua A. Hirsch, MD, Boston, MA (Moderator) Consultant, Medtronic plc; Consultant, Globus Medical, Inc; Data Safety Monitoring Board, Johnson & Johnson;

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 microcatheter 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

RC431A Devices and Data that Support IA Treatment as the Standard of Care for Ischemic Stroke

Participants
Allan L. Brook, MD, Bronx, NY (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

RC431B 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.

RC431C Breaking: Imaging Extends the Window: DAWN AND DEFUSE 3

Participants
Sameer A. Ansari, MD,PhD, Chicago, IL (Presenter) Nothing to Disclose

For information about this presentation, contact:
s-ansari@northwestern.edu

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 (CT, CTA, CT perfusion, DWI, MR perfusion) in acute stroke patients and a critical review of the literature and has been validated in clinical trials. The approach focuses on answering the following key questions using modern imaging: 1. Is there a hemorrhage? Noncontrast CT 2. Is there an occlusion of the distal ICA and/or proximal MCA? CTA 3. Is irreversible brain injury below a specific threshold (e.g. <70ml)? DWI

Perfusion imaging is not employed unless patients cannot undergo MRI, or they do not meet the criteria for intervention.
Investigations to understand the reasons for the unsuitability of perfusion CT to substitute for DWI have revealed theoretical and practical shortcomings of CTP. A major problem is the low signal-to-noise (SNR) ratio of CT perfusion that results in a poor contrast-to-noise (CNR) ratio in severely ischemic brain. In a comparison between DWI and CTP in over 50 consecutive patients with LVA, Schaefer, et al. showed that the mean CNR of DWI was >4 while it was <1 for CTP derived CBF. The poor CNR results in large measurement error: using Bland-Altman analyses it was found that the 95% confidence interval was ~+/− 50 ml for ischemic lesion volume measurements in individual patients. The Cleveland Clinic adopted a nearly identical algorithm and their results were published. They reported that after the new algorithm was adopted, there was a ~50% reduction in mortality and a ~3-fold increase in good outcomes, despite a ~50% decrease in the number of procedures. A recent prospective observational trial at the MGH using stentrieverhs and this imaging approach demonstrated >50% favorable outcomes (mRS 0-2) that is similar to recent randomized clinical trials. However, only 3 patients were evaluated for every patient that was treated, a screening to treatment ratio that is much lower than in recently published clinical trials. 1. Gonzalez RG, Copen WA, Schaefer PW, Lev MH, Pomerantz SR, Rapalino O, et al. The Massachusetts General Hospital acute stroke imaging algorithm: an experience and evidence based approach. Journal of neurointerventional surgery. 2013;5 Suppl 1:i7-12. 2. Wisco D, Uchino K, Saqqur M, Gebel JM, Aoki J, Alam S, et al. Addition of hyperacute MRI AIDS in patient selection, decreasing the use of endovascular stroke therapy. Stroke; a journal of cerebral circulation. 2014;45(2):467-72. 3. Bland JM, Altman DG. Statistical methods for assessing agreement between two methods of clinical measurement. Lancet. 1986 Feb 8;1(8476):307-10. 4. 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.
LEARNING OBJECTIVES

1) Understand the different facets of the latest anatomical and functional neuroimaging techniques. 2) Understand their potential as clinical tools for evaluating the breadth of diseases affecting the brain.

ABSTRACT

During the past decade, we have seen an explosion of innovation in structural and functional neuroimaging techniques, providing exciting insights into new aspects of the human brain that transcend simple visualization of anatomy. New scanners that are faster with better image quality and higher magnetic field strength — as well as higher spatial and temporal resolution — allow fully quantitative assessment of the brain, including macroscopic structure, microstructural organization, functional connectivity, perfusion and metabolism. The resultant exponential increase in highly granular neuroimaging data that can be rapidly acquired creates challenges — but also opportunities — for better characterization of neurological, neurosurgical and psychiatric disorders that arise from complex central nervous system dysfunction. Indeed, neuroimaging is now appropriately recognized as a big data technique, sharing similar needs with other data-rich methods for further innovation in analysis and meaningful information extraction, as well as for integration with the other big data disciplines such as genomics and proteomics. There is a continued need for this technology to be translated from basic “bench top” science into clinical practice, so that these remarkable advances in the ability to characterize the brain can benefit patients. Critical to meaningful clinical translation is comparative effectiveness and outcome research to gain widespread acceptance in the modern, economically constrained healthcare system.
CS40

Can New Imaging Technologies Improve Patient Outcomes?: Presented by Toshiba America Medical Systems, Inc.; Canon, Canon Group

Wednesday, Nov. 29 8:30AM - 10:00AM Room: S101AB

PARTICIPANTS

Junsung Choi, MD Tampa, FL; Kenneth Snyder, MD Buffalo, NY; Miyuki Sone, MD Tokyo, Japan

PROGRAM INFORMATION

Join us to learn about new imaging technologies improving patient outcomes. Speakers and topics include: 'Improving Oncologic Outcomes Using a Unique 4DCT Solution,' Junsung Choi, M.D., Moffitt Cancer Center, Florida; 'Saving Brain and Improving Patient Outcomes with a Better Acute Stroke Protocol,' Kenneth Snyder, M.D., Gates Vascular Institute, New York; and 'Can UHR CT Improve Outcomes with Better Detection, Diagnoses and Staging,' Miyuki Sone, M.D., National Cancer Center Hospital, Japan

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Neuroradiology Series: Brain Tumors

Wednesday, Nov. 29 8:30AM - 12:00PM Room: E451B

RC505-01  Treatment of Glioblastoma in 2017: Where Do We Stand?

Participants
Rajan Jain, MD, Hartsdale, NY (Moderator) Consultant, Cancer Panels; Royalties, Thieme Medical Publishers, Inc
James M. Provenzale, MD, Durham, NC (Moderator) Consultant, ArmaGen; Research Grant, Bayer AG; Consultant, Bayer AG; Consultant, Biomedical Systems; Consultant, Laboratory Corporation of America Holdings; Consultant, CurAccel, LLC; Research Grant, General Electric Company; Consultant, sanofi-aventis Group; Consultant, Guerbet SA; Consultant, Takeda Pharmaceutical Company Limited; Consultant, F. Hoffmann-La Roche Ltd

For information about this presentation, contact:
rajan.jain@nyumc.org

LEARNING OBJECTIVES
1) To review latest advances in brain tumor imaging diagnosis and assessment of therapy.

Sub-Events

RC505-02  Compactness of Peritumoral Edema on Routine MRI Appears to Distinguish Tumor Recurrence from Pseudo-Progression in Primary Brain Tumors: Preliminary Findings

Participants
Marwa Ismail, PhD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Prateek Prasanna, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Raymond Y. Huang, MD, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Gagandeep Singh, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Rajat Thawani, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Anant Madabhushi, PhD, Piscataway, NJ (Abstract Co-Author) Nothing to Disclose
Pallavi Tiwari, PhD, Cleveland, OH (Presenter) Nothing to Disclose

For information about this presentation, contact:
pxt130@case.edu

PURPOSE
Following aggressive chemo-radiation, a significant challenge in brain tumors is distinguishing pseudo-progression (PsP), a temporary radiation-induced treatment effect, from tumor recurrence (TR). On conventional MRI, PsP closely mimics the appearance of TR, making their visual identification challenging. It is suggested that PsP causes a pronounced local inflammatory tissue response due to inherent and radiotherapy-induced capillary permeability, leading to more pronounced edema. Unfortunately, guidelines set by RANO/Macdonald's criteria are based solely on 2-dimensional (2D) measurements of the enhancing tumor alone, and do not capture subtle morphometric differences in the edema component across PsP and TR. In this work, we hypothesized that quantitative 3D shape features (e.g. roundness, spherical radius, flatness, compactness) obtained from the edema component contribute to morphometric differences across PsP and TR, and may help distinguish them on routine MRI.

METHOD AND MATERIALS
33 MRI studies (Gd-T1w, T2w, FLAIR) were acquired from an IRB approved study (11 PsP, 22 TR cases). Co-registration, bias correction, and intensity standardization were first performed. Expert delineation of enhancing lesion was performed on T1w, and of peritumoral edema on T2w and FLAIR. 14 shape features, including volume, major and minor axis lengths, eccentricity, elongation, orientation, perimeter, roundness, spherical radius, flatness, compactness, were then computed from enhancing tumor and edema regions for all subjects. Finally, Wilcoxon Rank-Sum Test was employed to identify the statistically significant features between PsP and TR.

RESULTS
Compactness in edema component showed significant differences between the two groups (p=0.05). Mean and standard deviation of the edema compactness were found to be 2.9 +/- 0.63 and 2.4 +/- 0.48 for TR and PsP groups respectively.

CONCLUSION

Differences in compactness of the edema region were reported between PsP and TR in this preliminary study. These morphometric differences may be attributed to pronounced edema in PsP due to increased inflammation, leading to less compact lesion characteristics.

CLINICAL RELEVANCE/APPLICATION

Reliable distinction of PsP from TR would allow for early identification of patients with TR who are subject to “wait-and-watch” as their tumor continues to grow, while avoiding overtreatment in PsP.

RC505-03  The Role of Apparent Diffusion Coefficient in Patients with Choroid Plexus Tumors

Participants

Tomoaki Sasaki, MD, Iowa City, IA (Presenter) Nothing to Disclose
Tosio Moritani, MD, PhD, Iowa City, IA (Abstract Co-Author) Nothing to Disclose
Yutaka Sato, MD, Iowa City, IA (Abstract Co-Author) Nothing to Disclose
Shunta Ishitoya, Asahikawa, Japan (Abstract Co-Author) Nothing to Disclose
Akiko Oya, Asahikawa, Japan (Abstract Co-Author) Nothing to Disclose
Koji Takahashi, MD, Asahikawa, Japan (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
tomoaki-sasaki@uiowa.edu

PURPOSE

The aim of this study is to explore the role of apparent diffusion coefficient (ADC) as a predictor of outcome for choroid plexus tumors.

METHOD AND MATERIALS

We retrospectively analyzed ADC maps in 14 patients histologically proven with 8 choroid plexus papillomas (CPP, WHO grade 1), 3 atypical choroid plexus papillomas (aCPP, grade 2), and 3 choroid plexus carcinomas (CPC, grade 3). Mean ADC and tumor volume were assessed with the WHO grades using Spearman rank test, Kruskal-Wallis test, ROC analysis, and multiple linear regression analysis. Moreover, we performed Log-rank test to determine survival.

RESULTS

The median mean ADCs were 1.82 x 10^-3 mm²/s in the CPP, 1.26 x 10^-3 mm²/s in the aCPP, and 0.983 x 10^-3 mm²/s in the CPC, respectively (Spearman rank coefficient r = -0.741, P = 0.002; Kruskal-Wallis test, P = 0.028). The median tumor volumes were 1.22 x 10^4 mm³ in the CPP, 1.30 x 10^4 mm³ in the aCPP, and 8.37 x 10^4 mm³ in the CPC, respectively (Spearman rank coefficient r = -0.650, P = 0.012; Kruskal-Wallis test, P = 0.033). The post-hoc tests revealed the significant differences between the CPP and CPC (P = 0.040 in the mean ADC, P = 0.028 in the tumor volume, respectively). The ROC analyses demonstrated the cutoff ADC value, 1.38 x 10^-3 mm²/s, showed sensitivity 0.833 and specificity 1.00 for aCPP, sensitivity 1.00 and specificity 0.818 for CPC, respectively. In the tumor volume, the ROC showed the cutoff value, 1.38 x 10^4 mm³, to diagnose CPC with sensitivity 1.00 and specificity 1.00. The multiple linear regression analysis demonstrated both the mean ADC (ß = -0.582, P = 0.002) and tumor volume (ß = 0.499, P = 0.005) significantly contributed to the WHO grades (Adjusted R² 0.769, P = 0.005). The mean follow-up period was 52 months. Three patients (1 aCPP and 2 CPC) died of their diseases during the follow-up period. The Log-rank test revealed the cutoff ADC value, 1.38 x 10^-3 mm²/s, or lower presented significantly worse prognosis (P = 0.007).

CONCLUSION

The mean ADC negatively and tumor volume positively correlated with WHO grade in the choroid plexus tumors. Both ADC and tumor volume contributed to the WHO grade. The lower ADC could be an adverse prognostic factor.

CLINICAL RELEVANCE/APPLICATION

A combination of ADC and tumor volume could distinguish the WHO grades in choroid plexus tumors. In addition to the WHO grades, lower ADC value could be an adverse prognostic factor.

RC505-04  Comparison of Dynamic Contrast Enhanced (DCE) and Dynamic Susceptibility Contrast (DSC) in Differentiating Tumor Recurrence and Radiation Necrosis in High Grade Gliomas

Participants

Nader Z. Zakhari, MBCh, Ottawa, ON (Presenter) Nothing to Disclose
Michael Taccone, Ottawa, ON (Abstract Co-Author) Nothing to Disclose
Carlos H. Torres, MD, FRCP, Ottawa, ON (Abstract Co-Author) Nothing to Disclose
Sanatnu Chakraborty, FRCR, FRCP, Ottawa, ON (Abstract Co-Author) Grant, Bayer AG Grant, General Electric Company
John Sinclair, MD, Ottawa, ON (Abstract Co-Author) Nothing to Disclose
Thanh Nguyen, MD, Ottawa, ON (Abstract Co-Author) Research Grant, GE;
Gerard Jansen, MD, Ottawa, ON (Abstract Co-Author) Nothing to Disclose
John Woulfe, MD, Ottawa, ON (Abstract Co-Author) Nothing to Disclose
Gregory O. Cron, Ottawa, ON (Abstract Co-Author) Nothing to Disclose
Rebecca Thomhill, PhD, Ottawa, ON (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
nader.zakhari.medical@gmail.com

PURPOSE

Reliable distinction of PsP from TR would allow for early identification of patients with TR who are subject to “wait-and-watch” as their tumor continues to grow, while avoiding overtreatment in PsP.

METHOD AND MATERIALS

We retrospectively analyzed ADC maps in 14 patients histologically proven with 8 choroid plexus papillomas (CPP, WHO grade 1), 3 atypical choroid plexus papillomas (aCPP, grade 2), and 3 choroid plexus carcinomas (CPC, grade 3). Mean ADC and tumor volume were assessed with the WHO grades using Spearman rank test, Kruskal-Wallis test, ROC analysis, and multiple linear regression analysis. Moreover, we performed Log-rank test to determine survival.

RESULTS

The median mean ADCs were 1.82 x 10^-3 mm²/s in the CPP, 1.26 x 10^-3 mm²/s in the aCPP, and 0.983 x 10^-3 mm²/s in the CPC, respectively (Spearman rank coefficient r = -0.741, P = 0.002; Kruskal-Wallis test, P = 0.028). The median tumor volumes were 1.22 x 10^4 mm³ in the CPP, 1.30 x 10^4 mm³ in the aCPP, and 8.37 x 10^4 mm³ in the CPC, respectively (Spearman rank coefficient r = -0.650, P = 0.012; Kruskal-Wallis test, P = 0.033). The post-hoc tests revealed the significant differences between the CPP and CPC (P = 0.040 in the mean ADC, P = 0.028 in the tumor volume, respectively). The ROC analyses demonstrated the cutoff ADC value, 1.38 x 10^-3 mm²/s, showed sensitivity 0.833 and specificity 1.00 for aCPP, sensitivity 1.00 and specificity 0.818 for CPC, respectively. In the tumor volume, the ROC showed the cutoff value, 4.39 x 10^4 mm³, to diagnose CPC with sensitivity 1.00 and specificity 1.00. The multiple linear regression analysis demonstrated both the mean ADC (ß = -0.582, P = 0.002) and tumor volume (ß = 0.499, P = 0.005) significantly contributed to the WHO grades (Adjusted R² 0.769, P = 0.005). The mean follow-up period was 52 months. Three patients (1 aCPP and 2 CPC) died of their diseases during the follow-up period. The Log-rank test revealed the cutoff ADC value, 1.38 x 10^-3 mm²/s, or lower presented significantly worse prognosis (P = 0.007).

CONCLUSION

The mean ADC negatively and tumor volume positively correlated with WHO grade in the choroid plexus tumors. Both ADC and tumor volume contributed to the WHO grade. The lower ADC could be an adverse prognostic factor.

CLINICAL RELEVANCE/APPLICATION

A combination of ADC and tumor volume could distinguish the WHO grades in choroid plexus tumors. In addition to the WHO grades, lower ADC value could be an adverse prognostic factor.
PURPOSE

The appearance of a new enhancing lesion after surgery and chemoradiation for high grade glioma (HGG) presents a common diagnostic dilemma. We compare the diagnostic accuracy of DCE and DSC in differentiating tumor recurrence (TR) from radiation necrosis (RN) in this clinical scenario.

METHOD AND MATERIALS

We prospectively enrolled 98 consecutive HGG patients with a new enhancing lesion on post-treatment MRI. Each patient underwent a 3T MR examination including DCE, DSC sequences. The lesions were classified as TR and RN based on histopathology or clinical/imaging follow-up. A neuropathologist identified the percentage of TR and RN in each surgical lesion. We performed hotspot and histogram quantitative analysis of CBV, corrected CBV, Ktrans, AUC, Vp and ADC maps using a commercial software (Olea Sphere 1, Olea Medical). Ratio (lesion/white matter) was also obtained. Differences between the two patient groups were assessed via Mann-Whitney U test. ROC curve analysis was also performed. Correlation coefficient was used to express the correlation between TR percentage and perfusion parameters.

RESULTS

Thirty-two patients were excluded due to inadequate follow up or technical limitation. Total of 68 lesions (37 TR, 28 RN, 3 equal proportions of TR and RN), 43 lesions were surgically resected. TR had significantly higher CBV (p= 0.01), corrected CBV (p= 0.03), CBV ratio (p= 0.02), corrected CBV ratio (p= 0.02), AUC ratio (p= 0.02) and Vp ratio (p= 0.02) than RN on hot spot analysis with ROC area under the curve 0.69 (p=0.0049), 0.67 (p=0.02), 0.67 (p=0.02), 0.68 (p=0.01), 0.67 (p=0.02) and 0.67 (p =0.01) respectively. On histogram analysis, TR had significantly higher CBV and corrected CBV maximal value (p= 0.02, p= 0.01) compared with RN. There is correlation between the TR % and corrected CBV (r=0.31, p=0.049), CBV (r=0.35, p=0.02) and AUC ratio (r=0.52, p=0.0005). No significant difference or correlation seen for the rest of the maps.

CONCLUSION

MR perfusion parameters assessing the blood volume (CBV, corr CBV, Vp) are more useful than leakage measurement in differentiating TR and RN. Permeability MR derived Ktrans did not show significant difference between the two groups nor significant correlation with TR percentage.

CLINICAL RELEVANCE/APPLICATION

The results of this study suggest that blood volume measurements from DSC or DCE are more useful than DCE derived permeability measurements (Ktrans) in differentiating TR and RN.

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 H. Torres, MD,FRCPC - 2017 Honored Educator

RC505-05 High Resolution Two and Three Dimensional Fast Magnetic Resonance Spectroscopic Imaging of Brain Tumors at 7 T

Wednesday, Nov. 29 9:30AM - 9:40AM Room: E451B

Participants

Stephan Guuber, MD, Vienna, Austria (Presenter) Nothing to Disclose
Gilbert Hangel, Vienna, Austria (Abstract Co-Author) Nothing to Disclose
Eva Heckova, Vienna, Austria (Abstract Co-Author) Nothing to Disclose
Bernhard Strasser, Vienna, Austria (Abstract Co-Author) Nothing to Disclose
Michal Povazan, Vienna, Austria (Abstract Co-Author) Nothing to Disclose
Siegfried Trattnig, MD, Vienna, Austria (Abstract Co-Author) Nothing to Disclose
Wolfgang Bogner, MSc, Vienna, Austria (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
stephan@nrr.at

PURPOSE

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 (7 T) offer increased SNR and spectral resolution which can be transformed to increased spatial resolution, better characterization of overlapping metabolites and/or acceleration of the measurement. With accelerated 2D/3D-FID-MRSI at 7 T metabolic maps of eight different metabolites can be obtained in clinical feasible measurement times. In this study, we applied accelerated MRSI with ultrashort acquisition delays (TE*) of 1.5ms in 9 patients with brain tumors.

METHOD AND MATERIALS

9 patients with glioma (6m/3f, age:42±5) were measured with 2D/3D-FID-MRSI (8/1 patients) at 7T (7T Magnetom, Siemens, Germany) using a 32-channel head coil. A 5-fold accelerated 2D-FID-MRSI 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 6min). One patient was measured with accelerated 3D-FID-MRSI (Hadamard encoded; 4 slices 0.8 cm thick, TE*=1.3, 2.3, 3.3, 4.3 ms; scan time 13.3 min). Metabolic maps were created based on results from LCModel.

RESULTS

Good data quality was achieved from all patients measured at 7T. Compared to techniques using pre-localization techniques (e.g. STEAM, PRESS) FID-CIS 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. In all patients, tNAA was reduced in glioma. tCho was increased in all patients, except in the patient with diffuse astrocytoma. In addition, we found alternations in several (j-coupled) resonances such as myo-Inositol, glutamate, glutamine and glycine.
CONCLUSION

Accelerated MRSI at 7 T allows to measure an extended neurochemical profile in only ~6min/~13min (2D-/3D-MRSI). This allows the quantification of potentially therapy-relevant metabolites such as myo-Inositol, glutamate, glutamine and glycine with low CRLBs and highlights the potential of fast clinical FID-MRSI at 7T in tumor patients.

CLINICAL RELEVANCE/APPLICATION

Accelerated, full-slice, high-resolution FID-MRSI with ultrashort TE* at 7T unveils the potential of clinical MRSI in tumor patients and neurologic studies in general.

RC505-06  WHO Decided to Reclassify Brain Tumors?

Wednesday, Nov. 29 9:40AM - 10:10AM Room: E451B

Participants

Soonmee Cha, MD, San Francisco, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Succinctly review the main highlights of 2016 WHO CNS Tumor Classification focusing on new or restructured CNS tumors. 2) Become familiar with several key molecular markers that define specific CNS tumor entities. 3) Discuss imaging relevance of the new or restructured CNS tumors. 4) Present importance of integrated diagnosis of CNS tumors and the role of imaging in the molecular era of tumor diagnosis and classification.

RC505-07  How Should Radiogenomics Influence Image Interpretation?

Wednesday, Nov. 29 10:20AM - 10:50AM Room: E451B

Participants

Rivka R. Colen, MD, Houston, TX (Presenter) Research Grant, General Electric Company;

LEARNING OBJECTIVES

1) Understand and review the literature on radiogenomics focusing on the predictions of key genomic markers such as MGMT, EGFR, IDH1, etc. 2) Obtain basic knowledge on the potential clinical radiogenomic biomarkers. 3) Understand the use of 2HG MRS for evaluation of IDH1 mutation. 4) Interpreting imaging in the era of genomics and radiogenomics.

ABSTRACT

Radiogenomics is the linkage of imaging characteristics with the genomic profile of the tumor or tissue. Currently, imaging is typically reviewed in isolation of the genomic profile of the patient. However, with the use of genomics for stratification into molecular-targeted clinical trials, use for prognosis, and evaluation of likely response, imaging reads and analysis in the context specific important genomic markers is important.

RC505-08  Assessment of Tissue Heterogeneity Using MR Textural Analysis for Grading Gliomas

Wednesday, Nov. 29 10:50AM - 11:00AM Room: E451B

LEARNING OBJECTIVES

1) Understand and review the literature on radiogenomics focusing on the predictions of key genomic markers such as MGMT, EGFR, IDH1, etc. 2) Obtain basic knowledge on the potential clinical radiogenomic biomarkers. 3) Understand the use of 2HG MRS for evaluation of IDH1 mutation. 4) Interpreting imaging in the era of genomics and radiogenomics.

ABSTRACT

Radiogenomics is the linkage of imaging characteristics with the genomic profile of the tumor or tissue. Currently, imaging is typically reviewed in isolation of the genomic profile of the patient. However, with the use of genomics for stratification into molecular-targeted clinical trials, use for prognosis, and evaluation of likely response, imaging reads and analysis in the context specific important genomic markers is important.

PURPOSE

Textural analysis can quantify variations in surface intensity or patterns, including some that are imperceptible to the human visual system. Our objective was to determine the diagnostic accuracy of textural analysis (TA) in differentiating high from low-grade gliomas by assessing tumor heterogeneity.

METHOD AND MATERIALS

Patients with a histopathological diagnosis of glioma and preoperative 3T MRI imaging were included in this retrospective study. A region of interest enclosing the largest cross-sectional area of the tumor was manually delineated on post contrast T1 images. TA was assessed with a commercially available research software (TexRAD Ltd, Cambridge, UK) using a filtration-histogram technique. The histogram parameters including mean pixel intensity, standard deviation of the pixel histogram (SD), entropy, mean of the positive pixels (MPP), skewness (asymmetry), and kurtosis (peakness) were analyzed at various spatial scaling factors (SSF) ranging from 0-6 mm. The parameters were correlated with WHO glioma grade using Spearman correlation. Areas under the curve (AUC) were calculated using ROC curve analysis to distinguish tumor grades.

RESULTS

Of a total of 94 patients, 14 had WHO low-grade gliomas (LGG) (Gr I = 2, Gr II =12) and 80 had WHO high-grade gliomas (HGG) (Gr III = 17, Gr IV = 63). TA parameters including mean, SD, MPP, entropy and kurtosis showed significant differences between glioma grades for different filters, most prominently at SSF 2 mm with lower values in LGG vs. HGG (p<0.001). The correlation between the glioma grades and HGG vs. LGG for all parameters except skewness for SSF 2 mm was significant (p<0.001) (Image). Diagnostic
ability for TA to differentiate between the different sub-groups (grade II-IV) at SSF 2 mm was also significant. LGG and HGG were best-discriminated using mean of 2 mm fine texture scale, with a sensitivity and specificity of 93% and 86% (AUC of 0.90).

**CONCLUSION**

Quantitative measurement of heterogeneity using textural analysis can discriminate high versus low-grade gliomas.

**CLINICAL RELEVANCE/APPLICATION**

Textural analysis can be a complimentary tool for lesion characterization, particularly where conventional MR features may not be sufficient.

**RC505-09  A CAD System to Track Brain Metastases on MRI Over Time**

*Wednesday, Nov. 29 11:00AM - 11:10AM Room: E451B*

**Participants**

Michel Bilello, MD, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose

**PURPOSE**

Interpreting serial brain MRI studies can be a tedious and error-prone task for the neuroradiologist, in both qualitative and quantitative assessment of change in metastatic disease load. This is particularly relevant as gamma knife radiotherapy is becoming widely used to treat metastases, and it is therefore critical to report response to treatment and possibly new metastases accurately. These limitations and opportunities highlight the need for the development of a computer-aided detection (CAD) system to detect and quantify changes in brain metastatic disease over time.

**METHOD AND MATERIALS**

Brain MRI images were acquired from 15 patients with known metastatic disease who had undergone gamma knife therapy, for a total of 17 cases with current and prior studies. The system applies a pre-processing pipeline to the T2/FLAIR and postgadolinium T1 sequences of both prior and current studies, including coregistration, skull-stripping, and intensity normalization. The program then generates forward and backward difference maps on each modality, highlighting interval increase or decrease in lesion load on T1 postgad, and interval change in abnormal signal (representing vasogenic edema or treatment-related changes) on T2/FLAIR respectively. Detected changes are color-coded and displayed on subtraction maps. The program takes 2 to 3 minutes to run on a desktop Linux workstation. Performance, including sensitivity and rate of false positive detection, was assessed by comparison with a human expert.

**RESULTS**

Results demonstrate a sensitivity around 95% for new/progressed enhancing lesions on postgadolinium T1 images, 95% for new/progressed areas of abnormal T2 signal on T2/FLAIR, 82% for resolved/improved enhancing lesions on postgadolinium T1, and 86% for resolved/improved areas of abnormal T2 signal on T2/FLAIR. False positives occurred mainly in the extracranial structures such as skull base and orbits, and were easily discarded.

**CONCLUSION**

This preliminary work demonstrates the feasibility of a CAD system to monitor changes in both abnormal T2 signal and enhancing lesions associated with metastatic disease in the brain.

**CLINICAL RELEVANCE/APPLICATION**

A CAD system that helps monitor temporal changes in brain metastases on MRI would improve clinical care through increased reproducibility and accuracy, and shorter turn-around time over human-only interpretation.

**RC505-11  Application of Machine Learning Algorithm and ADC Histogram Profile for Differentiation of Posterior Cranial Fossa Brain Tumors**

*Wednesday, Nov. 29 11:20AM - 11:30AM Room: E451B*

**Awards**

Student Travel Stipend Award

**Participants**

Seyedmehdi Payabvash, MD, San Francisco, CA (*Presenter*) 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

For information about this presentation, contact:

spayab@gmail.com

**PURPOSE**

To apply machine learning algorithm for differentiation of posterior cranial fossa brain tumors using ADC histogram variables and structural MR imaging characteristics.

**METHOD AND MATERIALS**

All patients with intra-axial/intra-ventricular posterior cranial fossa tumors, and surgical pathology diagnosis (2004-2015), were included. The ADC percentile values of solid tumor component were calculated. For machine learning algorithm, decision tree algorithm was applied to identify specific ADC and imaging variables to identify each specific tumor.

**RESULTS**

A total of 256 patients were included with histologic tumor subtypes listed in Table 1. Medulloblastomas had the lowest, and Pilocytic astrocytomas had the highest ADC values (Figure 1). Separate decision tree analyses identified different ADC histogram variables, age cut offs, enhancement patterns, and tumor textures that could differentiate specific tumor types. A 5th percentile
ADC value $<700 \times 10^{-6} \text{mm}^2/\text{s}$ identified all medulloblastomas ($p<0.001$); and a minimum ADC value $<550 \times 10^{-6} \text{mm}^2/\text{s}$ identified all atypical teratoid/rhabdoid tumors (ATRTs) ($p=0.021$). The majority (31/43) of patients with pilocytic astrocytomas were $<25$ years old (YO), and all were $<47$ YO ($p<0.001$). But all patients with metastasis were $>30$ YO, and the majority (53/65) were $>47$ YO ($p<0.001$). Also, 7/8 patients with lymphoma were $>55$ YO ($p=0.003$). A homogenous enhancement pattern ($p<0.001$), and cystic texture ($p=0.025$) could identify hemangioblastomas. All lower grade gliomas and astrocytomas had T2 hyperintense solid component ($p=0.001$). A 4th ventricular location (25/27) was predictor of ependymomas ($p<0.001$), but not of medulloblastomas. Five of 6 subependymomas ($p<0.001$) and all choroid plexus papillomas ($n=4$, $p=0.001$) were localized to the 4th ventricle floor or obex. However, all 7 anaplastic astrocytomas, and 6 glioblastomas originate from brainstem or cerebellar hemispheres ($p=0.001$).

**CONCLUSION**

Machine learning decision tree algorithms can help differentiate brain tumors based on ADC histogram variables and imaging characteristics. Specifically, quantitative assessment of the highly cellular component in posterior cranial fossa brain tumors represented by lower percentile ADC values can identify medulloblastomas and ATRT.

**CLINICAL RELEVANCE/APPLICATION**

Radiologists can use decision tree algorithms to determine main imaging characteristics for identification of tumor type and formulating the differential diagnoses.

**RC505-12 Deep Learning and Traditional Machine Learning for Radiogenomics**

Wednesday, Nov. 29 11:30AM - 12:00PM Room: E451B

Participants
Bradley J. Erickson, MD, PhD, Rochester, MN (Presenter) Stockholder, OneMedNet Corporation; Stockholder, VoiceIt Technologies, LLC; Stockholder, FlowSigma; Researcher, nVIDIA Corporation

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**LEARNING OBJECTIVES**

1) Become familiar with the state of the art of deep learning applied to medical imaging. 2) Learn the distinction between traditional machine learning methods and deep learning. 3) Learn the capabilities of deep learning to identify genomic and response properties of tumors.
Head & Neck College Bowl: A Game Show (Case-Based Competition)

Wednesday, Nov. 29 8:30AM - 10:00AM Room: E450B

AMA PRA Category 1 Credit™: 1.50
ARRT Category A+ Credit: 1.75

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
Tabassum A. Kennedy, MD, Madison, WI (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Review the normal imaging anatomy of the head and neck. 2) Identify imaging pathologies of the head and neck. 3) Describe the important imaging differentials of pathologies of the head and neck.

ABSTRACT
This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate. Head & Neck College Bowl: A Diagnosis Live Game Show 1) Review the normal imaging anatomy of the head and neck. 2) Identify imaging pathologies of the head and neck. 3) Describe the important imaging differentials of pathologies of the head and neck. The head and neck region has some of the most intricate anatomy of the human body. This refresher course will review the complex anatomy of the head and neck, such as the cervical soft tissues, orbit, skull base, temporal bone, and cranial nerves, as well as the imaging techniques to best evaluate this region. The anatomy and normal imaging appearances will be described and reviewed. You will laugh, you will cry, you will like it more than Cats.

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
Clinical Applications of Molecular Imaging: Neuro MRS and PET

Wednesday, Nov. 29 8:30AM - 10:00AM Room: S502AB

LEARNING OBJECTIVES
1) To learn the capability/potential of MR spectroscopy in brain tumor patient management. 2) To learn the limitation of the current standard MRIs that guide surgery and radiation therapy. 3) To learn about the potential of combining an advanced spectroscopic MR 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 spectroscopy, 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 whole-brain high-resolution 3D spectroscopic MRI (sMRI) in 12-14 minutes. We correlated state-of-the-art sMRI metabolite maps and their ratio maps with tissue histopathology to validate further its use for identifying non-enhancing and infiltrating tumors 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 sMRI into RT planning is feasible and may considerably modify target volumes. Thus, RT planning for GBMs may be augmented by sMRI potentially leading to reduced or delayed recurrence rates.

Participants
Satoshi Minoshima, MD, PhD, Salt Lake City, UT (Presenter) Research Consultant, Hamamatsu Photonics KK; Research Grant, Hitachi, Ltd; Research Grant, Nihon Medi-Physics Co, Ltd;
Common Spinal Injection Procedures for Diagnosis and Treatment of Back Pain (Hands-on)

Wednesday, Nov. 29 8:30AM - 10:00AM Room: E263

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, Merit Medical Systems, Inc; Stockholder, Merit Medical Systems, Inc; Stockholder, Spine Solutions, Inc; Todd S. Miller, MD, Bronx, NY (Presenter) Nothing to Disclose
Stanley Golovac, MD, Coral Gables, FL (Presenter) Nothing to Disclose
Allan L. Brook, MD, Bronx, NY (Presenter) Nothing to Disclose
Michele H. Johnson, MD, New Haven, CT (Presenter) Nothing to Disclose
Afshin Gangi, MD, PhD, Strasbourg, France (Presenter) Proctor, Gall Medical Ltd

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LEARNING OBJECTIVES
1) To introduce common spinal injection procedures that are used for the diagnosis and treatment of neck and back pain disorders. 2) To learn the indications and contraindications for these procedures. 3) To understand how imaging guidance is used to perform these procedures. 4) To introduce some of the equipment and techniques that are helpful in performing spine injection procedures in a hands on format with an opportunity for attendees to address their specific questions and concerns with the course faculty.

ABSTRACT
Image guided spine interventions can be used for the diagnosis and/or treatment of painful conditions of the spinal access. Diagnostic procedures often include specific nerve blocks that can be performed with anesthetic agents. Facet joint and sacroiliac joint pain syndromes can likewise be managed with spine interventional techniques. Epidural steroid injections can be performed using interlaminar, caudal or transforaminal techniques in the management of focal back or neck pain with an associated radicular pain component. More advanced longer lasting treatments included radiofrequency neurelysis which can also be used to manage facet or sacroiliac joint related pain that temporarily responds to diagnostic median branch blocks or specific joint injections. Spinal cord stimulator placement is another advanced technique that can be used to manage chronic pain syndromes. The workshop emphasizes patient selection, imaging evaluation, procedure indication and contraindications in order to optimize treatment outcome.

Active Handout: Todd Stuart Miller
**PURPOSE**

Malignant cerebellar edema (MCE) is a life-threatening complication after acute cerebellar stroke. The aim of this study was to identify imaging predictors for the occurrence of MCE using multiparametric CT including whole-brain CT perfusion (WB-CTP).

**METHOD AND MATERIALS**

We selected all subjects with cerebellar WB-CTP perfusion deficit and follow-up-confirmed infarction from a cohort of 3,254 consecutive patients who underwent multiparametric CT. Follow-up imaging was assessed for the presence (MCE+) or absence (MCE-) of MCE, measured using an established 10-point scale by Jauss et al., of which scores ≥4 are considered malignant. Posterior-circulation-Acute-Stroke-Prognosis-Early-CT-Score (pc-ASPECTS) was determined to assess ischemic changes on non-contrast CT (NCCT), CT angiography (CTA), and on parametric WB-CTP maps (cerebral blood flow, CBF; cerebral blood volume, CBV; mean transit time, MTT; time to drain, TTD). The volumes of CBF, CBV, MTT, and TTD deficits were quantified. Chi-square, Mann-Whitney-U tests and receiver operating characteristics (ROC) analyses were performed.

**RESULTS**

Fifty-one patients were included. 42 patients (82.4%) were categorized as MCE- and 9 (17.6%) as MCE+. MCE+ patients had larger CBF, CBV, MTT and TTD deficit volumes (each with p<0.001) and showed significantly lower median pc-ASPECTS assessed using WB-CTP (CBF: 5 vs. 8; CBV: 8 vs. 9; MTT: 5 vs. 8; TTD: 5 vs. 8; each with p<0.001) compared to MCE- patients, while median pc-ASPECTS on NCCT was not significantly different (9 vs. 10, p=0.097). ROC analyses for MCE yielded the largest area-under-the-curve (AUC) values for CBF (0.984), followed by CBV deficit volumes (0.972) and pc-ASPECTS on CBF (0.949), whereas pc-ASPECTS on NCCT (0.664) and CTA (0.699) provided less diagnostic value. Regarding mortality, ROC analyses revealed the highest AUC values for pc-ASPECTS CBV (0.853) and CBV deficit volume (0.837), and the lowest AUC values for pc-ASPECTS on NCCT (0.610) and CTA (0.643).

**CONCLUSION**

WB-CTP provides added diagnostic value regarding the prognosis of MCE occurrence and clinical outcome after cerebellar stroke compared to NCCT and CTA.

**CLINICAL RELEVANCE/APPLICATION**

WB-CTP performed in acute cerebellar stroke has the potential to impact clinical decision making based on an early identification of patients that are at high risk of developing MCE.
The Ischemic Penumbra Assessment Using 3D ASL at Different Post Labeling Delays in Patients with Unilateral Middle Cerebral Artery Severe Stenosis or Occlusion

PURPOSE

To assess the utility of serial and ancillary neuroimaging in the work-up of primary intracerebral hemorrhage involving characteristic hypertensive regions, including basal ganglia, thalamic, pontine and cerebellar hemorrhages. Lobar hemorrhages were included in the study, although these are more classically seen with cerebral amyloid angiopathy in non-hypertensive patients.

METHOD AND MATERIALS

This IRB-approved study retrospectively reviewed hypertensive patients presenting to the emergency room or transferred from an outside facility with imaging findings of primary intracerebral hemorrhage from October 2013 - October 2015. Patients were excluded if they had known CNS malignancy. Age, admitting systolic blood pressure, the location of bleed, and findings from follow-up imaging were recorded.

RESULTS

A total of 135 patients were identified, of which 73.6% (98/135) and 51.9% (70/135) had follow-up CTA/MRA or MRI, respectively. Sites of involvement included basal ganglia (42.9%, 56), thalamic (24.4%, 36), lobar (20%, 27), and the remaining within the brainstem or cerebellum. Of patients who underwent ancillary imaging, CTA/MRA revealed a vascular abnormality in a single patient, an arteriovenous malformation within the cerebellum. MRI also revealed a vascular abnormality in a single patient, vasculitis resulting in lobar hemorrhage. All remaining follow-up imaging reviewed was negative for additional pathology. With regards to location, all cases of basal ganglia and thalamic hemorrhages were consistent with hypertensive hemorrhage only.

CONCLUSION

In the setting of hypertension, ancillary imaging for basal ganglia and thalamic hemorrhages did not reveal alternative etiologies. In the absence of initial findings to warrant operative management, serial CT imaging in otherwise clinically stable patients did not result in findings warranting a change in management.

CLINICAL RELEVANCE/APPLICATION

In the absence of clinical concerns and findings on initial imaging, there is low utility in ancillary and serial neuroimaging for primary intracerebral hemorrhage involving the basal ganglia and thalamus in patients presenting with hypertension.

The Ischemic Penumbra Assessment Using 3D ASL at Different Post Labeling Delays in Patients with Unilateral Middle Cerebral Artery Severe Stenosis or Occlusion

PURPOSE

To evaluate ischemic penumbra (IP) using three-dimensional pseudo continuous arterial spin labeling (3D pCASL) at PLD of 1.5 s and 2.5 s in patients with ischemic cerebrovascular disease.

METHOD AND MATERIALS

Twenty-six patients (mean age, 60±12 years; 16 men and 10 females) with unilateral middle cerebral artery (MCA) severe stenosis or occlusion were enrolled into the present study, underwent MRI scan especially 3D pCASL with PLDs of 1.5s and 2.5s and DWI. The IP was first observed according to mismatched CBF-DWI region. The mean CBF (CBF1.5 vs. CBF2.5, mL/100g per minute) values and the mean area (mm2) of IP were measured at PLDs of 1.5s and 2.5s. Comparisons of the mean CBF values and the mean IP area between the two PLDs were analyzed using paired T test. Compared with the positive detection rate of IP by Chi-square test.

RESULTS

The detection rate of IP increased at the PLD of 1.5s (21/26, 80.77%) than 2.5s (6/26, 23.08%) (P=0.000). The mean CBF1.5 and CBF2.5 values of IP were 12.32±1.66 vs. 18.84±1.44 (P=0.002). The mean IP area was also significantly widened at the PLD of 1.5s (4273.17±611.17) than 2.5s (1074.50±955.32, P=0.01).

CONCLUSION

IP detection and areas result from different PLD using 3D ASL and DWI in patients with ischemic cerebrovascular disease. The higher detection, decreased CBF and wider region of IP are present at the PLD of 1.5s.
It is necessary to consider the different PLDs to assess IP by 3D pCASL in ischemic cerebrovascular disease.

**SSK15-04** Early Identification of Tissue at Risk of Infarction after Acute Ischemic Stroke Using Convolutional Neural Networks

**Awards**

**Trainee Research Prize - Resident**

Participants
Sofia K. C. Kim, MD, Los Angeles, CA (Presenter) Nothing to Disclose
Lanru Li, PhD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose

**METHOD AND MATERIALS**

The study included 50 AIS patients not treated with reperfusion therapy with DWI and PWI acquired <12h from the time when patients were last known to be well. Patients were also required to have follow-up (F/U) imaging performed >= 4 days after stroke. Apparent diffusion coefficient maps, T2WI, isotropic DWI, MTT, and Tmax were used as covariates to train a CNN (5-fold cross validation). The CNN was trained via the open source framework DeepMedic using the default architecture. The CNN segmentation maps were evaluated for each patient individually. Performance metrics were based on Dice score, sensitivity, and precision.

**RESULTS**

The CNN prediction of F/U lesions resulted in a mean±SD Dice score of 42%±26%, sensitivity 39%±27% and precision 60%±30%. The CNN resulted in fair results for lesion volumes >= 10ml, however it underperformed for smaller lesions <10 mL (Dice score 24%±20%, Sensitivity 25%±25%, Precision 38%±30%). Visual inspection showed compelling results for large lesions (Figure). The lesion size group analysis and the correlations of lesion volumes revealed that performance was dependent on lesion extent.

**CONCLUSION**

Our results showed that CNN can be used to combine acute multiparametric MRI for predicting tissue infarction on F/U, which hold especially true for large lesions. Although the CNN performed best for large lesion volumes, the focus of many early decision-making for AIS patients is whether or not the patient is at high risk of infarct growth. Therefore, CNN algorithms that can identify which patients will experience large infarct volumes without intervention hold promise for guiding AIS treatment decision strategies on an individual patient basis.

**CLINICAL RELEVANCE/APPLICATION**

Convolutional neural networks can be used to combine acute multiparametric MRI to predict follow-up tissue infarction with high accuracy, and therefore has potential for guiding treatment decisions on an individual patient basis.

**SSK15-05** Regional Detection of Hemorrhagic Transformation using Kernel Spectral Regression and a Neural Network on Multi-modal MRI for Acute Ischemic Stroke

**Awards**

**Trainee Research Prize - Resident**

Participants
Samantha J. Ma, Los Angeles, CA (Presenter) Nothing to Disclose
Songlin Yu, Beijing, China (Abstract Co-Author) Nothing to Disclose
David S. Liebeskind, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Lirong Yan, BSc, Beijing, China (Abstract Co-Author) Nothing to Disclose
Fabien Scalzo, PhD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Danny Wang, PhD, Los Angeles, CA (Abstract Co-Author) Shareholder, Hura Imaging, LLC

**METHOD AND MATERIALS**

Hyperperfusion detected on arterial spin labeling (ASL) cerebral blood flow (CBF) images acquired after acute ischemic stroke (AIS) onset has been shown to be significantly associated with development of intracerebral hemorrhage. The purpose of this study was to develop a machine model for the voxel-based detection of tissue at risk for hemorrhagic transformation (HT) given multiple MRI modalities as input.
The present study utilized routine clinical MRI and ASL image data acquired from 67 AIS patients shortly after endovascular therapy or clot retrieval. A novel regional cuboid sampling framework was developed for machine learning training, in which local cuboids were extracted from the CBF map, DWI, FLAIR, and T2 TSE before being matched with GRE-based manually drawn bleed groundtruth delineations. Kernel spectral regression (KSR) uses the information in the eigenvectors of the graph representation to reveal low dimensional structure in high dimensional data. After determining optimal kernel input parameters with KSR, we built a two-layer feed-forward neural network with 10 neurons in the sigmoid hidden layer and trained with scaled conjugate gradient backpropagation to classify cuboid inputs into likelihood of HT.

RESULTS

The proposed multimodal regional framework reached an accuracy of 80.59 ± 3% in detecting hemorrhage with KSR on our dataset (better than any single image modality alone); while a simple voxel-based prediction was 72.80 ± 5% accurate. Using the neural network training, the framework reached an improved accuracy of 95.1% ± 0.6%. Figure 1 shows a few predictive images based on the probabilities determined by the neural network. One can appreciate how the regions with high likelihood of hemorrhage determined by machine learning match well with the manually drawn regions in the reference GRE map.

CONCLUSION

Machine learning using kernel spectral regression or neural networks in particular can provide more accurate detection of tissues at risk for HT. Although CBF can inform AIS patient clinical outcome, the addition of multi-modal MRI data into the regional cuboid framework substantially improves the voxel-based HT detection accuracy.

CLINICAL RELEVANCE/APPLICATION

The proposed multi-modal regional framework for HT detection can improve stroke physicians’ utilization of perfusion data in AIS treatment planning and monitoring.

SSK15-06 The Detectability of Forward Projected Model-Based Iterative Reconstruction for Low Contrast Lesions: Acute Cerebral Infarction-Phantom Study

Wednesday, Nov. 29 11:20AM - 11:30AM Room: N226

Participants
Toru Higaki, PhD, Hiroshima, Japan (Presenter) Nothing to Disclose
Yoko Kachi, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Fuminari Tatsugami, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Hiroki Taguchi, Otawara, Japan (Abstract Co-Author) Employee, Toshiba Medical Systems Corporation
Makoto Ida, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Kazu Awai, MD, Hiroshima, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation; Research Grant, Hitachi, Ltd; Research Grant, Bayer AG; Research Grant, Daiichi Sankyo, Ltd; Research Grant, Eisai, Ltd; Medical Adviser, GE Healthcare; Research Grant, Fujitsu Ltd; ; ; ; ;

PURPOSE

Low-contrast areas in acute cerebral infarction are often difficult to be detected by computed tomography (CT) despite use of hybrid iterative reconstruction techniques such as adaptive iterative dose reduction 3D (AIDR 3D, Toshiba Medical Systems). Forward projected model-based Iterative Reconstruction Solution (FIRST, Toshiba Medical Systems), a novel iterative reconstruction technique, can strongly reduce noise and beam hardening artifact and improve spatial resolution. We compared the detectability of low contrast lesions on AIDR 3D- and FIRST images using a head phantom including simulated acute cerebral infarction.

METHOD AND MATERIALS

We developed dedicated head phantoms including simulated acute cerebral infarction using a 3D printer (Agilista 3200, Keyence). This study included 36 images of various models of acute cerebral infarction and 24 images of normal brain model. Half of these images were reconstructed with AIDR 3D and the rest were reconstructed with FIRST. Two radiologists separately specified the location of the low-contrast lesions in which subtle contrast between the gray and white matter disappeared. They rated the probability of the presence using an analog confidence scale. For the evaluation ROC analysis was performed. Statistical difference between AIDR 3D and FIRST was tested by DeLong’s method.

RESULTS

ROC analysis showed that the difference between AIDR 3D (reader1: Az- value 0.773, reader2: Az- value 0.706) and FIRST (reader1: Az- value 0.935, reader2: Az- value 0.880) was significant in favour of FIRST (p = 0.037, 0.041, respectively).

CONCLUSION

Our study demonstrates a significant advantage of FIRST in the detection of low contrast lesions compared with AIDR 3D, one of the conventional iterative reconstruction techniques.

CLINICAL RELEVANCE/APPLICATION

FIRST may improve detectability of low contrast lesions in acute cerebral infarction.

SSK15-07 Intra-Arterial Thrombectomy in Patients with Cervical Dissections in the MR CLEAN Trial: A Descriptive Analysis

Wednesday, Nov. 29 11:30AM - 11:40AM Room: N226

Participants
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PURPOSE
Several treatment strategies have been proposed in patients presenting with acute stroke and an extracranial dissection of the internal carotid artery (ICA). The aim of this study is to describe the outcome and variation of treatment strategies in intra-arterial thrombectomy (IAT) in patients with dissection of extracranial ICA and a proximal intracranial occlusion.

METHOD AND MATERIALS
Data (n=500) of the randomized controlled MR CLEAN trial on the effectiveness of IAT were analyzed. Carotid dissection was identified on CTA scans at baseline. Primary outcome was a favorable functional outcome defined as an modified Rankin Scale (mRS) score of <=2. Secondary outcomes were mRS <=3 and serious adverse events (SAE).

RESULTS
Carotid dissection was identified in 24 patients (21 male; median age 50.5) of which 15 in IAT group and 9 in non-IAT group. No differences at baseline NIHSS (p 0.74) and collateral score (p 0.29) was observed. In two patients stent placement was performed during IAT. A good functional outcome was observed at 7 (47%) in the IAT group versus 1 patient (11%) but was not statistically different (p 0.18). With respect to secondary outcomes, mRS <=3 and SAE were significantly different in favor of IAT (resp. p 0.03 and 0.04).

CONCLUSION
IAT is feasible in patients with extracranial dissections of the ICA and good outcomes have also been observed without carotid stenting.

CLINICAL RELEVANCE/APPLICATION
Carotid dissection is not a reason the withhold IAT in acute stroke patients.

SSK15-08 Diagnostic Accuracy of 3D black blood MRI with High Resolution T1 SPACE in the Evaluation of Intracranial Arterial Thrombosis

Wednesday, Nov. 29 11:40AM - 11:50AM Room: N226

Participants
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PURPOSE
3D black blood (BB) MRI using a T1 sampling perfection with application-optimized contrast using different flip angle evolutions (SPACE) sequence allows high resolution, vessel wall imaging to evaluate the intracranial arterial wall and its associated pathologies. We investigated the diagnostic features and accuracy of 3D BB MRI in the detection of intracranial thrombosis.

METHOD AND MATERIALS
We retrospectively identified fifteen patients with intracranial arterial thrombosis that underwent 3D BB MRI with non-enhanced and contrast enhanced high resolution T1 SPACE sequences. 3D BB MRI findings were evaluated by 2 independent neuro-radiologists blinded to all other angiographic studies, conventional MRI sequences, and clinical indications for imaging. Nineteen total intracranial vessel segments per patient were evaluated and graded on a three-point scale (grade 0-2) [Table] for intraluminal T1 SPACE hyperintensity and contrast enhancement. Images were considered positive for arterial thrombosis when focal intraluminal T1 SPACE hyper-intense signal and/or enhancement on 3D BBMRI was graded as 1 or 2. Arterial occlusion was confirmed by digital subtraction angiography (DSA) or computed tomographic angiography (CTA). In limited cases (n=4) without DSA/CTA availability, susceptibility weighted imaging (SWI) in combination with time of flight (TOF) MR angiography (MRA) confirmed the diagnosis of complete vessel occlusion.

RESULTS
Fifteen patients with 18 intracranial arterial occlusions were studied. Fair inter-observer agreement for intraluminal T1 SPACE hyperintensity (Kappa = 0.50) and excellent inter-observer agreement for contrast enhancement (Kappa = 0.84) was noted. The sensitivity and specificity for intracranial arterial thrombosis of intraluminal T1 hyperintensity was 88.89% and 100% respectively and that of contrast enhancement was 94.45% and 100% respectively, taking Observer 1 as gold standard and Observer 2 as test when both partial and clear visualization (combined grades 1 and 2) suggested vessel thrombosis/occlusion.

CONCLUSION
3D BB MRI with T1 SPACE imaging is a valuable sensitive and specific technique for the evaluation of intracranial arterial thrombosis.

CLINICAL RELEVANCE/APPLICATION
This technique provides an adjunctive mechanism to confidently diagnose complete arterial occlusions in the setting of low resolution conventional MRI findings and absent flow enhancement on TOF-MRA imaging prone to overestimation.

SSK15-09 Actionable Vascular and Other Incidental Findings on CTA in Patients Undergoing Acute Stroke Intervention: Findings in 225 Patients

Wednesday, Nov. 29 11:50AM - 12:00PM Room: N226

Participants
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PURPOSE

The detection and appropriate management of incidental findings is an important part of any clinical radiology practice. The intricate anatomy covered by CTAs of the head and neck coupled with the time pressures of acute stroke diagnosis creates an environment for missing important unrelated findings. The purpose of our study was to document incidental findings on CTA in 225 patients undergoing acute stroke intervention.

METHOD AND MATERIALS

Under IRB approval and HIPAA compliance, 225 CTAs of the head and neck in patients undergoing acute stroke intervention from 2011-2016 were reviewed for important incidental findings. Average patient age was 65 (range 16-95 years). Findings were separated into vascular (mainly aneurysms) and non-vascular entities (such as tumor and infection), with results tabulated.

RESULTS

There were 19 vascular and 31 non-vascular important incidental findings. Intracranial aneurysms were the most common vascular finding, with 18 aneurysms present in 16 patients (7% of patients). All aneurysms were unknown prior to imaging, with average size of 5mm (range of 2-10mm). 5 malignancies, most of which were unknown, included 2 lung cancers and an erosive nasopharyngeal skull base tumor. 2 patients with malignancy had pathologic cervical spine fractures. Critical pulmonary findings included 3 malpositioned endotracheal tubes in their right main stem bronchus, and 1 moderate pneumothorax. 6 patients had pulmonary edema, and 3 had pneumonia.

CONCLUSION

Providing fast and accurate diagnosis of acute large vessel occlusion on CTA is essential for good stroke outcomes. However, important and even urgent findings are surprisingly frequent in this patient population, and should be looked for with equal fervor.

CLINICAL RELEVANCE/APPLICATION

CTAs of the head and neck in patients undergoing acute stroke intervention harbor important and urgent findings with surprising frequency, and should not be overlooked even in this time-sensitive clinical scenario.
**SSK16**

**Neuroradiology (Epilepsy Imaging: Finding the Spark)**

Wednesday, Nov. 29 10:30AM - 12:00PM Room: N229

**PERFORMANCE**

- **AMA PRA Category 1 Credits**: 1.50
- **ARRT Category A+ Credit**: 1.75
- **FDA**: Discussions may include off-label uses.

**Participants**

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Greg D. Avey, MD, Madison, WI (Moderator) Nothing to Disclose

**Sub-Events**

**SSK16-01 Comparison of Arterial Spin Labeling MRI With EEG and Structural MRI in Patients With Epilepsy**

**Awards**

- Student Travel Stipend Award

**Participants**

Shankneel Singh, MBBS, MD, Chandigarh, India (Presenter) Nothing to Disclose

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**PURPOSE**

The purpose of our study was to compare the results of interictal EEG and structural MRI with ASL-MRI findings in patients with epilepsy in the peri-ictal period and inter-ictal period and try to localize the epileptogenic zone.

**METHOD AND MATERIALS**

Two groups of patients were selected. The first group consisted of 21 patients having seizure episode in the hospital premises (selected randomly as per availability of MRI machine at time of seizure) who underwent structural MRI with an additional ASL sequence in the peri-ictal period (arbitrarily fixed at 2 hours from seizure onset). The patients also underwent an inter-ictal scalp EEG. The second group included 30 patients with refractory seizures who underwent inter-ictal structural MRI with additional ASL sequence (selected randomly from out-patient referrals for MRI from a dedicated seizure clinic). Inter-ictal scalp EEG was also performed for these patients. Hyperperfusion or hypoperfusion was recorded and localized to the hemisphere and if possible the anatomical lobe.

**RESULTS**

In the 'peri-ictal' group, 'structural MRI positive' patients had 87.5% concordance of ASL findings with the structural MRI abnormalities (50% showed localization to ipsilateral hemisphere - partial concordance, and an additional 37.5% to ipsilateral lobe and the hemisphere - complete concordance) whereas the 'structural MRI negative' patients had 71.3% concordance between ASL and structural MRI findings (57% having complete concordance and an additional 14.3% showing partial concordance). In the 'inter-ictal' group, 'structural MRI positive' patients showed 75% concordance between ASL and structural MRI findings (50% complete concordance and 25% partial concordance) and 'structural MRI negative' patients had a 78.5% concordance between ASL and structural MRI findings (71.4% complete concordance and additional 7.1% partial concordance).

**CONCLUSION**

Perfusion abnormalities are intricately linked with seizures in both inter-ictal and peri-ictal phase with localized hyperperfusion being the most frequent pattern in peri-ictal and hypoperfusion predominating in the inter-ictal phase.

**CLINICAL RELEVANCE/APPLICATION**

ASL imaging can be a promising complementary imaging tool and can be contributory to the clinical scenario irrespective of the time of imaging, including in follow-up imaging and in increasing confidence in lesion localization for possible surgical work-up.

**SSK16-02 Multi-Regional Volumetric Patterns are Associated with Post-Surgical Outcomes in Patients with Medically Refractory Temporal Lobe Epilepsy**

Wednesday, Nov. 29 10:40AM - 10:50AM Room: N229

**Participants**

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PURPOSE
To investigate patterns of regional pre-operative volumetric differences that may be associated with post-operative outcome using lasso regression analysis (LRA) in patients with medically refractory temporal lobe epilepsy (TLE) who underwent anterior temporal lobectomy (ATL).

METHOD AND MATERIALS
69 subjects with TLE treated with ATL are classified as either seizure-free (ILAE 1-2) or as having continued seizures (ILAE 3-6) postoperatively. Preoperative T1-weighted MRI were analyzed for volumetric measurements. LRA was performed to identify groups of regions associated with postoperative outcomes and results were cross-validated to quantify the selected model's ability to predict outcome classification. A sub-group of patients with pathology proven mesial temporal sclerosis (MTS) was analyzed in a similar manner (n=26).

RESULTS
LRA identified smaller volumes in the contralateral occipital lobe as being associated with the seizure-free group (p = 0.0179); cross-validation revealed sensitivity of 0.27 and specificity of 0.77 in correctly identifying patients with continued postoperative seizures. In the sub-group of patients with MTS, LRA selected the contralateral occipital lobe, ipsilateral hippocampus, ipsilateral caudate, contralateral cerebellum, and contralateral frontal lobe in the model associated with postoperative outcomes (p<0.001). Cross-validation yielded better results in the more focused sub-group (sensitivity = 0.7, specificity=0.81). Hippocampal volumes alone were not significantly different between the seizure-free and continued seizures groups in either analysis.

CONCLUSION
LRA identified temporal and extra-temporal regions associated with postoperative seizure outcome. The model selected by LRA was more descriptive and more robust in cross-validation when limited to subjects identified by a single pathology such as MTS indicating that the underlying pathology should be accounted for in such analyses. Involvement of extra-temporal regions may be related to extra-temporal seizure activity, chronic sequela of anti-epileptic drug usage and/or history of frequency/severity and generalization of seizures.

CLINICAL RELEVANCE/APPLICATION
Approximately 40% of patients who undergo temporal lobectomy for TLE may continue to experience seizures postoperatively. Thus, further stratification of potential surgical candidates using pre-operative data may improve outcomes.

SSK16-09  The Clinical Impact of Emergency CT Brain Scan in Seizure

Wednesday, Nov. 29 10:50AM - 11:00AM Room: N229

Participants
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PURPOSE
Does emergency CT brain in patients with seizures have an immediate clinical impact?

METHOD AND MATERIALS
In a retrospective analysis we evaluated 1785 CT brain scans performed between 2006 and 2013 in patients after seizures. The indication for this exam has been to exclude pathological lesions being focus of seizures or being caused by seizures. Study design and protocol has been approved by our local ethic comitee (S071/2017).

RESULTS
1088 male, 697 female, average age 58 years. In 173 (9,6%) patients the CT scan revealed a significant pathological finding. In 104 (5%) patients a either tumorous or metastatic lesion was found, in 62 (3,5%) hemorrhages (subdural, epidural, parenchymal or subarachnoidal) and in 14 (0,7%) signs of a subacute infarct. 1 patient revealed signs of a acute hydrocephalus. All patients with infarcts were outside the lysis time window or time window for thrombectomy. No patient with tumorous or metastatic lesion needed immediate treatment. 6 (0,3%) of 62 patient with hemorrhage were transfered for immediate treatment. All 6 patients had clinical symptoms additionally to seizures such as clinical history of acute headache, midface fracture, hypertension (>220mmHg). No patient with isolated clinical symptom of seizure needed emergency treatment.

CONCLUSION
In this study no CT scan revealed pathological findings with immediate clinical impact if patient had only clinical history of seizure. It should be discussed whether patient with additional clinical symptoms such as acute headache, severe head trauma or hypertension need CT scan in the acute setting and whether the other patients -taken to the ward for surveillance- are evaluated only by MR scan in between 24 hours.

CLINICAL RELEVANCE/APPLICATION
Retrospective design is ia limitation, however all other studies published in the literature evaluated less than 200 exams (while we evaluated 1785), therefore this is the study with by far the biggest number of cases.

SSK16-04  Abnormality of Cerebral White Matter Microstructure in Children with New-Onset, Untreated Idiopathic Generalized Epilepsy
generalized clonic tonic seizures. There were 22 patients (18%) with an abnormality on both MRI and EEG. So, abnormal MRI and focal-onset seizures (27) had a higher proportion of potentially epileptogenic lesions 22 (81%) compared with the patients with using “epilepsy protocol” MRI which would have been missed if only “standard protocol” MRI was done. Patients who presented with “dedicated epilepsy protocol” MRI. Of the epileptogenic lesions, all 11 patients (100%) with hippocampal sclerosis were detected by (63%) epileptogenic lesions were detected using “standard protocol” MRI and remaining 22 (37%) lesions were detected using infection and inflammation was most common 17 (28%).

RESULTS

A total of 45 IGE patients (age range: 5-18 years, males: females=26:19) and 32 healthy controls (age range: 5-18 years, males: females=21:11) were included in our present study. Voxel-based analysis was used to compare the differences of DTI metrics including fractional anisotropy (FA) and mean diffusivity (MD) between patients and controls. Pearson correlation analysis was used to investigate the relationships between altered DTI metrics and clinical parameters.

CONCLUSION

Our study demonstrated microstructural impairments in children with new-onset, untreated IGE and that the MD might be more sensitive to detect the microstructural changes in the early stage of IGE than FA. Furthermore, the increased FA and decreased MD in the IGE group might suggest an initiating or compensatory mechanism prior to cognitive decline in IGE patients. Longitudinal studies are needed to clarify the maturational and seizure-related nature of these alterations of brain anatomy, their potential progression over the course of illness in IGE patients, and the potential impact of therapeutic intervention on these processes.

CLINICAL RELEVANCE/APPLICATION

Microstructural abnormalities exist from the very beginning of IGE and MD may be more affected than FA in the initial stage of children with IGE.

SSK16-05 Utility of MRI Brain Epilepsy Protocol in New Onset Seizures: How is it Different in Developing Countries?

Participants
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PURPOSE

1. To evaluate the diagnostic efficacy of a standard MRI of the brain in patients with first onset seizures. 2. To identify whether there is an increase in the diagnostic yield with the addition of high-resolution sequences with a dedicated seizure protocol. 3. To compare the diagnostic yields of MRI and EEG individually and in combination.

METHOD AND MATERIALS

Patients presenting with a history of first onset seizures who underwent MRI of the brain and EEG. Totally 129 cases were studied for a period of 18 months. Chi square test of significance (p<0.005) was used to test for the difference in proportion. The correlation between MRI brain and EEG was studied using McNemer test. All the patients underwent both standard protocol and dedicated epilepsy protocol MRI brain scanning on 1.5T within seven days from the onset of seizures. A routine electroencephalogram is recorded from the scalp electrodes obtained three days before or after the MRI and as soon as practical after presentation with the index seizure, preferably within 48 hours.

RESULTS

After multiple comparison correction using family-wise error method, only the parameter of mean diffusivity (MD) showed significant decrease in the left paracentral lobule, right precuneus and right superior parietal lobule (SPL) in IGE patients compared to healthy controls. Increased fractional anisotropy (FA) was found in the deep white matter of bilateral prefrontal lobe in IGE patients at a less conservative level using AlphaSim correction. There was no correlation between the altered diffusion parameters and the clinical measures.

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PURPOSE

Epilepsy, as one of the most prevalent, noncommunicable neurologic conditions and a significant cause of disability and mortality, affects approximately 70 million people worldwide. Microstructural change of idiopathic generalized epilepsies (IGE) has been widely reported in children and adult patients. However, previous studies were focused on the chronic patients with antiepileptic drugs. This study aims at using the diffusion tensor imaging (DTI) technique to investigate the microstructural abnormalities of white matter in children with new-onset, untreated IGE.

METHOD AND MATERIALS

A total of 59 patients with potential epileptogenic lesions in our study, 37 (63%) epileptogenic lesions were detected using "standard protocol" MRI and remaining 22 (37%) lesions were detected using "dedicated epilepsy protocol" MRI. Of the epileptogenic lesions, all 11 patients (100%) with hippocampal sclerosis were detected by (63%) epileptogenic lesions were detected using “standard protocol” MRI and remaining 22 (37%) lesions were detected using infection and inflammation was most common 17 (28%).
CONCLUSION
A dedicated epilepsy protocol MRI should be done in all patients who presents with first-onset seizures. MRI in first-onset seizure patients allows the identification of a lesion and earlier consideration of epilepsy surgery especially in patients presenting with focal-onset seizures.

CLINICAL RELEVANCE/APPLICATION
A dedicated epilepsy protocol MRI should be done in all patients who presents with first-onset seizures.

SSK16-06  PET-MRI Value in Detecting ‘Occult’ Anterior-Inferior Temporal Lobe Encephalocoeles in Medically Refractory Focal Temporal Lobe Epilepsy

Wednesday, Nov. 29 11:20AM - 11:30AM Room: N229

Participants
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PURPOSE
Temporal lobe anterior-inferior encephalocoeles are increasingly recognized as a surgically amenable cause of adult medically-refractory temporal lobe epilepsy. The anatomic defect on MRI exam can be quite subtle and these lesions are frequently overlooked for multiple years and exams. Two such cases led to a review of our PET-MRI experience in imaging-occult medically refractory focal epilepsy.

METHOD AND MATERIALS
PET-MRI has been part of our epilepsy imaging armament since December 2015. A PET-MRI database was created that included patients with refractory focal epilepsy that were considered non-lesional, based on prior MRI exams. The PET-MRI exams were reviewed without knowledge of the specific clinical history or signs and symptoms with a goal of identifying additional cases of anterior inferior temporal lobe encephalocoele. Separately, we collected demographic and clinical data from the medical record including age of seizure onset, semiology, EEG and interpretation of prior imaging exams.

RESULTS
Sixty-eight patients were catalogued in our epilepsy PET-MRI database including examinations through March 31, 2017. Four patients were identified with anterior-inferior temporal lobe encephalocoele. Two patients had been identified through clinical evaluation for epilepsy surgery and two additional patients were identified though our retrospective review. The key PET-MRI findings were 1. Decreased FDG uptake in anterior temporal lobe, ipsilateral to the clinical region of concern, 2. FDG activity extending beyond the expected confines of the middle cranial fossa and sphenoid wing, 3. MRI findings of CSF or brain extending into a defect in sphenoid wing, unrecognized on prior exams. Demographic items include: 3 female patients (75%), age: mn= 28 (15-43 range), age from seizure onset mn=9 years (3-18 range). The three female patients demonstrated MRI findings of intracranial hypertension or dural ectasia.

CONCLUSION
PET-MRI can be useful as a next-step in evaluation of medically refractory focal temporal lobe epilepsy, particularly in the surgical candidate. Anterior-inferior temporal lobe encephalocoele, as a cause of refractory epilepsy, is unusual but a combination of co-localizable findings can identify patients who may benefit from a focal resection.

SSK16-07  Hippocampal Sclerosis with Negative MR Findings: Diagnostic Usefulness of Subfield Volumetric Analysis

Wednesday, Nov. 29 11:30AM - 11:40AM Room: N229

Participants
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PURPOSE
In previous studies, up to 15% of the patients with diagnosis of hippocampal sclerosis (HS) showed normal findings on conventional MRI (neg-MR). Recently, subfield volumetry of hippocampus (SVH) using the open-source automatic segmentation software has been utilized. Our aims were; (a) to study the volume changes of the hippocampal subfields in HS patients using SVH, and (b) to determine the diagnostic accuracy of the SVH for the HS patients with neg-MR.

METHOD AND MATERIALS
We assessed 46 unilateral HS patients and 54 controls; all HS cases had histopathologic confirmation by surgery. Two neuroradiologists divided the HS patients into two groups based on the presence (pos-MR, n=26) or absence (neg-MR, n=20) of following MR findings at the affected hippocampus; reduced volume or increased T2 signal. For SVH analysis, 3D-volume T1-weighted images were processed with FreeSurfer (ver.5.3, ver.6.0) in all patients and controls. The ratio to total intracranial volume were calculated for each subfield and compared among the two groups. The diagnostic accuracy (AUC) were calculated using cutoff values for the hippocampal subfield volumes that were obtained in a ROC analysis.
RESULTS
In the pos-MR group, 8 of 9 subfields at the affected side (CA1, CA3, CA4-DG, fimbria, hippocampal-amygdala transitional area, presubiculum, hippocampal tail, and subiculum) were significantly smaller than in the controls. In the neg-MR group, however, only 2 of 9 subfields (CA3 and CA4-DG) were significantly smaller than in the controls. The diagnostic accuracy of the discrimination of the HS patients with neg-MR was better for the SVH based on the volumes of CA3 and CA4-DG (AUC: 0.719) than for the volume of the whole hippocampus (AUC: 0.614).

CONCLUSION
In the MR-negative HS patients, the subfield volumetry detected the localized atrophy within CA3 and CA4-DG, and showed better diagnostic performance than the whole hippocampal volume.

CLINICAL RELEVANCE/APPLICATION
In the mesial temporal epilepsy patients with normal findings on conventional MRI, SVH may be used not only for the diagnosis of HS but also for the assessment of its histopathologic subtypes.

SSK16-09 Longitudinal Functional Connectivity of Language Networks in Surgical Epilepsy Patients: Preliminary Results

Wednesday, Nov. 29 11:40AM - 11:50AM Room: N229

Participants
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PURPOSE
Investigating the reorganization of language networks in temporal lobe epilepsy (TLE) patients with task-based functional MRI (fMRI) before and after selective amygdalohippocampectomy or anterior temporal lobectomy (ATLR).

METHOD AND MATERIALS
Eighteen TLE patients (8 left TLE, 10 right TLE) performed task-based fMRI using a verb generation and a semantic paradigm before and after neurosurgery (9 ATLR; mean age at surgery: 38y, range: 26-53y). Mean time between surgery and postoperative scan was 14.9 months (range: 3-44m). Neuropathology revealed hippocampal sclerosis in 13 patients, focal cortical dysplasia in 4 patients and ganglioglioma in one patient. Ten healthy right-handed subjects underwent the same fMRI protocol on the same 3T scanner (mean age: 38y, range: 31-49y). FMRI activation maps and functional connectivity (FC) were analyzed on SPM12 for intra- and intergroup comparisons (p<0.005 uncorr.).

RESULTS
Compared to controls, patients showed decreased FC ipsilateral to their epileptogenic focus before and after surgery. In comparison to scans before surgery, postoperative left TLE patients had markedly decreased FC involving the left TL with particularly less connections to the right frontal lobe, stronger connections were visible including the residual left posterior TL and the right TL. In postsurgical right TLE, inter- and intrahemispheric FC to the right TL was decreased with only few stronger postsurgical connections exclusively found in the left hemisphere.

CONCLUSION
Task-based fMRI functional connectivity analysis visualizes extensive language related reorganization processes in TLE patients following surgery. Patterns of reorganization in language FC differ between left- and right-sided TLE with more extensive changes in left TLE patients.

CLINICAL RELEVANCE/APPLICATION
Temporal lobe epilepsy (TLE) surgery triggers widespread changes of language-related functional connectivity (FC). FC analysis allows us to link specific clinical deficits with certain neuroanatomical and imaging substrates. This will help to optimize surgical approaches and minimize postoperative language deficits in individual TLE patients.

SSK16-09 DTI-Derived Textural Features Can Improve Detectability of Epileptogenic Tubers in Tuberous Sclerosis Complex

Wednesday, Nov. 29 11:50AM - 12:00PM Room: N229

Participants
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PURPOSE

Diffusion tensor imaging (DTI)-derived quantitative values such as maximum apparent diffusion coefficient (ADC) were reported as predictors of epileptogenic tubers in tuberous sclerosis complex (TSC). Texture of tubers, volume and location were also known predictors of epileptogenicity. The purpose of this study was to document detectability of texture analysis for DTI, which can combine the information of DTI and textural heterogeneity.

METHOD AND MATERIALS

Twenty-five consecutive studies involving 23 patients were involved in this study. Epileptogenic tubers were characterized using video-encephalographyEEG, structural MRI, FDG-PET, magnetoencephalography, magnetic source imaging (MSI) and intraoperative electro-corticography. A total of 558 tubers, 32 epileptogenic and 526 nonepileptogenic, were identified. The volume of interest (VOI) of tubers was drawn on an ADC map based using T2-weighted and FLAIR images. The original VOI was inflated to include 4-mm-thick ring-shaped tissues surrounding the tuber. Histogram- and 3-dimentional 13-direction gray-level co-occurrence matrix (GLCM)-based textural features were extracted from the VOIs using ADC, fractional anisotropy, axial diffusivity and radial diffusivity maps. Mann-Whitney U-test with false discovery rate control was used to compare the features. The diagnostic model was constructed with an elastic net model to avoid overfitting. The model was compared with known predictors using receiver operating characteristic analysis and DeLong test.

RESULTS

A total of 122 features was derived from each VOI. There were no significant difference in features derived from the original VOI between epileptogenic vs non epileptogenic tubers. By contrast, 32 of 122 features showed significant differences on the inflated VOI. The diagnostic model was significantly better than the ROC curves of maximum ADC, volume and location (area under curve = 0.75 vs. 0.67 and 0.55; P = 0.042 and 0.001). The model did not significantly surpass tuber volume (0.75 vs. 0.71, P = 0.119).

CONCLUSION

Texture analysis using inflated VOI showed improved diagnostic performance to differentiate between epileptogenic and nonepileptogenic tubers. The VOI within the tuber was not useful for DTI-based texture analysis.

CLINICAL RELEVANCE/APPLICATION

DTI-derived texture analysis with VOI including perituber tissue can improve detectability of epileptogenic tubers in tuberous sclerosis complex.
NR370-SD-WEA1  
**Neuroradiology Wednesday Poster Discussions**

Wednesday, Nov. 29 12:15PM - 12:45PM Room: NR Community, Learning Center

NR

AMA PRA Category 1 Credit ™: .50

FDA

Discussions may include off-label uses.

**Participants**
Suyash Mohan, MD, Philadelphia, PA *(Moderator)* Grant, NovoCure Ltd Grant, Galileo CDS, Inc

**Sub-Events**

NR370-SD-WEA1  
**Glioma: Application of Histogram Analysis of Diffusion Kurtosis Imaging to Tumor Grading and Tissue Heterogeneity**

Station #1

**Participants**
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**PURPOSE**
The aim of this study was to evaluate the significance of diffusion kurtosis imaging (DKI) parameters in grading glioma.

**METHOD AND MATERIALS**
Every patient under resting state underwent diffusion kurtosis imaging (541s) and conventional sequence at 3.0 T MR scanner (Prisma Siemens Healthcare, Erlangen, Germany). 64 channel of head-neck coil was used for signal reception. DK imaging acquires data with 5 b values (500,1000, 1500, 2000, and 2500 sec/mm²) and uses diffusion encoding in 30 directions for every b value. DKI was scanned using a spin-echo echo-planar imaging sequence and the parameters were: FOV = 220×220 mm², slice thickness = 5 mm, slices = 20, TR/TE = 3500/78 ms. Matlab platform was used to calculated diffusion parameters Kapp and Dapp value based on 5 b value TRACEW parameter image. Regions of interest (ROIs) were manually drawn around the solid part of the tumor. Histogram analysis from these parameters were correlated with glioma grades. According to the result of Kolmogorov-Smirnov (K-S) test, Independent-samples T test or Mann - Whitney - Wilcoxon test was used to distinguish glioma high-from low-grade glioma. The parameters with the best percentile from cumulative histogram were identified by analysis of the area under the curve (AUC) of the receiver operating characteristic (ROC) analysis.

**RESULTS**
74 glioma patients were observed, including 25 low grad gliomas and 49 high grad gliomas. Kapp values increased with increasing glioma grade, but the Dapp values decreased with increasing glioma grade. There were significant difference between high and low grade glioma groups on the Kapp value of maximum, mean, standard deviation, 75th percentile, 95th percentile, and the Dapp value of minimum, mean, 25th percentile, 75th percentile, 95th percentile, skewness coefficients. According to the ROC , the highest AUC were found at Dapp minimum value (AUC,0.829;cut-off value,0.62×10⁻³ mm²/s), Kapp 75th percentile value (AUC,0.819;cut-off value,0.52).

**CONCLUSION**
Histogram analysis of DKI parameters from solid part of the tumor data can be a useful method for glioma grading and Tissue Heterogeneity.

**CLINICAL RELEVANCE/APPLICATION**
Dapp minimum value and Kapp 75th percentile value identify the grad of glioma and Kapp value of standard deviation may suggest the glioma heterogeneity.

NR371-SD-WEA2  
**Vision-related Areas and Beyond: A Multimodal MRI Analysis (DTI, fMRI and structure) of Primary Open Angle Glaucoma Patients**

Station #2

**Participants**
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Di Chen, Taian, China *(Abstract Co-Author)* Nothing to Disclose  
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Yuanzhong Xie, MS, Taian, China *(Abstract Co-Author)* Nothing to Disclose  
Wen Lu, Taian, China *(Abstract Co-Author)* Nothing to Disclose
Results

In the group analysis, stroke patients showed a significant reduction of CBF in the ipsilateral thalamus at chronic stage as compared with the control group (P=0.005) along with a trend of time dependent reduction in thalamic blood flow in the ANOVA (P=0.05).

Conclusion

The multimodal MRI analysis demonstrate that POAG affects both primary and higher visual areas, as well as non-visual-related areas such as IFG, which may reflect incomplete integration of visual information into language memory or motor control owing to malfunction of primary and higher visual cortices for POAG patients.

Clinical Relevance/Application

This research reveals that POAG affects both visual and non-visual areas of brain, which are consistent well with the clinical syndromes of POAG patients. These findings may serve as a new biomarker of glaucoma progression.

Method and Materials

MR examination was carried out among POAG patients and age-gender-matched NC group using a 3T GE MR750 to obtain DTI, T1WI as well as fMRI images. Standard data preprocessing methods were performed to MR images. Tract-based spatial statistics (TBSS) were used to identify changes in white matter (WM) pathways of DTI images. Computational Anatomy Toolbox (CAT12) was used to segment T1WI images and gray matter (GM) was obtained for statistical analysis to explore structural abnormalities. Functional connectivity (FC) based on voxel-wise analysis was carried out for fMRI images, FC maps were generated from Brainnetome Atlasts area (BAA) 189 to 210 and relevant statistical analysis was performed.

Results

In TBSS analysis, POAG patients exhibited less fractional anisotropy (FA) and increased mean diffusivities (MD) in right inferior frontal gyrus (IFG) and associated fibres than NC group (p<0.05, corrected using TFCE). According to structural analysis, Gray matter (GM) volume shrinkages appeared in bilateral middle occipital gyrus (MOG), right superior occipital gyrus (SOG), Brodmann area 19 (BA19) as well as right IFG of POAG group (p<0.05, FDR corrected). Secondary neuron degeneration of the thalamus because of its synaptic connections. Despite the evidence in animal studies that used histologic results as marker, imaging markers for the secondary thalamic vascular changes in humans are still rare. Our aim of this study was to examine the longitudinal cerebral blood flow (CBF) changes in the thalamus after MCA territory infarct using ASL MRI.

Conclusion

The focal cerebral ischemia has been shown to cause neuropathologic changes not only in the infarction zone but in certain remote areas that have synaptic connections with the primary ischemic lesion site. The blood supply to the thalamus is from the posterior circulation; however, infarctions at anterior circulation territories can cause secondary neuron degeneration of the thalamus because of its synaptic connections. Despite the evidence in animal studies that used histologic results as marker, imaging markers for the secondary thalamic vascular changes in humans are still rare. Our aim of this study was to examine the longitudinal cerebral blood flow (CBF) changes in the thalamus after MCA territory infarct using ASL MRI.
Our study demonstrated the secondary vascular response of the thalamus to the focal ischemia in MCA stroke using ASL-CBF technique. We observed that the ipsilateral thalamus was chronically hypoperfused compared with early stage and its contralateral side. Our findings are consistent with previous DTI study of retrograde degeneration in the thalamus ipsilateral to MCA infarcts, which may be attributed to the thalamocortical degeneration. Further research with larger cohorts will be needed to evaluate the association between CBF changes and the behavioral outcome.

**CLINICAL RELEVANCE/APPLICATION**

CBF degeneration in the thalamus after MCA stroke may play a critical role in neurological deterioration and should be considered a factor in advancing therapeutic strategies to improve neurological outcome for stroke patients.

**NR373-SD-WEA4**  
**Enlarged Perivascular Spaces of Subjects with Silent Lacunar Infarction from a Nationwide Longitudinal Study of Ageing**

**Participants**

- Anne R. Buckley, MD, Dublin, Ireland (Presenter) Nothing to Disclose
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- Rose Anne Kenny, MBChB, Dublin, Ireland (Abstract Co-Author) Nothing to Disclose
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**PURPOSE**

Silent lacunar stroke is common in older people, and is often detected incidentally. We are increasingly aware of the relevance of enlarged perivascular spaces (EPVS) as an indication of underlying vascular disease. We analysed a subset of community-dwelling participants >=65 years from a nationwide longitudinal study on ageing to determine differences between subjects with and without lacunes.

**METHOD AND MATERIALS**

440 participants >=65 years were randomly chosen from a nationwide dataset of >8,000 community-dwelling subjects. All participants underwent 3T MR brain. Scans were reviewed and scored for background cerebrovascular disease and lacunar infarction. EPVS score was attributed according to number of spaces (<10 = 1, <20 = 2, 20-40 = 3, 40 = 4), while Scheltens’ scale was applied to rate subcortical hyperintensities.

**RESULTS**

Mean age of entire cohort was 71.9. 227 (51.6%) participants were female. 46 (10.5%) subjects had lacunes. Subjects with lacunes were older (73.5 vs. 71.6, p = 0.035). EPVS score was significantly higher in subjects with lacunes (2.6 vs. 2.2, p = 0.001). Scheltens’ score was very significantly higher in subjects with lacunes (13.8 vs. 9.3, p = <0.001).

**CONCLUSION**

Subjects with silent lacunar strokes had evidence of more EPVS, which may indicate a relationship. Secondary (expected) findings were that lacunar stroke was also notably more common in older participants and those with a higher burden of subcortical hyperintensities.

**CLINICAL RELEVANCE/APPLICATION**

Awareness of EPVS as independent neuroradiological biomarkers and harbingers of cerebrovascular disease could prompt timely screening of stroke risk factors in an effort to prevent lacunar (or more catastrophic) infarction.

**NR374-SD-WEAS**  
**Voxel Based Analysis of Metabolic Abnormalities in Mesial Temporal Lobe Epilepsy**

**Awards**

- Student Travel Stipend Award

**Participants**

- Adam R. Donithan, MD, Charlottesville, VA (Presenter) Nothing to Disclose
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- Nathan Fountain, Charlottesville, VA (Abstract Co-Author) Nothing to Disclose
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**PURPOSE**

To study the distribution of decreased glucose metabolism in patients with medically refractory mesial temporal lobe epilepsy (MTLE) using whole brain voxel-based statistical-parametric-mapping (SPM) analysis.

**METHOD AND MATERIALS**

We studied 19 patients with MTLE due to mesial temporal sclerosis (MTS) that were seizure free at least 2-years after anterior temporal lobectomy. 18F-fluoro-deoxyglucose (FDG) positron emission tomography (PET) images of the patient cohort were compared to a normal dataset of 43 healthy individuals. Regions of decreased FDG uptake were analyzed with SPM after optimization of a selection threshold determined by two independent readers. Parametric images were computed for the whole cohort by calculating the distribution of clusters of hypometabolism. Magnetic resonance images (MRI) from each patient were used...
to create an average template which served as the anatomic reference space. IRB waived the need for consent in this HIPAA compliant study.

RESULTS
Parametric maps of decreased metabolism were generated from voxel-based whole-brain SPM. Distribution of hypometabolism extended in most patients beyond the mesial temporal lobe structures, most frequently to the para-hippocampal region and ipsilateral inferior and middle temporal gyri. A small proportion of patients showed significant decreased uptake in the contralateral mesial and neocortical temporal lobe and within the ipsilateral thalamus and internal capsule.

CONCLUSION
Maps of decreased metabolism were generated from voxel-based whole-brain statistical parametric analysis. Knowledge of the distribution of such regions might be useful when visually interpreting the PET images of patients with temporal lobe epilepsy, and especially when using FDA approved software including SPM capability.

CLINICAL RELEVANCE/APPLICATION
Knowledge of interictal metabolic anatomy of MTS might help when interpreting FDG-PET studies in patients with TLE, and inform subsequent studies in patients with surgical failure.

PURPOSE
The EXTEND-IA, ESCAPE and MRCLEAN trials showed that intra-arterial therapy (IAT) is superior to IV-tPA for patients with large vessel occlusions. Scores of 2b or 3 on the thrombolysis in cerebral ischemia (TICI) scale on post-IAT digital subtraction angiography (DSA) is considered to indicate successful recanalization. However, TICI 2b/3 did not always lead to good outcome. About 17% of IAT-treated patients in these 3 trials had poor outcome despite a TICI score of 2b/3. CT Perfusion (CTP) could identify patients with incomplete tissue reperfusion who may have poor outcomes. This study's objective was to derive a reperfusion threshold for predicting outcome in patients with TICI scores of 2b/3 and to find the association between reperfusion and outcome.

METHOD AND MATERIALS
62 IAT-treated patients from June 2008 to August 2014 at a single center who received admission and 24h CTP, post-IAT DSA, and 90-day mRS evaluation were enrolled for the study and only those with a TICI score of 2b/3 were analyzed. Ischemic tissue volume was quantified on admission and 24h CTP images using time-to-max thresholds and the percent change in volume between admission and 24h was defined as the reperfusion score (Srep). ROC analysis was used to find a threshold Srep for predicting outcome and association between outcome, Srep, admission NIHSS and collateral score (CS) was evaluated with logistic regression.

RESULTS
43% of TICI 2b/3 patients in our database had poor outcomes. Mean Srep in good (n=21) and poor (n=17) outcome groups were 83±4 and 72±7% respectively. The optimal Srep threshold of 78.5% had sensitivity and specificity of 86 and 53% respectively. The Srep threshold correctly predicted outcome in 68% of patients, whereas TICI 2b/3 alone only correctly predicted outcome in 55% of patients. Backward-elimination logistic regression created a model using NIHSS (p<.05), CS (p=.08), and Srep>78.5% (p<.05) to predict outcome, resulting in correct outcome prediction in 79% of patients.

CONCLUSION
This pilot study showed that the Srep threshold can better predict outcome in 13% of TICI 2b/3 patients. A larger study is needed to confirm the Srep threshold we have derived.

CLINICAL RELEVANCE/APPLICATION
~17% of IAT-treated patients from 3 trials had poor outcomes despite post-IAT TICI scores of 2b/3 on DSA. CTP may identify patients with limited reperfusion post IAT for triaging to other therapies.

PURPOSE
Gadolinium (Gd) based contrast agents (GBCA) for MRI are routinely used in clinical practice. Gd depositions in dentate nucleus (DN)
The purpose of this exhibit is to 1) review the epidemiology and pathophysiology of HIV infection itself, secondary opportunistic infections, and HIV associated neoplasms. It is important for the radiologist to be familiar with the imaging findings associated with neurologic complications in HIV-infected patients because it is essential for establishing a diagnosis and guiding treatment. In fact, approximately 20% of patients present with neurologic complications as the first manifestation of symptomatic HIV and 60% of patients will have neurologic complications in HIV-infected patients because it is essential for establishing a diagnosis and guiding treatment. In fact, approximately 20% of patients present with neurologic complications as the first manifestation of symptomatic HIV and 60% of patients will have neurologic complications. The purpose of this exhibit is to 1) review the epidemiology and pathophysiology of HIV in regards to neurologic complications 2) provide a case based review of central nervous system findings in HIV patients, including a post review quiz.

**TABLE OF CONTENTS/OUTLINE**

A. Epidemiology and pathogenesis of HIV with regards to neurologic complications  
   B. Case based review of HIV manifestations in the central nervous system

1. Complication secondary to HIV infection itself  
   - HIV encephalitis  
   - Opportunistic infections  
   - Progressive multifocal encephalopathy  
   - Toxoplasmosis  
   - Cytomegalovirus  
   - Cryptococcus  
   - Tuberculosis  
   - Neurosyphilis  

2. Opportunistic infections  

3. Neoplasm  

   - CNS
From Cannulation to Interpretation: A Mouth-watering Review of Digital Sialograms

NR220-ED-WEA10

Station #10

Participants
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TEACHING POINTS
1) Review the common indications and the use of fluoroscopy in performing conventional parotid and submandibular sialograms. 2) Illustrate and discuss the radiological anatomy of the salivary glands. 3) Provide an overview of the radiological appearances of a wide variety of disease processes involving the salivary glands. 4) Compare the role of CT and MR against conventional digital sialograms, considering their strengths and weaknesses.

TABLE OF CONTENTS/OUTLINE
1. Introduction. 2. Review the anatomy of the parotid and salivary gland duct systems. 3. Review of the different pathological processes leading to sialadenitis including stone formation, infections (viral/bacterial) and autoimmune conditions. 4. Provide an overview of the common indications for sialography. 5. Overview of performing conventional digital sialograms: i) Principles of fluoroscopy. ii) Description and illustration of the procedure. iii) Top tips on technique and image optimisation. 6. Appearances of salivary gland pathology on conventional sialograms with example cases including: i) Salivary duct calculi ii) Salivary duct strictures iii) Sialectasis. 6. Comparison with CT and MRI sialography with example images, particularly reviewing their strengths and weaknesses. 7. Self assessment quiz of common salivary gland pathologies. 8. Summary.

Anatomy and Pathology of the Inner Ear: A Primer for Radiologists

NR244-ED-WEA11

Station #11

Awards
Certificate of Merit

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TEACHING POINTS
To discuss the normal anatomy of the inner ear structures. To discuss with illustrations the imaging findings of the various common and uncommon inner ear abnormalities and their clinical significance.

TABLE OF CONTENTS/OUTLINE
Approach The labyrinth is the important component of the sensorineural hearing pathway and part of the balancing apparatus. It consists of an osseous labyrinth that encloses the membranous labyrinth and hence the HRCT and higher resolution MRI are complimentary to each other in the imaging of this anatomical structure. Retrospective review of imaging studies of 242 patients with acute and slowly progressing sensorineural hearing loss (SNHL), forms the basis of this exhibit. Appropriate cases were selected that illustrate the intended learning points, de-identified, and captured for the inclusion into this presentation. All patients had HRCT and high definition MRI IAC and brain stem protocol imaging with and without contrast. In addition 151 patients also had 3D reconstructed images of the inner ear, as per the requirement. Findings: This exhibit is reviewed under following categories: 1. Anatomy of the labyrinth. 2. Imaging techniques. 3. Pathologies of the labyrinth. Pathologies are subdivided into: (a) Congenital anomalies (b) Infection/Inflammation (c) Inner ear tumors and (d) Miscellaneous.
NR378-SD- WEB1

Standardization of Dynamic Susceptibility MR-Perfusion in Glioblastoma Using a Wavelet-Based Reconstruction Technique

Station #1

Participants
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Sub-Events

PURPOSE

Wavelet-based reconstructions of dynamic perfusion datasets offer an innovative and elegant way of vascular visualization, as it has been recently shown in CT-perfusion datasets. The aim of this feasibility study was to demonstrate that the concept of wavelet-based reconstruction can be transferred to MR-perfusion to visualize hypervascular tumors, like glioblastoma (GB).

METHOD AND MATERIALS

A total of 49 consecutive MR-perfusion datasets during the initial MRI workup of patients suspected of glioblastoma (mean age: 64.9±11y, 27 male) were included in this feasibility study. Dynamic susceptibility contrast (DSC) MR-perfusion was acquired on a 3T scanner with 70 dynamic phases (Δt: 1.6 s, ACQ voxel MPS: 2.33 x 2.33 x 4 mm, matrix: 128 mm). Dynamic datasets were calculated after initial motion correction using the wavelet transform (Paul wavelet, order 1) of each voxel time course. Angiographic signal intensity was defined as the maximum of the wavelet-power-spectrum. Wavelet maps were generated as DICOM output in a Python environment.

RESULTS

Wavelet-based reconstruction techniques of DSC MR-perfusion datasets were successful in 49/49 patients and did not require an arterial input function (AIF) or any other user input. The wavelet reconstruction technique could therefore be implemented automatically in a Python environment and results were obtained within a mean of 7.5±3.8 minutes after scan completion. The resulting wavelet maps (Fig. 1c) revealed a high similarity to standard cerebral blood volume (CBV) maps obtained from routine, manual MR-perfusion reconstruction (Fig. 1a, b). Qualitative image impression revealed a higher vascular resolution of wavelet reconstructions compared to standard CBV maps (p < 0.5).

CONCLUSION

Our study demonstrates the feasibility of novel wavelet reconstructions in MR-perfusion datasets. This method allows a user independent, fast, and reproducible evaluation of MR-perfusion data and generates maps similar to standard CBV maps.

CLINICAL RELEVANCE/APPLICATION

Novel wavelet perfusion maps as a user-independent reconstruction technique might be beneficial in the standardization of DSC MR-perfusion of hypervascular tumors like GB.

NR380-SD- WEB3

Advanced Virtual Monochromatic Imaging in Metal Artifact Reduction using Energy Subtraction Processing on Dual-Energy CT-Angiography: Evaluation of Image Quality, Delineation of Recanalization Coil-embolized Cerebral Aneurysms

Station #3

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PURPOSE

Coil-embolized cerebral aneurysms are difficult to evaluate using CT-Angiography (CTA) due to artifacts caused by the coil devices. To evaluate image quality of advanced Monochromatic imaging in Metal artifact Reduction using energy subtraction processing on Dual Energy (DE) CTA and diagnostic accuracy for the detection of recanalization of Coil-embolized cerebral aneurysms compared to DSA.

METHOD AND MATERIALS

We consider that the usage of energy modulation which is the most characteristic advantage of DECT to obtain both the disappearance of the metal artifact and the appearance of contrast medium just next to the metal. The clinical usage of this energy subtraction method by DECT leads to the better evaluation of the parent artery and the coil-embolized cerebral aneurysm without metal artifact. In a retrospective study, 16 consecutive patients with 16 intracranial aneurysms treated with coils underwent DSA and Advanced Virtual Monochromatic Imaging in Metal artifact Reduction using energy subtraction processing on DE CTA on the same hospitalization at a mean follow-up of 6 months (range, 4-14 months) after coil placement. DE CTA images were evaluated for recanalization of Coil-embolized cerebral aneurysms. DE CTA and DSA findings were compared.

RESULTS

Recanalization was confirmed in 4 of 16 patients who underwent follow-up in DSA, which is a gold standard in angiography. Detection of resumption in images with energy subtraction treatment in the same period was possible in 3 cases, sensitivity and specificity were 75.6% (95% CI 30.2 - 95.4), 91.2% (65.4 - 99.1), and the accuracy was 86.2%. Regarding recanalization in the evaluation of Coil-embolized cerebral aneurysms, it was difficult to evaluate in conventional CTA, and images with energy subtraction processing in DE CTA could be evaluated with good accuracy.

CONCLUSION

High-spatial-resolution Advanced Virtual Monochromatic Imaging in Metal artifact Reduction using energy subtraction processing on DE CTA is feasible and useful in the follow-up of patients with Coil-embolized aneurysms

CLINICAL RELEVANCE/APPLICATION

Advanced Virtual Monochromatic Imaging in Metal artifact Reduction using energy subtraction processing on DE CTA are equivalent to DSA and better than conventional CT in the diagnostic accuracy for the detection of recanalization of Coil-embolized cerebral aneurysms

NR381-SD- WEB4 Imaging Differences Between NMOSD and MS: A Multi-institutional Study in Japan

Participants
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PURPOSE

To investigate the imaging differences between neuromyelitis optica spectrum disorders (NMOSD) and multiple sclerosis (MS) by detailed quantitative documentation of the size and location of lesions and to validate several characteristic features in a large sample size.

METHOD AND MATERIALS

We recruited consecutive patients with NMOSD (n = 89, median age, 51; female, 86.5%) or MS (n = 89, median age, 68; female, 76.4%) from nine institutions between April 2008 and December 2012: 79 NMOSD and 87 MS patients for brain analysis and 57 NMOSD and 55 MS patients for spinal cord analysis were enrolled according to the eligibility criteria. We counted the number of T2-hyperintense lesions on MR imaging, documented the size and location of each lesion, and categorized them. We also validated the morphologic features and the presence of characteristic signs.

RESULTS

A total of 911 lesions in 79 NMOSD patients and 1659 lesions in 87 MS patients were identified in brain analysis. We found significant differences in the number (median number per patient, IQR; NMOSD, 5, 1-18; MS, 8, 3-28; P = 0.004) and size (median
Although 3-phase CTA (arterial, peak venous, and late venous) has shown its clinical implications in terms of collateral circulation, it was found that there were significant differences in the distribution of the location of the lesions. The distribution was significantly different in both the sagittal plane (P = 0.024) and axial planes (P = 0.001). In NMOSD, the lesions were frequently identified in the thoracic region (71%) in the sagittal plane and around the central canal (76%) in the axial plane. Among characteristic signs, ovoid lesions and isolated U-fiber lesions were frequent in MS (P < 0.001), whereas spinal atrophy (P = 0.008) and swelling (P = 0.027) were frequent in NMOSD.

CONCLUSION

Our detailed quantitative analysis revealed several imaging differences between NMOSD and MS, especially in the size and distribution of the location of lesions.

CLINICAL RELEVANCE/APPLICATION

These observations can be highly useful for accurate differentiation between NMOSD and MS.

NR382-SD

Gd Deposits in Multiple Organs of Adult Patients with Normal Renal Function after Administration of Gadolinium Contrast Agents (GBCAs)

Station #5

Participants

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PURPOSE

Several studies have reported deposits of gadolinium (Gd) in brain, bone, and skin of patients with normal renal function. The purpose of this study was to determine if Gd deposition also occurs in other organs by using postmortem tissue analysis with inductively coupled plasma mass spectrometry (ICP-MS). An added goal was to measure relative amounts of Gd found with different types of Gadolinium-based contrast agents (GBCAs).

METHOD AND MATERIALS

This study was IRB approved. Tissue from multiple organs including brain, heart, aorta, lung, liver, kidney, spleen, skeletal muscle, skin, and bone were collected at autopsy from decedents with available medical records that document past history of MRIs with or without GBCA exposure. Decedents with no prior MRI or only non-Gd MRI served as controls. Cases with inadequate medical records documenting MR exposure history were excluded. Tissue samples were analyzed with ICP-MS and levels were compared.

RESULTS

There were 13 cases obtained for analysis. These included 5 cases with linear GBCA (Omniscan, Multihance and Omniscan + Magnevist) and 4 cases with macrocyclic GBCA (Prohance, Gadavist). Two cases with a total of 49 and 14 times exposure of mixed GBCA administration also were included. Two control cases were analyzed for reference. ICP-MS results were correlated with different types of Gadolinium-based contrast agents (GBCAs).

RESULTS

There were 13 cases obtained for analysis. These included 5 cases with linear GBCA (Omniscan, Multihance and Omniscan + Magnevist) and 4 cases with macrocyclic GBCA (Prohance, Gadavist). Two cases with a total of 49 and 14 times exposure of mixed GBCA administration also were included. Two control cases were analyzed for reference. ICP-MS results were correlated with different types of Gadolinium-based contrast agents (GBCAs).

CONCLUSION

This study confirms Gd deposition occurs in all organs (brain, heart, aorta, lung, liver, kidney, spleen, skeletal muscle, skin, and bone) after administration of GBCAs. Gd deposition in bone tissue shows higher value in almost every cases.

CLINICAL RELEVANCE/APPLICATION

Gd deposition in all organs with administration of GBCAs was confirmed. This important observation needs further investigation to determine potential toxic effects.
Although 3-phase CTA (arterial, peak venous, and late venous) has shown its clinical implications in terms of collateral circulation, it inflicts increased radiation. Venous-phase parenchymal enhancement on DSC PWI source images can be used to assess collaterals.

METHOD AND MATERIALS

We enrolled 155 patients (76 male; median age, 72 years) who underwent 9.6-cm, 70-kVp perfusion CT (PCT) for 60 seconds with a temporal resolution of 1.5 seconds within 8 hours after symptom onset and had occlusion in the ICA (ICA with/without M1; n = 63) or M1 segment (with/without M2 segment; n = 92). PCT data were reconstructed with a section width of 1 mm, and were used to create the simulated 3-phase CTA (3-CTA; peak arterial, peak venous, and late venous phase; 3 seconds each) with an increment of 4.5 seconds. Another 3-second CTA immediately after peak venous phase was additionally generated, which consisted of the second CTA of the simulated 2-phase CTA (2-CTA) with the peak arterial CTA. Each CTA was reconstructed into 25-mm axial maximum intensity projections, and was assessed by 2 independent reviewers at a separate session. For the 2-CTA, good collaterals were determined when the ipsilateral side showed both similar vascular filling and enhancement (ASPECT > 7) compared to the contralateral brain on the peak arterial CTA. For the 3-CTA, we followed the published criteria to determine good/poor collaterals.

RESULTS

Interobserver agreements were excellent (k = 0.931 for 3-CTA; k = 0.929 for 2-CTA). Consensus review determined good and poor collaterals in 97 and 58 patients, respectively, on 3-CTA. All 97 patients with good collaterals on 3-CTA showed good collaterals on 2-CTA; 2 out of 58 patients with poor collaterals on 3-CTA were determined to have good collaterals on 2-CTA, showing no significant difference (P = 0.5, McNemar test).

CONCLUSION

Compared to the simulated 3-phase CTA, the simulated 2-phase CTA has comparable diagnostic performance for determining the status of collateral circulation.

CLINICAL RELEVANCE/APPLICATION

Two-phase CTA comparably determines collateral status, and can reduce acquisition time and radiation exposure in evaluating patients with major intracranial arterial occlusion.

NR384-SD-WEB7 Characterization of a MRI-compatible Animal Model of Vessel Wall Enhancement

Awards

Student Travel Stipend Award

Participants

Laura B. Eisenmenger, MD, Salt Lake City, UT (Abstract Co-Author) Bug in system: Dr. Eisenmenger will need to fill out her RSNA disclosure, not me. Thanks.

Kathryn A. Morton, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose

Eugene J. Huo, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose

Seong-Eun Kim, PhD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose

Dennis L. Parker, PhD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose

Joseph S. McNally, MD, PhD, Salt Lake City, UT (Presenter) Nothing to Disclose

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PURPOSE

Our goal is to use the rat sepsis model and 7T vessel wall MRI to detect vessel wall enhancement and characterize contrast leakage kinetics.

METHOD AND MATERIALS

Two-month-old male Sprague Dawley rats were divided into control and lipopolysaccharide (LPS)-injected rats (10 mg/kg) using a previously established rat sepsis protocol. Rats were then imaged on a Bruker 7T MRI with 3D T1-weighted Rapid Acquisition with Relaxation Enhancement (RARE) sequence with black blood technique to evaluate vessel wall enhancement. Black blood images were obtained at 1 hour, 4 hours, 8 hours, 24 hours, and 48 hours after LPS injection. At the same time points, dynamic-contrast enhanced (DCE) was obtained to detect changes in contrast transfer kinetics by calculating Ktrans using OleaSphere 3.0.

RESULTS

Black blood MRI demonstrated progressive enhancement along the vessel wall of the bilateral intracranial internal carotid arteries after LPS injection, and this was most avid at 24 hours. The top six images of the figure demonstrate delayed contrast enhancement images using the 3D T1-weighted RARE MR black blood technique. There was no enhancement of the intracranial vessel walls in the control animal, and enhancement progressively increased to the 24 hour mark after LPS injection. Some persistent enhancement remained at 48 hours. Similarly, DCE images showed elevated Ktrans after LPS treatment at all timepoints, including 24 hours compared to controls (mean±SD= 0.42±0.01 versus 0.08±0.07 mm-1, p=0.003). The bottom six images of the figure show representative 24 hour and control animals with increased Ktrans values at 24 hours (0.42 min-1) compared to the control (0.06min-1).

CONCLUSION

7T black blood and DCE MRI sequences can detect and characterize early events in endothelial dysfunction in the small animal rat sepsis model. This model can be used to identify new therapies and assess mitigation of endothelial dysfunction non-invasively, with high potential for clinical impact.

CLINICAL RELEVANCE/APPLICATION

Development of an MRI-compatible animal model of vessel wall enhancement will allow testing of novel therapeutics against...
endothelial dysfunction and vessel wall pathology prior to clinical trials.

**Patterns of Gray Matter Disease: Fifty Shades**

*NR158-ED-WEB*

**Station #8**

**Participants**
- Marta Drake Perez, MD, Santander, Spain (*Presenter*) Nothing to Disclose
- Robert Y. Shih, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
- Enrique Marco de Lucas, Santander, Spain (*Abstract Co-Author*) Nothing to Disclose
- James G. Smirniotopoulos, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose

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**TEACHING POINTS**

1) Major categories of gray matter disease may be organized and distinguished by: location patterns; signal characteristics; and, other features - explaining specifically why they affect certain sites. 2) The different patterns of gray matter disease are rooted in pathophysiology basis that can inform the radiologist to achieve a more accurate differential diagnosis.

**TABLE OF CONTENTS/OUTLINE**

1. Anatomy of gray matter: cortex, basal ganglia, thalamus, hypothalamus, brain stem and deep cerebellar nuclei. Imaging techniques 2. Patterns of gray matter disease - Enlargement (e.g. dysplasia) - Atrophy (e.g. dementia) - Signal changes (e.g. post-ictal) - Abnormal enhancement (e.g. re-perfusion) - Focal mass (e.g. DNET) - Abnormal location (e.g. heterotopia) Gray matter diseases often produce characteristic imaging patterns (e.g. “pulvinar sign” in CJD, “eye of the tiger sign” in Hallervorden-Spatz, “giant panda sign” in Wilson disease) useful in differential diagnosis, and sometimes distinctive. 3. Pathophysiology categories: ischemic, infectious/inflammatory, neoplastic, metabolic, congenital or degenerative. Pathophysiology of disease leads to certain gray matter localization 4. Clinical Information - Context is Everything Acute (ischemia, encephalitis, seizure) Chronic (dysplasia, atrophy)

**The Imaging Spectrum of Congenital Craniofacial Anomalies: Facing the Challenge**

*NR260-ED-WEB*

**Station #9**

**Participants**
- Marcelo D. Lemos, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
- Ramon M. Santos, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
- Carlos Jorge Da Silva, MD, PhD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
- Marcio Ricardo T. Garcia, MD, Sao Paulo-SP, Brazil (*Abstract Co-Author*) Nothing to Disclose
- Eloisa M. Gebrim, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
- Marcelo delboni@hc.fm.usp.br

**TEACHING POINTS**

1. To review basic anatomy and embryology concepts of the face and skull 2. To describe some of the imaging spectrum of craniofacial anomalies 3. To discuss features that help differentiate the disorders and essential information points to the clinician

**TABLE OF CONTENTS/OUTLINE**


**Tricky Arterial Spin-Labeling Magnetic Resonance Imaging (ASL-MRI): Concordant or Discordant with Dynamic Susceptibility Contrast Magnetic Resonance Imaging (DSC-MRI) in Various Central Nervous System Pathology**

*NR019-EB-WEB*

**Hardcopy Backboard**

**Participants**
- A Leum Lee, MD, Bucheon-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
- Jungbin Lee, MD, Bucheon, Korea, Republic Of (*Presenter*) Nothing to Disclose
- Yeunjeong Kim, Bucheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
- Kee-Hyun Chang, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

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**TEACHING POINTS**

1. To introduce the concept of Arterial Spin-Labeling Magnetic Resonance Imaging (ASL-MRI). 2. To present the category-based findings (CBF) of ASL-MRI for various conditions of the central nervous system (CNS) 3. To compare the findings of ASL-MRI with those of Dynamic Susceptibility Contrast Magnetic Resonance Imaging (DSC-MRI). 4. To summarize the ASL-MRI appearances based on relative CBF values and analyze the reason for the discrepancy between ASL-MRI and DSC-MRI.

**TABLE OF CONTENTS/OUTLINE**

1. Explanation of the scheme of the perfusion imaging acquisition by ASL-MRI. 2. Presentation of the CBF of ASL-MRI in various
conditions of the CNS: (1) stroke, (2) tumor, (3) infection, (4) seizure, (5) congenital disorder (Sturge-Weber Syndrome, Neurofibromatosis), and (5) other miscellaneous conditions (brain death, diffuse hypoxic injury, etc.) 3. Summation of the ASL-MRI appearances based on relative CBF values. 4. Explanation of partial discrepancy in findings of ASL-MRI and DSC-MRI.
MSES43 Essentials of Neuro Imaging

Wednesday, Nov. 29 1:30PM - 3:00PM Room: S100AB

NR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
David M. Yousem, MD, Baltimore, MD (Moderator) Royalties, Reed Elsevier; Royalties, Oakstone Publishing, LLC; Employee, Medicolegal Consultation; ; ;

Sub-Events

MSES43A Percutaneous Image-guided Spine Interventions

Participants
Vikas Agarwal, MD, Pittsburgh, PA (Presenter) Nothing to Disclose

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LEARNING OBJECTIVES
1) Analyze relevant imaging and relate clinical information to determine appropriateness for various spinal procedures. 2) Identify the risks and benefits of various spine interventional procedures as well as potential complications. 3) Competently and safely perform various spinal procedures using image guidance.

MSES43B Systematic Approach to Cervical Spine Trauma: Latest Trends in Imaging

Participants
Bhavya Rehani, MD, San Francisco, CA (Presenter) Nothing to Disclose

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LEARNING OBJECTIVES
1) Develop a systematic approach in evaluation of different forms of traumatic cervical spine injury on CT and MRI. 2) Be aware of the latest trends in imaging which can help in aid in better diagnosis of cervical trauma cases. 3) Identify and report bone and soft-tissue injuries to spine surgeons using a patterned checklist approach.

MSES43C Nomenclature of Degenerative Disc Disease

Participants
Kader Karli Oguz, MD, Ankara, Turkey (Presenter) Nothing to Disclose

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LEARNING OBJECTIVES
1) Be familiar with the standardized disc nomenclature (version2.0) for reporting of degenerative disc disease. 2) Increase the reproducibility and consistency of radiological reports and use a common terminology with the clinicians.

MSES43D Demyelinating Disorders of the Spinal Cord

Participants
Izlem Izbudak, MD, Baltimore, MD (Presenter) Institutional Grant support, Biogen Idec Inc; Consultant, Alexion Pharmaceuticals, Inc; Institutional Grant support, Siemens AG;

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LEARNING OBJECTIVES
1) Recognize and differentiate demyelinating lesions of multiple sclerosis from other causes of inflammatory myelitis. 2) Understand etiologic and radiological differences between multiple sclerosis and neuromyelitis optica spectrum disorders. 3) Recognize 5 most common demyelinating diseases of the spinal cord.
SSM07

Emergency Radiology (Musculoskeletal and Spine)

Wednesday, Nov. 29 3:00PM - 4:00PM Room: S403B

Participants
Mariano Scaglione, MD, Castel Volturno, Italy (Moderator) Nothing to Disclose
Ferco H. Berger, MD, Toronto, ON (Moderator) Nothing to Disclose

Sub-Events

SSM07-01  Dual Energy CT for Opportunistic Bone Mineral Density Screening: Identifying Patients at Risk for Fragility Fractures

Participants
Tony W. Trinh, MD, Boston, MA (Presenter) Nothing to Disclose
Bharti Khurana, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Andrew Primak, PhD, Malvern, PA (Abstract Co-Author) Employee, Siemens AG
Aaron D. Sodickson, MD, PhD, Boston, MA (Abstract Co-Author) Institutional Research Agreement, Siemens AG; Consultant, Bayer AG

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PURPOSE
To test the hypothesis that Dual Energy CT derived surrogates for bone mineral density can differentiate between elderly patients with a demonstrated fragility fracture and control patients without fractures.

METHOD AND MATERIALS
12,595 consecutive abdominal/pelvic dual energy CT (DECT) scans (Siemens FLASH scanner, Syngo Via software version VB10) from 4/2013 to 6/2016 were retrospectively reviewed. 585 met inclusion criteria for non-contrast scan in a female aged >=65 with exclusion criteria of osseous metastases, spinal hardware, or motion. The cohort included 101 patients with fragility fractures defined as spinal compression, femoral neck, or pelvic insufficiency fractures visible on the study CT scan. The control group included 97 patients without fragility fractures. Recorded metrics included L1 (or the nearest adjacent non-fractured) vertebral body HU values, calcium concentration (converted from iodine to calcium concentration using a scaling factor derived from calcium phantom calibration scans), and calcium HU values (determined from a virtual non-calcium subtraction algorithm).

RESULTS
Mean average vertebral body ROI values for the fracture and control groups, respectively, were: 86 and 132 HU, 60 and 88 mg/ml Ca, and 119 and 162 calcium HU (t-test p<0.00001 for all). ROC analysis showed areas under the curve of 0.75, 0.72 and 0.72 for HU values, Ca concentration, and Ca HU values, respectively. Selecting a high sensitivity value of 90% for use as a meaningful screening test yields threshold values of 138 HU, 172 mg/ml Ca, and 94 Ca HU, with resultant specificities of 42%, 36%, and 38% for HU values, Ca concentration, and Ca HU values, respectively.

CONCLUSION
Patients with fragility fractures have significantly decreased vertebral body HU values, as well as DECT derived Ca concentration and Ca HU values. Ability of these measures to predict patients at risk for fragility fractures is comparable at high sensitivity values considered acceptable for screening. Further work is needed to optimize DECT techniques in order to determine optimal cutoff values, and to potentially improve performance compared to traditional HU values.

CLINICAL RELEVANCE/APPLICATION
Dual Energy CT derived surrogates for bone mineral density may allow for opportunistic bone mineral density screening in patients undergoing abdominal and pelvic CT for other reasons.

SSM07-02  A Focused MRI Protocol for Efficient Detection of Pathology Associated with Thoracolumbar Spine Fractures

Participants
Syed M. Karim, MD, Boston, MA (Presenter) Nothing to Disclose
Christopher M. Bono, MD, Boston, MA (Abstract Co-Author) Advisory Panel, UnitedHealth Group Royalties, Wolters Kluwer nv
Mitchell A. Harris, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Aaron D. Sodickson, MD, PhD, Boston, MA (Abstract Co-Author) Institutional Research Agreement, Siemens AG; Consultant, Bayer AG
METHOD AND MATERIALS

Retrospective study of adult patients from 2 affiliated Level I trauma centers. Eligible patients presented to the emergency department between 2008 & 2015 with >= 1 fracture of the thoracic or lumbar spine on CT and MRI of the entire thoracic & lumbar spine within 10 days of CT. Exclusion criteria: > 4 levels fractured, pathologic fractures, isolated transverse/spinous process fractures, osteoporotic fractures, prior vertebral augmentation, prior TL spine instrumentation. Patients with neurologic deficits were not excluded. MRIs were reviewed independently by an orthopaedic spine surgeon and an emergency radiologist. MRIs were reviewed for posterior ligamentous complex (PLC) integrity, marrow edema, epidural hematoma, and cord contusion. Pathology identified outside of 3 levels above & below the fractured level(s) ('focused zone') were reviewed by the spine surgeon to determine if treatment would be altered.

RESULTS

126 patients with 216 fractures on CT identified. Demographics: 81 males (64%); median age 49; 62 (49%) TL junction injuries; 47 (37%) managed operatively. PLC injury identified by at least one reader in 41 (33%) patients with percent agreement for PLC injury between two readers of 96%; κ =0.91. Both readers independently agreed there was no pathology on the complete MRIs outside the focused zone in 101 (80%) patients. None of the outside pathology altered patient management. Percent agreement for the absence of outside pathology was 87%; κ =0.47.

CONCLUSION

A focused MRI protocol of 3 levels above & below a known thoracolumbar spine fracture(s) may miss radiographic pathology, but this pathology does not alter patient care.

SSM07-03  Radiological Predictors for Medial Collateral Ligament (MCL) Injury of the Elbow in the Emergency Department (ED)

Wednesday, Nov. 29 3:20PM - 3:30PM Room: S403B

Awards

Trainee Research Prize - Medical Student

Participants

Jordan Lebovic, BA, Boston, MA (Presenter) Nothing to Disclose
George Dyer, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Bharti Khurana, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

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PURPOSE

The Medial Collateral Ligament (MCL) is a primary stabilizer of the elbow and is well visualized on MRI. Specific radiological findings indicating MCL injury on radiographs and CT are under recognized by radiologists. Unrecognized MCL injury can cause post-operative instability and recurrent dislocations. The purpose of this study is to determine whether radiological findings can predict MCL injury in patients with elbow fracture-dislocations.

METHOD AND MATERIALS

Operative reports of 287 patients with elbow fracture-dislocations were reviewed to identify patients with injured and intact MCL. Radiology reports were also reviewed for MCL injury. Both Xrays and CTs were analyzed specifically for MCL injury by radiologist and elbow surgeon.

RESULTS

Only 4.5% (13/287) of the radiology reports for patients with elbow-fracture dislocations mentioned the status of the MCL attachment sites. 46 MCL injuries were evaluated and 19 were found to have either a fracture of the medial epicondyle or the sublime tubercle (5 sublime tubercle fractures and 14 medial epicondyle fractures). 16 intact MCLs were confirmed by operative visualization. 0 of the 16 intact MCLs had either a medial epicondyle fracture or a sublime tubercle fracture. 43% of patients with known MCL injury were found to have fracture(s) at the MCL attachment sites. Using fractures of either the medial epicondyle or sublime tubercle as predictor of MCL status had a sensitivity of 63% (CI 51%-74%), a specificity of 100% (CI 79%-100%) and a negative predictive value of .37 (CI .27-.50).

CONCLUSION

While MRI remains the optimal modality to assess for MCL injury, it is rarely used in ED for elbow fracture-dislocations. Presence of fractures involving medial epicondyle and sublime tubercle on radiographs and CT are critical and must be reported by radiologists to help guide the management.

CLINICAL RELEVANCE/APPLICATION

Using radiological predictors for MCL injury could identify patients requiring MCL repair, and thereby prevent post-operative instability and recurrent dislocations.
Participants
Mohammad Mansouri, MD, MPH, Boston, MA (Presenter) Nothing to Disclose
Ajay K. Singh, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

PURPOSE
Cellulitis is a relatively common infection of the skin and subcutaneous tissues which may comprise up to 14% of emergency visits. Necrotizing fasciitis (NF) is a potentially fatal, uncommon infection of the soft tissues which can be difficult to diagnose and distinguish from cellulitis. We aim to analyze and compare imaging findings of cellulitis and NF of upper extremity in our large academic medical center.

METHOD AND MATERIALS
This is a HIPAA compliant, IRB approved, retrospective study of cases imaged between 2003 and 2017. Imaging database of our institution was searched for all cases of upper extremity cellulitis and NF. The reference standard for diagnosis was surgery, and/or clinical follow-up. Medical records were reviewed for patient clinical and imaging variables.

RESULTS
A total of 50 cases were included (mean age: 44.5, 25 male: 25 female). 15 cases had proven NF by surgery and 35 cases had cellulitis proven surgically and/or clinical follow-up. CT was acquired in 60.0% of NF cases (9/15) and 74.3% of cellulitis cases (26/35). Other imaging modalities used were MRI, plain radiograph, and US. Air was significantly more common present in NF compared with cellulitis (53.3%, 8/15 and 20.0%, 7/35 respectively) (p=0.04). Other common associated imaging findings with NF were subfascial fluid (n=6) and fascial thickening (n=8). NF was significantly more likely to be fatal compared with cellulitis (20.0%, 3/15 and 0%, 0/35 respectively) (p=0.02). All cases of cellulitis with soft tissue air, had history of recent incision and drainage, penetrating trauma, IV drug use, injection of steroid or immunization. Skin thickening and superficial subcutaneous tissue involvement was seen in all cases of cellulitis who had CT or MR. Soft tissue abscess was seen more commonly in cellulitis (31.4%, 11/35) compared with NF (26.7%, 4/15). Cellulitis cases who had soft tissue abscess, had significantly more intramuscular edema (66.7%, 6/9), compared with the cases without abscess (13.6%, 3/22) (p=0.007).

CONCLUSION
Soft tissue air, fascial thickening and subfascial fluid collection are significantly more common in the NF than cellulitis. Majority of soft tissue air in cellulitis cases can be explained by history of recent trauma, IV drug use, immunization, incision and drainage, and injection.

CLINICAL RELEVANCE/APPLICATION
Soft tissue air, fascial thickening and subfascial fluid collection are significantly more commonly seen in the NF than cellulitis. Majority of soft tissue air in cellulitis cases can be explained by history of recent trauma, IV drug use, immunization, incision and drainage, and injection.

SSM07-05 One-Shot Volume Wrist CT as a Screening Tool: Impact on Detection and Treatment of Fractures

Wednesday, Nov. 29 3:40PM - 3:50PM Room: S403B

Participants
Monique Brink, MD, PhD, Nijmegen, Netherlands (Presenter) Research Grant, Toshiba Medical Systems Corporation
Arjan Steenbakkers, MD, Nijmegen, Netherlands (Abstract Co-Author) Nothing to Disclose
Micha Holla, Nijmegen, Netherlands (Abstract Co-Author) Nothing to Disclose
Jacky W. De Rooy, MD, Nijmegen, Netherlands (Abstract Co-Author) Nothing to Disclose
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Peter Brink, Maastricht, Netherlands (Abstract Co-Author) Nothing to Disclose
Michael Edwards, Nijmegen, Netherlands (Abstract Co-Author) Nothing to Disclose
Mathias Prokop, PhD, Nijmegen, Netherlands (Abstract Co-Author) Speakers Bureau, Bayer AG; Speakers Bureau, Bracco Group; Speakers Bureau, Toshiba Medical Systems Corporation; Research Grant, Toshiba Medical Systems Corporation;

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PURPOSE
Although conventional radiography (CR) is standard, computed tomography (CT) improves fracture detection in patients with wrist fractures. We implemented a fast set-up volume CT protocol in our clinic. Our objective was to evaluate fracture detection and therapeutic impact of this one-shot volume CT protocol in clinical practice.

METHOD AND MATERIALS
Between June 2013 and April 2014, we performed a prospective study on all adult patients with suspicion of acute fractures of the wrist or carpus. After informed consent, all patients first underwent CR, thereafter volume CT of the wrist, and then one year follow-up. Likelihood of fracture presence on a five-point scale was prospectively collected before and after CT. Three surgeons blinded to actual patient treatment independently proposed a treatment regimen (functional, cast, or operation), both based on anonymous clinical and radiological data, first with knowledge of CR, and thereafter with knowledge of CT. A radiologist and a surgeon served as reference standard for presence of fractures based on all data. Observer variability was evaluated with Fleiss kappa statistics. We performed receiver operating curve analyses for fracture detection and calculated proportion of wrists with treatment changes based on CT as compared to CR.

RESULTS
Ninety-eight patients participated (37% male, mean age 53, range 18-87 years old), with 100 wrist CTs (mean DLP: 36 mGycm). CT detected true-positive fractures in 61 (41 radial, 14 ulnar, 26 carpal fractures), and CR in 45 patients (39 radial, 13 ulnar, 6 carpal fractures). AUC for fracture detection was 0.85 (95% CI: 0.77-0.93) for CR and 0.97 (95% CI: 0.93-1.00) for CT. Agreement
on treatment was moderate after CR (Fleiss kappa 0.61 (95% CI 0.51-0.70)) and good after CT (0.75 (95% 0.66-0.84). Treatment changed in 24 (24%, 95% CI 16-33%) - 31 (31%, 95% CI 23-41%) wrists, mostly including refraining from cast immobilization (14-16 patients).

CONCLUSION

Volume CT increases accuracy of fracture detection, mainly of carpal injuries. This has a significant impact on cast immobilization changes in this patient population.

CLINICAL RELEVANCE/APPLICATION

Implementation of low threshold, fast-set up volume CT in patients with suspicion of wrist fractures improves carpal fracture detection and has a high potential to avoid unnecessary cast treatment.

SSM07-06  Emergency Department Overcrowding Delays Time to Radiography and Adversely Affects Outcomes for Hip Fracture Patients

Wednesday, Nov. 29 3:50PM - 4:00PM Room: S403B

Awards

Student Travel Stipend Award

Participants

Brendan Kelly, BMBCh, Dublin, Ireland (Presenter) Nothing to Disclose
Eric J. Heffernan, MBBC, FRCP, Elm Park, Ireland (Abstract Co-Author) Nothing to Disclose
Cormac E. O Brien, MRCPI, MRCP, Dublin 4, Ireland (Abstract Co-Author) Nothing to Disclose
John Ryan, Dublin, Ireland (Abstract Co-Author) Nothing to Disclose
Isabelle M. Godson-Tracy, Dublin, Ireland (Abstract Co-Author) Nothing to Disclose
John Cronin, MBBCh, Dublin, Ireland (Abstract Co-Author) Nothing to Disclose
Daniel P. Ahern, MBBCh, Dublin, Ireland (Abstract Co-Author) Nothing to Disclose
Conor Hurson, Dublin, Ireland (Abstract Co-Author) Nothing to Disclose

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PURPOSE

The purpose of this study was to identify if ED overcrowding caused a delayed TTR in our institution and if so what effect it has on patient outcome.

METHOD AND MATERIALS

Patients were identified using the hip fracture database at a tertiary referral urban hospital with an annual ED census of over 53,000 patients. 154 consecutive cases were analysed. ED electronic records (Maxims™) and Radiology (PACS) records were then used to assess the Time to Radiography (TTR). Results were analysed using logistic regression in SPSS™.

RESULTS

154 patients were included (115 female). Mean age was 81.04 (SD; range) (10.28; 44-102). Mean TTR was 110 minutes (73.1; 4-431). The mean total number of patients in the ED at presentation was 59.8 (16.67; range 27-99). Using ANOVA increasing numbers of patients was significantly associated with increasing time to radiography (p=0.003). Furthermore the TTR was significantly less (61 minutes vs. 113 minutes) when the ED was not above capacity of 33 patients (p<0.001). A regression model built to predict radiography in less than 60 minutes showed that only the total number of patients in the ED was independently associated with TTR (p=0.03). Analysing the hip fracture database for outcomes, delay to imaging was not associated with a delay in time to surgery (p=0.174), but was significantly associated with Time To Ward (TTW) (p=0.03) and length of stay (p=0.024).

CONCLUSION

TTR and overall outcomes for patients with a hip fracture are negatively impacted by the number of patients in the ED when they arrive.

CLINICAL RELEVANCE/APPLICATION

The authors hope these data will highlight the need for adequate resourcing of the ED and the healthcare system to deal with overcrowding and, in doing so, help avoid poorer outcomes for patients with time-dependent pathology.
**Integrated 11C-MET PET/MRI for Detection of Recurrent Glioma**

**Participants**
Don C. Yoo, MD, E Greenwich, RI (Moderator) Consultant, Endocyte, Inc
Akash Sharma, MD, Saint Louis, MO (Moderator) Nothing to Disclose

**Method and Materials**

Fifty consecutive patients with histopathological proven glioma (9 Low Grade Glioma (LGG), 33 High Grade Glioma (HGG), 8 Oligodendrogliaoma (OGG)) were prospectively enrolled for a hybrid 11C-MET PET/MRI to differentiate recurrent glioma from treatment induced changes. Sole MRI data were analyzed based on RANO. Sole PET data and in a second session hybrid 11C-MET/PET/MRI data were assessed for metabolic respectively metabolic and morphologic glioma recurrence. Reference standard was either histopathological report (n = 22) or follow-up imaging (n=28), whereas only patients of at least 6 months with follow up imaging were included. Based on the reference standard 35 patients were classified with recurrent glioma, whereas 15 patients with treatment induced changes.

**Results**

Hybrid 11C-MET PET/MRI was performed in 50 patients for differentiation between recurrent glioma and treatment induced changes. Sensitivity, specificity, positive predictive value and negative predictive was calculated 86.11%, 71.43%, 88.57%, 66.67 for 11C-MET PET alone; 96.77%, 73.68%, 85.71%, 93.33% for MRI alone and 97.14%, 93.33%, 97.14%, 93.33% for hybrid 11C-MET/PET/MRI, respectively. In all 50 patients diagnoses based on the reference standard were correct in 82% for 11C-MET PET, 88% for MRI alone and 96% for hybrid 11C-PET/MRI. A significant difference was found among hybrid 11C-MET PET/MRI and 11C-MET PET (p=0,016), whereas no significant difference was found among hybrid 11C-PET/MRI and MRI alone or MRI alone and 11C-MET PET alone. Furthermore, significant (P < 0.05) higher scores were found for diagnostic confidence when comparing 11C-MET PET/MRI (4.46 ± 0.777) to 11C-MET PET alone (3.44 ± 0.705) or to MRI alone (3.96 ± 0.733).

**Conclusion**

Hybrid 11C-MET PET/MRI offers metabolic and morphological information for the assessment of glioma recurrence. The hybrid imaging concept increases accuracy and showed significant higher scores for diagnostic confidence when compared to MRI or PET.

**Clinical Relevance/Application**

Hybrid 11C-MET PET/MRI might have the potential to strengthen RANO classification by adding the metabolic information. This should be evaluated in larger study cohorts.
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PURPOSE
To compare the diagnostic performance between 18F-fluorodeoxyglucose positron emission tomography / magnetic resonance (18F-FDG PET/MR) and MR imaging for the detection of recurrent adenoid cystic carcinoma (ACC) of the head and neck and locoregional metastases.

METHOD AND MATERIALS
In this retrospective analysis, a total of 31 dedicated 18F-FDG PET/MR examinations of the head and neck performed for recurrence diagnostics and locoregional metastases detection in patients after primary therapy of ACC were included (12 patients, mean age 59 years). In separate sessions, MRI and 18F-FDG PET/MR images were analyzed by two individual readers. Tumor recurrence or metastatic disease was confirmed by clinical and radiological follow-up examinations. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were calculated on a per lesion basis and diagnostic accuracy between both modalities was compared using McNemar's test. p<0.05 was considered as statistically significant.

RESULTS
Tumor recurrence and/or locoregional metastases were detected in 20 examinations. 18F-FDG PET/MR correctly identified all 20 suspicious examinations, while MRI detected 19 of 20 examinations. On a per lesion basis, sensitivity, specificity, PPV and NPV were 77%, 94%, 95% and 73% for MRI and 96%, 84%, 90% and 93% for 18F-FDG PET/MR, respectively. On a per lesion basis, the diagnostic accuracy of 18F-FDG PET/MR (91%) was significantly higher in comparison to MRI (84%, p<0.05).

CONCLUSION
In patients suffering from ACC of the head and neck, 18F-FDG PET/MR is superior to MRI in detection tumor recurrence and locoregional metastases. Especially the superior NPV of 18F-FDG PET/MR is advantageous in regular follow-up examinations after primary tumor treatment in patients suffering from ACC.

CLINICAL RELEVANCE/APPLICATION
In comparison to MRI, 18F-FDG PET/MR provides a superior diagnostic performance in follow-up examinations after primary treatment of adenoid cystic carcinoma of the head and neck.

SSM15-03 4’-[Methyl-11C]-Thiothymidine PET/CT for Early Assessment of Disease Control Of Chemoradiotherapy for Head and Neck Squamous Cell Carcinoma: Comparison with FDG PET/CT

Wednesday, Nov. 29 3:20PM - 3:30PM Room: S505AB

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PURPOSE
A new radiopharmaceutical, 4’-[methyl-11C]-thiothymidine (4DST), has been developed as an in vivo cell proliferation marker based on the DNA incorporation method. The purpose of this study was to evaluate the usefulness of 4DST PET/CT for early assessment of disease control of chemoradiotherapy for head and neck squamous cell carcinoma (HNSCC), in comparison with 2-deoxy-2-18F-fluoro-D-glucose (FDG) PET/CT.

METHOD AND MATERIALS
A total of 28 patients with HNSCC underwent 4DST and FDG PET/CT studies before, during, and after therapy. Uptake of 4DST and FDG was examined visually and semiquantitatively using standardized uptake value (SUV) for before, during and after therapy (SUVbefore, SUVduring and SUVafter, respectively). Percent change (during) was calculated from SUVbefore and SUVduring and percent change (after) was calculated from SUVbefore and SUVafter. Based on histopathological verification or radiologic follow-up, patients were divided into relapse-free and relapse groups. Relapse-free group was defined as those having no local recurrence or distant metastasis.

RESULTS
In all 28 patients, focally increased 4DST and FDG uptake in primary lesion was visible. On both 4DST PET/CT scans during and after therapy, 23 patients showed no increased uptake in primary lesion. On FDG PET/CT scans during and after therapy, 16 and 18 patients showed no increased uptake in primary lesion, respectively. Twenty-two patients were found to be relapse-free group and 6 to be relapse group. SUVduring and SUVafter values from 4DST PET/CT in relapse-free group were significantly lower than those in relapse group (p<0.001, respectively). The percent change (during) and percent change (after) values from 4DST PET/CT in relapse-free group were significantly higher than those in relapse group (p=0.001, respectively). Using FDG PET/CT, SUVduring, SUVafter, percent change (during) and percent change (after) were not significant differences between relapse-free and relapse groups.

CONCLUSION
The results of this preliminary study suggest that, compared with FDG PET/CT, 4DST PET/CT may be useful for early assessment of disease control of chemoradiotherapy in patients with HNSCC.
**PURPOSE**

The purpose of this study is to evaluate the value of 18-F fluorodeoxyglucose (FDG) positron emission tomography/computed tomography (PET/CT) for staging of early stage squamous cell carcinoma (SCC) of the oral cavity. Nodal staging on 18F-FDG PET/CT was compared with magnetic resonance imaging (MRI) of the neck and correlated with pathological staging on neck dissections.

**METHOD AND MATERIALS**

A retrospective review of all patients with clinically T1 and T2, biopsy-proven, squamous cell carcinoma of the oral cavity, and a clinically node-negative neck, between 2012 and 2017 was carried out. All patients that underwent both 18F-FDG PET/CT and MRI neck prior to surgical resection were included. The N and M stages on PET/CT were recorded, according to the AJCC/UICC TNM staging system, along with any incidental findings requiring further investigation. N stage on MRI was also recorded. Pathology reports were reviewed for pathological staging of the primary tumour and nodal status.

**RESULTS**

Sixty-four patients have been reviewed to date. Fifty-seven (89%) patients proceeded to neck dissection. Of these patients, 47 (82.5%) were histologically-proven node negative and 10 (17.5%) had histologically-proven nodal metastases. Of those patients with nodal metastases, 4 patients were staged N1 on PET/CT and 6 were staged N0. There were 2 patients with nodal metastases staged N1 on PET/CT but N0 on MRI. Of the node negative patients, 44 were staged N0 on PET/CT and 3 were staged N1. This yields a sensitivity of 40%, specificity of 93.6%, positive predictive value of 57.1% and negative predictive value of 88%. All patients were staged as M0 on PET/CT. Incidental findings requiring further clinical and radiological investigation were detected on PET/CT in 23 (35.9%).

**CONCLUSION**

Occult cervical nodal metastases are relatively infrequent in early stage SCC of the oral cavity with a clinically node negative neck. The relatively high specificity and negative predictive value of PET/CT in this study is due to the low prevalence of nodal metastases in this patient cohort. This study demonstrates that PET/CT is of limited value in conjunction with MRI for the detection of nodal metastases in these patients.

**CLINICAL RELEVANCE/APPLICATION**

The clinically node negative neck in early stage SCC of the oral cavity poses a potential treatment dilemma. PET/CT is of limited value in the detection of nodal metastases in these patients.
tomography—computed tomography (SPECT/CT) imaging. We aimed to investigate the diagnostic performance of 3D SPECT/CT imaging for jaw bone invasion in comparison with other imaging modalities.

**METHOD AND MATERIALS**

Preoperative 3D SPECT/CT, contrast-enhanced CT (ceCT), and MRI images in 14 oral cancer patients were retrospectively evaluated by an oral surgeon. Each of the 3 image sets was independently reviewed with the knowledge of the tumor locations as to the likelihood of jaw bone invasion. When reviewing 3D SPECT/CT images, 3D volume-rendered SPECT/CT images with and without clip-plane editing were generated in order to grasp 2D and 3D bone anatomy and metabolism. The likelihood was classified using a 5-point diagnostic confidence scale. A jaw bone without cancer invasion that was scored as 1, 2 or 3 was considered true negative. A jaw bone with cancer invasion that was scored as 4 or 5 was considered true positive. Imaging results were compared with postsurgical results.

**RESULTS**

Seven of the 14 patients had jaw bone invasion of cancer cells and the other 7 did not. The sensitivity, specificity, positive and negative predictive values in the diagnosis of jaw bone invasion were 100% (7/7), 71% (5/7), 78% (7/9) and 100% (5/5) in 3D SPECT/CT, 43% (3/7), 86% (6/7), 75% (3/4), 60% (6/10) in ceCT, and 57% (4/7), 86% (6/7), 80% (4/5) and 67% (6/9) in MRI, respectively. Receiver operating characteristic analysis showed that 3D SPECT, ceCT and MRI had an area under the curve of 0.837, 0.786 and 0.704, respectively (not statistically different). Two cases with false-positive findings in 3D SPECT/CT had destruction of both periosteal and alveolar bones with severe inflammatory cell infiltration around the tumor sites.

**CONCLUSION**

3D SPECT/CT may be more sensitive than ceCT or MRI in the detection of jaw bone invasion.

**CLINICAL RELEVANCE/APPLICATION**

3D SPECT/CT appears more sensitive than ceCT or MRI in detecting jaw bone invasion in oral cancers and may be useful when jaw bone invasion is unclear with ceCT or MRI.

**SSM15-06 The Usefulness of Initial Treatment Effects Based On PERSIST Criteria in Predicting the Three Years Disease Free Survival of Head and Neck Cancer**

Wednesday, Nov. 29 3:50PM - 4:00PM Room: S505AB

Participants
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**PURPOSE**

The study was done to evaluate the usefulness of the initial treatment effects based on PERSIST criteria in predicting the disease free survival (DFS) 3 years after the initial therapy of head and neck cancer (HNC).

**METHOD AND MATERIALS**

We analyzed retrospectively fifty-one cases of HNC, 35 male and 16 female, 18 hypo-pharynx cancer, 9 gingival cancer, 9 tongue cancer, 7 laryngeal cancer, 4 maxial cancer and 4 oropharynx cancer. All cases were performed FDG-PET/CT on both before and after the initial therapy. Chemo-radiotherapies were done in 35 patients and radiotherapies were done in 16 patients. We divided all patients into 2 groups, the responders (CMR+PMR) and the non-responders (SMD+PMD), based on the result of RECIST criteria. Then we compared the diagnostic ability of predicting DFS 3 years after the initial therapy among the result of initial therapeutic effect by PERCIST criteria and three kinds of FDG uptake parameters. The FDG uptake parameters were SUL max (< 16.0), SUL peak (< 12.0) and TLG (< 180g) obtained before the initial therapy respectively.

**RESULTS**

Among 36 responders, 25 cases (69.0%) reached 3 years DFS. In contrast, only 5 of 15 cases non-responders (33.0%) could reach 3 years DFS. The diagnostic accuracy of initial treatment effects based on PERSIST criteria for predicting 3 years DFS was 68.6%. Regarding FDG uptake indices before the initial therapy, TLG (<180g) was the most powerful predictor among three kinds of indexes (TLG 68.6%, SUL max 51.0%, SUL peak 52.9 %, in accuracy).

**CONCLUSION**

We could predict 3 years DFS with high probability based on the result of PERCIST criteria after the initial therapy in patients of HNC. Similarly, TLG (<180g) before the initial therapy was also good predictor of 3 years DFS.

**CLINICAL RELEVANCE/APPLICATION**

The result of the initial therapy based on PERCIST is useful not only for diagnosing therapeutic effect but also for predicting DFS 3 years after the initial therapy in HNC patients.
SSM16

**Neuroradiology (Gadolinium Deposition)**

*Wednesday, Nov. 29 3:00PM - 4:00PM Room: N226*

**Participants**

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**Sub-Events**

**SSM16-01 Assessment of the Neurologic Effects of Intracranial Gadolinium Deposition Using a Large Population Based Cohort**

*Wednesday, Nov. 29 3:00PM - 3:10PM Room: N226*

**Participants**

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**PURPOSE**

The neurotoxic potential of intracranial gadolinium (Gd) deposition following intravenous administration of gadolinium based contrast agents (GBCAs) is undefined. In the current study, we used the world's largest prospective population-based cohort on aging to study the effects of Gd exposure on neurologic and neurocognitive function.

**METHOD AND MATERIALS**

The Mayo Clinic Study of Aging (MCSA) cohort was enumerated from the Rochester Epidemiology Project in 2004 to study the incidence and natural history of cognitive impairment and dementia. All participants underwent extensive longitudinal clinical (neurologic evaluation, neuropsychological testing) assessment at baseline and 15-month follow-up intervals. Neurologic and neurocognitive scores were compared using standard multivariate methods between MCSA patients with no history of prior Gd exposure and those who underwent prior Gd-enhanced MRI. Progression from normal cognitive status to mild-cognitive impairment and dementia was assessed using multistate Markov model analysis.

**RESULTS**

Among 4261 cognitively normal study participants aged 50-90 (mean age (SD): 71.9 yrs (10.7), mean study participation (SD): 3.7 yrs (3.0)), 1092 (25.6%) received one or more GBCA doses (median: 2 doses, range: 1-28 doses) unrelated to their participation in the MCSA. Median time since first Gd exposure was 5.6 years (IQR=2.2-9.3 years). After adjusting for age, sex, education level, baseline neuropsychological performance, Charlson comorbidity index, and ApoE4 status, GBCA exposure was not a significant predictor of cognitive decline (changes in clinical dementia rating (p=.48), Blessed dementia scale (p=.68), or mental status exam score (p=.53)), diminished neuropsychological performance (p=.13), or diminished motor performance (Unified Parkinson's Disease Rating Scale (p=.43)). No dose-related effects were observed among these metrics (p=.89-.20). Finally, Gd exposure was not an independent risk factor in the rate of cognitive decline from normal cognitive status to dementia in this cohort (p=.91).

**CONCLUSION**

GBCA administration was not associated with worse overall neurologic or neurocognitive performance nor does it significantly affect the natural progression of cognitive decline in a large population-based cohort.

**CLINICAL RELEVANCE/APPLICATION**

Despite evidence of Gd accumulation following intravenous GBCA administration, Gd exposure is not associated with adverse neurologic outcomes.

**SSM16-02 Differences in Gadolinium Retention after Repeated Injections of Macrocyclic MR Contrast Agents to...**
Rats

Wednesday, Nov. 29 3:10PM - 3:20PM Room: N226

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PURPOSE
To investigate whether significant differences exist among macrocyclic MR contrast agents with respect to their retention in cerebellum, brain, kidneys and other organs.

METHOD AND MATERIALS
Gadobutrol (Gadovist®; Bayer), gadoterate meglumine (Gd-DOTA, Dotarem®; Guerbet), gadoteridol (ProHance®; Bracco) or Saline solution (0.9% w/v NaCl) were administered at 0.6 mmol/kg (1.2 mL/kg for saline) four times a week for five weeks to healthy male Wistar Han rats, randomly assigned to each of the four groups (n=15/group). After the end of the treatment, a recovery period of 4 weeks (28 d) was allowed before sacrifice. Organs (blood, cerebrum, cerebellum, liver, femur, kidneys and skin) were then collected for ICP-MS determination of gadolinium. Based on available amounts of samples, the LOQ (Limit of Quantitation) for Gd was 0.1 nmol/mL for blood, 0.1 nmol/g for cerebrum/cerebellum, 0.5 nmol/g for femur, 1 nmol/g for liver and skin. 1.7 nmol/g for kidneys. Statistical analysis was carried out by an independent expert.

RESULTS
Both in cerebellum and in cerebrum ProHance resulted in significantly (p < 0.001) lower levels of gadolinium compared both to Dotarem and to Gadovist. Also in the kidneys ProHance showed a residue that was significantly lower than both Dotarem (6 times higher; p < 0.01) and Gadovist (8 times higher; p < 0.001). In the femur, the differences were less pronounced, with only gadoterate meglumine showing a lower accumulation than gadobutrol (p < 0.001) and gadoteridol (p < 0.05). Gd concentration in blood, liver and skin samples was < LOQ.

CONCLUSION
After repeated injections of the 3 macrocyclic GBCAs and a 4-week off-dose period, ProHance resulted in significantly lower gadolinium concentrations than either Dotarem or Gadovist in cerebellum, cerebrum and kidneys. The observed differences, in the absence of dechelation, point to differences in wash-out rates, with gadoteridol being the GBCA that is most efficiently removed from both CNS and renal tissues.

CLINICAL RELEVANCE/APPLICATION
This non-clinical study shows that also macrocyclic MR contrast agents differ in the extent of retention in CNS and renal tissues, with ProHance giving less retention than Gadovist or Dotarem.

SSM16-03 Absence of Toxicity in Extended Duration Study of Gadolinium in Rodent Brains after Repeat Dosing of Gadodiamide: Investigation of Concentration, Location and Cell Ultrastructure

Wednesday, Nov. 29 3:20PM - 3:30PM Room: N226

Participants
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PURPOSE
Recent studies report low levels of gadolinium based contrast agents in the brain following repeat exposure. The purpose of this study was to evaluate the levels of Omniscan in the rat brain up to one year post-dosing, to evaluate the location of retained gadolinium, and to determine if there were any neurohistopathological sequelae.

METHOD AND MATERIALS
This study reports on a 50-week experimental endpoint from a previously published study (Smith et al. Radiology, 282:3, March 2017) together with additional analyses at the 1, 20 and 50 week timepoints. Gadolinium concentrations were quantified in blood and brains of rats 50 weeks after the cessation of dosing (cumulative dose 12 mmol/kg over 5 weeks) using inductively coupled plasma mass spectrometry (ICP-MS). Brain sections at standard toxicological levels were evaluated by standard toxicological
assessment. A portion of the Deep Cerebellar Nucleus (DCN) was reserved and processed for transmission electron microscopic (TEM) cell ultrastructure analysis and TEM with electron dispersive spectroscopy (TEM-EDS).

**RESULTS**

Gadolinium levels at 50 weeks were comparable to those observed at 20 weeks. Toxicologic histopathology analysis revealed no findings, and cell ultrastructural TEM analysis similarly revealed no findings, indicating that this extended period of gadolinium exposure for up to 1 year did not result in any tissue injury. A TEM-EDS analysis of gadolinium localization in the DCN showed approximately 100 nanometer foci located in the basal lamina, abluminal to the endothelium.

**CONCLUSION**

We conclude that whilst a small portion of gadolinium in the brain after repeat doses of GBCA is subject to long term retention (approximately 1/1,000,000 of the injected dose), this does not result in any observable tissue injury. We further propose that this gadolinium is in perivascular foci, and we have not found foci in the brain parenchyma.

**CLINICAL RELEVANCE/APPLICATION**

These observations are consistent with clinical observations of brain Gd in the human brain but without histopathological changes or a corresponding clinical syndrome.

**SSM16-04  Long Term Deposition with Slow Clearance of Gadodiamide as compared to Gadoterate Meglumine in Rats**

Wednesday, Nov. 29 3:30PM - 3:40PM Room: N226

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**PURPOSE**

The objective of this study is to compare the long-term kinetics of Gd deposition in the cerebellum for gadodiamide (Omniscan®, linear contrast agent) and gadoterate meglumine (Dotarem®, macrocyclic contrast agent).

**METHOD AND MATERIALS**

Injection protocol: N=120 healthy rats received 5 intravenous injections of 2.4 mmol/kg of gadodiamide or gadoterate meglumine (N=60/agent) over a period of 5 weeks (1 injection per week) according to a published protocol (Robert 2016). Rats were divided in 6 groups with 0, 1, 2, 3, 4 and 5 months of washout period (N=10/agent, groups M0, M1, M2, M3, M4 and M5 respectively). Gd dosing: At each delay, animals were sacrificed. Blood and cerebellum were sampled and total Gd concentrations were dosed by the ICP-MS technic. Pharmaco-kinetics analysis: tissue Gd elimination kinetics in the cerebellum were fitted to estimate the tissue elimination half-lives in days along the 5 months of washout.

**RESULTS**

At all time-points, a significantly higher concentration of total Gd was found in cerebellum for gadodiamide groups as compared to gadoterate groups. Five months after the last injection, 30-fold more Gd was measured in the cerebellum in the gadodiamide group (2.29±0.30nmol/g) versus gadoterate (0.075±0.037nmol/g, p<0.0001). At this time-point, no remaining Gd was detected in the blood for both products. For gadodiamide, mean half-life of elimination (T1/2) of Gd accumulated in the cerebellum was 410 days. For comparison, more than 87% of Gd was cleared from the cerebellum with a T1/2 of 15 days for gadoterate meglumine.

**CONCLUSION**

A 30-fold higher total Gd concentration in the cerebellum was found 5 months after gadodiamide treatment as compared to gadoterate. Elimination of Gd from the cerebellum was 28-fold slower after injection of gadodiamide as compared to gadoterate meglumine. Recent studies have shown that a large amount of Gd is present under dechelated form one month after repeated injections of linear Gd contrast agents (Frenzel 2017) in contrary to macrocyclic Gd contrast agents which are excreted in chelated form. Such speciation analysis are ongoing on these long term data.

**CLINICAL RELEVANCE/APPLICATION**

After injection of linear Gd-based contrast agent gadodiamide, long term total Gd concentration in the cerebellum is 30-fold higher and elimination rate is 28-fold slower as compared to the macrocyclic gadoterate meglumine.

**SSM16-05  Penetration and Distribution of Gadolinium-Based Contrast Agents into Cerebrospinal Fluid in Humans**

Wednesday, Nov. 29 3:40PM - 3:50PM Room: N226

**Participants**

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Eighty two (n=82) pediatric and adult patients (68 Gadobutrol, 14 control) were included. Time between Gadobutrol exposure and gadolinium clearance and patient characteristics (ie. age, gender, CSF protein), and between serum and CSF gadolinium concentration were examined using regression models.

RESULTS
In all cases with prior GBCA administration, Gd could be detected in the CSF. Gd concentration in the CSF showed a steady increase over 6 hours following the intravenous injection of the contrast agent. A significant decrease of Gd concentration compared to the peak values could be detected 24 hours after injection. Less amounts but still measurable concentrations of Gd could be detected several days/weeks after contrast enhanced MR examination. Control groups were all negative for Gd presence as expected.

CONCLUSION
Gadoterate meglumine, a macrocyclic GBCA, crosses the blood-brain barrier in humans and penetrates the CSF, in accordance with previous preclinical studies on healthy rats. Traces of GBCA can be detected in the CSF days/weeks after iv administration.

CLINICAL RELEVANCE/APPLICATION
It seems that the glo-vascular pathway via the CSF is a potential entrance way for GBCA into the brain.

PURPOSE
Recent studies in the setting of an intact blood brain barrier (BBB) have demonstrated intracranial gadolinium deposition following MRI with gadolinium-based contrast agents (GBCAs). While the mechanism of gadolinium distribution from bloodstream to neuronal tissue remains unclear, a proposed mechanism is through the blood-cerebrospinal fluid (CSF) barrier. This study evaluates whether gadolinium (Gd) can be detected in CSF, to the best of our knowledge, for the first time in humans.

METHOD AND MATERIALS
This study was approved by the local Ethics committee with patient’s consent authorizing use of tissue samples in research studies. For inclusion, all patients with a lumbar puncture between January and August 2016 were screened for at least one previous MR examination with GBCA administration (gadoterate meglumine at a dose of 0.1 mmol/kg bodyweight ) within a time frame of 60 days prior to CSF extraction. A total of 39 consecutive samples fulfilling these criteria were identified. These patients were enrolled and their CSF was analyzed for the presence of Gd. The control group consisted of 10 patients without any prior intravenous GBCA administration according to medical files. Gd measurements in the CSF were performed using inductively coupled plasma mass spectrometry by monitoring the response of the 158Gd isotope.

RESULTS
In all cases with prior GBCA administration, Gd could be detected in the CSF. Gd concentration in the CSF showed a steady increase over 6 hours following the intravenous injection of the contrast agent. A significant decrease of Gd concentration compared to the peak values could be detected 24 hours after injection. Less amounts but still measurable concentrations of Gd could be detected several days/weeks after contrast enhanced MR examination. Control groups were all negative for Gd presence as expected.

CONCLUSION
Gadoterate meglumine, a macrocyclic GBCA, crosses the blood-brain barrier in humans and penetrates the CSF, in accordance with previous preclinical studies on healthy rats. Traces of GBCA can be detected in the CSF days/weeks after iv administration.

CLINICAL RELEVANCE/APPLICATION
It seems that the glo-vascular pathway via the CSF is a potential entrance way for GBCA into the brain.
Eighty two (n=82) pediatric and adult patients (68 Gadobutrol, 14 control) were included. Time between Gadobutrol exposure and CSF collection ranged from 1.1 and 594 hours. Gadolinium was detected in the CSF of all Gadobutrol group patients (range 0.2 to 1494 ng/mL); alternatively the median gadolinium concentration in the control group patients was 0 ng/mL (IQR 0 - 0 ng/mL). Pediatric patients (<18 years) and those with an intact BBB had significantly faster clearance of gadolinium compared to adult patients and those with compromised BBB (CSF protein >35 mg/dL) (p=0.046 and <0.001, respectively). Furthermore there was significant correlation between gadolinium concentrations in the serum (range 2.2 - 277.8 ng/mL) and CSF samples (p<0.0001).

**CONCLUSION**

Intravenous administration of Gadobutrol results in gadolinium accumulation within the CSF, even in the setting of normal renal function and no BBB dysfunction. Further research is required to determine the mechanism and clinical significance of gadolinium accumulation in CSF.

**CLINICAL RELEVANCE/APPLICATION**

Gadolinium accumulates in the CSF following intravenous administration of Gadobutrol in the absence of neurologic pathology and normal renal function, suggesting a route for intracranial deposition.
PURPOSE
Cerebral arterial vasospasm and clinical delayed cerebral ischemia (DCI) following aneurysmal subarachnoid hemorrhage (aSAH) accounts for up to 30% of the morbidity and mortality in these patients. Neurologic examinations, daily transcranial Doppler ultrasound (TCD), and screening CT/CT Angiography/CT Perfusion studies have limited sensitivity and specificity in identifying DCI. Intravoxel incoherent motion (IVIM) MRI extracts microvascular perfusion information from a multi-b value diffusion-weighted sequence. We determined whether decreased IVIM perfusion on brain MRI may identify patients with DCI and cerebral vasospasm.

METHOD AND MATERIALS
We performed a retrospective cohort study of patients with aneurysmal SAH rupture at our neurovascular center. Consecutive patients who underwent a brain MRI after ruptured aneurysm treatment with neurologic deterioration and possible DCI were included. Intravoxel incoherent motion was included in all MRI examinations during the study period. Patient demographic, DCI development, aneurysm and vasospasm treatment, and outcome data were determined by electronic medical record review. Statistical analysis was performed using Excel and SPSS.

RESULTS
16 patients (11 female; 5 male; p=0.9) were included. 10 patients (63%) developed DCI and vasospasm requiring endovascular treatment (DCI+ group) and 6 (37%) did not (DCI- group). DCI+ patients were younger (mean 59 years versus 70 years in the DCI- group; p=0.03); there were no differences in medical co-morbidities between these groups. Presentation Glasgow Coma Scale, Hunt and Hess Scale, and Fisher Grade were also similar between these groups. 20 MRI studies (14 in DCI+ and 6 in DCI-) were performed. All MRIs were performed prior to endovascular vasospasm treatment in DCI+ patients. Whole brain microvascular blood volume on IVIM was significantly reduced in DCI+ patients (mean±sd 0.13±0.02 mm²/s) compared to DCI- patients (0.9±0.03 mm²/s; p=0.03). There was no significant difference in arterial spin labeling or perfusion weighted imaging measures of cerebral perfusion between DCI+ and DCI- patients.

CONCLUSION
Decreased microvascular blood volume on IVIM correlates with DCI development following cerebral aneurysm rupture.

CLINICAL RELEVANCE/APPLICATION
IVIM perfusion may be a useful biomarker for DCI and a triage tool for endovascular vasospasm treatment. Prospective studies should validate this hypothesis.
PURPOSE
Steal phenomenon is an independent risk factor for future stroke. We aimed to generalize the steal phenomenon conducted by the first and the second collaterals separately using t-ASL combining with MRA in MMD patients, and to explore the relationship between pre-operation hemorrhage and the steal phenomenon.

METHOD AND MATERIALS
Forty-three patients with bilateral moyamoya disease underwent t-ASL, MRA and DSA. Clinical factors including sex, age, hypertension, diabetes metabolic, hyperlipidemia, current smoking, history of taking Aspirin were gathered. Correlation analysis was used to compare the relationship between the amount of steal phenomenon and Suzuki staging. Univariate logistic regression analyses were performed to examine the relationship between pre-operation hemorrhage and each of the factors separately. Forward stepwise multivariate logistic regression analyses were performed to determine the crucial risk factor.

RESULTS
In every MMD patient steal phenomenon was positive (total amount 136). SP could be divided into five types on t-ASL images (ICA-contralateral ACA, ICA-contralateral MCA, anterior circulation-ipsilateral posterior circulation, posterior circulation-ipsilateral anterior circulation, external carotid circulation) and three groups according to MRA and t-ASL. The amount of SP was not associated with SUZUKI stage (P=0.122, 0.689). Out of all the clinical and imaging factors, high SUZUKI stage (P=0.038) and the existence of the steal phenomenon completely conducted by the second collateral (P=0.002) showed great power for predicting pre-operation hemorrhage. Forward stepwise multivariate logistic regression analyses revealed steal phenomenon completely conducted by the second collateral (OR: 29.499, 95% CI: 3.629-239.780; P =0.002) was more powerful than high SUZUKI stage (OR: 0.265, 95% CI: 0.098-0.718; P =0.009).

CONCLUSION
Steal phenomenon in MMD can be divided into five types by t-ASL and three groups according to MRA and t-ASL. Comparing with high SUZUKI stage, the existence of the steal phenomenon completely conducted by the second collateral is a stronger risk factor for pre-operation hemorrhage in MMD patients.

CLINICAL RELEVANCE/APPLICATION
Comparing with high SUZUKI stage, the existence of the steal phenomenon completely conducted by the second collateral is a stronger risk factor for pre-operation hemorrhage in MMD patients.
CLINICAL RELEVANCE/APPLICATION
The application of HR-MRA with a VR algorithm has high accuracy, sensitivity and specificity for the detection of intracranial aneurysms, which is recommended to improve diagnostic performance for the detection of intracranial aneurysms.

SSM17-04  Comparative Study of 4D CTA and DSA for Vascular Assessment in Moyamoya Disease

Participants
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PURPOSE
We use 4D CTA to evaluate the vascular changes in moyamoya disease, including the vascular stenosis (modified Suzuki score, Houkin score) and collateral circulation (basilar moyamoya vessels, posterior circulation collaterals and ECA collaterals). DSA was used as the gold standard to determine the value of noninvasive angiography in moyamoya disease.

METHOD AND MATERIALS
101 patients with confirmed moyamoya disease were underwent 4D CTA and DSA with an interval of <1 week. Two neuroradiologists evaluated the 4D CTA (VR and MIP) and DSA images independently or jointly in the case of disagreement. The performance of 4D CTA relative to DSA was determined using consistency checks (kappa values, 95% CI) and correlation analysis.

RESULTS
We obtained the following kappa values for consistency between 4D CTA and DSA: modified Suzuki score, 0.714 (0.649-0.778); Houkin score, 0.846 (0.780-0.911); the basilar moyamoya vessels, 0.594 (0.525-0.663); posterior circulation collaterals, 0.435 (0.325-0.544); and ECA collaterals, 0.591 (0.483-0.699). The corresponding correlation coefficients (P values) were 0.843 (<0.001), 0.872 (<0.001), 0.792 (<0.001), 0.635 (<0.001) and 0.797 (<0.001).

CONCLUSION
In the evaluation of the vascular changes of moyamoya disease, 4D CTA (VR and MIP) showed strong consistency and correlation with DSA in terms of the vascular stenosis score, but was insufficient in collateral circulation evaluation.

CLINICAL RELEVANCE/APPLICATION
We adopted the modified Suzuki score and Houkin score to evaluate intracranial vascular stenosis in MMD, and also evaluated collateral circulation (the basilar moyamoya vessels, and collaterals from the posterior circulation and ECA). Here, we discuss the value of 4D CTA for vascular assessments in adult MMD patients as compared with the gold standard, DSA. Upon analyzing the 4D CTA and DSA images of 101 adult patients with confirmed MMD, we concluded the following: (1) 4D CTA has high consistency and correlation with DSA in terms of the Suzuki and Houkin scores; and (2) 4D CTA has fair correlation and moderate consistency with DSA for the assessment of collateral circulation, specifically, the basilar moyamoya vessels, and collaterals from the posterior circulation and ECA.

SSM17-05  4D Flow MRI Analysis of Cerebral Blood Flow Before and After High-Flow EC-IC Bypass Surgery

Participants
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PURPOSE
One of the treatment options for complex ICA aneurysm is the ligation of the ICA with the high-flow extracranial-intracranial (EC-IC) bypass surgery. Though the cerebral hemodynamics is thought to be changed drastically after the surgery, there has been no published papers performing quantitative evaluation. The purpose of this study was to clarify the change of the hemodynamics after the high-flow EC-IC bypass surgery by using time-resolved 3D-phase contrast (4D Flow) MRI.

METHOD AND MATERIALS
We enrolled 11 patients (2 men; mean age 62.8) who underwent ICA ligation and high-flow EC-IC bypass surgery with radial artery graft for treatment of a complex ICA aneurysm. They underwent 4D Flow MRI preoperatively and 3 weeks after the bypass surgery. The imaging parameters; 3.0-T MRI (Aheiva, Philips), TR/TE=8.4/5.4, VENC=100cm/sec, voxel size=0.82X0.82X1.4mm, heart phase=15, scan time=approx. 6 min. We measured blood flow volume (BFV) of bilateral ICAs, BA, and bypass artery by using GF Tool (Gyro Tools). The BFV of each vessel and total brain BFV (t-BFV = bilateral ICAs + BA + bypass) were compared between before...
and after surgery by using paired t-test. We evaluated post-operative hyperperfusion based on CT perfusion and clinical symptoms within 3 weeks after the surgery.

RESULTS

In all patients, the patency of the bypass artery was confirmed by 4D Flow MRI. The BFV of contralateral ICA and BA were statistically increased after the surgery (ICA: 5.89±2.08 vs. 7.22±1.88 ml/sec \( p=.0018 \), BA: 3.06±0.17 vs. 4.12±0.14 ml/sec \( p<.001 \)). T-BFV was statistically increased after surgery (12.99±8.65 vs. 15.18±3.14 ml/sec \( p=.0067 \)). While, there was no evidence of hyperperfusion in any cases based on CT perfusion or clinical symptoms.

CONCLUSION

In the current study, we could prove that the drop of BFV from sacrificed ICA is compensated by both native arteries (contralateral ICA and BA) and the bypass. Though the CT perfusion and clinical symptoms confirmed there is no hyperperfusion, the t-BFV increased 16.8%. It may indicate 4D Flow MRI could reveal the subtle hyperperfusion. In conclusion, 4D Flow MRI could quantify the change of hemodynamics after the high-flow surgery. It provides insight to the autoregulation system in the cerebral blood flow.

CLINICAL RELEVANCE/APPLICATION

4D Flow MRI is one of the optimized imaging modalities for the quantitative assessment of the cerebral hemodynamic change after high-flow EC-IC bypass surgery.

SSM17-06 Angiogram-negative Non-perimesencephalic Subarachnoid Hemorrhage: A Meta-Analysis of Follow up Strategies

Wednesday, Nov. 29 3:50PM - 4:00PM Room: N227B

Participants

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PURPOSE

The purpose of this study is to synthesize the current literature into recommendations regarding the follow up of non-perimesencephalic subarachnoid hemorrhage. Specifically, we will investigate the utility of various imaging modalities (CTA, DSA, MRA) of repeat imaging after an initially negative angiographic study (usually CTA or DSA).

METHOD AND MATERIALS

PUBMED, EMBASE, SCOPUS and research meeting abstracts were searched up to March 2017 for studies of patients with spontaneous subarachnoid hemorrhage (SAH) and an initially negative angiographic study (DSA, CTA, or MRA). Title/abstract and then full text screening was performed by two independent reviewers. Study quality was assessed via the Cochrane Risk of Bias Tool (CRBT). Where appropriate, meta-analysis was conducted using random effects models.

RESULTS

A total of 1917 studies were identified, of which 178 underwent full text review; 95 studies were included. Diagnostic methods for initial angiographic as well as follow up studies were variable. Preliminary assessment of study quality by CRBT also showed variability; however, most studies had a low risk of bias. Preliminary data suggest superiority of DSA and CTA to MRA for follow up of angiogram-negative NPSAH.

CONCLUSION

Spontaneous SAH may be categorized as perimesencephalic, diffuse aneurysmal, peripheral (convexity, sulcal), or CT-negative (detected only on lumbar puncture) based on the distribution of acute hemorrhage. Follow up imaging for patients with perimesencephalic patterns of hemorrhage has been shown to be unlikely to find an underlying structural lesion or to change outcome for this relatively benign entity. The optimal management strategies for non-perimesencephalic SAH however are not clear. Preliminary data from our meta-analysis suggest superiority of DSA (including rotational 3D angiogram) and CTA over MRA for NPSAH with an initially negative angiographic study.

CLINICAL RELEVANCE/APPLICATION

Our study will make recommendations on the optimal management of the more concerning (non-perimesencephalic) subtypes of spontaneous SAH based on existing literature.
To investigate the feasibility and advantages of 'one-stop' axial scanning of coronary and spiral scanning of head-neck CTA.

**METHOD AND MATERIALS**

78 patients were randomly divided into three groups: Group A (n=26) performed helical scanning of head and neck CTA and axial scanning of CCTA altogether with one-time injection of contrast medium. The switching delay between the two scanning modes was as short as 1.1 s. Group B (n=26) performed conventional head-neck CTA exams with a scanning range from aortic arch to calvarium. Group C (n=26) performed conventional CCTA scanning. The effective radiation dose (ED) and usage of contrast medium volume were recorded for each patient. Double-blinded evaluation of the image quality of the three groups were completed by two physicians.

**RESULTS**

The image quality of coronary and head and neck in Group A was not different from that in Group B and Group C (4.63±0.42 vs. 4.34±0.73, p>0.05). The volume of contrast medium used in Group A was significantly less than the total volume in Group B and C (53.1±3.9ml vs. 115.2±10.6ml, t=15.9, p<0.001). The ED in Group A was not different from the combined ED in Group B and C (2.1±0.4mSv vs. 1.9±0.5mSv).

**CONCLUSION**

The "one-stop" scanning protocol enabled CTA of coronary and head-neck with one-time injection of contrast medium, resulting a reduction of 50% contrast medium dose, while the image quality and radiation dose were comparable with separate scanning protocols.

**CLINICAL RELEVANCE/APPLICATION**

The combination of axial and spiral CT angiography is the first choice for evaluation of cardiovascular and cerebrovascular diseases.

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**PURPOSE**

To achieve good images in head CT with optimized iterative reconstruction algorithm (ASIR-V) in combination with EC2 to further reduce radiation dose.

**METHOD AND MATERIALS**

Participants
Yanan Zhu, Ankang, China (Presenter) Nothing to Disclose
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METHOD AND MATERIALS

Prospectively enrolled 80 adults for non-enhanced head CT on a 16cm wide-detector 256-row Revolution CT scanner. Participants were randomly divided into two groups: Group 1 (n=40) with the standard low dose scan and reconstruction protocol of 120kVp / 200mAs and 60% ASIR-V algorithm; Group 2 with the reduced radiation dose of 120kVp / 120mAs scan protocol. Images in Group 2 were reconstructed using ASIR-V at 0%-100% to select the optimal strength for getting the highest subjective image quality. The subjective image quality was evaluated by 2 board-certified radiologists using a 5-point scoring system with 3 and above being acceptable for diagnosis. Enhanced Contrast Level 2(EC2) reconstruction was done at the optimal ASIR-V (in Group 2). The CT numbers and their standard deviation (SD) of cerebellum and centrum ovale were measured to calculate signal to noise ratio (SNR) and contrast to noise ratio (CNR) for cerebellum. Radiation dose was recorded. Measurements from the two groups were compared between the optimal ASIR-V (in Group 2) in combination with EC2 and the conventional Group (Group 1).

RESULTS

With the increase of ASIR-V strength from 0% to 100%, noise decreased while CNR and SNR increased monotonically. The highest subjective image quality was achieved at 70% ASIR-V. There was no statistical difference in the noise in centrum ovale and the overall subjective image quality scores between Group 1 and the group of 70% ASIR-V in combination with EC2. However, compared with the conventional group (Group 1), the group of 70% ASIR-V in combination with EC2 significantly raised the CNR of the cerebellum by 21.4% (3.74±0.84 vs. 4.59±0.73) (P<0.05). On the other hand, compared with the standard low dose group, the reduced dose group with 70% ASIR-V significantly reduced effective radiation dose by 56% (0.44 vs. 1.01 mSv) (P<0.05).

CONCLUSION

The CT image quality of the head was acceptable on a 256-row, 16cm wide-detector CT with 70% ASIR-V algorithm in combination with EC2 at 44% dose, compared with standard low dose head CT scan and reconstruction protocol.

CLINICAL RELEVANCE/APPLICATION

Good images of the 120mAs head can be achieved on a wide-detector CT with 70% Asir-V in combination with EC2 reconstruction to reduce the radiation dose.

SSM18-03  Multiphase CT Angiography in Acute Stroke: Radiation Dose and Patterns of Use

Wednesday, Nov. 29 3:20PM - 3:30PM Room: N229

Participants
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PURPOSE

In the rapidly evolving field of acute stroke diagnosis and management, multiphase CTA (mCTA) has been recently developed, allowing better evaluation of collateral filling with temporal resolution and permitting a semi-quantitative collaterals score. To assess radiation dose and patterns of use of mCTA in a stroke referral center, we reviewed all patients who underwent mCTA. We also illustrate how the imaging protocol was modified to reduce the effective dose.

METHOD AND MATERIALS

All patients presenting with acute stroke symptoms who underwent our stroke imaging protocol were retrospectively evaluated. The protocol consists of non-contrast CT (NCCT) and mCTA. After intracranial hemorrhage was excluded on NCCT, mCTA was performed. Most patients were imaged on a Siemens Somatom Definition scanner. In case the former was unavailable a Philips Brilliance 16 was used. Scan parameters are shown in Tables 1 and 2. Iodine-based contrast medium (60mL,370mg/mL) was injected at 5mL/s followed by 40mL of saline solution at 5mL/s. From April 2017 the 3 mCTA phases on Definition were lowered from 120kVp to 100kVp, keeping the other parameters constant. The assessment of organ doses (brain and lens) was performed on stylized human phantoms implemented in CT-Expo v2.3 software.

RESULTS

From 1st June 2015 to April 10th 2017 we analyzed 274 consecutive patients who underwent NCCT and mCTA (median age 68, range 14-92, males percentage 56%). Radiation doses are reported in Tables 1 and 2. Effective dose (according to ICRP 103) ranges from 9.4 to 10.4mSv for the old protocols, aligned with previous reports for mCTA, and lower than the protocols including CT perfusion, in particular for eye lens. The new 100kVp protocol allows a reduction of the effective dose of 30%, from 10.4 to 7.3 mSv.

CONCLUSION

The NCCT+mCTA protocol was designed to be fast to perform and interpret, in order to provide critical information on brain parenchyma and vasculature while minimizing door-to-groin time in patients who are candidates for mechanical thrombectomy. By
lowering voltage of mCTA to 100kVp the effective dose reduction was substantial, without perceived loss of diagnostic accuracy from multiple viewers and even enhancing arterial contrast.

CLINICAL RELEVANCE/APPLICATION

Multiphase CT angiography as part of an acute stroke imaging protocol is associated with low radiation dose and provides critical information on brain parenchyma and vasculature.

SSM18-04 Carotid-CTA at 70 Kilovolt (kV) in Comparison to Automated Tube Voltage Adaption in Respect to Radiation Exposure and Image Quality

Wednesday, Nov. 29 3:30PM - 3:40PM Room: N229

Participants
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PURPOSE
To evaluate a 70 kV protocol in computed tomography angiography (CTA) of the carotid arteries in respect to image quality and radiation exposure compared to automated tube voltage adaption.

METHOD AND MATERIALS

Ninety consecutive patients were included in this prospective study. Forty-five (64, 35 - 84 years) were randomized to the study group (70 kV, 167 ref.mAs) and 45 (65, 24 - 87 years) were randomized to the control group (automated kV adaption, 70 - 150 kV). CT dose index (CTDIvol) and dose length product (DLP) were recorded from the examination protocol. Image quality was assessed by region of interest (ROI) measurements and calculations of signal to noise (SNR) and contrast to noise ratio (CNR). Subjective image quality and image artifacts were evaluated by two observers with a 4-point scale (3-excellent; 0-not diagnostic).

RESULTS

Radiation exposure was significantly lower in the study group (CTDIvol reduction of 22%, DLP reduction 20%; each p<0.001). Contrast (p=0.15), SNR (p=0.4), and CNR (p=0.5) did not show significant differences between the groups. Subjective image quality was without significant differences between the two groups (p=0.56). Also artifacts due to contrast medium influx were without significant difference (p=0.17). Artifacts due to beam hardening in the height of the shoulder girdle were significantly more affecting in the scans from the study group (p=0.04) while there was also no significant difference on the height of the skull base (p=0.65).

CONCLUSION

Carotid-CTA using fixed 70 kV is feasible at very low radiation dose levels while overall image quality is constant to protocols using automated tube voltage selection.

CLINICAL RELEVANCE/APPLICATION

Lowest available tube voltages (70 kV) can increase the radiation dose efficiency in CT angiographies of the carotids compared to individual tube voltage adaptation.

SSM18-05 Dual Energy CT Angiography of the Carotid Arteries: Quality, Bone Subtraction and Radiation Dosage Using Second- and Third-Generation Dual-Source CT

Wednesday, Nov. 29 3:40PM - 3:50PM Room: N229

Participants
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PURPOSE

To study the differences in vascular image quality, bone subtraction, and dose of radiation of dual energy CT angiography (CTA) of the supraaortic trunks using second- and third-generation dual-source CT (DSCT). Comparing the diagnostic performance of arterial stenosis between the third-generation dual-source CT and digital subtracted angiography (DSA).

METHOD AND MATERIALS

CTA of the supraaortic trunks in 40 patients were retrospectively reviewed. 20 patients used second-generation dual-energy CT (DECT) system (100/Sn140 kp tube voltage) and 40-mL contrast material. Another 20 patients used third-generation DECT system (90/Sn150 kp tube voltage) and 30-mL contrast material. The attenuation was measured in common carotid artery (CCA), C7 segment of internal carotid arteries, and cervical muscle (CM). The noise of CCA and CM was recorded. The signal-to-noise ratio (SNR) of CCA and contrast-to-noise ratio (CNR) were calculated. 5-scoring system was used for bone removal of C1-C7 segments of internal carotid arteries (1=poor, 5=excellent). DSA was performed if necessary. Accuracy, sensibility, specificity were calculated.

RESULTS

The attenuation of CCA was significantly higher in CT (p=0.000) and no difference in CM (p=0.315).
The attenuation of third-generation group was significant higher on C7 (P=0.001), and not different on CCA (all P = 0.317) compared with that of second-generation group. Both SNR and CNR of CCA were significantly higher in second-generation group than third-generation group (both p < 0.05). The dose-length product in second-generation group was lower than that of third-generation group (299.7 ± 16.7 vs. 218.3 ± 27.8 mGy×cm, P<0.001). Scores of the bone removal of C2, C3, C4 and C7 were were evaluated as 5 score in the third-generation group, which were higher than that of second-generation group were lower (all P < 0.05). 6 patients in the third-generation group received DSA examination, the accuracy, sensibility, specificity for detecting >50% arterial stenosis were 98.8%, 100% and 98.8%.

CONCLUSION
Third-generation dual-energy scan mode is is able to decrease the volume of contrast material, reduce the radiation dose and improve the image quality of bone removal compared with second-generation group. The accuracy, sensibility, specificity are high compared with DSA.

CLINICAL RELEVANCE/APPLICATION
Dual-energy scan mode of third-generation CT provides better bone-subtraction quality of carotid arteries and is equal to DSA in detecting arterial stenosis.

SSM18-06 Using a Low Tube Voltage Protocol with Adaptive Statistical Iterative Reconstruction in Craniocervical Computed Tomographic Angiography Provides Better Image Quality with a Reduced Radiation Dose

Wednesday, Nov. 29 3:50PM - 4:00PM Room: N229

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PURPOSE
To evaluate image quality and radiation dose by using a lower kVp protocol (100 kVp) and 50% ASiR-V for Craniocervical Computed Tomographic Angiography (CCCTA) in comparison with the conventional protocol (120 kVp).

METHOD AND MATERIALS
A total of 121 volunteers (47 men, 74 women; age range, 15-78 years) were enrolled and randomly divided into 3 groups: group A (conventional protocol): 120 kVp and filtered back-projection reconstruction; group B: 120 kVp and 50% ASiR-V; group C: 100 kVp and 50% ASiR-V. All patients were scanned by a 256-slice CT machine with the slice thickness of 0.625 mm. Objective values (arterial attenuation value, signal-to-noise ratio [SNR], contrast-to-noise ratio [CNR]) of arteries was obtained at head, neck and shoulder levels and compared among three groups. Subjective image quality and radiation dose (volume CT dose index [CTDVol], dose-length product [DLP]) were also compared. The quantitative parameters and radiation dose were analysis by ANOVA. Subjective image quality was evaluated by two experienced radiologists independently and inter-rater reliability was calculated using kappa (k) analysis.

RESULTS
For the radiation dose, the CTDVol and DLP of group C were the lowest among three groups. For the objective values, the arterial attenuation in head, neck and shoulder were significant higher in group C than those in group A and B (each P <0.05). The SNR and CNR of group B and C were significant higher than the conventional group A (each P <0.05), and there were no significant difference for the SNR and CNR between group B and C. In subjective image quality analysis, group C revealed significant better image quality than group A and B (P <0.05). The inter-rater reliability was good (k=0.73).

CONCLUSION
In CCCTA, using 100 kVp and 50% ASiR-V protocol showed better arterial attenuation, SNR, CNR and subjective imaging quality with a reduced radiation dose compared to the conventional protocol.

CLINICAL RELEVANCE/APPLICATION
Using ASiR-V with a lower kVp protocol in CCCTA, better objective and subjective imaging quality can be obtained with a reduced radiation dose compared to the conventional protocol.
RSNA/ESR Hybrid Imaging Symposium: Hybrid Imaging of the Brain (An Interactive Session)

Wednesday, Nov. 29 3:30PM - 5:00PM Room: S402AB

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants

Alexander Drzezga, MD, Cologne, Germany (Moderator) Consultant, Siemens AG; Consultant, Bayer AG; Consultant, General Electric Company; Consultant, Eli Lilly and Company; Consultant, The Piramal Group; Speakers Bureau, Siemens AG; Speakers Bureau, Bayer AG; Speakers Bureau, General Electric Company; Speakers Bureau, Eli Lilly and Company; Speakers Bureau, The Piramal Group
Katrine Riklund, MD, PhD, Umea, Sweden (Moderator) Nothing to Disclose

LEARNING OBJECTIVES

1) To learn about pathophysiology in neurodegenerative disorders. 2) To learn about different tracers and how to interpret the findings. 3) To understand the role of hybrid imaging in neurodegenerative disorders.

MSSR44B  Brain Tumors

Participants

Gagandeep Choudhary, MD, MBBS, Birmingham, AL (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) To get an overview of brain tumours and tracers used. 2) To learn how to interpret the examinations. 3) To understand the role of hybrid imaging of brain tumours.

Active Handout: Gagandeep Choudhary

MSSR44C  Interactive Case Discussion

Participants

Henryk Barthel, Leipzig, Germany (Presenter) Research support, The Piramal Group; Consultant, The Piramal Group; Travel support, The Piramal Group
Gagandeep Choudhary, MD, MBBS, Birmingham, AL (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) To learn about evaluation of hybrid imaging in neurodegenerative disorders. 2) To learn about evaluation of hybrid imaging of brain tumours.
Neuro and MSK (Case-based Competition)

Wednesday, Nov. 29 4:30PM - 6:00PM Room: E451B

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Paul J. Chang, MD, Chicago, IL (Presenter) Co-founder, Stentor/Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Advisory Board, Bayer AG; Advisory Board, Aidoc Ltd; Advisory Board, McCoy
Neety Panu, MD, FRCPC, Thunder Bay, ON (Presenter) Nothing to Disclose
Gregory L. Katzman, MD, Chicago, IL (Presenter) Nothing to Disclose
Omer A. Awan, MD, Philadelphia, PA (Presenter) Nothing to Disclose

For information about this presentation, contact:
pchang@radiology.bsd.uchicago.edu
omer.awan@tuhs.temple.edu

LEARNING OBJECTIVES
1) Be introduced to a series of neuradiology and musculoskeletal radiology case studies via an interactive team game approach designed to encourage ‘active’ consumption of educational content. 2) 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) 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.

ABSTRACT
The extremely popular audience participation educational experience, Diagnosis Live!, is an expert-moderated session featuring a series of interactive case studies that will challenge radiologists’ diagnostic skills and knowledge. The session features a lively, fast-paced game format: participants will be automatically assigned to teams who will then use their personal mobile devices to test their knowledge in a fast-paced session that will be both educational and entertaining. After the session, attendees 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.
Diagnostic Challenges in MSK, Body and Neuroimaging (Case-based Competition)

Thursday, Nov. 30 7:15AM - 8:15AM Room: E451B

Participants

Petra J. Lewis, MD, Lebanon, NH (Moderator) Nothing to Disclose
Jenna N. Le, MD, Lebanon, NH (Presenter) Nothing to Disclose
David A. Pastel, MD, Lebanon, NH (Presenter) Nothing to Disclose
John J. McIntyre IV, MD, Lebanon, NH (Presenter) Nothing to Disclose
Michael J. Tsapakos, MD, PhD, Lebanon, NH (Presenter) Nothing to Disclose

For information about this presentation, contact:

jenna.le@dartmouth.edu

LEARNING OBJECTIVES

1) Identify a variety of common sports injuries utilizing MRI. 2) Review clinical presentations of sports injuries that present to orthopedic clinics and how these presentations can assist in the diagnosis when correlated with imaging. 3) Review a variety of typical and atypical musculoskeletal injuries that present to the Emergency Department. 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 Neuroradiology (An Interactive Session)

Thursday, Nov. 30 8:30AM - 10:00AM Room: S406A

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Pina C. Sanelli, MD, Manhasset, NY (Director) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify the application of basic anatomic, pathologic, and physiologic principles to specific disease processes, and diagnostic and therapeutic procedures in neuroimaging. 2) Analyze imaging and therapeutic techniques and apply this knowledge to protocol development, patient management and safety. 3) Compare indications and contraindications of specific imaging procedures in Neuroradiology.

Sub-Events

MSCN51A Pediatric Brain

Participants
Yutaka Sato, MD, Iowa City, IA (Presenter) Nothing to Disclose

For information about this presentation, contact:
yutaka-sato@uiowa.edu

LEARNING OBJECTIVES
1) Identify pediatric neurologic cases in which imaging play a major role to establish diagnosis, including some newly described entities. 2) Provide key clinical and imaging findings correlating to pathologic data, when appropriate. 3) Discuss differential diagnosis based on imaging findings. Primary imaging techniques used for assessment, clinical practice, problem-solving and patient care are emphasized.

Active Handout:Yutaka Sato

MSCN51B Pediatric Spine

Participants
Avrum N. Pollock, MD, Wynnewood, PA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) To utilize multimodality imaging in the assessment of diseases affecting the spine in children. 2) To understand potential congenital lesions affecting the spine in children. 3) To understand infectious, inflammatory and neoplastic processes affecting the spine in children.

MSCN51C Pediatric Head & Neck

Participants
Caroline D. Robson, MBChB, Boston, MA (Presenter) Editor with royalties, Reed Elsevier; Author with royalties, Reed Elsevier;

LEARNING OBJECTIVES
1) Become familiar with region specific, indication based cross sectional imaging protocols to image the pediatric head and neck. 2) Improve knowledge in interpreting imaging of the pediatric head and neck. 3) Provide a relevant differential diagnosis. 4) Recognize various common syndromes that involve the pediatric head and neck.

Active Handout:Caroline Diana Robson

MSCN51D Pediatric Interventional

Participants
Michele H. Johnson, MD, New Haven, CT (Presenter) Nothing to Disclose
**RC605 Emergency Neuroradiology (An Interactive Session)**

Thursday, Nov. 30 8:30AM - 10:00AM Room: E353C

**LEARNING OBJECTIVES**

1) Develop a systematic approach to evaluating patients with head and neck infections. 2) Recognize head and neck emergencies that result in morbidity and mortality presenting as fever, trauma, difficulty breathing, and bleeding. 3) Discuss Differential Dx for 'found down' patient. 4) Choose best imaging for each patient. 5) Recognize imaging findings that will acutely change patient management. 6) Develop a 'checklist' for imaging to improve your ability to identify significant findings.

**SAM**

New in 2017: PLEASE NOTE - All courses designated for SAM credit at RSNA 2017 will require attendees bring a personal device e.g. phone, iPad, laptop to complete the required test questions during the live session.

**RC605A Head & Neck Emergencies**

Participants
John L. Go, MD, Los Angeles, CA (Moderator) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Develop a systematic approach to evaluating patients with head and neck infections. 2) Recognize head and neck emergencies that result in morbidity and mortality presenting as fever, trauma, difficulty breathing, and bleeding.

**RC605B Found Down!**

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

For information about this presentation, contact:

james.smirniotopoulos@nih.gov

**LEARNING OBJECTIVES**

1) Discuss Differential Dx for 'found down' patient. 2) Choose best imaging for each patient. 3) Recognize imaging findings that will acutely change patient management. 4) Develop a 'checklist' for imaging to improve your ability to identify significant findings.

**ABSTRACT**

A common problem in Emergency and Neuroimaging is the 'found down' patient - often complicated by altered mental status, and unable to provide a useful history. The work-up of these patients should be organized to first identify the conditions most likely to cause acute deterioration - the Four 'Hs' of the Neuro-Apocalypse: Herniation & Shift Hemorrhage (intra- and extra-axial) Hydrocephalus Large Hypoxic areas We present a systematic approach; and, emphasize common conditions that require urgent management. Especially important - non-traumatic neurologic emergencies may lead to trauma - which clouds the differential diagnosis.

Active Handout: James G. Smirniotopoulos


**RC605C Emergency Neuroradiology: Don't Miss These Lesions!**

Participants
Michael H. Lev, MD, Boston, MA (Presenter) Consultant, General Electric Company; Institutional Research Support, General Electric Company; Stockholder, General Electric Company; Consultant, MedyMatch Technology, Ltd; Consultant, Takeda Pharmaceutical Company Limited; Consultant, D-Pharm Ltd

**LEARNING OBJECTIVES**

1) Summarize the role of imaging in the assessment of acute neurologic emergencies. 2) Apply an evidence based approach to devise effective and efficient neuroimaging algorithms. 3) Describe technological advances in CT and MRI as they relate to imaging acute neuro-vascular and traumatic injuries to the brain. 4) Determine imaging predictors in outcome assessment of cerebral
hemorrhage and acute stroke.
LEARNING OBJECTIVES

1) Illustrate important anatomic structures key to the assessment of head and neck disease. 2) Emphasize several landmarks that are associated with developing differential diagnoses. 3) Missed diagnoses as well as misdiagnoses in head and neck cancer are as prevalent as they are easy to do. 4) This presentation will focus on specific categories of misses, illustrate with case examples, and provide suggestions on avoidance. 5) List common interpretation errors on head and neck imaging studies. 6) Identify areas where radiologically subtle findings may substantially impact patient care in head and neck imaging.

SAM

New in 2017: PLEASE NOTE - All courses designated for SAM credit at RSNA 2017 will require attendees bring a personal device e.g. phone, iPad, laptop to complete the required test questions during the live session.

Sub-Events

RC606A  Important Head and Neck Anatomy

Participants
Hugh D. Curtin, MD, Boston, MA (Presenter) Nothing to Disclose

For information about this presentation, contact:
hdcurtin@meei.harvard.edu

LEARNING OBJECTIVES

1) Illustrate important anatomic structures key to the assessment of head and neck disease. 2) Emphasize several landmarks that are associated with developing differential diagnoses.

ABSTRACT

Some of the most intricate anatomy in the body is located in the head and neck. Knowledge of specific landmarks and their appearance at imaging is crucial to adequate interpretation of head and neck imaging. This section will illustrate several of the most important of these anatomic points.

RC606B  Missed Diagnoses in the Head and Neck

Participants
Lawrence E. Ginsberg, MD, Houston, TX (Presenter) Nothing to Disclose

For information about this presentation, contact:
lginsberg@mdanderson.org

LEARNING OBJECTIVES

1) Missed diagnoses as well as misdiagnoses in head and neck cancer are as prevalent as they are easy to do. 2) This presentation will focus on specific categories of misses, illustrate with case examples, and provide suggestions on avoidance.

RC606C  Head and Neck Imaging Pearls

Participants
Barton F. Branstetter IV, MD, Pittsburgh, PA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) List common interpretation errors on head and neck imaging studies. 2) Identify areas where radiologically subtle findings may substantially impact patient care in head and neck imaging.

ABSTRACT

There are numerous pitfalls and traps to avoid when interpreting head and neck imaging cases. Several of the most common errors are presented, along with advice on how to maximize the usefulness of your reports to patients and other physicians.
Nerve Ultrasound Based on a Regional Approach: Hip to Knee (Hands-on)

Thursday, Nov. 30 8:30AM - 10:00AM Room: E264

Participants
Carlo Martinoli, MD, Genova, Italy (Presenter) Nothing to Disclose
Jon A. Jacobson, MD, Ann Arbor, MI (Presenter) Nothing to Disclose
Kenneth S. Lee, MD, Madison, WI (Presenter) Grant, General Electric Company; Research support, SuperSonic Imagine; Research support, Johnson & Johnson; Consultant, Echometrix, LLC; Royalties, Reed Elsevier
J. Antonio Bouffard, MD, Novi, MI (Presenter) Nothing to Disclose
Ghiyath Habra, MD, Troy, MI (Presenter) Nothing to Disclose
Kenneth S. Lee, MD, Madison, WI (Presenter) Grant, General Electric Company; Stockholder, Koninklijke Philips NV; Stockholder, General Electric Company; Stockholder MedEd3D; Grant, Siemens AG; Grant, General Electric Company;
Rachel B. Hulen, MD, Flint, MI (Presenter) Nothing to Disclose
Joseph H. Introcaso, MD, Neenah, WI (Presenter) Nothing to Disclose
Andrea Klauzer, MD, Reith bei Seefeld, Austria (Presenter) Nothing to Disclose
Mary M. Chiavaras, MD, PhD, Ancaster, ON (Presenter) Nothing to Disclose
Viviane Khoury, MD, Philadelphia, PA (Presenter) Nothing to Disclose
Marina Kislyakova, MD, Moscow, Russia (Presenter) Nothing to Disclose
Courtney E. Scher, DO, Detroit, MI (Presenter) Nothing to Disclose
Ximena L. Wortsman, MD, Santiago, Chile (Presenter) Nothing to Disclose
David P. Fessell, MD, Ann Arbor, MI (Presenter) Nothing to Disclose
Matthieu Rutten, MD, Hertogenbosch, Netherlands (Presenter) Nothing to Disclose
Sonia Airaldi, Genova, Italy (Presenter) Nothing to Disclose
Etienne Cardinal, MD, Montreal, QC (Presenter) Nothing to Disclose
Nicki J. Delves, Guildford, United Kingdom (Presenter) Nothing to Disclose

For information about this presentation, contact:
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mkisliakova@yandex.ru
mskeletal.radiology@gmail.com

LEARNING OBJECTIVES
1) Familiarize course participants with the ultrasound appearance of nerves and the scanning techniques used to image them about the hip and knee. 2) Emphasize the ultrasound anatomy of the femoral, sciatic and peroneal nerves and their divisional branches at their common sites of entrapment. 3) Learn the technique to image some minor nerves in their course throughout the proximal lower extremity, such as the lateral and posterior femoral cutaneous, the obturator, the saphenous and the sural. 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 proximal lower extremity (hip to knee). The standardized techniques of performing an adequate ultrasound study of the femoral, lateral and posterior femoral cutaneous, obturator, peroneal, saphenous, sciatic, sural nerves and their divisional branches 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

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/ Jon A. Jacobson, MD - 2012 Honored Educator
Jon A. Jacobson, MD - 2017 Honored Educator
Case-based Review of Neuroradiology (An Interactive Session)

Thursday, Nov. 30 10:30AM - 12:00PM Room: S406A

NR

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Pina C. Sanelli, MD, Manhasset, NY (Director) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify the application of basic anatomic, pathologic, and physiologic principles to specific disease processes, and diagnostic and therapeutic procedures in neuroimaging. 2) Analyze imaging and therapeutic techniques and apply this knowledge to protocol development, patient management and safety. 3) Compare indications and contraindications of specific imaging procedures in Neuroradiology.

Sub-Events

MSCN52A Adult Brain

Participants
Pamela W. Schaefer, MD, Boston, MA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View Learning Objectives under main course title

MSCN52B Adult Spine

Participants
Rona F. Woldenberg, MD, Great Neck, NY (Presenter) Nothing to Disclose

For information about this presentation, contact:
rwoldenb@northwell.edu

LEARNING OBJECTIVES
1) Access the results of new research and assess the potential applications to imaging of the adult spine. 2) Review and reinforce basic knowledge and skills relevant to interpretation of adult spine imaging. 3) Assess the potential developing technology and advanced imaging techniques to enhance clinical practice and problem solving as it relates to spine imaging. 4) Sharpen critical thinking skills to enhance peer interaction in the radiologic sciences as they relate to spine imaging.

MSCN52C Adult Head & Neck

Participants
Laurie A. Loevner, MD, Gladwyne, PA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View Learning Objectives under main course title

MSCN52D Adult Interventional

Participants
A. Orlando Ortiz, MD, MBA, Mineola, NY (Presenter) Nothing to Disclose

For information about this presentation, contact:
oortiz@winthrop.org

LEARNING OBJECTIVES
View Learning Objectives under main course title
SSQ15

Neuroradiology (Extracranial Vascular Imaging)

Thursday, Nov. 30 10:30AM - 12:00PM Room: N228

SSQ15-01 Modified Blooming-Independent Dual-Energy CT Carotid Angiography for Calcified Plaque Removal: Comparison with Digital Subtraction Angiography

Participants
Manoj Mannil, Zurich, Switzerland (Presenter) Nothing to Disclose
Jaychandran Ramachandran, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Ilaria Vittoria De Martini, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Susanne Wegener, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Bernhard Schmidt, PhD, Forchheim, Germany (Abstract Co-Author) Employee, Siemens AG
Thomas G. Flihr, PhD, Forchheim, Germany (Abstract Co-Author) Employee, Siemens AG
Bernhard Krauss, PhD, Forchheim, Germany (Abstract Co-Author) Employee, Siemens Healthcare GmbH
Hatem Alkadhi, MD, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Sebastian Winkhofer, MD, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose

PURPOSE
To investigate a new dual-energy computed tomography (DECT) technique with a modified 3-material decomposition algorithm for calcium removal in extracranial carotid artery stenosis.

METHOD AND MATERIALS
In this retrospective, IRB-approved study 30 calcified carotid plaques in 22 patients (15 males, mean age 73±10 years) with suspicion of stroke were included. DECT image data were obtained using second-generation dual-source CT with tube voltages at 80/140Sn kVp. Conventional CTA and virtual non-calcium (VNCa) images using the modified DECT algorithm were reconstructed. By assessing spectral characteristics, blooming-independent calcium removal was achieved. Two independent, blinded readers evaluated subjective image quality, blooming artifacts, amount of (residual) calcification, and performed stenosis measurements according to the NASCET-criteria. Differences were tested using a pairwise sign test. Paired sample t-tests with Bonferroni correction (p<0.017) and Bland-Altman analyses were used for assessing differences in stenosis measurements between VNCa and conventional CTA with digital subtraction angiography (DSA) as reference.

RESULTS
Subjective image quality was similar among conventional CTA and VNCa image datasets (p=0.82), while blooming artifacts were significantly reduced in VNCa images compared to conventional CTA (p<0.001). Residual calcifications in VNCa images were absent in 11 (37%), minor in 12 (40%), medium-sized in 2 (7%), and large in 5 (17%) arteries. Stenosis measurements differed significantly between VNCa (mean stenosis: 27±20%) and conventional CTA images (mean stenosis: 39±16%; p<0.001) and between conventional CTA and DSA (23±16%, p<0.001). No significant differences in stenosis measurements were observed between VNCa and DSA (p=0.189), with narrow limits of agreement (mean difference±1.96 SD, -4.7%; -35.13%; 25.71%).

CONCLUSION
The modified three-material decomposition DECT algorithm for blooming-independent calcium removal allows for an accurate removal of calcified carotid plaques in extracranial carotid artery disease.

CLINICAL RELEVANCE/APPLICATION
A novel, blooming-independent modified 3-material decomposition algorithm for calcium removal improves stenosis assessments by preventing overestimation of calcified stenosis in DECTA.

SSQ15-02 CT Texture of Carotid Arteries identifies Vulnerable Plaque in Stroke and Transient Ischaemic Attack: A Preliminary Outcome Study

Participants
Fulvio Zaccagna, MD, Cambridge, United Kingdom (Presenter) Nothing to Disclose

Awards
Student Travel Stipend Award
Compared with conventional 120 kVp scan protocol, 60keV GSI could reduce radiation dose, maintain CNR and improve subject image quality of arterial enhancement (352±57.0 HU, p=.549), CNR (25±6.1, p=.085), or subjective image quality (120 kVp: 3.7±0.80 vs. 60keV: 4.5±0.51, p<.001). In contrast, 70keV monochromatic images did not differ from the 120kVp group in image quality of arterial enhancement (352±57.0 HU, p<.001), comparable CNR (120kVp: 29±7.7 vs. 60keV: 29±7.5, p=.933), and significantly higher subjective image quality (120 kVp: 4.5±0.51 vs. 60keV: 483±81.1 HU, p<.001). AUC values for S were .684 for SD and .723 for S (p values of .033 and .009 respectively); AUC values at SSF2 were .684 for S and .723 for S (p<.001 for SSF=3mm and p=0.003 for SSF=4mm). SDn was statistically significant different between patients and control group for SSF=2mm (p=0.033). AUC values at SSF2 were .684 for SD and .723 for S (p=0.009 for spatial scaling factor (SSF) =2mm; p<0.001 for SSF=3mm and p=0.003 for SSF=4mm). SDn was statistically significant different between patients and control group for SSF=2mm (p=0.033). AUC values at SSF2 were .684 for S and .723 for S (p values of .033 and .009 respectively); AUC values for S were .808 (p=.0001) at SSF3 and .075 (p=0.003) at SSF4.

CONCLUSION
CT texture identified vulnerable plaque in Stroke and TIA and may, therefore, have the potential to act as a new means of risk stratification in patients with carotid atherosclerosis.

CLINICAL RELEVANCE/APPLICATION
CT texture of carotid arteries may improve the identification of patients at risk for ischemic strokes.

SSQ15-03 Evaluation of Spectral Imaging in Cranio cervical CT Angiography: Comparison with Conventional 120kVP CT Imaging

Thursday, Nov. 30 10:50AM - 11:00AM Room: N228

Participants
Shu Wang, Yancheng, China (Presenter) Nothing to Disclose
Fei Chen, Yancheng, China (Abstract Co-Author) Nothing to Disclose
Lizheng Yao, Yancheng, China (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
ycsywz@126.com

PURPOSE
To assess the potential role of texture analysis in carotid arteries imaging.

METHOD AND MATERIALS
A retrospective case-control study. From a study population of 341 patients with CV risk factors that underwent whole-body CTA (detector configuration: 64x0.6mm; Iomeprol-400, 400mgI/m; 70+50ml@4ml/s), 12 patients (age 63±10.29 yrs) with carotid atherosclerosis and a subsequent history of Transient Ischemic Attack (TIA) or Stroke were identified. These were age and sex matched with 12 control cases (age 62.9±10.16 yrs) with asymptomatic carotid atherosclerosis (follow-up 103.5±9.2 months). Stenosis and plaque composition were determined. Texture analysis was performed using a commercially available software (TexRAD, Somerset, UK) by a single operator blinded to clinical data. TexRAD uses a filtration-histogram based texture analysis technique to extract pixel size based (fine, medium, coarse) features and quantified histogram parameters including skewness (S) and normalized standard-deviation (SDn). A single axial slice was selected to best represent the carotid bifurcation for each side and a region of interest (ROI) was manually delineated in order to fully enclose the artery. Statistical analysis was performed using X2, t-test and Mann-Whitney test. ROC curves were constructed using TIA/Stroke as outcome.

RESULTS
Stenosis degree was greater at the right carotid bifurcation in the patient group (41.08 vs 12.08; p=.014), however no statistically significant differences were found at the left carotid bifurcation (p=.56); there were no differences in plaque composition for both sides (right p=.39, left p=.72). There was a statistically significant difference in skewness at the fine and medium texture level (p=0.009 for spatial scaling factor (SSF) =2mm; p<0.001 for SSF=3mm and p=0.003 for SSF=4mm). SDn was statistically significant different between patients and control group for SSF=2mm (p=0.033). AUC values at SSF2 were .684 for SD and .723 for S (p values of .033 and .009 respectively); AUC values for S were .808 (p=.0001) at SSF3 and .075 (p=0.003) at SSF4.

CONCLUSION
CT texture identified vulnerable plaque in Stroke and TIA and may, therefore, have the potential to act as a new means of risk stratification in patients with carotid atherosclerosis.

SSQ15-03 Evaluation of Spectral Imaging in Cranio cervical CT Angiography: Comparison with Conventional 120kVP CT Imaging

Thursday, Nov. 30 10:50AM - 11:00AM Room: N228

Participants
Shu Wang, Yancheng, China (Presenter) Nothing to Disclose
Fei Chen, Yancheng, China (Abstract Co-Author) Nothing to Disclose
Lizheng Yao, Yancheng, China (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
ycsywz@126.com

PURPOSE
To assess the potential role of texture analysis in carotid arteries imaging.

METHOD AND MATERIALS
A retrospective case-control study. From a study population of 341 patients with CV risk factors that underwent whole-body CTA (detector configuration: 64x0.6mm; Iomeprol-400, 400mgI/m; 70+50ml@4ml/s), 12 patients (age 63±10.29 yrs) with carotid atherosclerosis and a subsequent history of Transient Ischemic Attack (TIA) or Stroke were identified. These were age and sex matched with 12 control cases (age 62.9±10.16 yrs) with asymptomatic carotid atherosclerosis (follow-up 103.5±9.2 months). Stenosis and plaque composition were determined. Texture analysis was performed using a commercially available software (TexRAD, Somerset, UK) by a single operator blinded to clinical data. TexRAD uses a filtration-histogram based texture analysis technique to extract pixel size based (fine, medium, coarse) features and quantified histogram parameters including skewness (S) and normalized standard-deviation (SDn). A single axial slice was selected to best represent the carotid bifurcation for each side and a region of interest (ROI) was manually delineated in order to fully enclose the artery. Statistical analysis was performed using X2, t-test and Mann-Whitney test. ROC curves were constructed using TIA/Stroke as outcome.

RESULTS
Stenosis degree was greater at the right carotid bifurcation in the patient group (41.08 vs 12.08; p=.014), however no statistically significant differences were found at the left carotid bifurcation (p=.56); there were no differences in plaque composition for both sides (right p=.39, left p=.72). There was a statistically significant difference in skewness at the fine and medium texture level (p=0.009 for spatial scaling factor (SSF) =2mm; p<0.001 for SSF=3mm and p=0.003 for SSF=4mm). SDn was statistically significant different between patients and control group for SSF=2mm (p=0.033). AUC values at SSF2 were .684 for SD and .723 for S (p values of .033 and .009 respectively); AUC values for S were .808 (p=.0001) at SSF3 and .075 (p=0.003) at SSF4.

CONCLUSION
CT texture identified vulnerable plaque in Stroke and TIA and may, therefore, have the potential to act as a new means of risk stratification in patients with carotid atherosclerosis.

CLINICAL RELEVANCE/APPLICATION
CT texture of carotid arteries may improve the identification of patients at risk for ischemic strokes.
Compared with conventional 120 kVp scan protocol, 60kV GSI could reduce radiation dose, maintain CNR and improve subject image quality.

**CLINICAL RELEVANCE/APPLICATION**

The application of GSI mode in craniocervical CTA with appropriate single energy level could significantly reduce radiation dose while maintaining image quality.

**SSQ15-04 Feasibility of 70kV and Adaptive Statistical Iterative Reconstruction V Technique in Low Dose Craniocervical CT Angiography**

**Thursday, Nov. 30 11:00AM - 11:10AM Room: N228**

Participants
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**PURPOSE**

To investigate the feasibility of 70kV and adaptive statistical iterative reconstruction V (ASiR-V) to reduce radiation dose in wide-coverage craniocervical CT angiography, compared with 100kV

**METHOD AND MATERIALS**

This study was approved by the institutional review board. Written informed consent was waived. Twenty cases planned to craniocervical CT angiography was enrolled and randomly divided into two groups: A with 70kV and 40% ASiR-V (n=10), B with 100kV and 0%ASiR-V (n=10). Regions of interest (ROI) were placed on the thoracic inlet of carotid artery and cranial segment of carotid artery to measure the CT attenuation value and standard deviation (SD), the signal-noise-ratio (SNR) and contrast-noise-ratio (CNR) were calculated. Two experienced radiologists, who were blinded to the scan and reconstruction information, independently graded the CT images in terms of visibility and artifacts with a 4-grade rating scale. Dose length product (DLP) and effective radiation dose (ED) were recorded and calculated. Measurement data was compared with independent student T test, the concordance of image quality scores by the two radiologists was evaluated with kappa analysis, the image quality score was compared with Mann-Whitney U test.

**RESULTS**

The kappa value for the image quality scores from two radiologists was 0.618. The image quality score had no significant difference between two groups (3.80±0.42 vs 3.90±0.21, P=0.842). The effective radiation dose in group A was 59.5% lower that in group B (0.30±0.27mSv vs 0.74±0.15mSv, t=8.957, P<0.001). The CT value of carotid artery in group A was higher than that in group B (501.20±113.22HU vs 328.39±53.34HU, F=16.937, P=0.001). The SD value of of carotid artery in group A was higher than that in group B (25.53±3.01 vs 22.52±3.89 F=1.463, P=0.242). The SNR and CNR of carotid artery in group A was higher than that in group B (SNR, 19.84±4.87 vs 16.51±5.50, F=13.862, P=0.002; CNR, 32.22±10.01 vs 24.12±10.62, F=5.435, P=0.032).

**CONCLUSION**

Application of 70kV and adaptive statistical iterative reconstruction V (ASiR-V) can achieve approximate 60% radiation dose reduction and provide similar image quality compared with 100kV.

**CLINICAL RELEVANCE/APPLICATION**

Application of 70kV and adaptive statistical iterative reconstruction V (ASiR-V) can achieve approximate 60% radiation dose reduction and provide similar image quality compared with 100kV.

**SSQ15-05 Who Is the Source of Redundant Imaging: Clinicians versus Radiologists?**

**Thursday, Nov. 30 11:10AM - 11:20AM Room: N228**

Participants
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**PURPOSE**

Redundant neurovascular imaging studies such as Carotid US, CTA, MRA, and DSA may add cost to healthcare in the evaluation of patients with new neurologic deficits. However there has been an assumption that this is due to clinicians’ mismanagement. We sought to determine to what extend such redundant studies are generated by radiologists’ recommendations.

**METHOD AND MATERIALS**

The study was considered a quality improvement analysis and therefore did not require an IRB submission and was HIPAA compliant. The Radiology Information System was queried for the presence of carotid ultrasound, CT angiography, Digital Subtraction Angiography (DSA) and MR angiography occurring within 48 hours, 72 hours, and 7 days of each other in the setting of new neurologic symptoms during calendar year 2016. The reports were reviewed to determine how often 1) there were redundant studies and 2) radiologists recommended the additional studies.
RESULTS

3,300 exams from 2,939 patients conducted at both inpatient and outpatient clinics at three affiliated institutions from January 1, 2016 to December 31, 2016 were included in this study. Redundant studies occurred in 86/2939 (6.7%) of these 2939 patients. Of these 86 redundant studies, the radiology report contained a recommendation for another vascular study in 35 out of the 86 (40.7%). This included 15 cases of recommending MRA after CTA, 15 cases of DSA after CTA, 3 cases of DSA after MRA and 2 cases of US after CTA. The remaining 51 of the 86 redundant studies were driven by the clinical services, not radiologists. Of the 35 instances in which the radiologist recommended a second study, that second study confirmed the first study in 24/35 (68.6%) cases and disagreed with the first study in 11/35 (31.4%). Of the 51 cases of redundant studies generated by clinicians, 36/51 (70.6%) of the subsequent studies agreed with the first study and 15/51 (29.4%) were discrepant.

CONCLUSION

Of cases of redundant neurovascular imaging, the majority (59.3% = 51/86) are generated by clinicians, but radiologists recommended additional imaging in 40.7% of cases. When radiologists at our institution recommend additional radiological studies, 32/35 (91.4%) occurred following a CTA. Most second studies (68.6%) confirmed the first study’s findings.

CLINICAL RELEVANCE/APPLICATION

Clinicians generate most redundant neurovascular studies but radiologists are responsible as well.

SSQ15-06 Optimizing Image Quality in Head and Neck CT Angiography with Spectral CT Optimal Monochromatic Image Technique

Thursday, Nov. 30 11:20AM - 11:30AM Room: N228

Participants
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PURPOSE

To study the use of the optimal monochromatic image technique in dual-energy Spectral imaging to optimize the image quality in head and neck CT angiography (CTA)

METHOD AND MATERIALS

28 patients were selected to undergo head and neck CTA using Spectral scan mode with patient body mass index (BMI)-dependent scan protocols (GSI-51 for BMI<23kg/m2 and GSI-1 for BMI>23kg/m2). After scanning, 5 sets of monochromatic images at 60, 65, 70, 75 and 80keV were reconstructed. Images were transferred to AW4.6 workstation for MPR, VR and CPR reconstruction. Two experienced radiologists evaluated the subjective image quality with a 4-point scoring system with the consistency of the scores evaluated by Kappa test. The CT values and their standard deviations of the aortic arch, common carotid artery, internal carotid artery, middle cerebral artery, cleidomastoid, and brain parenchyma were measured. The signal-to-noise ratio (SNR) and contrast to noise ratio (CNR) of the cervical vessels were calculated. Measurements in the 5 groups were compared by using the single factor variance analysis

RESULTS

The differences of SNR, CNR and subjective image scores among the 5 groups were statistically significant (P < 0.05). The average subjective image quality scores were the highest at 60keV (3.64±0.49) and 65keV (3.61±0.50) and the two observers had excellent agreement (Kappa>0.8). The highest SNR and CNR values were also obtained at these two energy levels. The SNR at 60keV and 65keV levels were (66.42±18.84 and 68.04±13.67) for the common carotid artery, (42.42±13.08 and 12.98±43.10) for the internal carotid artery, middle cerebral artery, cleidomastoid, and brain parenchyma were measured. The signal-to-noise ratio (SNR) and contrast to noise ratio (CNR) of the cervical vessels were calculated. Measurements in the 5 groups were compared by using the single factor variance analysis

CONCLUSION

The optimal energy levels in Spectral CT for head and neck CTA were at 60-65keV to provide adequate enhancement and to improve image quality.

CLINICAL RELEVANCE/APPLICATION

The optimal energy level technique in Spectral CT imaging may be used in head and neck CT to provide adequate enhancement and to improve image quality.
Company: Research Grant, Toshiba America Medical Systems
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PURPOSE
The purpose of this study is to assess the ability of whole-body CT (WBCT) to detect blunt cerebrovascular injury (BCVI) in a trauma patient population.

METHOD AND MATERIALS
All trauma patients presenting to our institution between 8/1/2013 and 10/31/2016 were retrospectively identified from a radiology report database. Patients were 18-years of age or older; had sustained blunt trauma causing BCVI; and underwent WBCT imaging with neck CTA reconstructions at presentation. A 64-detector WBCT consisting of a chest CTA extending through the circle of Willis with 2 mm thick axial slices was performed, and neck CTA reconstructions with 1 mm thick axial slices and coronal, sagittal, and oblique MIP reconstructions were generated from WBCT source data. A neuroradiologist blinded to clinical history prospectively evaluated each WBCT, noting injury presence, location, and grade using the Biffl scale for BCVI grading. Following a 7 day washout period, neck CTA reconstructions were evaluated by the same rater in identical fashion. Twenty-one normal WBCT and neck CTA were randomly inserted into each respective group, and the reviewer was told that an unknown number of normal studies were present prior to evaluation. Sensitivity, specificity, and positive and negative predictive values were calculated with neck CTA findings serving as the reference standard.

RESULTS
During this study period, 3,392 trauma patients presented for WBCT with 118 trauma patients diagnosed with BCVI. Six patients were subsequently excluded due to poor image quality, resulting in a final cohort of 112 (3.3%) BCVI patients who met all inclusion criteria and possessed 133 individual vascular injuries. WBCT correctly detected 115 BCVI. Eighteen BCVI were missed by WBCT whereas 5 vessels were incorrectly identified as having BCVI. The sensitivity of WBCT for detecting BCVI was 86.5%, and its specificity was 76.2%. The positive predictive value was 95.8% and the negative predictive value was 47.1%. Of the 18 missed BCVI, 8 (44.4%) were grade I injuries, 9 (50.0%) were grade II injuries, and 1 (0.6%) was grade III. No grade IV injuries were missed.

CONCLUSION
WBCT is sufficiently sensitive and specific for detecting BCVI, with grade I and II injuries accounting for the majority of missed lesions.

CLINICAL RELEVANCE/APPLICATION
WBCT is sensitive enough to detect the majority of BCVI and should be used as a first-line screening tool in trauma patients.

SSQ15-09 Improving the Accuracy of Quantifying Carotid Atherosclerotic Plaques with High Definition Acquisition and Reconstruction

Thursday, Nov. 30 11:50AM - 12:00PM Room: N228

Participants
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PURPOSE
To investigate the accuracy of quantifying carotid atherosclerotic plaques with high-definition (HD) acquisition and reconstruction model on a high-definition computed tomography (HDCT) system.

METHOD AND MATERIALS
20 Patients with carotid stenosis and plaques (9 males, 11 females, mean age 66±0.46y) underwent HDCT carotid arteries angiography with a high-definition acquisition mode. Images were reconstructed with the high-definition algorithm with the new adaptive statistical iterative reconstruction (ASIR-V) at 50% strength (50% ASIR-V) and standard algorithm with 40% ASIR-V. The axial images of the two reconstructions were further processed to generate the maximum intensity projection (MIP) and multi-planar reconstruction (MPR) three-dimensional images. CT values, standard deviation (SD) in arteries and muscle and the areas of plaques, calcifications and the degree of stenosis in vessels were measured. Contrast-to-noise ratio (CNR) for the carotid arteries was calculated \( \text{CNR} = \frac{\text{CT value of blood vessel}}{\text{SD of muscle}} \). The area measurement for the calcified plaques with the HD reconstruction (3.60±3.00mm²) was statistically smaller than that with the standard reconstruction (4.27±3.45mm²) (p=0.02). There was no difference between the two reconstructions in the vascular stenosis degree (P = 0.129) and plaque area measurement (P = 0.598).

RESULTS
73 plaques, including 28 calcified plaques, 23 mixed plaques and 22 soft plaques were identified in both standard and HD reconstructions. CNR values of two reconstruction methods were statistically the same (P>0.05). However, the area measurement for the calcified plaques with the HD reconstruction (3.60±3.00mm²) was statistically smaller than that with the standard reconstruction (4.27±3.45mm²) (p=0.02). There was no difference between the two reconstructions in the vascular stenosis degree (P = 0.129) and plaque area measurement (P = 0.598).

CONCLUSION
High-definition acquisition and reconstruction on a HDCT system improves the accuracy of quantifying calcified carotid atherosclerotic plaques.
CLINICAL RELEVANCE/APPLICATION

High-definition acquisition and reconstruction on a HDCT system improves the accuracy of quantifying calcified carotid atherosclerotic plaques.
Neurotransmitters in Young People with Internet and Smartphone Addiction: A Comparison with Normal Controls and Changes after Cognitive Behavioral Therapy

**PURPOSE**
To reveal changes in neurotransmitters in internet and smartphone addicted youth compared with normal controls and after cognitive behavioral therapy, and to identify the correlations between neurotransmitters and affective factors related to addiction.

**METHOD AND MATERIALS**
Institutional review board approved this prospective study and informed consents were obtained. Nineteen young persons with internet and smartphone addictions consisted of 9 males and 10 females and their mean age was 15.47±3.06 years. Nineteen gender and age-matched healthy controls were also included. Nine weeks cognitive behavioral therapy was administered to 12 addicts ages 11 to 17 years. MEGA-press MRS was used to measure GABA and glutamate-glutamine (Glx) levels in the anterior cingulate cortex. GABA and Glx levels in the addicted group were compared to controls and after 9 weeks of cognitive behavioral therapy. GABA and Glx levels were correlated to clinical scales of internet and smartphone addictions, impulsiveness, depression, anxiety, insomnia and sleep quality.

**RESULTS**
Brain-parenchymal and gray-matter volume adjusted GABA to creatine ratios (p=0.028 and 0.016) and GABA to Glx ratios (p=0.031 and 0.021) were significantly increased in internet and smartphone addictions. After 9 weeks of cognitive behavioral therapy, brain-parenchymal and gray-matter volume adjusted GABA to creatine ratios (p=0.034 and 0.026) and brain-parenchymal volume adjusted GABA to Glx ratio (p=0.05) were significantly decreased. Glx was not statistically significant. Most brain-parenchymal and gray-matter volume adjusted GABA to creatine ratios and GABA to Glx ratios were significantly correlated with clinical scales of internet and smartphone addictions, depression and anxiety.

**CONCLUSION**
The increased GABA level and disrupted balance between GABA and glutamate in the anterior cingulate cortex may contribute to understanding the pathophysiology of and treatment for internet and smartphone addictions. Correlations between neurotransmitters and psychology tests in internet and smartphone addictions may reveal the relation and solution to their psychological comorbidities.

**CLINICAL RELEVANCE/APPLICATION**
The increased GABA in internet and smartphone addicted youth and its decrease after cognitive behavioral therapy will be useful to reveal the neurobiology of comorbidities and treatment.
Cortex in the aMCI ε4 carriers may be interpreted as reflecting greater cognitive "effect" by aMCI ε4 carriers to achieve the same

The APOE genotype has disease-specific effects on cerebral perfusion; the increased CBF within the lateral prefrontal and temporal

**CONCLUSION**

-0.453, P = 0.014; r = -0.497, P = 0.006).

anterior cingulate/medial prefrontal gyrus and superior temporal gyrus were negatively correlated with the similarity test scores (r =

exhibited higher CBF values primarily in the left superior and middle frontal gyrus. (4) We found that the CBF values in the right

and posterior cingulate cortex than the ε2 carriers and ε3ε3 carriers respectively; (3) Compared with HC group, the aMCI group

(1) Significant diagnosis-by-genotype interactions on CBF were observed in the left superior frontal gyrus, right anterior

cingulate/medial prefrontal cortex and bilateral superior temporal gyrus. Post-hoc pairwise analysis revealed that compared with the

ε2 carriers and ε3ε3 carriers, the ε4 carriers had significant higher CBF values in the above areas in the aMCI group, but there were

no significant genotype differences in the HC group. (2) APOE ε4 carriers showed significant higher CBF values in the right anterior

and posterior cingulate cortex than the ε2 carriers and ε3ε3 carriers respectively; (3) Compared with HC group, the aMCI group

exhibited higher CBF values primarily in the left superior and middle frontal gyrus. (4) We found that the CBF values in the right

 anterior cingulate/medial prefrontal gyrus and superior temporal gyrus were negatively correlated with the similarity test scores (r =

-0.453, P = 0.014; r = -0.497, P = 0.006).

**CONCLUSION**

The APOE genotype has disease-specific effects on cerebral perfusion; the increased CBF within the lateral prefrontal and temporal
cortex in the aMCI ε4 carriers may be interpreted as reflecting greater cognitive "effect" by aMCI ε4 carriers to achieve the same
level of performance as aMCI ε4 non-carriers (e.g., ε2 carriers and ε3ε3 carriers).

**CLINICAL RELEVANCE/APPLICATION**
(dealing with functional MR and cortical activation) ’fMRI may lay a foundation for the perfusion index of AD early diagnosis, disease severity, the following-up of AD and drug efficacy determination.’

**SSQ16-04 Interaction of Systemic Oxidative Stress and Mesial Temporal Network Degeneration in Parkinson’s Disease with and without Cognitive Impairment**

Thursday, Nov. 30 11:00AM - 11:10AM Room: N229

Participants
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**PURPOSE**
Systemic oxidative stress is the well-investigated factor and contributes to neuroinflammation of Parkinson's disease (PD). Cognitive impairments in PD are strongly associated with mesial temporal lobe (MTL) dysfunction. In the present study, we sought to evaluate the relationship between systemic oxidative stress and MTL function by measuring the morphology and functional network alteration in PD patients with and without cognitive impairment.

**METHOD AND MATERIALS**
Forty-one patients with PD (subgrouping into 3 groups [PD-normal, PD-mild cognitive impairment, PD-dementia]) and 29 normal control volunteers underwent peripheral blood sampling to quantify systemic oxidative stress markers, and T1W volumetric and resting state functional MRI (rs-fMRI) scans. Rs-fMRI was used to derive the healthy intrinsic connectivity patterns seeded by the epicenter vulnerable to any of significant oxidative stress markers. The functional connectivity correlation coefficient (fc-CC) and gray matter volume (GMV) of the network seeded by the epicenter among groups were compared. The correlation analysis among fc-CC, GMV and cognitive impairment were performed.

**RESULTS**
The oxidative stress markers including leukocyte apoptosis and LFA-1 values were significantly higher in the PD group. Using whole brain VBM based correlation analysis, bilateral MTL were identified as the most vulnerable epicenters of lymphocyte apoptosis (p < 0.005). The following resting state functional connectivity analysis further revealed the MTL network seeded by the epicenter. The MTL network of normal connectivity profile was resembled the PD-associated atrophy pattern. The GMV of the MTL network also demonstrated the significant difference between groups. Reduced fc-CC and GMV were associated with the progressed cognitive impairment.

**CONCLUSION**
The epicenters vulnerable to lymphocyte apoptosis can be linked to an altered MTL network that modifies both architecture and functional connectivity, with relationship to cognitive impairment. The possible relations among them may represent consequent cognitive impairment processes of systemic oxidative stress and MTL network injuries in PD patients.

**CLINICAL RELEVANCE/APPLICATION**
The volumetric and re-fMR can demonstrate damages of MTL network vulnerable to oxidative stress.

**SSQ16-05 Effects of Mentally Stimulating Activities Training On Resting-State Network Functional Connectivity in Amnestic Mild Cognitive Impairment: A Pilot Controlled Trial**

Thursday, Nov. 30 11:10AM - 11:20AM Room: N229

Participants
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**PURPOSE**
To explore the resting-state network functional connectivity alterations in patients with amnestic mild cognitive impairment (aMCI) before and after mentally stimulating activities training.

**METHOD AND MATERIALS**
Cognitive diagnosis was made by an expert consensus panel based on previous published criteria. Thirty-eight elderly subjects with aMCI comprising of training group (18) and control group (18), with age-, sex- and MoCA score-matched participated in this study. Rest-state fMRI (rs-fMRI) and neuropsychological assessment were conducted at baseline and after 6-month following training/control program. The global functional connectivity of rs-fMRI was analysed based on the graph theoretical modeling and seed-based analysis. The changes of functional connectivity and neuropsychological scores were compared between the two groups.
RESULTS

After 6-month training/control program, the MoCA score was significantly increased in training group (25.53±2.51) compared with the control group (21.81±2.02). Based on the graph theoretical modeling, the bilateral angular gyrus presented positive connectivity with the global brain in training group. Seed-based analysis, functional connectivity between the hippocampus and a set of regions was decreased in training group, these regions are: the right angular, cingulate gyrus and praecuneus; While, the left supplement motor area showed increased connectivity to the hippocampus.

CONCLUSION

These findings would be helpful to aid our understanding of the neurofunctional mechanisms associated with effects of mentally stimulating activities training on the cognitive function in aMCI.

CLINICAL RELEVANCE/APPLICATION

The network functional connectivity analysis of resting-state fMRI maybe a potentially useful tool for exploring the mechanism of mentally stimulating activities in aMCI.

SSQ16-06 Multi-voxel Pattern Analysis with Large-scale Granger Causality to Investigate Brain Connectivity Changes in Resting-State Functional MRI of Patients with HIV-Associated Neurocognitive Disorder

Participants
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PURPOSE

To develop and evaluate a novel machine learning framework using large-scale Granger causality (lsGC) for identification of subjects with HIV-Associated Neurocognitive Disorder (HAND) by capturing differences in resting-state functional MRI (rsfMRI) connectivity.

METHOD AND MATERIALS

Resting-state fMRI scans (3T, EPI sequence, TR=1.65s, 250 acquisitions) were acquired in a cohort of 45 age-matched subjects (20 healthy, 25 HIV+ of which 16 had HAND symptoms (HAND+)). After pre-processing, data was parcellated into regions defined by the Automated Anatomical Labeling (AAL) atlas. Regions were represented by their average time-series. A novel multivariate directional extension of Granger causality, lsGC, quantified the interdependence between time-series. Generalized matrix learning vector quantization, a method that combines supervised machine learning with embedded feature selection was used to classify HAND+ and healthy subjects from the resulting connectivity matrix in a Multi-Voxel Pattern Analysis (MVPA) framework. Strict data separation (90% train/10% test) was carried out in a 100-iteration cross-validation scheme. As a standard reference method, we used conventional multivariate Granger Causality (mGC) for comparative evaluation. Area Under the Curve (AUC) for Receiver Operator Characteristics (ROC) analysis and prediction accuracy were used to quantitatively evaluate the diagnostic quality of HAND+ subject classification.

RESULTS

Our novel lsGC rsfMRI connectivity analysis approach outperformed mGC in identifying HAND+ subjects, with AUC = 0.86 ± 0.29 and accuracy = 0.88 ± 0.17% for lsGC compared to AUC = 0.70 ± 0.35 and accuracy = 0.64 ± 0.25% for the conventional mGC method, respectively. Diagnostic quality differences between both methods were statistically significant (p < 0.01, Wilcoxon signed-rank test) for both AUC and prediction accuracy.

CONCLUSION

Our results suggest that the novel lsGC analysis method significantly improves the diagnostic quality for identification of patients with HAND. We conclude that, when compared to conventional mGC analysis, our MVPA framework is better suited to capture disease-related brain network connectivity changes based on rsfMRI neuroimaging.

CLINICAL RELEVANCE/APPLICATION

Our framework identifies HAND+ subjects by revealing disease-related changes in brain connectivity patterns, which can serve as a useful diagnostic biomarker in HIV-related neurologic disease.

SSQ16-07 The Altered Resting-State Functional Connectivity and Regional Homogeneity in Type 2 Diabetes with Mild Cognitive Impairment

Participants
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PURPOSE

Patients with Type-2 Diabetes Mellitus (T2DM) have considerably higher risk of developing cognitive impairment and dementia. This
Patients with Type 2 Diabetes Mellitus (T2DM) have considerably higher risk of developing cognitive impairment and dementia. This study aims to investigate the possible alterations in spontaneous neural activity of brain through resting state-functional MRI (rs-fMRI) in T2DM patients with and without mild cognitive impairment.

**METHOD AND MATERIALS**

Eighteen T2DM patients with mild cognitive impairment (DM-MCI) and 18 matched T2DM patients with normal cognition (DM-NC) were enrolled. On a 3 Tesla scanner, rs-fMRI data were obtained axially using a gradient-echo planar imaging sequence. Using the Brainnetome toolkit (BRAT) (www.brainnetome.org/en/brat) and SPM8 software, the regional homogeneity (ReHo) was calculated to represent spontaneous brain activity in different brain areas. ReHo changes were correlated with neuropsychological scores and disease duration. Based on the anatomically labeled (AAL) template, the whole-brain partitional analysis on functional connectivity was also applied to search for significant links.

**RESULTS**

Compared to DM-NC group, DM-MCI group exhibited decreased ReHo value in the right inferior, middle, and superior temporal gyrus; but increased ReHo value in the bilateral superior and medial frontal gyrus, the right orbital gyrus and the inferior frontal gyrus(fig.1). In the DM-MCI group, ReHo value was negatively correlated with Montreal Cognitive Assessment scores in the left medial frontal gyrus (R=-0.662, p=0.01), and positively correlated with diabetes duration in the right inferior and middle frontal gyrus (R=0.594, p=0.026)(fig.2). Correlation between ReHo and glycosylated hemoglobin A1c was not significant. The DM-MCI group showed 11 pairs of weaker functional connectivity between different brain areas (p<0.01, FDR corrected)(fig.3).

**CONCLUSION**

The abnormal brain activity reflected by ReHo measurements and the weaker functional connectivity of multiple brain regions could help uncover the susceptible regions of T2DM patients who progress into cognitive dysfunction, and may provide insights into the pathogenesis of T2DM related cognitive impairment.

**CLINICAL RELEVANCE/APPLICATION**

Resting state-fMRI may be able to track early progression of brain functional alterations, and can be an appropriate approach for studying the spontaneous brain activity in diabetes related cognitive impairment.

**SSQ16-08 Early Volume Reduction of Hippocampus after Whole-Brain Radiation Therapy: Automated Brain Structure Segmentation Study**

Thursday, Nov. 30 11:40AM - 11:50AM Room: N229

Participants

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Yukunori Korogi, MD, PhD, Kitakyushu, Japan (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

It is well known that cognitive decline often occurs after whole-brain radiation therapy (WBRT), especially in the long survivors. Our hypothesis was that the hippocampus is vulnerable to radiation and may become atrophic even at early stage after WBRT. Therefore, using automated segmentation of brain structures, we assessed volume changes of the various brain structures including the hippocampus within 10 months after WBRT.

**METHOD AND MATERIALS**

Twenty patients with lung cancer who underwent both WBRT and chemotherapy were recruited as a WBRT group. As a control group, 18 patients with lung cancer who underwent only chemotherapy were also recruited. Pre-treatment MRI was performed within one month before radiation or chemotherapy, and post-treatment MRI were performed 6 to 10 months after the radiation or chemotherapy. Contrast enhanced high-resolution 3D T1-weighted images of pre- and post-treatment were analyzed using longitudinal processing of FreeSurfer. We calculated volume reduction ratios \[\frac{\text{volume of pre-radiation} - \text{volume of after radiation}}{\text{volume of pre-radiation}} \times 100\%\] for the whole-brain cortex and white matter, hippocampus, and amygdala defined by Aseg atlas in FreeSurfer.

**RESULTS**

In the WBRT group, the hippocampus showed significant volume reduction (5.7%, \(p < 0.01\)), while the whole-brain cortex and white matter, and amygdala did not show significant volume reduction (4.9%, \(p = 0.21\), 1.3%; \(p = 0.19\), 1.3%; \(p = 0.95\), respectively). The volume reduction ratio of the hippocampus was significantly higher than those of the whole-brain cortex and white matter (\(p = 0.01\) and 0.02, respectively). In the control group, there was no significant volume reduction in any regions (the ratios: 0.3%, 1.0%, 1.0%, and 0.9% for the hippocampus, amygdala, whole-brain cortex and white matter, respectively).

**CONCLUSION**

Among the whole-brain cortex and white matter, hippocampus, and amygdala, only the hippocampus showed significant volume reduction within 10 months after WBRT suggesting its vulnerability to radiation.

**CLINICAL RELEVANCE/APPLICATION**

Our study may support the validity of the "hippocampus-sparing" WBRT to prevent the radiation-induced cognitive impairment.

**SSQ16-09 Nonlinear Modulation of Interacting Between COMT and Depression on Brain Function**

Thursday, Nov. 30 11:50AM - 12:00PM Room: N229

Participants

Cancan He, Nanjing, China (Presenter) Nothing to Disclose
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Chunming Xie, Nanjing, China (Abstract Co-Author) Nothing to Disclose

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PURPOSE
The catechol-O-methyltransferase (COMT) gene is related to dopamine degradation and has been suggested to be involved in the pathogenesis of major depressive disorder (MDD). However, how this gene affects brain function properties in MDD is still unclear.

METHOD AND MATERIALS
Fifty patients with MDD and 35 cognitively normal participants were underwent a resting-state functional magnetic resonance imaging scan. A voxel-wise data-drive global functional connectivity density (gFCD) analysis was used to investigate the main effects and interactions of disease states and COMT rs4680 on brain function.

RESULTS
We found significant group differences on the gFCD in bilateral fusiform area (FFA), postcentral and precentral cortex, left superior temporal gyrus (STG), rectal and superior temporal gyrus, right ventrolateral prefrontal cortex (vlPFC), and the abnormal gFCDs in left STG was positively correlated with depressive severity in MDD patients. Significant disease × COMT interaction effects were found in the bilateral calcarine gyrus, right vlPFC, hippocampus, and thalamus, and left SFG and FFA. Further post-hoc tests showed a nonlinear modulation effect of COMT on gFCD in the development of MDD. Interesting, an inverted U-shaped modulation was showed in the prefrontal cortex (control system), while U-shaped modulations were found in the hippocampus, thalamus and occipital cortex (processing system).

CONCLUSION
Our study manifested a nonlinear modulation of interacting between COMT and depression on brain function. This findings expand our understudying of the COMT effect underlying pathophysiology in MDD patients.

CLINICAL RELEVANCE/APPLICATION
The brain functional features detecting combined with COMT genotyping may provide a useful biomarker to the occurrence and development of depression.
**Science Session with Keynote: Pediatrics (Neuroradiology)**

**Thursday, Nov. 30 10:30AM - 12:00PM Room: S103CD**

**AMA PRA Category 1 Credits ™:** 1.50
**ARRT Category A+ Credit:** 1.75

**FDA** Discussions may include off-label uses.

**Participants**
- Susan Palasis, MD, Atlanta, GA (Moderator) Nothing to Disclose
- Daniela Prayer, MD, Vienna, Austria (Moderator) Nothing to Disclose

**Sub-Events**

**SSQ17-01 Pediatrics Keynote Speaker: Pediatric Neuroimaging in the Age of Precision Medicine**

**Participants**
- Susan Palasis, MD, Atlanta, GA (Presenter) Nothing to Disclose

**SSQ17-02 Association of Childhood Obesity with the Central Nervous System (CNS): Study of Diffuse Tensor Imaging (DTI)**

**Participants**
- Pamela Bertolazzi, Sao Paulo, Brazil (Presenter) Nothing to Disclose
- Fabio L. Duran, DSc, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
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- Marília Seelaender, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
- Thaysa Neves, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
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**PURPOSE**

The aim of this work is to investigate the influence of childhood obesity on changes in anatomy and cerebral connectivity, using the DTI by Magnetic Resonance Imaging (MRI). The hypothesis is that the brain is an organ also affected by high adiposity, particularly the hypothalamus, which is a complex region involved in the regulation of appetite and hormonal homeostasis.

**METHOD AND MATERIALS**

The images were obtained on Achieva 3T Phillips Magnetic Resonance. The sample for statistical analysis consisted of 120 subjects: 59 obese adolescents and 61 healthy adolescents, aged 11 years to 18 years, and matched regarding gender, age, and schooling. The images were processed with the FSL-Tbss (Tract Based Spatial Statistics) program and analyzed statistically by the same program with Randomize.

**RESULTS**

Statistical analysis showed decrease in the values of Fractional Anisotropy (FA) of obese pediatric patients compared with healthy controls in amygdala, hippocampus, thalamus, cingulate gyrus, fornix, insula, putamen, orbital gyrus and bilateral hypothalamus. There was no region of higher FA in obese patients in relation to the control group.

**CONCLUSION**

The data reveal a pattern of involvement in important regions in the control of appetite and emotions. Limbic structures, such as amygdala, hippocampus, thalamus, cingulate gyrus, fornix and insula are altered. Important regions related to impulse control, reward and pleasure in eating (putamen and orbital gyrus) and autonomic appetite control (bilateral hypothalamus) were also shown to have decreased FA.

**CLINICAL RELEVANCE/APPLICATION**

Childhood obesity is a subject of high clinical importance, and presents data of ascent from 10 to 40% of the last 10 years in most countries. Previous studies have pointed to obesity as a risk factor for neurodegenerative disorders through DTI tractography. In this way, we investigated previous or early cerebral changes in obesity.
RESULTS

Significant correlations of adjusted FA with postnatal age were found in preterm CST (p=0.042), term OR (p=0.018) and PTR (p=0.001) using Matlab; p<0.05 was considered as statistically significant difference.

METHOD AND MATERIALS

The DTI-derived fractional anisotropy (FA) and neonatal neurobehavioral assessment were separately used to characterize the brain WM microstructure and neurobehavioral development levels. The scatterplot with linear fitting was used to investigate the relations of FA and neurobehavioral scores (active tone and behavior) with postnatal age (day), setting gestational age (GA) as a covariate. Here, OR (optical radiation), AR (auditory radiation), CST (corticospinal tract), PTR (posterior thalamic radiation) and thal-PSC (thalamus-primary somatosensory cortex) were selected as regions of interest; active tone and behavior were used to separately evaluate the abilities of motor and integrated visual, auditory and sensory. All statistical analysis were performed by using Matlab; p<0.05 was considered as statistically significant difference.

RESULTS

Significant correlations of adjusted FA with postnatal age were found in preterm CST (p=0.042), term OR (p=0.018) and PTR (p=0.001) using Matlab; p<0.05 was considered as statistically significant difference.

METHOD AND MATERIALS

The DTI-derived fractional anisotropy (FA) and neonatal neurobehavioral assessment were separately used to characterize the brain WM microstructure and neurobehavioral development levels. The scatterplot with linear fitting was used to investigate the relations of FA and neurobehavioral scores (active tone and behavior) with postnatal age (day), setting gestational age (GA) as a covariate. Here, OR (optical radiation), AR (auditory radiation), CST (corticospinal tract), PTR (posterior thalamic radiation) and thal-PSC (thalamus-primary somatosensory cortex) were selected as regions of interest; active tone and behavior were used to separately evaluate the abilities of motor and integrated visual, auditory and sensory. All statistical analysis were performed by using Matlab; p<0.05 was considered as statistically significant difference.
Significant correlations of adjusted FA with postnatal age were found in preterm CST (p=0.02), term OR (p=0.003) and PTR (p=0.002). Compared to term neonates, preterm showed an obviously higher correlation in CST (0.29 vs 0.08), while less correlations in visual, auditory and somatosensory-associated WMs (Figure 1). Being relatively consistent, neurobehavioral results indicated that preterm neonates presented relatively higher and lower correlations than term in active tone (0.48 vs 0.35) and behavior scores (0.36 vs 0.52), respectively (Figure 2).

CONCLUSION
Although being delayed, preterm neonates show a 'catch-up' pattern toward the term in motor development during the neonatal period.

CLINICAL RELEVANCE/APPLICATION
Postnatal trajectory of neonatal sensorimotor function e.g. preterm 'catch-up' motor development provide valuable references in guiding the early intervention and thus gaining more effective outcomes.

SSQ17-05 **Visually Accessible Rembrandt Imaging (VASARI) Features Predict Survival and Identify Distinct Groups of Pediatric High Grade Glioma**

**Thursday, Nov. 30 11:10AM - 11:20AM Room: S103CD**

**Participants**
John T. Lucas JR, MD, MS, Memphis, TN (Presenter) Nothing to Disclose
Scott N. Hwang, MD, PhD, Memphis, TN (Abstract Co-Author) Nothing to Disclose
Brent A. Orr, MD, PhD, Memphis, TN (Abstract Co-Author) Nothing to Disclose
Chihyang Hsu, Memphis, TN (Abstract Co-Author) Nothing to Disclose
Thomas E. Merchant, DO, PhD, Memphis, TN (Abstract Co-Author) Nothing to Disclose
Alberto Broniscer, Memphis, TN (Abstract Co-Author) Nothing to Disclose
Amar Gajjar, MD, Memphis, TN (Abstract Co-Author) Nothing to Disclose
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**PURPOSE**
To understand the relationship of Visually Accessible Rembrandt Imaging (VASARI) features to prognosis and disease subgroups in pediatric high grade glioma (pHGG).

**METHOD AND MATERIALS**
Seventy one consecutive cases of newly diagnosed pHGG were systematically reviewed and scored for VASARI features by two expert radiologists. Agreement between reviewers was scored for each VASARI feature. The inter-correlation between VASARI features and impact on hierarchical clustering of patients were evaluated. The distance between variables is as follows; Pearson correlation was used among the continuous variables, Kendall's correlation was used among binary/ordinal variables, and Spearman correlation was used between continuous variables and binary/ordinal variables. Pearson correlation was used to measure the distance between subjects. The number of clusters was determined using the hybrid method proposed by Langfelder and Zhang (2008). Patient clusters were evaluated for their subgroup specific survival. Analyses were completed in either SAS v9.3 or R 3.3.3.

**RESULTS**
The median concordance between reviewers for VASARI features was 60% (range, 29-79%). The most concordant features include tumor location, diffusion characteristics, and pial invasion, while the most discordant features were ependymal invasion, proportion of non-contrast enhancing tumor (nCET), and proportion of edema. Univariate cox proportional hazards analysis identified hemorrhage (HR 5.6, 95% CI 1.1-28.2, p=0.035), nCET crossing midline (HR 2.5 95% CI 1.2-5.2, p=0.048), and size (HR 1.15 95% CI 1.01-1.33, p=0.05) as features which increased the hazard for progression. Hierarchical clustering identified 5 patient subgroups with distinctive correlated imaging features and varied survival.

**CONCLUSION**
VASARI features require refinement in their definition before broad acceptance for pHGG. Some features may be prognostic at diagnosis, and may aid further risk classification beyond classic clinical and pathologic factors.

**CLINICAL RELEVANCE/APPLICATION**
VASARI features may be prognostic and identify distinct populations in pHGG.

SSQ17-06 **Post Treatment DSC-MRI is Predictive of Early Treatment Failure in Children with Supratentorial High-Grade Glioma Treated with Erlotinib**

**Thursday, Nov. 30 11:20AM - 11:30AM Room: S103CD**

**Participants**
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**SSQ17-07 Differentiation of Medulloblastoma and Astrocytoma in Children Using Histogram Analysis of Enhancement MRI**

Thursday, Nov. 30 11:30AM - 11:40AM Room: S103CD

**Participants**
Weijian Wang, Zhengzhou, China (Presenter) Nothing to Disclose
Jingliang Cheng, MD, PhD, Zhengzhou, China (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To investigate the diagnostic value of the histogram analysis derived from enhancement MR imaging in differentiating medulloblastomas from astrocytomas.

**METHOD AND MATERIALS**
Retrospective analysis of 47 patients which were pathologically confirmed posterior fossa tumors, including 29 cases of medulloblastoma, 18 cases of astrocytoma. Drawing the region of interest (ROI) on the maximum level of enhanced MR sagittal image and going on histogram analysis, these two steps are all performed on the software named Mazda. Performed a statistical analysis on the histogram parameters to find out the characteristics of the significant differences between the two groups.

**RESULTS**
In the 9 parameters which are extracted from histogram, C99 has the statistical significance. The maximum area under the ROC curve was 0.85. The optimum C99 to distinguish medulloblastomas from astrocytomas was 176.5 (76% specificity and 61% sensitivity).

**CONCLUSION**
Histogram analysis of enhancement MR imaging can provide reliably objective basis for differentiating medulloblastomas from astrocytomas.

**CLINICAL RELEVANCE/APPLICATION**
Histogram analysis of enhancement MR imaging is a new method, can provide reliably objective basis for differentiating medulloblastomas from astrocytomas.

**SSQ17-08 Diagnostic Accuracy of MRI Perfusion (DSC) to Determine Grades and Types of Pediatric Primary Brain Tumors: A Multiparametric Approach**

Thursday, Nov. 30 11:40AM - 11:50AM Room: S103CD

**Participants**
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Cesare Colosimo, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
The role of perfusion imaging in the management of pediatric high grade glioma is unclear. We evaluated the ability of DSC-MRI to determine grade, evaluate post-treatment response and predict treatment failure.

**METHOD AND MATERIALS**
Twenty-two patients with high-grade glioma underwent biopsy and were treated with concurrent and sequential radiotherapy and erlotinib as part of a phase I/II clinical trial (NCTXXXX). Pre-, immediate post-radiotherapy, 6-month, and treatment failure DSC MR images were reviewed, registered, and processed for the ratio of CBF and CBV. Processed, derived perfusion, and T1WI, T2WI, and FLAIR MRI sequences were used for segmentation and extraction of tumor perfusion parameters at all time-points. Patient, tumor, treatment, and outcome data were summarized and related to perfusion data.

**RESULTS**
Regional CBF in tumors increased from diagnosis to post radiotherapy, while they decreased to levels below those at diagnosis from post radiotherapy to 6-month follow up. At 6 months, the median regional CBF was higher in tumors that progressed (median, 1.16) than in those that did not (median, 0.95; P< .05). Patients with CBF ratios above 1.4 at diagnosis had shorter survival times relative to CBF ratios below 1.4 (P = .77). Tumors with a regional CBF above 1.15 at the post-radiotherapy (1- to 3-month) follow-up scan were associated with an earlier time to death than that of tumors with a CBF below 1.15 (P < .05).

**CONCLUSION**
Post-treatment perfusion characteristics are prognostic and may predict survival. Perfusion MRI is useful for managing pediatric high-grade glioma and should be incorporated into future trials.

**CLINICAL RELEVANCE/APPLICATION**
DSC-MRI is recommended in the evaluation of treatment response in pediatric patients with high grade glioma.
The goal of this prospective study was to assess the diagnostic accuracy of multiple parameters from dynamic susceptibility contrast (DSC) perfusion, in the distinction of pediatric brain tumor grades and types.

**METHOD AND MATERIALS**

A retrospective blinded review of 53 histologically proven pediatric brain tumors with DSC perfusion was performed independently by two neuroradiologists. Tumors were categorized by grade and by histological. Maximum rCBV (rCBVmax), Percentage Signal Recovery (PSR) and Contrast Leakage Patterns (CLP) were measured from manual ROI placement for each reviewer and averaged. Results from all three analyses were compared to WHO grade and tumors type. Multivariate statistical analysis was performed to evaluate the diagnostic accuracy of single and combined perfusion parameters, and of single parameters to distinguish the different groups.

**RESULTS**

rCBVmax demonstrated a positive correlation with tumor grade, but limited specificity for tumors type. PSR and CLP demonstrated a positive correlation with tumor type when tumors were grouped by astrocytic and non-astrocytic. The highest diagnostic accuracy for tumor grading and typing was obtained using all three perfusion parameters. Pilocytic astrocytomas demonstrated a peculiar perfusional pattern: rCBV<1.6, high PSR and T1-dominant leak.

**CONCLUSION**

Multiparametric MR imaging can be accurate in determining tumor grades and types (mainly pilocytic astrocytomas and embryonal tumors) in children.

**CLINICAL RELEVANCE/APPLICATION**

Perfusion MRI is of utility to increase diagnostic accuracy for adult brain tumor. In pediatric population the heterogeneity of tumors need more than one perfusion parameter to gain an higher sensitivity and specificity for grading and distinguishing brain neoplasms.
NR385-SD-THA1

Utility of CT in Screening for Acute Invasive Fungal Sinusitis in Bone Marrow Transplant Patients: Is Fever a True Indication?

Station #1

PURPOSE
This IRB approved retrospective cohort study evaluated the utility of obtaining a sinus CT to rule out acute invasive fungal sinusitis (AIFS) in a population of patients who were hospitalized after bone marrow transplantation (BMT).

METHOD AND MATERIALS
We conducted a search of the Carolina Data Warehouse for Health (CDW-H) database to identify patients with hematologic malignancies who underwent CT sinus while in our hospital's adult or pediatric BMT units from 2002-2016. Patients were excluded if BMT was not performed, if CT was performed for reasons other than suspected sinus infection, or if insufficient data was available. Electronic medical records were reviewed for CT findings, patient symptoms (fever, sinusitis, facial pain or swelling, headache, visual symptoms, epistaxis or altered mental status) and pathology results. Clinical features of patients with and without AIFS were compared using a Fisher exact test.

RESULTS
171 unique CT instances were identified from the CDW-H database, 66 were excluded. A total of 105 scans performed in 68 patients were included for analysis. 4 cases of AIFS were diagnosed. 50% (2/4) had osseous erosion on CT, 25% (1/4) had imaging findings of acute sinusitis, 25% (1/4) had mild sinus mucosal thickening. Clinical complaints were visual change 75% (3/4), facial pain 75% (3/4), headache 50% (2/4), epistaxis 25% (1/4), and change in mental status 25% (1/4). No patients with AIFS had fever. In the remaining 101 instances in which CT was performed, a diagnosis of AIFS was not made. 11% (11/101) had CT findings of acute sinusitis. Clinical complaints at the time of imaging were fever 57% (57/101), headache 13% (13/101), change in mental status 6% (6/101), facial pain 2% (2/101), visual changes 2% (2/101), and epistaxis 2% (2/101). AIFS patients were significantly more likely to be afebrile, have vision changes, and facial swelling (p<0.05).

CONCLUSION
Fever was not a presenting symptom in any of the cases of AIFS in our study cohort. Patients with AIFS presented with visual changes, facial pain, headache, epistaxis, or changes in mental status. These findings bring into question the utility of obtaining sinus CT in BMT patients presenting with fever alone to rule out AIFS.

CLINICAL RELEVANCE/APPLICATION
Sinus CT to rule out invasive fungal infection in BMT patients with fever in the absence of more worrisome clinical findings is unlikely to be clinically useful.

NR386-SD-THA2

Has Implementation of the British Thyroid Association's 2014 Guidelines Reduced Thyroid Nodule Sampling?

Station #2

PURPOSE
This study evaluated the impact of the British Thyroid Association’s 2014 guidelines on thyroid nodule sampling in patients with thyroid nodules.

METHOD AND MATERIALS
We conducted a retrospective analysis of patients with thyroid nodules who underwent thyroid imaging at our institution before and after the implementation of the BTA guidelines. The guidelines recommend that patients with thyroid nodules undergo imaging only if there is a high suspicion for malignancy or if there are concerning clinical features.

RESULTS
Before the implementation of the guidelines, a total of 100 patients with thyroid nodules underwent imaging. After the implementation of the guidelines, a total of 80 patients with thyroid nodules underwent imaging. The number of patients who underwent thyroid imaging decreased significantly after the implementation of the guidelines (p<0.05).

CONCLUSION
The implementation of the British Thyroid Association’s 2014 guidelines significantly reduced the number of thyroid nodules sampled for imaging.

CLINICAL RELEVANCE/APPLICATION
The implementation of these guidelines has the potential to reduce the burden of thyroid imaging in patients with thyroid nodules.
**PURPOSE**
We aimed to assess the efficacy of the 2014 British Thyroid Association's guidelines for the sonographic assessment of thyroid nodules using the 'U-grade' scoring system as a predictor of neoplasm. We also aimed to find out whether we invasively sampled fewer nodules with the guidelines in place.

**METHOD AND MATERIALS**
A retrospective cohort analysis was carried out on ultrasounds which identified thyroid nodules. This sample was divided into two groups taken six months pre- and post- guideline introduction (10/2014), comparing number of nodules found, fine needle aspirations (FNAs) performed and neoplasms identified. For the post-guideline group, U-grades (if provided) were collated and, if FNA was performed, corresponding cytological Thy-grades were recorded. We then assessed whether U-grading was a suitable predictor of neoplasia using Receiver Operating Characteristic (ROC) analysis.

**RESULTS**
In the pre-guideline group, 303 nodules were assessed and 83 (27%) went to FNA. Of these, 23 (28%) were found to be neoplastic. In the post-guideline group, a total of 264 thyroid nodules were identified with 81 (31%) receiving an FNA and 19 (23%) demonstrating neoplasia. In the post guideline group, 63 nodules were given a U3 grade, 45 of these were benign and only 6 were neoplastic, 12 were lost to follow up. A similar number of malignancies were identified in each group. ROC analysis produced an average area under the curve of 0.724 (p=0.004, 95% CI 0.624-0.823).

**CONCLUSION**
As recommended by the 2014 BTA guidelines, the use of U-grade classification for assessment of thyroid nodules is a good predictor of neoplasm, as demonstrated by the significant ROC value. With the new guidelines in place, there was no appreciable difference in the number of FNAs performed. This is because a large proportion of nodules were given a U3 'indeterminate' grade. Further analysis of the U3 category would be helpful to see if some were overcalled, given the high proportion of these that were benign. These cases were done in the early days of introduction of the BTA guidelines and future audits may detect any improvement in categorising these.

**CLINICAL RELEVANCE/APPLICATION**
Accurate identification of neoplastic thyroid nodules is important to identify those at risk of developing thyroid cancer. It is important to try to reduce the number of benign nodules sampled.

**NR387-SD-THA3**
**New Method for Diagnosing Metastatic Cervical Lymph Nodes with Head and Neck Squamous Cell Carcinoma Using Third-Generation Dual-Energy CT**

**Participants**
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Munetaka Matoba, MD, Isikawa, Japan (Abstract Co-Author) Nothing to Disclose
Mariko Doai, Ishikawa, Japan (Abstract Co-Author) Nothing to Disclose
Yuuki Ishida, RT, Shimane, Japan (Abstract Co-Author) Nothing to Disclose
Hisao Tonami, MD, Kahoku, Japan (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**
Aims of this exhibit: 1. presentation of our new method for diagnosing head and neck squamous cell carcinoma (HNSCC) with metastatic lymph nodes using dual-energy computed tomography (CT); 2. presentation of threshold in a fixed-quantity evaluation of fat (QEOF); and 3. presentation in a dual-energy index of benign and metastatic lymph nodes.

**TABLE OF CONTENTS/OUTLINE**
1) We evaluated 87 lymph nodes (25 metastatic) whose minor axis was less than 10 mm in 41 patients with HNSCC. Metastatic lymph nodes were identified by histology or imaging. 2) We analyzed them using the three-material decomposition method in dual-energy CT, and calculated the fixed-quantity evaluation of iodine and the QEOF (Figs. 1,2). In addition, the threshold was calculated from receiver operating characteristic (ROC) analysis (Fig. 3). 3) Metastatic lymph nodes produce differences in contrast enhancement. Therefore, we can calculate each tube voltage CT value on a plain CT image and on a contrast-enhanced image to create a dual-energy index (Figs. 4,5). We believe that fat content fixed-quantity evaluation is very useful in the diagnosis of HNSCC.

**PDF UPLOAD**

**NR389-SD-THA5**
**Computed Diffusion Weighted Imaging with Noise Reduction: Utility in Diagnosing Middle Ear Cholesteatoma**

**Participants**
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Taro Takahara, MD, PhD, Ishihara, Japan (Abstract Co-Author) Nothing to Disclose
Hirosi Honda, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To evaluate whether computed DWI (cDWI) with noise reduction increases the contrast-to-noise ratio (CNR) compare to that without noise reduction algorithm in middle ear cholesteatoma.
RESULTS
The study group consisted of 25 patients (M:F = 14:11, median age = 51 years). The CNR of ADC0 (mean ± SD = 6.72 ± 1.77) and ADC0.4 (mean ± SD = 7.00 ± 2.21) were significantly higher than those of the control (mean ± SD = 5.17 ± 1.43; p < 0.01 and p <0.001, respectively).

CONCLUSION
The cholesteatoma-background CNR was increased using a noise reduction algorithm for cDWI.

CLINICAL RELEVANCE/APPLICATION
The computed DWI (cDWI) with noise reduction algorithm may be useful to distinguish cholesteatoma from adjacent soft tissues such as granulation or fibrous tissue. The increase of CNR could improve in the diagnostic accuracy of cholesteatoma.

NR390-SD-THA6 Effect of Luminal CT Number on Detection of Neointimal Formation after Carotid Artery Stenting at 320-Detector CT Angiography: Comparison among Filtered Back Projection, Hybrid Iterative Reconstruction and Full Iterative Reconstruction

Station #6 Participants
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Kazuo Awai, MD, Hiroshima, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation; Research Grant, Hitachi, Ltd;
Research Grant, Bayer AG; Research Grant, Daiichi Sankyo, Ltd; Research Grant, Eisai, Ltd; Medical Adviser, GE Healthcare;
Research Grant, Fujitsu Ltd; ; ; ; ;
Eiji Nishimaru, RT, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
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PURPOSE
Neointima after carotid artery stenting (CAS) for carotid artery stenosis can be assessed on CT angiography (CTA). However, the CT value of the stent lumen may affect identification of neointima due to artifact. Images reconstructed with model-based iterative reconstruction (MBIR) can provide higher spatial resolution and fewer artifacts than that with filtered back projection (FBP) or hybrid iterative reconstruction (hybrid IR). The purpose of this study was to compare effect of luminal CT number on detectability of neointima after CAS among images with FBP, hybrid IR and MBIR in a phantom study.

METHOD AND MATERIALS
We scanned a neck phantom created by a 3D printer using a 320-detector CT scanner (Aquilion One, Toshiba). We placed carotid WALLSTENT (8 x 21 mm, Boston Scientific, USA) in the simulated carotid artery and filled the carotid arteries with 3 concentrations of contrast medium (CT values: 660, 460, and 300 HU). We created 0.4-, 0.6-, 0.8-, and 1.0 mm-thick neointimal models along the stents. CT studies were repeated 5 times; the images were reconstructed with FBP, hybrid IR (AIDR 3D, Toshiba) and MBIR (forward projected model-based iterative reconstruction solution: FIRST; Toshiba). We reformatted cross-sectional images and measured neointimal thickness on images with FBP, hybrid IR, and full IR.

RESULTS
Neointimal models with 0.4- and 0.6 mm thickness were not be detected on images with FBP and hybrid-IR at all luminal CT values. As to neointima with 0.8- and 1.0 mm thickness, hybrid IR and FBP underestimated thickness of neointima, especially when luminal CT number was 300 HU. On the other hand, the MBIR well demonstrated intimal thickness: measured intimal thickness was 70 % or more of true thickness in all intimal thickness and intraluminal CT number (Figure).

CONCLUSION
Images reconstructed with MBIR could more accurately evaluate neointimal formation after carotid artery stenting than that with hybrid-IR or FBP.

CLINICAL RELEVANCE/APPLICATION
The MBIR achieves higher ability demonstrating neointimal formation than hybrid-IR or FBP and aggressive use of the MBIR is recommended for evaluating neointimal formation after carotid artery stenting at 320-detector CT angiography.
TEACHING POINTS

1. To review skeletal maturation and associated dentofacial anomalies that might influence treatment approach.
2. To know what should be assessed before alveolar bone graft.
3. To describe what should be looked for after bone grafting.
4. To ensure appropriate dental eruption and occlusion in long-term follow-up until adulthood.

TABLE OF CONTENTS/OUTLINE

Introduction: Unilateral cleft lip and palate is the most frequent craniofacial anomaly. Treatment is complex and includes lip and palate repair (<1 y), bone graft before canine eruption and orthodontics. CT at diagnosis and follow-up is paramount for selecting the appropriate approach in each case.

Imaging technique: Orthopantomogram (OPG) and cephalometrics can be used for initial evaluation and follow-up, but CT can better depict the cleft and associated anomalies, fundamental for treatment planning.

Presurgical alveolar bone graft planning: Cleft size, canine eruption stage, associated dentofacial deformities, osteogenesis after palatoplasty, and absence of hard palate fistula must be considered.

Bone graft follow-up: CT is used to assess proper graft integration.

Long-term follow-up: Dental eruption, occlusion, and maxillary growth should be assessed to plan orthodontic treatment with or without orthognathic or osteogenic distraction.

NR265-ED-THA8 Ultrasound of the Oral cavity and Its Surrounding Structures: A Play of Techniques!

For information about this presentation, contact:
36385mgc@comb.cat

TEACHING POINTS

To understand the Ultrasound (US) appearance of oral cavity and surrounding structures.
To demonstrate various techniques to enhance visualization of these structures on US.
To illustrate the clinical applications of these techniques.

TABLE OF CONTENTS/OUTLINE

1. Introduction to anatomy of oral cavity and surrounding structures.
2. Tips and tricks to visualize various structures on US.
3. Cheek - US anatomy including cheek layers - Techniques: Direct, Puffed cheek, Jelly, Clenching, Tongue touch - Illustration of dental space infections, intra maseteric lesions, squamous cell carcinoma extending into cheek layers, etc.
4. Tongue and Floor of Mouth - US Anatomy - Techniques: Direct, Tongue touch, Jelly, Submental approach - Illustration of vascular malformations, lingual thyroid, ranula, malignancy, etc.
7. Osseous - Indications for US in intraosseous lesions - Illustration of osteomyelitis, dentigerous cyst, ossifying fibroma, etc.
8. Role of contrast enhanced US and elastography with illustration of cases.
NR391-SD-THB1
Extraspinal Incidental Findings Identified on Lumbar Spine Diffusion-Weighted MR Neurography

Station #1

Participants
Mai-Lan Ho, MD, Rochester, MN (Moderator) Nothing to Disclose

Sub-Events

NR391-SD-THB1
Extraspinal Incidental Findings Identified on Lumbar Spine Diffusion-Weighted MR Neurography

站#: 1

Participants
Shuji Nagata, MD, Kurume, Japan (Presenter) Nothing to Disclose
Hiroshi Nishimura, MD, Chikushino, Japan (Abstract Co-Author) Nothing to Disclose
Kimberly K. Arram, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Hideo Arai, Chikushino, Japan (Abstract Co-Author) Nothing to Disclose
Asako Kuhara, Kurume, Japan (Abstract Co-Author) Nothing to Disclose
Akiko Sumi, MD, Kurume, Japan (Abstract Co-Author) Nothing to Disclose
Tatsuyuki Tonan, MD, Kurume City, Japan (Abstract Co-Author) Nothing to Disclose
Yusuke Uchiyama, MD, Kurume, Japan (Abstract Co-Author) Nothing to Disclose
Kiminori Fujimoto, MD, PhD, Kurume, Japan (Abstract Co-Author) Nothing to Disclose
Toshi Abe, MD, Kurume, Japan (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
sn4735@med.kurume-u.ac.jp

PURPOSE
Diffusion-weighted MR neurography (DW-MRN) is useful to detect nerve root swelling by providing better contrast between the nerves and the surrounding tissues. We have routinely added DW-MRN at lumbar spine MRI for assessing entrapped nerve roots and found that clinically important extraspinal incidental findings (IFs) were detected easily due to high contrast resolution and large FOV. The purpose of this study was to identify the prevalence of relevant extraspinal IFs in patients undergoing DW-MRN of lumbar spine.

METHOD AND MATERIALS
From October 2014 to September 2016, a total of 1414 consecutive patients (male 664, female 750, average age 65.2) who had undergone lumbar spine MRI at our institution were included in this study. We excluded all repeated lumbar spine MRI. Patients were scanned with a 1.5- or 3.0-T MRI unit using both 32-channel Torso coil and FlexCoverage anterior coil. DW-MRN was obtained using a single-shot EPI (FatSat=STIR). The scan parameters were as follows: b value=800 s/mm2, TR/TE=8000/75ms, TI=170ms or 230ms, slice thickness=5mm, FOV=350mm, MPG direction AP, and scan time 2min 40s. Extraspinal IFs were classified four groups according to a modified CT Colonography Reporting and Data System (C-RADS) as follows: Patients with C-RADS E4 have potentially important findings that should be communicated to the referring physician; patients with E3 have findings that are likely unimportant, but workup may be indicated; patients with E2 have clinically unimportant findings that requiring no further work-up or assessment; patients with E1 have only anatomic variants.

RESULTS
C-RADS E4 and E3 extraspinal IFs were in 20 (1.4%) and 25 (1.7%) of the 1414 patients. The most common finding in the E4 group was primary malignant tumors (10/20, 50%) including colon cancer, gastric cancer, ovarian cancer, uterine cancer, and lung cancer. The most common finding in the E3 group was ovarian cystic tumors (9/25, 36%).

CONCLUSION
Clinically important extraspinal IFs were identified in 1.4% of patients on DW-MRN of lumbar spine.

CLINICAL RELEVANCE/APPLICATION
By adding DW-MRN which can be obtained clinically relevant scanning time, we can find several clinically important extraspinal incidental findings as well as assessment entrapped spinal nerve roots.

NR392-SD-THB2
Utility of Concomitant Head and Facial CT in Trauma Setting

Station #2

Participants
Jason S. Chu, MD, Syracuse, NY (Presenter) Nothing to Disclose
Kanak Durwas, MD, Syracuse, NY (Abstract Co-Author) Nothing to Disclose
Amide Proton Transfer (APT) Imaging of Parotid Tumors: Differentiation between Malignant and Benign Tumors

PURPOSE

Amide proton transfer (APT) imaging, one of the chemical exchange saturation transfer (CEST) imaging, is a novel molecular MRI technique to detect endogenous mobile proteins and peptides through chemical exchange saturation transfer. Previous studies reported the usefulness of APT imaging for assessing aggressiveness of brain tumor or prostate cancer. Here, we assessed the usefulness of APT imaging in differentiating parotid tumors.

METHOD AND MATERIALS

We enrolled 62 patients who underwent MR imaging of the parotid gland including APT imaging at our institute between June 2013 and January 2017 who subsequently received a histopathological diagnosis. The tumors smaller than 2 cm were excluded because small lesions decrease the reliability of the APT signal intensity (SI). Tumors with prominent cystic components or mixed solid and cystic components were excluded. A non-invasive carcinoma ex pleomorphic adenoma was also excluded. Then, 23 patients (14 men, 9 women; age range 24-84 years, mean 55.9 years) with histopathologically proven parotid solid tumors 2cm or larger in diameter were included. Fifteen tumors were benign (12 pleomorphic adenomas, 1 basal cell adenoma, 1 Warthin tumor, 1 schwannoma) and 8 tumors were malignant (2 salivary duct carcinomas, 1 mammary analogue secretory carcinoma, 1 metastatic sebaceous carcinoma, 1 MALT lymphoma).

RESULTS

For the same injury, a total of 18/51 patients (35.3%) had positive head CT and 24/51 patients (47.1%) had positive facial CT. By setting the degree of freedom to 1 (95% CI -8.55 to 31.17), the resulting p value was 0.23. We were therefore unable to reject the null hypothesis (p >0.05), and thus conclude there is no difference in the proportion of positive head CT and facial CT for the same trauma patients.

CONCLUSION

Given the lack of statistically significant difference between the proportion of positive head and facial CT results, it can be inferred the two studies have similar efficacy in detecting facial trauma. It may be prudent to reserve the facial CT for only when facial injury is detected on the initial head CT, and therefore reducing the patient's radiation exposure.

CLINICAL RELEVANCE/APPLICATION

By employing a more judicious approach to ordering CT of the maxillofacial region, radiation exposure to the neck region can be minimized. Possible harm to the vital organs in the region, such as the thyroid gland, can therefore be reduced.

NR393-SD-THB3

Amide Proton Transfer (APT) Imaging of Parotid Tumors: Differentiation between Malignant and Benign Tumors

Participants

Takeshi Kamitani, MD, Fukuoka, Japan (Presenter) Nothing to Disclose
Satoshi Kawanami, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Koji Sagiyama, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Osami Togao, MD, PhD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Yuzo Yamasaki, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Hiroshi Honda, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Takuya Hino, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Ryuji Yasumatsu, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Hidetake Yabuuchi, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE

Amide proton transfer (APT) imaging, one of the chemical exchange saturation transfer (CEST) imaging, is a novel molecular MRI technique to detect endogenous mobile proteins and peptides through chemical exchange saturation transfer. Previous studies reported the usefulness of APT imaging for assessing aggressiveness of brain tumor or prostate cancer. Here, we assessed the usefulness of APT imaging in differentiating parotid tumors.

METHOD AND MATERIALS

We enrolled 62 patients who underwent MR imaging of the parotid gland including APT imaging at our institute between June 2013 and January 2017 who subsequently received a histopathological diagnosis. The tumors smaller than 2 cm were excluded because small lesions decrease the reliability of the APT signal intensity (SI). Tumors with prominent cystic components or mixed solid and cystic components were excluded. A non-invasive carcinoma ex pleomorphic adenoma was also excluded. Then, 23 patients (14 men, 9 women; age range 24-84 years, mean 55.9 years) with histopathologically proven parotid solid tumors 2cm or larger in diameter were included. Fifteen tumors were benign (12 pleomorphic adenomas, 1 basal cell adenoma, 1 Warthin tumor, 1 schwannoma) and 8 tumors were malignant (2 salivary duct carcinomas, 1 mammary analogue secretory carcinoma, 1 adenocarcinoma, 1 mucocoeidermoid carcinoma, 1 adenoid cystic carcinoma, 1 metastatic sebaceous carcinoma, 1 MALT lymphoma). APT imaging was conducted at 3T clinical scanner with a saturation time of 2 seconds and B1 amplitude of 2 μT. Z-spectra were obtained at 25 frequency offsets from -6 to +6 ppm (step 0.5 ppm). A point-by-point B0 correction was performed with a B0 map. APT SI was defined as magnetization transfer asymmetry at 3.5 ppm: magnetization transfer ratio (MTR) asym = (S[-3.5 ppm] - S[+3.5 ppm])/S0. Mean APT SI was compared between the benign and malignant tumors by t-test.

RESULTS

The mean and standard deviation of the APT SIs were 1.90 ± 0.60 % in the benign tumors and 2.73 ± 1.28 % in the malignant tumors. Malignant tumors showed significantly higher APT SI than benign tumors (P = 0.046). All the malignant tumors except a mucocoeidermoid carcinoma showed APT SIs of 2% or more.
CONCLUSION
The mean APT SI of malignant parotid tumors was significantly higher than that of benign parotid tumors.

CLINICAL RELEVANCE/APPLICATION
APT imaging is useful for differentiation between malignant and benign parotid tumors.

NR394-SD-THB4
Cortical Thickness Abnormalities in Non-Comorbid Medication-Naive Patients with Major Depressive Disorder and Patients with Social Anxiety Disorder

Participants
Youjin Zhao, Chengdu, China (Presenter) Nothing to Disclose
Su Lui, MD, Chendu, China (Abstract Co-Author) Nothing to Disclose

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PURPOSE
An overlap of clinical symptoms between major depression disorder (MDD) and social anxiety disorder (SAD) suggests similar brain mechanisms of the two disorders. However, few studies directly compare the brain structure between the two disorders. Aim of this study was to assess cortical thickness alterations between non-comorbid medication-naive MDD patients and SAD patients.

METHOD AND MATERIALS
High resolution T1 weighted images were acquired from 37 non-comorbid MDD patients, 24 non-comorbid SAD patients and 41 healthy controls (HC). Vertex-based analysis of cortical thickness (corrected with clusterwise probability of p<0.001) were performed and groups differences were compared by ANOVA analysis followed by post-hoc analysis.

RESULTS
Both MDD and SAD patients, relative to HC, showed cortical thickening in the bilateral medial prefrontal cortex, posterior dorsolateral prefrontal cortex, insular cortex, left temporal pole, and right superior parietal cortex; cortical thinning in the left lateral OFC and bilateral rostral middle frontal cortex. Besides, MDD patients showed specifically greater thickness in left fusiform, right lateral occipital cortex; thinner thickness in bilateral lingual, and left cuneus; SAD patients showed specifically thinner cortical thickness in the right precentral cortex. Furthermore, there were significant negative correlations between HAMD score and cortical thickness in the left SFC, right caudal MFC and right insula in MDD group.

CONCLUSION
Our results indicated that MDD and SAD share a common pattern of gray matter abnormalities in sacilence network and dorsal attention network. In addition, we found disorder-specific involvement of the visual recognition network in MDD and the fear circuitry in SAD.

NR395-SD-THB5
The Feasibility of Ultrashort Echo Time Imaging for Visualization of Sinonasal and Skull Base Bony Structures: Preliminary Study

Participants
Miran Han, MD, Suwon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Youngjin Yoo, Suwon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hye Lin Kim, MD, Suwon, Korea, Republic Of (Presenter) Nothing to Disclose
Jin Wook Choi, MD, Suwon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sungmin Gho, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Young Ju Lee, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
miranhanajou@gmail.com

PURPOSE
The aim of this study was to evaluate the feasibility of ultrashort echo time (UTE) imaging in the visualization of normal sinonasal and skull base bony structures.

METHOD AND MATERIALS
In this retrospective study, 15 patients (median age: 51 [20-83], 6 females, 9 males) who underwent MRI including UTE sequence and had previous head CT images that reconstructed as 1mm thickness using bone algorithm and acquired within interval of 6 months were included. UTE imaging was acquired with following parameters: TR 6.4 ms, TE 0.032 ms, flip angle 2°, 0.8x0.8x0.8mm resolution, FOV 200x200, matrix 320x320, 6 min 25 s acquisition time. Two independent reviewers evaluated the visualization of 19 notable anatomical landmarks and two anatomical variation types (Keros type and uncinate process attachment type). The visibility of anatomic landmarks were scored as 3 scales as follows; 0 = not demonstrated, 1 = demonstrated but not clearly visualized, 2 = clearly visualized. In addition, radiologist's subjective impression for the overall diagnostic imaging quality was recorded as 5 point scales. The inter-reader and inter-modality agreements were estimated.

RESULTS
The average image quality scores for visibility of 19 anatomic landmarks are 1.86 ± 0.12. Only 7 structures in 3 patients were not
demonstrated in UTE images (1.3% of all structures evaluated in study population). The inter-reader agreement for visualization of anatomic landmarks were distributed from 56.7 % to 100 % of concordance. The inter-reader agreements for assessing anatomic variations, the uncinate process attachment type and the Keros type, were moderate (weighted κ=0.52) to good (weighted κ=0.79), consequently. Compared to CT scan, the inter-modality agreements were good (weighted κ=0.62) to the perfect (weighted κ=1.00), consequently. The overall diagnostic quality were scored from 2 to 5 (mean 3.93± 0.12) with good inter-reader agreement (weighted κ=0.66).

CONCLUSION

With UTE imaging, MRI applications for sinonasal and skull base bony structures are feasible. This technique may lead to a new application of diagnostic MRI on head and neck imaging.

CLINICAL RELEVANCE/APPLICATION

MRI with UTE imaging are feasible to assess the bony structures of sinonasal cavity and skull base, which could be expected to prevent additional CT imaging and consequently reduce radiation exposure.

PURE96-SD-THB6  Head and Neck Angiography at 70 kVP with a Third-Generation Dual-Source CT System in Patients: Compare with 100kVP

Participants
Yu Chen, MD, Beijing, China (Presenter) Nothing to Disclose
Yuanli Zhu, Beijing, China (Abstract Co-Author) Nothing to Disclose
Boxiao Zhang, Beijing, China (Abstract Co-Author) Nothing to Disclose
Huanan Xue, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose
Zhengyu Jin, Beijing, China (Abstract Co-Author) Nothing to Disclose
Yumei Li, Beijing, China (Abstract Co-Author) Nothing to Disclose
Yun Wang, Beijing, China (Abstract Co-Author) Nothing to Disclose

PURPOSE

To evaluate the image quality, radiation dose of 70-kVP tube voltage and 25-mL contrast medium (CM) volume for head and neck CT angiography (CTA) and assess the diagnostic accuracy for arterial stenosis.

METHOD AND MATERIALS

Fifty patients were prospectively divided into two groups randomly: Group A (n=25), 70 kVP head and neck CTA with 25-mL CM and advanced modeled iterative reconstruction (ADMIRE) and Group B (n=25), 100 kVP with 40-mL CM with filtered back projection (FBP) reconstruction. CT attenuation values, noise, signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) of the aortic arch (AA), subclavian arteries (SA), common carotid arteries (CCA), vertebral arteries (VA), middle cerebral arteries (MCA) and basilar arteries (BA) were measured for objective image quality. Subjective image quality of SA and MCA were also evaluated. CM residues at the side of injection were evaluated. Effective dose (ED) was recorded. For patients undergoing DSA, diagnostic accuracy of CTA was assessed with DSA as reference standard.

RESULTS

The CT attenuation of AA in Group A were lower than that of Group B (P=0.002). The SNRs of SA, CCAbi and V2 and MCA in Group A were higher than that of Group B (P<0.05). The CNRs of SA, CCAbi and V2 in Group A were higher than that of Group B (P<0.05). The other quantitative values of Group B were not significant (P>0.05). There was no significant difference in subjective image quality of arteries between Group A and Group B (P=0.05). CM residues of Group A was fewer than that of Group B (P<0.001). The accuracy, sensibility, specificity were noted 96.4% (160/166), 100% (7/7) and 96.2% (153/159) at Group A and 99.2% (137/138), 100% (1/1) and 99.3% (136/137) at Group B for 50-69% stenosis. Compared with Group B, the radiation dose of Group A was significantly decreased by 56%.

CONCLUSION

Head and neck CTA at 70kVP using 25-mL CM can obtain diagnostic image quality with lower radiation dose while maintaining the high accuracy, sensibility and specificity compared with the 100kVP and 40-mL CM.

CLINICAL RELEVANCE/APPLICATION

70kVP and 25-mL CM of third-generation dual-source CT has equal arterial image quality and better venous image quality, compared with 100kVP and 40-mL CM in head and neck CTA. The accuracy, sensibility and specificity were high in the two groups, compared with DSA.

NR171-ED-THB7  Something Doesn’t Sound Right: Congenital Anomalies of the Ear and Associated Syndromes

Participants
Hugo Tames, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Lais Fajardo, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Maira Sarpi, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Carlos Toyama, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Regina L. Gomes, PhD, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Eloisa M. Gebrim, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
hugotames@gmail.com

TEACHING POINTS

The purpose of this exhibit is: 1. To review the embryology and anatomy of the ear. 2. To describe the congenital anomalies of the
auricular pavilion, external, middle and inner ear. 3. To understand the connection between the congenital inner ear malformation and the gestational age at which the insult occurred. 4. To review the syndromic associations with ear malformations. 5. To be able to access and classify the congenital malformations of the ear, as well as the hearing prognosis.

TABLE OF CONTENTS/OUTLINE
- Embriology and developmental anatomy
- Malformations of the ear - Auricular pavilion, external and Middle ear - Inner ear
- Syndromes associated with congenital ear malformation
- Branchio-oto-renal syndrome
- CHARGE syndrome
- Crouzon syndrome
- Goldenhar syndrome
- Hemifacial microsomia
- X-linked progressive mixed hearing loss
- Moebius syndrome
- Pierre Robin syndrome
- Treacher-Collins syndrome
- Others
- Take home messages
Participants
Vinil Shah, MD, San Francisco, CA (Moderator) Nothing to Disclose

LEARNING OBJECTIVES
1) Examine ways to effectively image the postop spine. 2) Differentiate normal postoperative imaging findings from those complications. 3) Identify imaging features of postoperative infection. 4) Understand the diagnostic criteria for SIH and the lesions that cause spinal CSF leaks. 5) Apply knowledge of these leak types in selecting the best imaging test to localize CSF leaks. 6) Suggest appropriate treatment for CSF leaks based on knowledge of the interventional and surgical treatments available. 7) Appraise the current literature concerning efficacy, safety, and cost-effectiveness of epidural steroid injections. 8) Describe the mechanism of action, safety profile, and effectiveness of traditional and investigative injectates. 9) Assess additional relevant issues, such as: a. Which type of back pain (radicular, stenosis, discogenic) should be treated with epidural steroid injection? b. Which route of injection is the safest and most efficacious? c. Does the type of image guidance make a difference?

SAM
New in 2017: PLEASE NOTE - All courses designated for SAM credit at RSNA 2017 will require attendees bring a personal device e.g. phone, iPad, laptop to complete the required test questions during the live session.

Sub-Events
RC70SA  Postoperative Spine: What Am I Looking For?
Participants
Lubdha M. Shah, MD, Salt Lake City, UT (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Examine ways to effectively image the postop spine. 2) Differentiate normal postoperative imaging findings from those complications. 3) Identify imaging features of postoperative infection.

RC70SB  Spontaneous Intracranial Hypotension: How to Find and Stop the Leak
Participants
Peter G. Kranz, MD, Durham, NC (Presenter) Nothing to Disclose

For information about this presentation, contact:
peter.kranz@duke.edu

LEARNING OBJECTIVES
1) Understand the diagnostic criteria for SIH and the lesions that cause spinal CSF leaks. 2) Apply knowledge of these leak types in selecting the best imaging test to localize CSF leaks. 3) Suggest appropriate treatment for CSF leaks based on knowledge of the interventional and surgical treatments available.

RC70SC  Epidural Injections: What is the Evidence?
Participants
Wende N. Gibbs, MD,MA, Los Angeles, CA (Presenter) Nothing to Disclose

For information about this presentation, contact:
Wende.Gibbs@med.usc.edu

LEARNING OBJECTIVES
1) Appraise the current literature concerning efficacy, safety, and cost-effectiveness of epidural steroid injections. 2) Describe the mechanism of action, safety profile, and effectiveness of traditional and investigative injectates. 3) Assess additional relevant issues, such as: a. Which type of back pain (radicular, stenosis, discogenic) should be treated with epidural steroid injection? b. Which route of injection is the safest and most efficacious? c. Does the type of image guidance make a difference?
Pearls and Pitfalls of Pediatric Head & Neck Imaging: An Interactive Review

Thursday, Nov. 30 4:30PM - 6:00PM Room: E451A

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

1) Describe the strengths of the various imaging modalities utilized for pediatric neck imaging in order to guide appropriate recommendations in clinical practice. 2) Review the most commonly encountered neck masses in children. 3) Classify pediatric neck masses using a categorical approach to develop a differential diagnosis. 4) Recognize key imaging features to distinguish among the most commonly encountered neck masses in children. 5) Apply the assessment tools by practicing with several cases.

Active Handout: Jennifer Ann Vaughn

Imaging the Child with a Neck Mass

Participants
Jennifer A. Vaughn, MD, Boston, MA (Presenter) Nothing to Disclose

Imaging the Child with Hearing Loss

Participants
Caroline D. Robson, MBChB, Boston, MA (Presenter) Editor with royalties, Reed Elsevier; Author with royalties, Reed Elsevier;

1) Become familiar with temporal bone cross sectional imaging protocols. 2) Improve knowledge in interpreting temporal bone exams in children with hearing loss. 3) Become familiar with an anatomic classification of inner ear malformations. 4) Recognize various syndromes that have a pathognomonic temporal bone imaging appearance.

Active Handout: Caroline Diana Robson

Imaging the Child with Proptosis

Participants
Mai-Lan Ho, MD, Rochester, MN (Presenter) Nothing to Disclose

1) Review the pathophysiology and major etiologies of pediatric proptosis. 2) Utilize clinical history and appropriate imaging modalities for evaluation. 3) Demonstrate pearls and pitfalls of diagnosis.

For information about this presentation, contact: mai.lan.ho@mayo.edu
**RC710A**  
**Thyroid Nodules: When and What to Biopsy**

**Participants**  
Jill E. Langer, MD, Philadelphia, PA (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
1) Identify and describe the sonographic features that are associated with thyroid cancer and those that are associated with benign thyroid nodules. 2) Discuss the rationale for the current biopsy and sonographic follow-up imaging recommendations.

**RC710B**  
**Thyroid Elastography**

**Participants**  
Richard G. Barr, MD, PhD, Campbell, OH (Presenter) Consultant, Siemens AG; Consultant, Koninklijke Philips NV; Research Grant, Siemens AG; Research Grant, SuperSonic Imagine; Speakers Bureau, Koninklijke Philips NV; Research Grant, Bracco Group; Speakers Bureau, Siemens AG; Consultant, Toshiba Medical Systems Corporation; Research Grant, Esaote SpA; Research Grant, BK Ultrasound; Research Grant, Hitachi, Ltd

**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.

**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 G. Barr, MD, PhD - 2017 Honored Educator

**RC710C**  
**Parathyroid and Other Neck Masses**

**Participants**  
Mary C. Frates, MD, Sharon, MA (Presenter) Nothing to Disclose

For information about this presentation, contact: mfrates@bwh.harvard.edu

**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.
Image-guided Biopsy of the Spine (Hands-on)

Thursday, Nov. 30 4:30PM - 6:00PM Room: E263

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

RC731A Pre- and Post Biopsy Assessment

Participants
Richard Silbergleit, MD, Royal Oak, MI (Presenter) Consultant, Relevant Medsystems, Inc

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 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.

RC731B 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.

RC731C 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

RC731D Cervical Spine Biopsies

Participants
A. Orlando Ortiz, MD, MBA, Mineola, NY (Presenter) Nothing to Disclose

For information about this presentation, contact:
oortiz@winthrop.org

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
Disc Biopsy and Aspiration

Participants
Amish H. Doshi, MD, New York, NY (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) To review the indications for spinal biopsies in the setting of discitis and osteomyelitis of the spine. 2) The various techniques and imaging modalities for these biopsies will be reviewed. 3) Sample collection and analysis as well as typical diagnostic yield will also be reviewed.
**RC805**

**Horse or Zebra? Mimics of Common Neuro and Head & Neck Lesions (An Interactive Session)**

Friday, Dec. 1 8:30AM - 10:00AM Room: E451B

**AMA PRA Category 1 Credits™: 1.50**

**ARRT Category A+ Credit: 1.75**

**FDA** Discussions may include off-label uses.

**Participants**

Deborah R. Shatzkes, MD, New York, NY (Moderator) Nothing to Disclose

Christopher P. Hess, MD, PhD, Mill Valley, CA (Moderator) Research Grant, General Electric Company; Research Grant, Quest Diagnostics Incorporated;

**Sub-Events**

**RC805A Brain Tumor or Mimic?**

Participants

Timothy J. Amrhein, MD, Cary, NC (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) List some important mimics of brain tumors. 2) Identify and describe imaging features helpful in distinguishing between brain tumors and their mimics.

**RC805B Lymph Node or Mimic?**

Participants

Bronwyn E. Hamilton, MD, Loma Linda, CA (Presenter) Editor, Reed Elsevier

**LEARNING OBJECTIVES**

1) Recognize normal anatomical structures and pathology that mimic lymph nodes on cross sectional imaging.

**RC805C Stroke or Mimic?**

Participants

Kambiz Nael, MD, New York, NY (Presenter) Medical Advisory Board, Toshiba Medical Systems Corporation

**LEARNING OBJECTIVES**

1) To become familiar with common brain pathologies associated with restricted diffusion using MR diffusion-weighted Imaging (DWI). 2) To distinguish ischemic stroke from stroke mimics using DWI pattern recognition. 3) To apply other MR methodology and understand their potential added value to DWI in differentiating stroke from stroke mimics.

**RC805D Sinonasal Polyp or Mimic?**

Participants

Kristen L. Baugnon, MD, Atlanta, GA (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify important potential mimics of sinonasal polyposis. 2) Describe imaging features of polypoid nasal cavity masses on CT that should prompt further workup.
New in 2017: PLEASE NOTE - All courses designated for SAM credit at RSNA 2017 will require attendees bring a personal device e.g. phone, iPad, laptop to complete the required test questions during the live session.

Sub-Events

RC813A  Pediatric Supratentorial Tumors

Participants
Usha D. Nagaraj, MD, Cincinnati, OH (Presenter) Co-author with royalties, Reed Elsevier

LEARNING OBJECTIVES
1) Review the differential of supratentorial pediatric brain tumors involving the cerebral hemispheres. 2) Review imaging findings of some of the most common pediatric supratentorial hemispheric brain tumors.

RC813B  Pediatric Suprasellar Tumors

Participants
Maura E. Ryan, MD, Chicago, IL (Presenter) Nothing to Disclose

For information about this presentation, contact:
mryan@luriechildrens.org

LEARNING OBJECTIVES
1) Identify relevant anatomy of the sellar/suprasellar region. 2) Become familiar with the classic imaging appearance and imaging surveillance of pediatric suprasellar neoplasms. 3) Recognize common mimics of pediatric suprasellar tumors.

Active Handout:Maura E. Ryan

RC813C  Pediatric Posterior Fossa Tumors

Participants
Alok I. Jaju, MD, Chicago, IL (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Become familiar with the different types of pediatric posterior fossa tumors. 2) Recognize the imaging features of these lesions and be able to provide a differential diagnoses based on location and imaging appearance. 3) Recognize the imaging findings that have clinical and prognostic implications.

Active Handout:Alok Indraprakash Jaju

RC813D  Pediatric Spinal Cord Tumors

Participants
Nadja Kadom, MD, Atlanta, GA (Presenter) Nothing to Disclose

For information about this presentation, contact:
nkadom@emory.edu

LEARNING OBJECTIVES
1) Discuss various types of spinal tumors in children. 2) List causes of spinal metastatic disease. 3) List state-of-the art MRI techniques.
SST08

Neuroradiology/Head and Neck (Head and Neck Imaging: Testing the Limits)

Friday, Dec. 1 10:30AM - 12:00PM Room: E353A

Participants
Brent D. Griffith, MD, Troy, MI (Moderator) Nothing to Disclose
Amanda S. Corey, MD, Atlanta, GA (Moderator) Nothing to Disclose

Sub-Events

SST08-01 Surgical Reconstruction of Ossicular Chain Defect with Custom 3D Printed Ossicular Prosthesis

Friday, Dec. 1 10:30AM - 10:40AM Room: E353A

Participants
Jeffrey D. Hirsch, MD, Baltimore, MD (Presenter) Nothing to Disclose
David Eisenman, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Richard Vincent, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
jhirsch@umm.edu

PURPOSE
Conductive hearing loss due to ossicular abnormalities occurs from many causes, including trauma, infection, cholesteatoma, surgery and congenital anomalies. Surgical reconstruction of the ossicular chain is a well-established procedure for repair of ossicular defects, but is still plagued by high failure rates. Underlying disease and proper sizing of prostheses are two challenges that lead to component failure. Three-dimensional (3D) printing has been used successfully to solve a number of medical prosthesis problems. Custom 3D printing an individualized ossicular prosthesis would be a potential solution for the wide range of anatomic variation encountered in the pathological middle ear, and could decrease the rate of post-operative prosthesis displacement by increasing the likelihood of a proper fit, in addition to decreasing surgical time.

METHOD AND MATERIALS
The incus was removed from three formalin-fixed cadaveric human temporal bones with no macro- or microscopic evidence of pathology. Imaging of the cadaveric bone was obtained using a standard temporal bone CT protocol. A custom prosthesis for each cadaveric human temporal bone was designed using the Mimics Innovation Suite software (Materialise, Belgium) and fabricated on a Form2 3D printer (FormLabs, Somerville, Massachusetts). Four surgeons then performed insertion of each prosthesis into each middle ear, blinded to the bone from and for which each was designed. The surgeons were asked to match each prosthesis to its correct parent bone.

RESULTS
Each prosthesis had unique measurements. Each of the four surgeons was able to correctly match the prosthesis model to its intended temporal bone. The chances of this occurring randomly are 1:1296.

CONCLUSION
A custom 3D printed ossicular prosthesis is a viable solution for conductive hearing loss due to ossicular chain defects. Commercially available CT scanners can detect significant anatomic differences in normal human middle ear ossicles. These differences can be accurately represented with current 3D printing technology and, more significantly, surgeons can detect these differences.

CLINICAL RELEVANCE/APPLICATION
This process overcomes a common technical challenge of properly sizing the prosthesis, as each model is custom made for an exact fit which should lead to an improved result and decreased operative time.

SST08-02 Assessment of Microvascular Compression for Facial-Acoustic Nerves: Role of Combined Isotropic 3D T2-DRIVE and 3D TOFMRA

Friday, Dec. 1 10:40AM - 10:50AM Room: E353A

Participants
Bo Jiang, MD, PhD, Canton, China (Presenter) Nothing to Disclose
Ximin Pan, Canton, China (Abstract Co-Author) Nothing to Disclose
Meiyu Hu, Canton, China (Abstract Co-Author) Nothing to Disclose
Bi Tao Pan, BS, Canton, China (Abstract Co-Author) Nothing to Disclose

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LONG VOLUMETRIC AND WIDE VOCAL TRACT ARE CHARACTERISTIC OF SINGERS WITH LOW-PITCHED VOICE TYPES (BASS, BARITONE, CONTRALTO) WHILE TESSITURA OF A SINGER. OUR RESULTS DEMONSTRATE A CORRELATION BETWEEN THE SURFACE OF THE VOCAL CORD AND THE CONFIGURATION OF VOCAL TRACT AND THE VOCAL SIZE BETWEEN SOPRANO AND MEZZOSOPRANO (P: 0.0641) AND BETWEEN TENORS AND BASSES (P: 0.0833) ARE TENDENTIALLY STATISTICALLY SIGNIFICANT. THE DIFFERENCE BETWEEN SOPRANOS AND MEZZOSOPRANOS IS NOT CONSIDERED SIGNIFICANT. THE VARIATION IN VOCAL TRACT SIZE DURING THE UTTERANCE OF THE VOWEL A BETWEEN TENORS AND BASSES IS CONSIDERED STATISTICALLY SIGNIFICANT (P: 0.0464). THE DIFFERENCE IN THE VOWEL REGISTER BETWEEN SOPRANO AND MEZZOSOPRANO IS LESS CONSIDERABLE IN COMPARISON WITH TENOR AND BASS OR WITH SOPRANO AND CONTRALTO.

CONCLUSION

OUR RESULTS DEMONSTRATE A CORRELATION BETWEEN THE SURFACE OF THE VOCAL CORD AND THE CONFIGURATION OF VOCAL TRACT AND THE VOCAL TESSITURA OF A SINGER.

CLINICAL RELEVANCE/APPLICATION

THE COMBINATION OF ISOTROPIC 3D T2-DRIVE AND ISOPTROPIC 3D TOFMRA PROVIDES A PRECISE AND ACCURATE DIAGNOSTIC APPROACH IN IDENTIFYING MICROVASCULAR COMPRESSION FOR FACIAL-AcouSTIC NERVES.

RESULTS

IN DISPLAYING FACIAL-AcouSTIC NERVES, 3D T2-DRIVE+3D TOFMRA AND T2 3D-DRIVE WERE SUPERIOR TO 3D TOFMRA (H=58.78, P=0.0000. H=53.18, P=0.0000 respectively), AND NO STATISTICALLY SIGNIFICANT DIFFERENCE EXISTED BETWEEN 3D T2-DRIVE+3D TOFMRA AND T2 3D-DRIVE (H=2.28, P=0.1313). IN DISPLAYING CULPRIT VESSELS, 3D T2-DRIVE+3D TOFMRA WAS SUPERIOR TO T2 3D-DRIVE AND 3D TOFMRA (H=54.12, P=0.0000. H=62.42, P=0.0000. RESPECTIVELY), AND NO STATISTICALLY SIGNIFICANT DIFFERENCE EXISTED BETWEEN 3D T2-DRIVE AND 3D TOFMRA (H=0.0083, P=0.9274). OF 36 PATIENTS, 32 WERE DETECTED WITH ARTERIOLAR COMPRESSION FOR FACIAL-AcouSTIC NERVES BY THE APPROACH OF 3D T2-DRIVE COMBINING 3D TOFMRA, AND 4 WITH NO COMPRESSION. THE RESULTS WERE CONFIRMED BY SURGICAL FINDINGS OR CLINICAL FOLLOW-UP, RESPECTIVELY. THE SENSITIVITY AND SPECIFICITY WAS 100%, 100% OF 3D T2-DRIVE+3D TOFMRA IN DIAGNOSING MICROVASCULAR COMPRESSION FOR FACIAL-AcouSTIC NERVES, RESPECTIVELY.

CONCLUSION

THE COMBINATION OF ISOTROPIC 3D T2-DRIVE AND ISOPTROPIC 3D TOFMRA PROVIDES A PRECISE AND ACCURATE DIAGNOSTIC APPROACH IN IDENTIFYING MICROVASCULAR COMPRESSION FOR FACIAL-AcouSTIC NERVES.
Long vocal cord and wide vocal tract are characteristic of singers with low-pitched voice types (bass, baritone, contralto) while short vocal cord and narrow vocal tract are characteristic of singers with high-pitched voice types (tenor, soprano).

**SST08-04  Basic Consideration for Facial Aging: Anatomic and Radiological Analysis of the Superficial Musculoaponeurotic System (SMAS)**

Friday, Dec. 1 11:00AM - 11:10AM Room: E353A

Participants
Iitsu Okuda, MD, Minato-Ku, Japan (Presenter) Nothing to Disclose
Masahiro Inamoto, MD, Minakuchi, Japan (Abstract Co-Author) Nothing to Disclose
Yasuo Nakajima, MD, Kawasaki, Japan (Abstract Co-Author) Nothing to Disclose
Katsuhiko Abe, Minato-ku, Japan (Abstract Co-Author) Nothing to Disclose
Keichi Akiti, MD, PhD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE
Facial aging is caused not only by skin aging, but also by aging changes of the subcutaneous structures. The SMAS is situated in the superficial fascia. SMAS weakness was reported as one factor of cheek sagging related with facial aging. The purpose of this study is to analyze the anatomic radiological correlation of the SMAS, and establish CT findings of the SMAS.

METHOD AND MATERIALS
This retrospective study was approved by the institutional review board. Step 1: Five cadaver faces were used to confirm the morphology and distribution of the SMAS. Right halves of those were dissected, and examined the structures of SMAS. The left were used for cross-sectional anatomic and histological examinations. Step 2: To select the interpretation sites of the SMAS, the SMAS's findings of the cadaveric studies were compared to the CT findings. Step 3: To confirm CT findings of SMAS, CT images of 18 females (age range, 21-82 years) without lesions that would influence the superficial structures of their faces were enrolled. Two observers assessed CT findings of SMAS independently, and the criteria was used for the following three-grade scales: G-2 (entire visualization as a thick layer); G-1 (entire visualization as a thin layer); or G-0 (obscured or partial visualization as a thin layer). The interobserver differences were assessed by kappa coefficient.

RESULTS
The SMAS was observed as a subcutaneous fibro-membranous structure extending from the superficial temporal fascia to the parotid fascia, and contained the major and minor zygomatic muscles and platysma. CT showed the subcutaneous linear opacities corresponding to the fibro-membranous structures of the cadaveric studies. Among the 18 cases, observer 1 judged G-2:11, G-1:7, G-0:0. Observer 2 judged G-2:13, G-1:5, G-0:0. There was good agreement between 2 observers about CT findings of SMAS (kappa=0.75, p<0.05).

CONCLUSION
The SMAS is a definite anatomic structure that can be demonstrated as an anatomic membranous layer in subcutaneous adipose tissue from the superficial temporal fascia to the parotid fascia on CT. This analysis is applicable to evaluating age-related changes of the face, and can contribute to the elucidation of the mechanism of facial aging.

CLINICAL RELEVANCE/APPLICATION
CT is the useful tool to evaluate the SMAS that is important structures to maintain a young appearance, and clinical applications can contribute to the elucidation of the mechanism for facial aging.

**SST08-05  CT Texture Analysis of Lymphoid Tissues on FDG-PET/CT in HIV-positive Patient**

Friday, Dec. 1 11:10AM - 11:20AM Room: E353A

Participants
Hironumi Kuno, MD, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Richa Patel, MD, Boston, MA (Presenter) Nothing to Disclose
Sara K. Meibom, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Baojun Li, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Margaret N. Chapman, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Mustafa Qureshi, Boston, MA (Abstract Co-Author) Nothing to Disclose
Minh T. Truong, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Garu Sakai, MD, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
kuno1623@gmail.com

PURPOSE
Differentiating lymphoid malignancy from reactive lymphoid tissue in HIV-infected patients with 18F-FDG PET/CT can be challenging as increased FDG uptake secondary to inflammation and infection may cause false-positive results for assessment of lymphoid tissue, such as palatine tonsils. The purpose of this study was to assess the utility of CT texture analysis characteristics of lymphoid tissues in HIV-positive patients on 18F-FDG-PET/CT in making the distinction between malignancy and non-neoplastic process with increased FDG uptake.

METHOD AND MATERIALS
Fifty-eight HIV-positive patients (age 9-80 years; median age, 48 years; median absolute CD4 count, 237 cells/mm3 [range: 17-1900]) who underwent contrast-enhanced CT with 18F-FDG-PET for various reasons were retrospectively reviewed. The whole normal right palatine tonsil was segmented on CT and texture analysis was performed using an in-house MATLAB-based texture analysis program. Forty-two texture features were extracted, including histogram-based, gray-level co-occurrence matrix-based (GLCM), gray-level run-length-based features (GLRL), gray level gradient matrix (GLGM), and Laws' features from the segmented volume. SUVmax values of the right palatine tonsil were obtained by manual selection of the lymphoid tissue at a PET/CT workstation. Multiple regression analyses were performed to assess the association between 42 texture features and the SUVmax value in palatine tonsil with adjustments for age and absolute CD4 cell counts.
RESULTS
The median SUVmax in normal tonsil of HIV positive patients was 4.4 (range, 1.2-10.4). Significant correlation were seen in 2 GLCM features [entropy (P=.039) and homogeneity (P=.008)], 7 GLRL features [RP (P=.018), LGRE (P=.019), HGRE (P=.018), SRLGE (P=.019), SRHGE (P=.001), LNLGE (P=.001), LRHGE (P=.003)], 7 Law’s features [L1 (P=.040), L2 (P=.002), L3 (P=.033), L4 (P=.003), L5 (P=.043), L7 (P=.042) L9 (P=.037)] and 4 GLGM features [MGR (P=.001), VGR (P=.001), skewness (P=.001) and kurtosis (P=.001)] with tonsil SUVmax value. There was no significant correlation between texture features and absolute CD4 cell counts in this model.

CONCLUSION
Lymphoid tissue CT texture analysis parameters are associated with abnormal FDG uptake in patients with HIV.

CLINICAL RELEVANCE/APPLICATION
CT texture analysis may be used as a type of noninvasive imaging biomarker capable of detecting obscure lymphoid inflammation in HIV positive patient.

SST08-06 Ultrasound and Clinicopathological Features of Papillary Thyroid Carcinomas with BRAF and TERT Promoter Mutations

Friday, Dec. 1 11:20AM - 11:30AM Room: E353A

Participants
Soo Yeon Hahn, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Jung Hee Shin, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Han Kyul Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jooyeon Cho, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Seung Mi Ha, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Solbee Han, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To investigate if any relationship exists between the telomerase reverse transcriptase (TERT) promoter or BRAF mutation and ultrasound (US) and clinicopathological features of papillary thyroid carcinomas (PTCs).

METHOD AND MATERIALS
The Institutional Review Board approved the study protocol and the use of human thyroid tissue. The study included 150 patients with surgically confirmed PTC from October 1994 to December 2004. The mean clinical and imaging follow up periods were 149.6 ± 24.6 and 143.1 ± 34.5 months, respectively. According to the existence of TERT promoter or BRAF mutations, we categorized patients into three groups (no mutation, BRAF mutation alone, or TERT+BRAF mutations) and analyzed the relationships between TERT promoter or BRAF mutation and US and clinicopathological features using univ- and multinomial logistic regression analysis and Cochran-Armitage trend test. The rate of recurrence or death according to mutation analysis was estimated by the Kaplan-Meier method.

RESULTS
There were 35 (23.3%) cases with no mutation, 104 (69.3%) with BRAF mutation alone, and 11 (7.3%) with TERT+BRAF mutations. According to the results of the Cochran-Armitage trend test, as the number of genetic mutations increased from no mutation to BRAF mutation alone to both BRAF and TERT mutations, the proportions of hypoechogenicity (31.4% vs. 66.4% vs. 54.5%, P = .0066), non-parallel orientation (25.7% vs. 49.0% vs. 72.7%, P = .0023), spiculated/microlobulated margin (45.7% vs. 51.9% vs. 72.7%, P = .0023), and kurtosis (P = .001) increased. PTCs with TERT+BRAF mutations recurred more frequently than other groups (odd ratio [OR] = 17.921 and 31.468). The intervals to recurrence and overall survival were significantly shorter in the TERT+BRAF mutation group than in the other groups (P < .0001 and P < .0001).

CONCLUSION
PTCs with no mutation, with BRAF mutation alone, and with both TERT and BRAF mutations linearly increase in the probability of displaying malignant US features. In PTCs, the coexistence of BRAF with TERT mutations is more strongly correlated with recurrence and mortality than BRAF mutation alone.

CLINICAL RELEVANCE/APPLICATION
US imaging characteristics of PTCs based on molecular biomarkers including BRAF and TERT promoter mutations can serve as predictors of patient prognosis.

SST08-07 Oral Carcinoma: Clinical Evaluation using Diffusion Kurtosis Imaging and its Correlation with Histopathologic Findings

Friday, Dec. 1 11:30AM - 11:40AM Room: E353A

Participants
Ichiro Yamada, MD, Bunkyo-ku, Japan (Presenter) Nothing to Disclose
Norio Yoshino, DDS, Bunkyo-ku, Japan (Abstract Co-Author) Nothing to Disclose
Keigo Hikishima, PhD, MS, Kawasaki, Japan (Abstract Co-Author) Nothing to Disclose
Junichiro Sakamoto, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Yu Okawa, DDS, Bunkyo-ku, Japan (Abstract Co-Author) Nothing to Disclose
Hiroyuki Harada, DDS, Bunkyo-ku, Japan (Abstract Co-Author) Nothing to Disclose
Tohru Kurabayashi, DDS, Bunkyo-ku, Japan (Abstract Co-Author) Nothing to Disclose
Yukihisa Saida, MD, Bunkyo-Ku, Japan (Abstract Co-Author) Nothing to Disclose
Ukhide Tateishi, MD, PhD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Toshiyuki Izumo, DDS, Bunkyo-ku, Japan (Abstract Co-Author) Nothing to Disclose
Shun Asahina, PhD, Shinagawa-ku, Japan (Abstract Co-Author) Employee, Siemens AG;
PURPOSE
To determine the clinical usefulness of diffusion kurtosis imaging (DKI) for patients with oral carcinoma as a noninvasive method of evaluating the histologic grades of oral carcinomas and lymph node metastasis by oral carcinomas.

METHOD AND MATERIALS
Twenty patients with oral carcinoma were examined with a 3-T MR system equipped with a 16-channel head and neck coil. DKI data were obtained by using a spin echo-based single-shot echo-planar imaging sequence: repetition time, 10000 ms; echo time, 94 ms; field of view, 250 mm x 204.25 mm; matrix, 120 x 98; section thickness, 4 mm without intersection gaps; four b values of 0, 500, 1000, and 2000 s/mm²; and motion-probing gradients set along three orthogonal directions. Diffusivity (D) and kurtosis (K) were calculated by using the equation: S = S₀ • exp(-b • D + b² • D² • K/6), and standard apparent diffusion coefficient (ADC) was also calculated by using the conventional monoexponential fit. The MR images were then compared with the histopathologic findings as the reference standard.

RESULTS
In all 20 oral carcinomas, the diffusivity was calculated as 1.777 ± 0.377 x 10⁻³ mm²/s, kurtosis 0.839 ± 0.130 (arbitrary unit [a.u.]), and ADC 0.790 ± 0.089 x 10⁻³ mm²/s. With the histologic grades (Grades 1, 2, and 3) of the oral carcinomas, the diffusivity showed a statistically significant inverse correlation (r = -0.893; P < 0.001) and the kurtosis showed a statistically significant positive correlation (r = 0.851; P < 0.001), while the ADC showed no significant correlation (r = -0.341; P = 0.196). Furthermore, between metastatic lymph nodes and nonmetastatic lymph nodes, the diffusivity (1.365 ± 0.395 vs. 1.985 ± 0.540 x 10⁻³ mm²/s; P < 0.05) and kurtosis (1.110 ± 0.242 vs. 0.746 ± 0.078; P < 0.01) showed statistically significant differences, while the ADC (0.726 ± 0.071 vs. 0.787 ± 0.056 x 10⁻³ mm²/s; P = 0.127) showed no significant differences.

CONCLUSION
In patients with oral carcinoma, DKI seems to be clinically useful for evaluating the histologic grades of oral carcinomas and lymph node metastasis by oral carcinomas.

CLINICAL RELEVANCE/APPLICATION
By using DKI for patients with oral carcinoma, we may have an effective tool to noninvasively diagnose the histologic grades of oral carcinomas and lymph node metastasis by oral carcinomas.

ST08-08 Computed Diffusion Weighted Imaging with Noise Reduction: Utility in Diagnosing Middle Ear Cholesteatoma

Friday, Dec. 1 11:40AM - 11:50AM Room: E353A

Participants
Koji Yamashita, MD, PhD, Fukuoka, Japan (Presenter) Nothing to Disclose
Akio Hiwatashi, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Osamu Togao, MD, PhD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Daichi Mamosaka, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Yamato Shimomiya, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Nozomu Matsumoto, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Taro Takahara, MD, PhD, Isehara, Japan (Abstract Co-Author) Nothing to Disclose
Hiroshi Honda, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate whether computed DWI (cDWI) with noise reduction increases the contrast-to-noise ratio (CNR) compare to that without noise reduction algorithm in middle ear cholesteatoma.

METHOD AND MATERIALS
This retrospective study was approved by the institutional review board, and the requirement for informed consent was waived. Consecutive patients diagnosed with suspected cholesteatoma who underwent preoperative MR imaging between October 2014 and August 2016 were eligible for inclusion. cDWI (b = 800 sec/mm²) was generated from two b-values of 0 and 400 sec/mm² by voxel wise fitting on a 3D workstation (Ziostation²). Noise reduction was performed by the cutoff values of ADC < 0 (ADC0) and 0.4 x 10⁻³ mm²/sec (ADC0.4). Region-of-interests were manually placed on the cholesteatoma and background, respectively. Subsequently, the CNR was compared between ADC0, ADC0.4, and the control (without noise reduction algorithm) using one-way ANOVA followed by the Bonferroni correction for multiple comparison.

RESULTS
The study group consisted of 25 patients (M:F = 14:11, median age = 51 years). The CNR of ADC0 (mean ± SD = 6.72 ± 1.77) and ADC0.4 (mean ± SD = 7.00 ± 2.21) were significantly higher than those of the control ( mean ± SD = 5.17 ± 1.43; p < 0.01 and p <0.001, respectively).

CONCLUSION
The cholesteatoma-background CNR was increased using a noise reduction algorithm for cDWI.

CLINICAL RELEVANCE/APPLICATION
The computed DWI (cDWI) with noise reduction algorithm may be useful to distinguish cholesteatoma from adjacent soft tissues such as granulation or fibrous tissue. The increase of CNR could improve in the diagnostic accuracy of cholesteatoma.
Participants
Xiao_quan Xu, Nanjing, China (Presenter) Nothing to Disclose

For information about this presentation, contact:
xiaoquanxu_1987@163.com

PURPOSE
Radiation damage to the salivary gland is a common complication of radioiodine therapy (RIT) in the patients with differentiated thyroid cancer (DTC). To investigate the feasibility of using intravoxel incoherent motion (IVIM) magnetic resonance (MR) imaging to detect radiation-induced changes of normal-appearing parotid glands in the patients after RIT for DTC.

METHOD AND MATERIALS
We prospectively enrolled 20 patients with RIT-induced sialoadenitis and 20 healthy control (HC) participants. The patients were divided into intermediate and late groups, and questionnaire was used to assess the related symptoms. IVIM MR imaging was scanned using 9 b values (0, 50, 100, 150, 200, 400, 600, 800 and 1000 sec/mm²). Quantitative parameters (pseudodiffusion coefficient, D*; perfusion fraction, f; tissue diffusivity, D) were obtained using a biexponential model, and compared among different groups using one-way analysis of variance (ANOVA) test. Correlations between significant parameters and symptom score were assessed using Spearman's correlation analysis.

RESULTS
The f and D value differed significantly (f, P=0.016; D, P=0.006) among different groups. Post hoc analysis showed that f and D value of intermediate group were significantly higher than those of HC group (f, P=0.012; D, P=0.004), while no significant differences between late group and HC group (f, P=0.852; D, P=0.707). Significant positive correlation was found between f value and the total symptom score of the patients in intermediate group (P=0.028, r=0.762).

CONCLUSION
The IVIM MR imaging might be feasible to detect the radiation-induced changes of parotid glands in the patients after RIT for DTC.

CLINICAL RELEVANCE/APPLICATION
Our study showed that both the perfusion fraction f and tissue diffusivity D of intermediate group were higher than the HC group. Perfusion fraction f had a significant correlation with symptom score. Our study results demonstrated that IVIM MR imaging was feasible to detect the radiation-induced changes of parotid glands of the patients after radioiodine therapy for DTC.
**Participants**

Bernard F. Laya, DO, Lincoln, IL (*Moderator*) Nothing to Disclose

Usha D. Nagaraj, MD, Cincinnati, OH (*Moderator*) Co-author with royalties, Reed Elsevier

**Sub-Events**

**SST09-01** Quantitative Measurement of Cerebral Blood Flow in Preterm by Multiple Inversion Time Arterial Spin Labeling Magnetic Resonance Imaging: Initial Study

Friday, Dec. 1 10:30AM - 10:40AM Room: E350

Participants

Hong Wang, Suzhou, China (*Presenter*) Nothing to Disclose

Wenlin Tang, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

Jianming Xu, Suzhou, China (*Abstract Co-Author*) Nothing to Disclose

Weiliang Qian, Suzhou, China (*Abstract Co-Author*) Nothing to Disclose

Mingming Qin, Suzhou, China (*Abstract Co-Author*) Nothing to Disclose

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**PURPOSE**

To investigate the influence of cerebral blood flow in preterm with perinatal asphyxia using multiple inversion time arterial spin labeling (mTI-ASL) technique.

**METHOD AND MATERIALS**

A total of 40 preterm infants at term-equivalent age underwent MRI examination in the study. A MRI examination including mTI-ASL prototype sequence and other conventional plain sequences was performed on MAGNETOM Skyra (Siemens Healthcare, Erlangen, Germany). According to clinical history and MR diagnosis, 40 preterm infants were divided into three groups: group1 (n=14, no brain injury without perinatal asphyxia), group 2 (n=12, no brain injury with perinatal asphyxia) and group 3 (n=14, brain injury with perinatal asphyxia). Mean cerebral blood flow (CBF) values from ROIs drawn in the basal ganglia and thalamus (BGT), gray matter (GM) including frontal lobe, temporal lobe and occipital lobe, and white matter (WM) were calculated and analyzed by SPSS 21.0 statistical software. CBF values for each ROIs were analyzed by one-way ANOVA across groups. And then if P <0.05, q test for multiple comparison with SNK would be conducted.

**RESULTS**

The difference of CBF_BGT and CBF_GM was statistically significant between Group 1 and Group 2 (P <0.05). The differences of CBF_BGT, CBF_GM and CBF_WM were statistically significant between Group 2 and Group 3 (CBF_BGT: P <0.01; CBF_GM, CBF_WM: P <0.05). However, the difference of CBF_WM between Group 1 and Group 2 was not statistically significant. And CBF_BGT, CBF_GM, CBF_WM between Group 1 and Group 3 were not statistically significant. In group1, the difference of CBF was statistically significant between frontal lobe and occipital lobe, between temporal lobe and occipital lobe, whereas the difference of CBF was not statistically significant between frontal lobe and temporal lobe.

**CONCLUSION**

mTI-ASL is a noninvasive MR method for accurately measuring CBF in neonates. Autoregulation of the cerebral blood flow has association with the outcome of preterm infants with perinatal asphyxia. Perinatal asphyxia may affect the regional regulation of CBF in gray matter.

**CLINICAL RELEVANCE/APPLICATION**

mTI-ASL is a feasible approach to measuring brain perfusion and it offers the possibility to investigate the impact of cerebral hemodynamics in high-risk preterm infants.

**Awards**

Student Travel Stipend Award
For information about this presentation, contact:
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PURPOSE
This study aimed to analyze the safeness and effectiveness of endovascular approach in pediatric intracranial recanalization and to propose a diagnostic and therapeutic algorithm for patients younger than 18 with acute ischemic stroke based on our experience.

METHOD AND MATERIALS
We studied patients prospectively included in SONIIA registry (2011-2015), a mandatory, externally audited registry that monitors the quality of reperfusion therapies in Catalonia. Clinical evaluation: neurological severity, functional independence. Radiological examination: multimodal CT/MRI. Treatment criteria: clinical-radiological mismatch. Analysis and outcome parameters: successful recanalization (TICI >=2b), dramatic neurological improvement (>=10 points decrease in NIHSS score at 24 hours), independent functional outcome (mRS <=2) at three months.

RESULTS
Among the 1640 patients included, mechanical thrombectomy occurred in five. Mean age was 14.6±1.6, four female. Median NIHSS score: 13 (7-19) on arrival, 4 (1-5) at 24 hours. Underlying diseases: Osler-Weber-Rendu (n=1), congenital heart defect (n=1), none (n=3). Etiology: iatrogenic (n=1), non-compliance of anticoagulation (n=1), idiopathic (n=3). Clinical presentation: hemiparesis (n=4), aphasia (n=1). We used the neuroimaging standard protocol during acute ischemic stroke: multimodal CT (n=3), multimodal MRI (n=2). Occlusion site: internal carotid artery (n=2), middle cerebral artery (n=2), basilar artery (n=1). We combined stent-retriever technology plus distal aspiration in four patients (median number of passes: 2), direct aspiration first pass technique in one (duration of aspiration: 30 s). Procedural time: 68.4±26.4 min. All patients achieved successful recanalization. All procedures resulted in functional independence. No complications were reported.

CONCLUSION
The presence of a clinical-radiological mismatch in acute ischemic stroke patients younger than 18 should let us consider an "aggressive treatment", such as mechanical thrombectomy, as it allows safe, effective, and prompt recanalization. The MRI should be the diagnostic technique in all types of stroke, diagnosing underlying conditions while reducing radiation exposure.

CLINICAL RELEVANCE/APPLICATION
Acute ischemic stroke in children is difficult to diagnose and manage due to atypical presentation and imaging challenge. There is a lack of evidence-based data concerning mechanical thrombectomy for patients younger than 18 years old.

SST09-03 Multi-Delay Arterial Spin Labeling MRI in Neonates: Regional Differences and Changes in Brain Perfusion during Brain Maturation
Friday, Dec. 1 10:50AM - 11:00AM Room: E350

Participants
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PURPOSE
The purpose of this study was to evaluate cerebral blood flow (CBF) in neonates using multi-delay arterial spin labeling (ASL).

METHOD AND MATERIALS
A 7 post-labeling delay pseudo-continuous ASL was applied on 20 neonates (6 preterm vs. 14 term-equivalent age [TEA]) and 4 infants (mean age, 3 months). We adjusted longitudinal relaxation rate of blood in each patient with hematocrit values. CBF in the thalamus, frontal gray matter (F_GM), occipital gray matter (O_GM), frontal white matter (F_WM), and occipital white matter (O_WM) were measured in ml/100g min and relative CBF (rCBF) to that of the whole brain CBF (wbCBF) were calculated.

RESULTS
In all neonates, CBF of O_WM was significantly higher than F_WM (16.5ml/100g min vs. 12.2ml/100g min, p = .001), but CBF of O_GM and F_GM showed no significant difference (26.2ml/100g min vs. 27.5ml/100g min, p = .253). Mean wbCBF significantly increased from 13.4ml/100g min at preterm to 18.0ml/100g min at TEA (p = .009) and it further increased to 32.8ml/100g min at 3 months (p = .001). From preterm to TEA, there was significant decrease of rCBF of thalamus (252% to 197%, p = 0.02) and F_GM (160% to 122%, p = .026) and significant increase of rCBF of O_GM (163% to 125%, p = .015). From TEA to 3 months, rCBF were significantly decreased in thalamus (197% to 140%, p = .046), F_WM (108% to 57%, p = .001), and O_WM (139% to 79%, p = .003).
CONCLUSION
Multi-delay ASL showed differences and changes in regional CBF in neonates and infants, which may reflect metabolic and developmental stages of brain.

CLINICAL RELEVANCE/APPLICATION
Multi-delay ASL can be a non-invasive tool to study brain maturation in neonates. Cerebral perfusion changes by hypoxic ischemic injury in neonates can further investigated with multi-delay ASL.

SST09-04 Expression Changes in Lactate and Glucose Metabolism and Associated Transporters in Basal Ganglia Following Hypoxic-Ischemic Reperfusion Injury in Piglets
Friday, Dec. 1 11:00AM - 11:10AM Room: E350

Participants
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PURPOSE
To investigate the regulatory mechanisms of energy metabolism in neurons and astrocytes in the basal ganglia of a neonatal hypoxic-ischemic brain injury piglet model.

METHOD AND MATERIALS
A total of 35 healthy piglets (3-5 days old, 1.0-1.5 kg) were selected. They were divided into control (n=5) and hypoxic-ischemic (HI) model groups. The HI model group was further divided into six groups according to 1H-MRS and PET/CT scan times after HI (0-2 h, 2-6 h, 6-12 h, 12-24 h, 24-48 h and 48-72 h; n = 5/group). The HI model was established by bilateral common carotid artery occlusion and simultaneous hypoxia treatment for 40 min. Piglets in the control group received the same surgical procedure without the hypoxia-ischemia process. 1H-MRS and 18F-FDG PET/CT imaging were performed at various time points after HI. The right basal ganglia were the ROI in 1H-MRS imaging for which data was processed by LCModel software. The bilateral basal ganglia (BG) and occipital cortex (OC) on the same slide were selected as the ROI for PET/CT imaging. Maximum standard uptake values (SUVmax) of basal ganglia to occipital cortex (BG/OC) ratios were determined. The right hemisphere was used for the pathological examination and immunohistochemical staining of glucose transporters (GLUTs) and monocarboxylate transporters (MCTs). The left hemisphere was immediately frozen at -80ºC for western blotting.

RESULTS
The lactate level became reduced after an initial increase, with the maximal level occurring around 2-6 h following HI. After HI, the BG/OC in the basal ganglia initially increased then decreased; the maximum value occurred at approximately 6-12 h. The content of lactate and the BG/OC showed a positive correlation (r = 0.74, P=0.003). The expression of GLUT-1 and GLUT-3 correlated positively with BG/OC (r = 0.64, P=0.014, and r = 0.75, P=0.036, respectively).

CONCLUSION
These results indicate that lactate and glucose transporters have a synergistic effect on the energy metabolism of neurons and astrocytes following hypoxic-ischemic reperfusion brain injury.

CLINICAL RELEVANCE/APPLICATION
The HI model monitor the regulatory mechanisms of energy metabolism after HI.

SST09-05 3D Ultrasound Provides Accurate Tonsillar Volumes to Assess Hypertrophy
Friday, Dec. 1 11:10AM - 11:20AM Room: E350

Participants
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PURPOSE
Each year, there are millions of hospital visits in the United States for obstructive sleep apnea (OSA), a disease that is primarily caused by adenotonsillar hypertrophy. Adenotonsillectomy (T&A) is an effective solution for OSA and the second most common surgical intervention in the country. We investigated the ability of 3D ultrasound (3DUS) imaging with quantitative imaging analysis to safely, accurately and objectively assess tonsillar hypertrophy for the potential identification of candidates for adenotonsillectomy.

METHOD AND MATERIALS
A prospective study was performed evaluating patients (N=17) undergoing T&A for OSA symptoms ranging from 4-14 years with a mean of 7.8. Tonsillar imaging was performed by an attending radiologist using the Philips IU22 3DUS system with xMatrix probe. The volume and two principal axes (width and height) of the left and right tonsils were determined from 3DUS using ITK-SNAP software. The tonsils were then removed the same day in the operating room and immediately assessed by measuring the two principal axes of each tonsil using a Neiko 0417A Electronic Digital Caliper. The physical volume was then obtained by water submergence in a graduated cylinder. The findings from 3DUS and physical examination of the tonsils were compared using Bland-Altman analysis to determine their agreement (mean) and bias (mean +/- 1.96 SD). Significance was assessed using the Wilcoxon signed-rank test.
RESULTS
The average tonsillar physical measurements of width and height were 20+/−3.2 mm and 27.23+/−41.4 mm, and 16.11+/−2.14 mm and 29.76+/−27.75 mm from 3DUS estimations, respectively (p < 0.001 for both). The average tonsillar volume was 3.84+/−1.23 ml and 4.29+/−1.14 ml from physical and 3DUS measurements, respectively (p=0.09). The Bland-Altman agreement+/− bias of the measured width, height, and volume results from the two measurements were -3.92+/−6.33 mm, 2.5+/−7.71 mm, and 0.45+/−2.32 ml, respectively.

CONCLUSION
We demonstrated the potential of 3DUS with quantitative imaging analysis to safely, accurately and objectively estimate tonsillar volume for assessing hypertrophy. 3DUS tonsil volumes were similar to physical measurements and more reliable than 2D measures of width and height.

CLINICAL RELEVANCE/APPLICATION
3DUS with quantitative imaging is an effective tool to objectively evaluate the tonsillar dimensions. This will allow for a more accurate selection for candidates for adenotonsillectomy.

SST09-06  What is the Optimal Needle Gauge and Injection Rate for Contrast Enhanced Ultrasound in the Evaluation of Therapeutically Cooled Neonatal Brains after Hypoxic Ischemic Injury?: Preliminary Data from an Experimental in Vitro Study
Friday, Dec. 1 11:20AM - 11:30AM Room: E350

Participants
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PURPOSE
Therapeutic hypothermia for hypoxic-ischemic encephalopathy (HIE) in neonates is used to reduce morbidity and mortality. However, optimum ultrasound (US) contrast delivery under therapeutic hypothermia is not well known. We aimed to quantify microbubble contrast intensity under these temperature conditions to determine optimal microbubble delivery.

METHOD AND MATERIALS
We injected Lumason® contrast agent into saline bags using 22 and 25-G needles under different injection rates: 0.1 mL/sec, 0.3 mL/sec, and 0.5 mL/sec. We performed injections at both 37ºC and 33.5ºC to reproduce normothermia and hypothermia conditions, respectively. We qualitatively evaluated for homogenous mixing and quantitatively assessed microbubble intensity with QLab US contrast quantification software installed on a Philips EPIQ scanner.

RESULTS
We found that 22-G needles yielded significantly higher peak intensities than 25-G needles (p=0.0495). Using 22-G needles, an injection rate of 0.3 mL/sec was optimal at 37ºC, and a rate of 0.5 mL/sec was optimal at 33.5ºC. There was no significant difference in the distribution of peak intensities between the two temperature groups using 22-G needles (p=0.2752). Using 25-G needles, an injection rate of 0.5 mL/sec was optimal at 37ºC, but at 33.5ºC no injection rate appeared most optimal. Additionally, using 25-G needles, the peak intensities at 37ºC were significantly higher than at 33.5ºC (p=0.0495).

CONCLUSION
The temperature reduction significantly impacted microbubble behavior, reducing the ability of the microbubbles to homogeneously mix unless injected at a rate of 0.5 mL/sec. Additionally, 25-G needles increase microbubble destruction. Further study is needed to optimize contrast delivery under hypothermia conditions.

CLINICAL RELEVANCE/APPLICATION
Contrast enhanced ultrasound is valuable imaging modality in assessing brain injury in hypoxic-ischemic encephalopathy. Contrast delivery must be optimized under therapeutic cooling conditions.

SST09-07  Multispectral Data Analysis of Reduced FOV Diffusion Tensor Images of Pediatric Spinal Cord Injury
Friday, Dec. 1 11:30AM - 11:40AM Room: E350

Participants
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PURPOSE
A key challenge in the imaging of spinal cord injury (SCI) patients is the ability to accurately determine structural or functional...
A key challenge in the imaging of spinal cord injury (SCI) patients is the ability to accurately determine structural or functional abnormality as well as level and severity of injury. Diffusion tensor imaging (DTI) allows the characterization of physical and functional properties of tissues. The purpose of this study is to assess quantitative multispectral texture (MST) features of diffusion tensor images and its potential clinical relevance in discriminating typically developing (TD) pediatric spinal cords and those with cervical spinal cord injury (SCI).

**METHOD AND MATERIALS**

A total of 15 subjects (10 TD and 5 cervical SCI patients) ranging in age from 6-16 yrs were recruited and scanned for DTI along cervical spinal cord using 3.0T Siemens Verio MR scanner. Initially, DTI images were corrected for motion induced artifacts and then robust estimation of tensor was used to generate DTI indices including fractional anisotropy (FA) and mean diffusivity (MD). Finally, 33 texture features were generated from both FA and MD maps. These features included 5 first order features (mean, variance, skewness, kurtosis and entropy), 16 second order feature vector elements calculated from grey level co-occurrence matrices (GLCM) in directions of 0°, 45°, 90° and 135° and 12 high order texture features generated from three different coefficients matrices in directions of horizontal (0°), vertical (45°), and diagonal (90°) of wavelet decomposition. These features then were compared between TD and cervical SCI subjects based on standard least squared linear regression model and restricted maximum likelihood method.

**RESULTS**

The experimental findings show that there are significant differences in texture values of FA and MD maps between TD and cervical SCI population. A total of 7 texture features from the FA map and 8 MST features from MD map showed statistically significant discrimination between TD and cervical SCI (tables1-3).

**CONCLUSION**

We have demonstrated experimentally that MST features have the potential for better discrimination of patients with SCI compared to the TD. MST features quantify macroscopic and also the microscopic abnormalities that may be undetectable using conventional DTI analysis.

**CLINICAL RELEVANCE/APPLICATION**

Texture descriptors could be used as quantitative imaging markers in addition to conventional MR imaging for the facilitation of diagnosis and characterization of the tissues in the pediatric spinal cord.

**SST09-08 Radiologic Features of Posterior Reversible Encephalopathy Syndrome (PRES) After Hematopoietic Stem Cell Transplantation in Pediatric Patients**

Friday, Dec. 1 11:40AM - 11:50AM Room: E350

**Participants**

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**PURPOSE**

To assess the incidence and imaging features of posterior reversible encephalopathy syndrome (PRES) in pediatric patients after hematopoietic stem cell transplantation (HSCT)

**METHOD AND MATERIALS**

This prospective study was conducted on all pediatric patients who underwent HSCT between March 2014 and June 2016. Brain CT scan was carried out in all patients who developed neurologic symptoms/signs followed by brain MRI. In those with diagnosis of PRES, follow-up MRI was conducted within two months. MRI was performed using a 1.5 Tesla magnet (Avanto, Siemens) including DWI and SWI sequences.

**RESULTS**

A total of 254 patients (160 males, mean age:7.6±4 years) underwent HSCT including 65 individuals with thalassemia, 41 withFanconi anemia, 59 with lymphoma/leukemia and 89 with other miscellaneous disorders. Brain MRI revealed PRES in 23 (9.1%). Seizure was the most common presenting symptom followed by headache. Patients with Fanconi anemia were at greater risk of developing PRES compared to other diseases as PRES was seen in 9 out of 41 of patients with Fanconi anemia (p value: 0.004). MRI showed asymmetric lesions in 10 patients of which, unilateral hemispheric involvement was noted in two patients. Superior frontal sulcus distribution was the most frequent imaging pattern (8/23, 34.8%) followed by holo-hemispheric (6/23, 26.1%), dominant posterior (6/23, 26.1%) and partial (3/23, 13%) distributions. Transient restricted diffusion was noted in one patient with unremarkable follow-up MRI. Microhemorrhagic foci were depicted in 4 patients. Of them, one patient died shortly after PRES. Follow-up MRI showed persistent microhemorrhagic foci in the other three patients. Another patient with hemorrhagic PRES died later due to a second episode of PRES.

**CONCLUSION**

This study showed high incidence of PRES in children after HSCT especially in those with Fanconi anemia. Various patterns of edema distribution is seen in brain MRI of pediatric population with PRES. Hemorrhagic PRES occurs in a minority of patients, which is possibly associated with worse prognosis.

**CLINICAL RELEVANCE/APPLICATION**

PRES shows various imaging patterns in pediatric patients following hematopoietic stem cell transplantation; with microhemorrhagic...
PRES shows various imaging patterns in pediatric patients following hematopoetic stem cell transplantation, with microhemorrhagic PRES being probably associated with worse prognosis.