Pediatric radiology
ED024

CME Learning Checkpoint Exhibit ED024 (Suspected Acute Appendicitis in Children: MRI Appearances, Alternative Diagnoses and Lessons Learned)

All Day Room: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

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ED025
CME Learning Checkpoint Exhibit ED025 (Hereditary Pediatric Renal Cystic Disorders: Imaging of the Kidneys and Beyond)
All Day Room: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

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TEACHING POINTS
To explore the definitions of chronic lung disease of premature neonates according to current advances in perinatal and neonatal medicine. • To establish the development of normal lung parenchyma. • To describe the pathogenesis of the disease and its relation with the radiological findings. • To remark the radiographic patterns of disease and its characteristics according to the evolution of perinatal strategies. • To give key clues for adequate differential diagnosis. • To show the importance of the radiology report for the neonatal care group.

TABLE OF CONTENTS/OUTLINE
Diagnostic Value of Diffusion Weighted Imaging in Intracerebral Pathologic Conditions of Neonates and Early Infants

All Day Room: PD Community, Learning Center

FDA

Discussions may include off-label uses.

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TEACHING POINTS
To review the general characteristics and finding of diffusion weighted imaging in normal neonatal brain. To investigate the clinical utility of diffusion weighted imaging in various intracerebral pathologic conditions of the neonates and early infants. To show distinct advantages of diffusion weighted imaging over conventional MR imaging.

TABLE OF CONTENTS/OUTLINE
1. General overview of normal diffusion weighted image in preterm and full term babies.
2. Review of imaging findings in various intracerebral pathologic conditions in neonates and early infants, to investigate advantages of diffusion weighted image over conventional MR imaging.
   A) Infection Meningoencephalitis (Group B Streptococci, E.coli, Rota virus related encephalopathy)
   Empyema
   B) Hypoxic ischemic injury Asphyxia Arterial ischemic infarction
   C) Trauma Birth trauma Shaken baby syndrome
   D) Neonatal seizure Seizure related edema
   E) Others Hypoglycemia Inborn error of metabolism
3. Summary and conclusion
**The Importance of the Occipital/Nuchal Assessment in Transcranial Ultrasonography for Cerebellar Hemorrhage Detection in Premature Babies**

**All Day Room: PD Community, Learning Center**

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### TEACHING POINTS

Transcranial ultrasonography (TCU) is the method of choice for the investigation of cerebellar hemorrhage in preterm babies. The aim of this presentation is to highlight the importance of occipital/nuchal window in the cerebellar analysis.

**TABLE OF CONTENTS/OUTLINE**

A case series of cerebellar hemorrhage diagnosed by transcranial ultrasonography in which the occipital/nuchal window was crucial for final diagnosis.- How do I do? Illustrations of the different acoustic windows and its anatomical repairs. - Preterm baby with antenatal cerebellar hemorrhage and its evolution.- Preterm baby with posterior fossa encephalomalacia due to cerebellar hemorrhage. - Preterm baby with cerebellar hematomas in reabsorption.- Preterm baby who developed atrophy of cerebellar hemisphere due to hemorrhage.-Take-home messages – All premature TCU must include the occipital/nuchal approach, which increases the sensitivity of cerebellar lesions diagnosis.
Imaging Findings of Kaposiform Hemangioendothelioma in Ten Children

All Day Room: PD Community, Learning Center

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TEACHING POINTS

The purpose of this exhibit is: to evaluate the imaging findings of kaposiform hemangioendothelioma in children

TABLE OF CONTENTS/OUTLINE

Our 10 cases of kaposiform hemangioendothelioma with final diagnosis through gun biopsy or operation Review of imaging findings - CT and MRI
Review of demographics and prognosisRepresentative cases
TEACHING POINTS

According to the Anderson-Carr-Randall's progression theory, medullary nephrocalcinosis can be divided into four stages, culminating in formation of kidney stones. The aim of this work is to present typical ultrasonographic (US) images of these evolutionary stages correlating with this theory.

TABLE OF CONTENTS/OFFLINE

A case-based approach to the US presentation of medullary nephrocalcinosis correlating with the evolutionary stages proposed by Anderson-Carr-Randall.-Case 1: 5 months old patient with Down's syndrome in which a routine abdominal US showed medullary nephrocalcinosis grade III. An abdominal US performed years later because of an urinary infection showed right kidney stone.-Case 2: Preterm newborn was submitted to an abdominal US that demonstrated nephrocalcinosis grade I. Follow up exams performed 1 and 2 months later showed nephrocalcinosis grades III and IV.-Case 3: Preterm newborn was submitted to an abdominal US that showed medullary nephrocalcinosis grade III. Follow up US showed renal calculi - final stage of nephrocalcinosis.-Take-home messages: Medullary nephrocalcinosis is a frequent finding in prematures. Its progression can lead to the formation of stones and hydronephrosis, being very important to perform ultrasonographic control evaluation correlating it with the evolutionary stages proposed by Anderson-Carr-Randall.
Radiologists play a crucial role in the diagnosis of the child with acute gynecological emergency. The goal of this educational exhibit is to provide a simple systematic approach for making an accurate diagnosis in this setting. Diagnosis of pediatric gynecological emergencies can be narrowed by categorizing pathologies by symptoms. US is the first line imaging modality to diagnose and differentiate gynecological pathology from other etiologies.

TABLE OF CONTENTS/OUTLINE

Symptomatic approach: Bleeding Premature menarche Trauma – accidental/nonaccidental Neoplasm – rhabdomyosarcoma, teratoma, adnexal tumors Fever Infection - PID or TOA Pelvic abscess Pain Ovarian/adnexal torsion Ovarian cysts/mass Hydrocolpos/hematometrocolpos, mullerian abnormalities Intrauterine or ectopic pregnancy In the acute setting, if imaging is required, transabdominal US is the first line imaging modality to evaluate gynecological emergencies. CT or MRI can aid in the final diagnosis or surgical planning.

Conclusion: The cause of pediatric gynecological emergencies is facilitated by correlating the patient’s symptoms with imaging findings. The aim of this pictorial review is to facilitate the diagnosis by providing a simplified framework upon which to distinguish gynecological diseases in the pediatric patient.
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**TEACHING POINTS**
To review arterial spin labeling (ASL) methodologies and clinical applications, while focusing on pediatric neuroscience.

**TABLE OF CONTENTS/OUTLINE**
METHODS
In our institution we have the opportunity of using ASL while performing 3 T MR for more than 3 years. We review some examples of ASL applications in different clinical neuropediatrics scenarios: stroke, hypoperfusion syndromes, PRES, infection, epilepsy, migraine, encephalopathy, oromotor disorders, neurooncology.

RESULTS
ASL provides an endogenous and completely noninvasive tracer for the quantification of regional cerebral blood flow (CBF) with magnetic resonance imaging (MRI).
ASL also plays a role as a biomarker of regional brain function in basic and clinical neuroscience.
We should be aware of nephrotoxicity of magnetic resonance contrast media, and about renal immaturity in infants under one year of life.
Radiologists must try to administrate gadolinium just when it is necessary and when additional information will be acquired.

CONCLUSIONS
ASL should be acquired as part of a multimodal MRI examination in our daily clinical practice because it may help us in the diagnosis of some pathologies and in the approach to a huge differential diagnosis. Its characteristics as a noninvasive, easy and fast method, make ASL a very important utility in pediatric MR imaging.
Pediatric Gallbladder in Health and Disease

Awards
Certificate of Merit

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TEACHING POINTS
1. To review the normal radiologic anatomy of gallbladder in children.
2. To describe normal variants that may simulate disease and the most common congenital malformations.
3. To discuss neoplastic and non-neoplastic diseases in pediatric gallbladder.
4. To remark the gallbladder findings that must be specifically viewed in neonates to rule out biliary atresia.

TABLE OF CONTENTS/OUTLINE
Although frequent in the adult population, acute and chronic gallbladder diseases are uncommon in pediatric patients. Gallbladder anomalies in children include a wide spectrum from normal variants and congenital anomalies to inflammatory or neoplastic disease. Congenital anomalies include gallbladder agenesis and duplication, septate gallbladder and cystic duct anomalies. Primary gallbladder diseases comprise cholelithiasis and inflammatory and neoplastic disease. Secondary manifestations of systemic illnesses (heart failure, systemic vasculitides, etc.) can also affect gallbladder. Neonatal gallbladder imaging can be the clue to diagnosis of biliary atresia. The size and wall thickness of the gallbladder should always be carefully scrutinized in abdominal ultrasound of the neonate with jaundice.
In this exhibit, normal anatomy and radiologic appearance, normal variants and congenital anomalies, and primary and secondary gallbladder diseases are reviewed.
Pediatric DXA: Height, Bone Age, and Muscle Development Matter!

All Day Room: PD Community, Learning Center

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TEACHING POINTS
Dual X-ray absorptiometry (DXA) technique should be performed in children at risk for low bone mineral density (BMD), being treated for low BMD, or being considered for treatment. It is important to understand the various factors influencing pediatric bone mineral density, such as age, gender, ethnicity, Tanner stage, height, weight, lean body mass, and bone age. When the bone mineral density Z score is abnormal, the radiologist should evaluate for patient factors that influence the BMD before a diagnosis of low bone density is made, thus translating the numeric Z score into a clinically useful result.

TABLE OF CONTENTS/OUTLINE
Our exhibit will discuss the principles, techniques, and analysis of DXA, including the databases used for the calculation of the DXA value, given as a percentile, or a standard deviation score (Z score). We will show the importance of incorporating height/age, bone area (BA)/height, lean body mass (LTM)/height, and bone mineral content (BMC)/LTM in DXA interpretation, for categorization of patients into primary, secondary, or mixed bone defects. The potential contribution of such informed interpretations of pediatric DXA will be illustrated in cases of children with primary musculoskeletal diseases, chronic inflammatory or nutritional conditions, medication induced bone loss or disorders of growth and development.
MRI Utility in the Diagnosis of Synovial Proliferative Disease in Children

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TEACHING POINTS
1. Review the function, structure and development of the synovium in children
2. Review the pathogenesis of proliferative synovial disorders in children and their classification
3. Review the differential diagnosis and role of MRI in diagnosing various non-infectious and non-malignant proliferative disorders with several examples from our institution

TABLE OF CONTENTS/OUTLINE
1. Structure and development of synovium in children
   a. Histology and development
   b. Anatomical relationships
   c. Function
2. Pathogenesis of proliferative synovial disorders
   a. Classification of proliferative synovial disorders with distinction from vascular malformations, infection, malignancy, cystic synovial disorders
   b. Pathogenesis with focus on non-infectious proliferative disorders
3. Diagnosis of non-infectious synovial proliferative disorders
   a. Epidemiology
   b. Clinical presentation
   c. Differential diagnosis and MRI role in diagnosis
   i. Synovial osteochondromatosis
   ii. Lipoma arborescens
   iii. Synovial hemangioma
   iv. Pigmented villonodular synovitis
   v. Juvenile inflammatory arthritis
   vi. Hemophilic arthritis
   vii. Miscellaneous
   d. Management
Fibroblast growth factor receptors (FGFR) play an important role in human limb and craniofacial development. Specific skeletal dysplasias and craniosynostosis syndromes are caused by specific mutations in gene encoding FGFR types 1, 2 and 3. Most common among these are Pfeiffer syndrome (FGFR 1 mutation), Crouzon syndrome & Apert syndrome (FGFR 2 mutation), Achondroplasia & Thanatophoric dysplasia (FGFR 3 mutation). Constellation of clinical features and imaging findings are helpful to suggest the diagnosis of Fibroblast Growth Factor Receptor (FGFR) gene mutations associated skeletal disorders.

1. Classification of skeletal disorders caused by FGFR genes mutations -I. FGFR 1 mutations - a) Pfeiffer syndrome b) Osteoglophonic dysplasia II. FGFR 2 mutations - a) Crouzon syndrome b) Apert syndrome III. FGFR 3 mutations - a) Achondroplasia b) Hypochondroplasia c) Thanatophoric dysplasia d) Crouzonodermoskeletal syndrome e) SADDAN syndrome. 2. Review of clinical and imaging features of skeletal disorders associated with mutations in fibroblast growth factor receptor gene in a case based format. Conclusion: Understanding the imaging findings of gene-encoded FGFR skeletal disorders will be helpful to select appropriate genetic tests to establish the diagnosis.
MR Imaging of Face and Neck Anomalies in the Fetus

All Day Room: PD Community, Learning Center

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TEACHING POINTS
The purpose of this exhibit is: 1. To review the embryology and anatomy of the face and neck 2. To review the technical considerations of fetal face and neck magnetic resonance imaging 3. To learn the imaging appearances of fetal normal face and neck and various face and neck anomalies on prenatal MRI

TABLE OF CONTENTS/OUTLINE
Embryology and anatomy of the face and neck
MR technique for fetal face and neck scanning
MR imaging of normal fetal face and neck
Imaging appearances of the various fetal face and neck anomalies – Eye abnormalities (Microphthalmia, Anophthalmia, Cyclopia, Dacrocystocele, Proptotic eyes, etc) – Nasal abnormalities (Absent nasal bone, Proboscis, etc) – Ear abnormalities (Anotia, Microtia, etc) – Cleft lip and palate – Micromandible – Goiter – Epignathus – Cervical lymphatic malformations
Sonography of Superficial Lumps and Bumps of the Pediatric Head and Neck: What You Need to Know

All Day Room: PD Community, Learning Center

Awards
Certificate of Merit
Identified for RadioGraphics

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TEACHING POINTS
1. Understand when and how sonography may be used to evaluate superficial masses to reduce radiation exposure, risk of iodinated contrast, sedation, and cost
2. To review the wide gamut of superficial masses encountered in the pediatric head and neck with a pictorial review of representative images of each entity
3. Describe the specific ultrasound findings that help to characterize various masses
4. To review when follow up/advanced imaging is necessary

TABLE OF CONTENTS/OUTLINE
Normal sonographic anatomy of the subcutaneous tissues Essential relevant clinical history and physical exam findings prior to scanning Utility of duplex/color Doppler in evaluating superficial masses Clinical and sonographic features of head masses: cephalohematoma, subgaleal hematoma, craniosynostosis, encephalomeningocele, cranium bifidum, dermoid cyst, epidermoid, Langerhan's histiocytosis Sonographic technique for scanning neck masses Clinical and sonographic features of neck masses: cervical adenitis, fibromatosis coli, thyroglossal duct cyst, cystic hygroma, dermoid, branchial cleft cyst, cervical thymus, hemangioma, teratoma, lymphoma, neuroblastoma, salivary gland abscesses and neoplasms Answering the ultimate question – "touch" or "no touch" lesion? Limitations of ultrasound and when to use advanced imaging
Pre- and Postoperative Congenital Diaphragmatic Hernia: What the Radiologist Needs to Know

All Day Room: PD Community, Learning Center

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TEACHING POINTS
To discuss the key fetal MRI features in patients with congenital diaphragmatic hernia (CDH) which most impact survival To review the imaging features of preoperative neonatal CDH To illustrate the expected evolution of imaging findings in the postoperative period To demonstrate the imaging features of potential complications after CDH repair

TABLE OF CONTENTS/OUTLINE
Pathophysiology of CDH and associated anomalies Fetal MRI and ultrasound imaging features and impact on survival: Sidedness Mediastinal involvement Percent liver herniation Fetal lung volumes Review preoperative neonatal imaging including atypical positioning of lines and tubes Surgical approach and intraoperative appearance Expected evolution of imaging features of the chest during the postoperative period Mediastinal position and indications for chest tube placement Postoperative monitoring: Intracranial hemorrhage ECMO and its complications Gastroesophageal reflux
Awards
Certificate of Merit

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TEACHING POINTS
The purpose of this exhibit is: 1. To discuss the pathophysiology and review the imaging modalities used to identify and follow the pulmonary manifestations of lymphoma and lymphoma-like disorders. 2. To demonstrate the spectrum of findings and review an imaging-based classification system for organizing the pulmonary parenchymal manifestations of lymphoma and lymphoma-like disorders.

TABLE OF CONTENTS/OUTLINE
1. Discuss the pathophysiology, epidemiology, clinical presentations, and potential complications of lymphoma and lymphoma-like disorders (LLD).
2. Review the classification of the LLD including: 1° and 2° lymphoma, post-transplantation lymphoproliferative disorders, and AIDs-related lymphoma.
3. Discuss the utility and limitations of imaging modalities including chest radiographs, CT and PET-CT for diagnosis and follow-up.
4. Review with imaging examples and sample cases of the spectrum of radiologic findings of pulmonary manifestations of LLD.
5. Demonstrate imaging mimics and how to differentiate the pulmonary appearances of LLD from them.
6. Future directions and summary.
Imaging of Physeal and Peri-Physeal Disturbances

Awards
Certificate of Merit
Identified for RadioGraphics

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TEACHING POINTS
Growth disturbances can result in life-long deformity and disability. A basic knowledge of the zonal anatomy, function, and maturation of the physis (growth plate) is essential in understanding the pathophysiology of physeal and peri-physeal injury patterns and possible resulting deformity. MR imaging is becoming the imaging modality of choice. Treatment decision is based on a combination of anatomic site of involvement, severity of the injury, and remaining growth potential.

TABLE OF CONTENTS/OUTLINE
1. Normal physeal anatomy & maturation- Histologic zonal anatomy & function- Dual vascularity & its contribution to enchondral ossification- Normal skeletal maturation changes
2. Pathophysiology of growth disturbance- Acute physeal injury can lead to premature closure (most commonly due to trauma)- Chronic physeal injury can result in physeal widening or bony bar (often observed with overuse)- Epiphyseal injury can blunt growth- Metaphyseal injury can prevent endochondral ossification
3. Pre-surgical imaging & management- Imaging considerations- Treatment opinions
Conclusion: The growth plate is visible on all imaging studies of skeletally immature patients. Familiarity with the common injury patterns and the potential long-term effects can increase diagnostic accuracy and ensure timely and appropriate patient management.
Beyond 'Water On the Knee': Imaging Spectrum of Knee Swelling in Children

All Day Room: PD Community, Learning Center

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TEACHING POINTS
Describe well recognized and subtle radiographic abnormalities in children with knee swelling
Correlate radiographic findings with clinical, sonographic and cross sectional imaging studies
Differentiate acute causes of knee swelling from chronic diseases using on clinical and radiological features
Provide an easy to use algorithm to diagnose various pathologies
Illustrate key imaging clues that point to specific diagnosis with the help of suitable clinical examples and differential diagnosis

TABLE OF CONTENTS/OUTLINE
Quiz based format will assess the readers ability to detect findings on knee radiographs, followed by corresponding sonographic and cross sectional images (CT and MRI). A wide gamut of disease processes in and around the knee joint will be provided ranging from common to the obscure. The following disease processes will be described in this review: post traumatic hemarthrosis and lipohemarthrosis, juvenile chronic arthritis, pyogenic arthritis, osteomyelitis of the knee, ganglion cysts, lymphatic and lymphaticovenous malformations, arteriovenous malformation, baker's cyst, osteochondroma, chondroblastoma, osteosarcoma, synovial sarcoma, synovial osteochondromatosis, giant cell tumor of tendon sheath, Morel Lavelle, prepatellar bursitis and dermatomyositis.
Awards
Certificate of Merit

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TEACHING POINTS
Upon completion of the educational presentation, the learner will be able to ...
1) Differentiate normal hematopoietic bone marrow signal from pathologic infiltration of marrow in the child.
2) Recognize normal variations in bone marrow signal of the growing skeleton, including stippled marrow and focal periphyseal edema.
3) Identify abnormal MR signal consistent with malnutrition and serous atrophy of marrow.
4) List typical imaging characteristics of post-radiation marrow changes.
5) Recognize marrow signal abnormalities seen with idiopathic arthritis and enthesitis.

TABLE OF CONTENTS/OUTLINE
- Understanding Normal Marrow: Conversion From Red to Yellow
- Example of Normal Marrow on MRI
  - Example of Variations of Normal Marrow on MRI
    - Stippled marrow
    - Focal periphyseal edema
    - Bone Marrow Abnormalities
    - Gelatinous Transformation of the Bone Marrow
  - Scurvy: Radiographic Findings & MRI Findings
  - Leukemia: Radiographic Findings & MRI Findings
  - Avascular necrosis
  - Post-radiation marrow change
  - Enthesitis related arthritis
**Cystic Abnormalities of the Pediatric Brain**

All Day Room: PD Community, Learning Center

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**TEACHING POINTS**

After completing this educational exhibit, the viewer will: Appreciate the diversity of appearances and etiologies of cystic abnormalities of the pediatric brain on modalities including ultrasound, CT and MR. Be able to describe clinical and radiologic findings to narrow the differential diagnosis for cystic abnormalities of the pediatric brain and discriminate between similar-appearing lesions. Know typical evaluation and management of these abnormalities.

**TABLE OF CONTENTS/OUTLINE**

Approach to cystic pediatric brain abnormalities Cases will include:

- Cysts
- Neuroepithelial cysts
- Connatal cysts
- Germinolytic cysts
- Arachnoid cysts
- Colloid cysts
- Rathke's cleft cyst
- Sequela of Injury (including vascular and hemorrhagic) and Infection
- Cystic encephalomalacia
- Porencephaly
- Macrocystic periventricular leukomalacia
- Infection
- Neurocystercerosis
- Abscess
- Cystic Neoplasms
- Astrocytoma, including juvenile pilocytic astrocytomas and pleomorphic xanthoastrocytoma
- Ganglioglioma
- DNET (Dysembryoplastic neuroepithelial tumor)
- Dermoid/Epidermoid
- Craniopharyngioma
From the Mouths of Babes: Common and Uncommon Oral Lesions in Pediatric Patients with Clinical, Radiologic, and Pathologic Correlation

All Day Room: PD Community, Learning Center

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TEACHING POINTS
1. To review the anatomy of the oral cavity and the spaces of the mouth.
2. To use case examples to discuss common, uncommon and rare benign and malignant oral cavity lesions in pediatric patients with the imaging characteristics of each lesion.
3. To provide clinical and pathologic correlation for each lesion as well as management strategies for these cases.

TABLE OF CONTENTS/OUTLINE
Anatomy of the oral cavity and spaces of the mouth
Cases will include:
Vascular: Palate and tongue hemangioma, transpatial lymphatic malformation
Neoplastic: 1. Benign: Tongue Schwannoma, PTLD of the tongue, Cystic teratoma of the floor of the mouth 2. Malignant: Ewing's sarcoma of the mandible, osteosarcoma of the mandible, yolk sac germ cell tumor with metastases to the palate
Other: Recurrent lingual thyroglossal duct cyst, mandibular giant cell granuloma, mucocele
Each case will include clinical presentation of the patient, classic features of the diagnosis on imaging, and correlation with the pathologic findings as well as subsequent management/treatment of the patient.
**Radiation Dose Reduction at CT Angiography Using CNR Based Radiation Dose Modulation: Experience in Pediatric CT Angiography**

**Participants**

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**TEACHING POINTS**

We reported that arterial enhancement in individual patients can be predicted before CT angiography (CTA) if we inject a test bolus of diluted contrast material and obtain a time-density curve (Acad Radiol, 2014). This facilitates the selection of the tube voltage and tube current for an optimal contrast noise ratio (CNR). CTA is the best modality in which CNR is arbitrarily controlled by operators. The combination of automatic tube voltage selection (ATVS) and automatic tube current modulation (ATCM) may allow a greater radiation dose reduction than ATCM alone. We use CNR-based dose modulation for pediatric CTA. In this educational exhibit we present our experience with radiation dose reduction methods using CNR-based dose modulation.

**TABLE OF CONTENTS/OUTLINE**

1. Optimal CNR at standard (120 kVp) and low kVp settings  
2. Variations in the CT number and image noise at low tube voltages  
3. Prediction of aortic enhancement for pediatric CT angiography using our test-bolus technique  
4. Practical scan and contrast material injection protocol for the CNR-based dose modulation technique  
5. Clinical experience with our method for pediatric CT angiography
**Pediatric Pontine Disorders: Case Based Review of the 'Usual' and 'Not So Usual Suspects'**

All Day Room: PD Community, Learning Center

**Participants**
Zara Wadood, Kansas City, MO (Presenter) Nothing to Disclose
Mohammed B. Alam, Kansas City, MO (Abstract Co-Author) Nothing to Disclose
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**TEACHING POINTS**

The diagnosis of pediatric pontine disorders is often strongly dependent on history and imaging findings. Often, the lesion is managed based on the radiological diagnosis without undergoing biopsy. Thus, radiologists play a crucial role in the treatment, and ultimately prognosis, of children with pontine disorders. The goal of this exhibit is to help learners develop an approach to common and uncommon pediatric pontine disorders, list the potential etiologies of focal and diffuse pediatric pontine lesions, and state key imaging features useful to distinguish among these disorders in order to arrive at a specific diagnosis. This will be accomplished using cases that highlight key features of the clinical history and imaging findings.

**TABLE OF CONTENTS/OUTLINE**

Image rich, case-based self-assessment examination approach to recognizing and understanding focal and diffuse pediatric pontine lesions will include the following disorders: Acute disseminated encephalomyelitis, Multiple Sclerosis, Tuberculous abscess, Pontine Infarct, Traumatic Brain Injury, Osmotic Demyelination Syndrome, Thrombotic Microangiopathy, Diffuse infiltrative pontine glioma, Hypertensive Encephalopathy.

Flowchart will include focal and diffuse pontine lesions as well as treatment plans and prognosis.
Imaging Challenges of Osteosarcoma: From Initial Diagnosis to Post-treatment Complications

All Day Room: PD Community, Learning Center

Participants
Mary D. Maher, MD, New York, NY (Presenter) Nothing to Disclose
Dana Lin, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
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TEACHING POINTS
Osteosarcoma is the most common primary malignant bone tumor in children. Imaging plays a key role not only for initial diagnosis, but also for follow-up imaging in the post-treatment setting. Although characteristic imaging findings have been described that highly favor the initial diagnosis, certain presentations can have imaging features that mimic other entities, some of which are less aggressive. In addition, evaluation for recurrence or other complications can be challenging, especially in the postoperative setting. By the end of this educational exhibit, the participant should be able to: Review the myriad presentations of osteosarcoma and potential mimickers Develop familiarity with common patterns of recurrence and possible complications Illustrate examples of difficult diagnoses of recurrence at imaging

TABLE OF CONTENTS/OUTLINE
I. Pre-testII. Epidemiology, pathogenesis, subtypes, and clinical presentationIII. Initial staging Staging systems Examples of initial presentation at imaging, highlighting mimicking features of entitiesIV. Management optionsV. Examples of post-treatment imaging Review recurrence (sites, imaging findings) Other complicationsVI. SummaryVII. Post-test
Acute Hip Pain in Children: What Technique and What to Look For?

All Day Room: PD Community, Learning Center

Awards
Certificate of Merit

Participants
Emilio Inarejos Clemente, MD, Barcelona, Spain (Presenter) Nothing to Disclose
Maria Navallas, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The aim of this exhibit is: 1. To illustrate different causes of acute hip pain in children correlating with examples on different imaging techniques. 2. To describe the most frequent normal variants encountered on the pelvis which may lead to a wrong diagnosis. 3. To review the advantages and disadvantages of the imaging modalities, emphasizing on the role of the x-ray, US and MR.

TABLE OF CONTENTS/OUTLINE

TEACHING POINTS

Review expected appearance of major types of CNS shunts. Familiarize viewers with common and clinically critical complications of CNS shunts. Emphasize salient systematic approach to viewers when encountering challenging imaging of CNS shunts to improve diagnostic accuracy.

TABLE OF CONTENTS/OUTLINE

1. Introduction to Pediatric CNS shunts
2. Types of shunts and review of normal appearance
   - Ventriculoperitoneal
   - Ventriculopleural
   - Ventriculoatrial
3. Complications associated with shunts (organized based on location) illustrated in a series of multimodality based cases with highlighted teaching points
   - Intracranial
   - Peritoneal
   - Pleural
   - Subcutaneous/soft tissues
4. Review of systematic approach to challenging cases
5. Conclusion
Participants
Akshay D. Baheti, MBBS, Seattle, WA (Abstract Co-Author) Nothing to Disclose
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Teresa Chapman, MD, MA, Seattle, WA (Presenter) Nothing to Disclose

TEACHING POINTS
Review the epidemiology and pathophysiology of hepatoblastoma. Discuss the imaging features of primary and recurrent hepatoblastoma and the appropriate differential diagnosis for a liver mass in an infant or young child. Review the radiologic PRETEXT (pre-treatment extent of disease) classification and its role in management. Explain the current management strategies based on the SIOPEL (International Childhood Liver Tumor Strategy Group) and COG (Children’s Oncology Group) guidelines, focusing on the role of the radiologist.

TABLE OF CONTENTS/OUTLINE
Discuss the epidemiology and pathophysiology, including epithelial, mixed mesenchymal and epithelial, and small cell undifferentiated histology subtypes. Describe the multimodality imaging features of primary and recurrent hepatoblastoma, including the role of the radiologist in assessing response to neoadjuvant therapy. Discuss and illustrate pediatric liver lesions that may be included in the differential diagnosis of hepatoblastoma. Elaborate on the radiologic PRETEXT classification. Review the current management based on the PRETEXT classification using SIOPEL and COG guidelines. Define the radiologist’s role in the multidisciplinary approach to hepatoblastoma.
Understanding Moyamoya Disease and Syndrome in Children

All Day Room: PD Community, Learning Center

Participants
Eva Almazan Mesa, MD, Barcelona, Spain (Presenter) Nothing to Disclose
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TEACHING POINTS
To describe the general features of moyamoya vasculopathy and the special features of pediatric disease. To explain the difference between moyamoya disease and moyamoya syndrome. To mention the diagnostic criteria and the special considerations for pediatric patients. To discuss the imaging findings of moyamoya vasculopathy and the different imaging techniques to acquire them. To describe the treatment and the role of imaging techniques in the pre and post-surgical management.

TABLE OF CONTENTS/OUTLINE
Introduction  Epidemiology  Etiology  Clinical presentation  Natural history  Pathology  Diagnosis:  Diagnostic criteria  Conventional digital subtraction angiography  Computed tomography  Magnetic resonance imaging and MR angiography  MRI-based perfusion methods: Dynamic Susceptibility Contrast (DSC), Dynamic Contrast-Enhanced (DCE) and Arterial Spin Labeling (ASL)  Electroencephalography  Transcranial Doppler  Treatment  Conclusion
Awards
Identified for RadioGraphics

Participants
Emilio Inarejos Clemente, MD, Barcelona, Spain (Presenter) Nothing to Disclose
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Josep Palau Rubio, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Asteria Albert Cazalla, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is:
1. To know the embryology and the normal anatomy of the parotid space, boundaries and relations.
2. To describe the major radiographic features of the different entities arising or extending into the parotid gland, highlighting the importance of the MRI, with pathologic correlation.
3. To briefly describe treatment and prognosis of the main parotid lesions.

TABLE OF CONTENTS/OUTLINE
1. Background, embryology and anatomy
2. Imaging techniques and study protocol
3. Imaging findings of lesions involving the parotid region in children:
   - Developmental: branchial cleft cyst, vascular malformations
   - Neoplasms:
     - Benign tumors: infantile hemangioma, pleomorphic adenoma, neurofibromas
     - Malignant lesions: mucoepidermoid carcinoma, lymphoma, rhabdomyosarcoma, metastasis
   - Inflammatory: parotitis, scrofula
4. Follow-up of these patients
5. Summary
Congenital and Acquired Clavicle Pathology in Children: What Radiologists Should Know about This Unique Bone

All Day Room: PD Community, Learning Center

Participants
Jesse K. Sandberg, MD, Saint Louis, MO (Presenter) Nothing to Disclose
Yang Li, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Eric P. Eutsler, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1) To review normal embryologic and postnatal development of the clavicle, with emphasis on its unique features 2) To review the imaging appearance of diseases, skeletal anomalies, and skeletal dysplasias that feature clavicular maldevelopment as a consistent finding 3) To review the multimodality imaging appearance of neoplasms and tumor-like lesions of the clavicle that occur in children

TABLE OF CONTENTS/OUTLINE
1. Embryologic and postnatal development of the clavicle (and why it matters) Anatomy Two primary ossification centers (medial 2/3 and lateral 1/3) Features of flat and tubular bones (e.g. intramembranous ossification early; endochondral ossification later) Imaging findings of congenital abnormalities Lateral hook (TAR, Holt-Oram, VACTERL, camptomelic, diastrophic) Absent central segment (congenital pseudoarthrosis, birth-related fracture) Absent peripheral segment [Hypoplasia/Aplasia] (Cleidocranial, Yunis-Varon, Mandibuloacral, CHILD, pyknodyostosis, progeria, phocomelia) 3. Imaging of tumors and tumor-like clavicle lesions in children Nonaggressive on radiographs: ABC/UBC, osteochondroma Aggressive on radiographs: Ewing family tumor, osteosarcoma, osteomyelitis (infectious and CRMO) Post-radiation (clavicle is radiosensitive): sarcoma, osteolysis, osteonecrosis
Beyond Birth Hypoxia: A Clinical and Imaging Review of Other ‘Accidents of Birth’

All Day Room: PD Community, Learning Center

Awards
Certificate of Merit

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Apeksha Chaturvedi, MD, Rochester, NY (Presenter) Nothing to Disclose

TEACHING POINTS

1. Birth-related injuries encompass all trauma sustained during delivery.
2. Some birth-related injuries require expeditious diagnosis/treatment to avoid permanent disability or death.
3. Hypoxic-ischemic brain injury may coexist with mechanical trauma.
4. Radiologists must recognize:
   - "Benign" birth-related injury patterns versus more worrisome patterns of injury.
   - Differences in injury patterns between mechanical birth trauma and non-accidental injury.
   - Mechanical birth trauma superimposed on hypoxic-ischemic injury.

TABLE OF CONTENTS/OUTLINE

1. Biomechanics of spontaneous and assisted vaginal birth; feto-maternal risk factors predisposing to birth-related trauma.
2. Imaging features of skull and facial bony and soft tissue injuries, intracranial hemorrhages (both extra- and intra-axial).
3. Clinical course/ prognostic implications of cephalhematoma, subgaleal hematoma and caput succedaneum.
4. Birth-related/antepartum subdural hemorrhages and distinction from SDH secondary to non-accidental trauma.
5. Cervical spinal cord injuries (brachial plexus, phrenic nerve); sternocleidomastoid injuries.
6. Fractures of clavicle, long bones, spine and skull, and less commonly, mandible, epiphyseal and mid-posterior rib fractures with birth trauma.
7. Role of imaging/optimizing protocols for detection of birth-related injuries.
Updates in Diagnosis, Management, and Treatment of Neuroblastoma

Awards
Identified for RadioGraphics

Participants
Caroline M. Cusack, MD, Omaha, NE (Abstract Co-Author) Nothing to Disclose
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TEACHING POINTS
Neuroblastoma is a complex disease, with natural history ranging from a benign course to terminal illness. The 2009 INRG staging system for neuroblastoma emphasizes pre-treatment image-defined risk classification not addressed in older staging systems. MIBG plays a key role in diagnosis, surveillance, and treatment of patients with neuroblastoma. Whole body MRI and PET-CT have adjunct roles in the management of certain patient subpopulations.

TABLE OF CONTENTS/OUTLINE
Introduction to neuroblastoma:
- Epidemiology and risk factors
- Clinical presentation and paraneoplastic syndromes
- Initial imaging and chemical diagnosis of disease
- Pathogenesis
- Genetic factors and mutations: MYCN, ALK, and loss of heterozygosity
- Implications for prognosis
- Imaging of neuroblastoma:
  - Prenatal diagnosis
  - CT and ultrasound appearance
  - Key image-defined risk factors
- Whole body MRI
- For investigating occult disease, troubleshooting
- Roles of MIBG in diagnosis, surveillance, and treatment
- MIBG as a functional imaging agent
- Use of SPECT improves anatomical localization of disease
- Curie scoring
- Therapeutic use of 131I-MIBG
- Review of INRG staging system
- Treatment:
  - Use of surgery, chemotherapy/immunotherapy (including crizotinib)
- MIBG therapy
Whole-body MR Imaging in Pediatric Oncology: Technical Considerations, Clinical Applications, Limitations and Future Perspectives

Participants

Jeong Rye Kim, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
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TEACHING POINTS

1. Understand the techniques of whole-body MR imaging in children
2. List the clinical applications of whole-body MR imaging in children focused on pediatric oncology.
3. Discuss the current limitations and future perspectives of whole-body MR imaging in children.

TABLE OF CONTENTS/OUTLINE

1. Technical consideration - Magnetic field strength
   - Coil system
   - Imaging sequences (brief discussion about basic MR physics and pros & cons of each techniques including emerging techniques)
   - Scan plane
   - Use of contrast agents
2. Clinical applications in pediatric oncology - Bone marrow imaging
   - Hematologic malignancy
   - Solid tumor
   - Tumor recurrence during follow-up
   - Complications in oncologic patients
   - Cancer screening at-risk population
3. Limitations & future perspectives
Neurological Complications of Influenza A Infection in Children: Imaging Patterns from the 2009 H1N1 Pandemic to the Current Seasonal Outbreak

All Day Room: PD Community, Learning Center

Participants
Katya Rozovsky, MD, Winnipeg, MB (Presenter) Nothing to Disclose
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Mubeen Rafay, MD, Winnipeg, MB (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this educational exhibit is: To review the MRI findings associated with the different neurological complications following an influenza A infection in pediatric patients. To gain an awareness of the unusual imaging presentation, which can mimic different pathologic entities, including other types of infection, ischemic changes and metabolic disorders. To characterize the patterns of brain involvement during the 2009 pandemic and subsequent influenza seasons, including the current 2015-2016 seasonal outbreak.

TABLE OF CONTENTS/OUTLINE
Clinical and radiological presentation of CNS complications associated with influenza A infection: Encephalitis Meningoencephalitis Acute disseminated encephalomyelitis (ADEM) Acute necrotizing encephalitis (ANE) Clinical nonspecific influenza encephalopathy Review of the spectrum of MRI imaging findings for each type of the CNS complications following an influenza A infection: Diffusion restriction pattern within the brain parenchyma Distribution of T1 and T2 signal abnormalities Pathologic leptomeningeal/parenchymal enhancement Residual changes/sequela Cases for illustration.
Imaging Findings of Childhood Interstitial Lung Disease (chILD) in Young Children

All Day Room: PD Community, Learning Center

Awards
Magna Cum Laude

Participants
Andrew Schapiro, MD, Cincinnati, OH (Presenter) Nothing to Disclose
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TEACHING POINTS
The purpose of this exhibit is to: 1) Introduce the concepts of childhood interstitial lung disease (chILD) and the chILD syndrome 2) Discuss the background and rationale behind the chILD classification system 3) Present the histopathology, clinical features, and imaging manifestations of the chILD conditions more prevalent in infancy

TABLE OF CONTENTS/OUTLINE
Definition and features of chILD and the chILD syndrome The background and rationale behind the chILD classification system Review of histopathology, clinical features, and imaging manifestations of: -Diffuse developmental disorders -Acinar dysplasia and congenital alveolar dysplasia -Alveolar-capillary dysplasia with misalignment of the pulmonary veins -Alveolar growth abnormalities -Specific conditions of undefined etiology -Pulmonary interstitial glycogenosis -Neuroendocrine cell hyperplasia of infancy -Surfactant dysfunction mutations and related disorders
Summary of key points that were highlighted throughout the presentation
Ultrasound Evaluation of the Pediatric Diaphragm

All Day Room: PD Community, Learning Center

Participants
Megan B. Marine, MD, Carmel, IN (Presenter) Nothing to Disclose
Brandon P. Brown, MD, MA, Indianapolis, IN (Abstract Co-Author) Nothing to Disclose
Boaz Karmazyn, MD, Indianapolis, IN (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Technique for Performing Ultrasound of the Pediatric Diaphragm
2. Ultrasound Appearance of the Normal Pediatric Diaphragm
3. Ultrasound Appearance of Common Pediatric Diaphragm Pathology

TABLE OF CONTENTS/OUTLINE
1. Normal diaphragm anatomy and function
2. Ultrasound technique for evaluation of the pediatric diaphragm
3. Normal ultrasound appearance of pediatric diaphragm
   a.) Anatomy
   b.) Contraction
4. Ultrasound appearance of common pediatric diaphragm pathology
   a.) Paralysis
   b.) Hernia
   c.) Eventration
Sinus Pericranii: Correlation of Clinical and Imaging Findings, Treatment and Outcomes in 16 Pediatric Cases

All Day Room: PD Community, Learning Center

FDA
Discussions may include off-label uses.

Participants
Alba Mas Sanchez, Esplugues de Llobregat, Spain (Presenter) Nothing to Disclose
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Monica Rebollo, MD, Esplugues de Llobregat, Spain (Abstract Co-Author) Nothing to Disclose
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TEACHING POINTS
Teaching points: 1. To show the correlation between radiological findings and clinical presentation in sinus pericranii. 2. To discuss the importance of appropriate imaging in the diagnosis of SP. 3. Review the treatment and outcome in pediatric patients.

TABLE OF CONTENTS/OUTLINE
Sinus pericranii is a rare vascular disease, presenting as a compressible venous scalp mass that connects to the intracranial dural sinuses through dilated diploic and emissary veins. We retrospectively analyzed 16 pediatric cases diagnosed in our center from 1995 to 2016. We have focussed on the state-of-the-art imaging protocol and major differential diagnosis entities. Most cases appear to be congenital, we reported a post-traumatic case (poorly described in the literature). Therapeutic choices are based on the presence of symptoms and radiological findings.
Brain Magnetic Resonance Spectroscopy in Children

All Day Room: PD Community, Learning Center

Participants
Recep Sade, MD, Erzurum, Turkey (Presenter) Nothing to Disclose
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Suat Eren, MD, Erzurum, Turkey (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. Review MRS metabolites and normal MRS findings of brain
2. Learn the MRS findings with age-related changes
3. Differentiate benign lesions from malignancies
4. Learn the major metabolite disease's MRS findings

TABLE OF CONTENTS/OUTLINE

MRS physics and normal MRS findings. After discussion of the normal MRS findings, cases are presented in a quiz format. MR and MRS findings of the relevant case are discussed after all case presentation. Cases have consisted of normal brain in 3 months, 1, 2, 3 years, mitochondrial disease, benign plaque, intoxication, Atypical teratoid rhabdoid tumor, pontine glioma, medulloblastoma, ependymoma. Case are organized based on differentiate benign lesions from malignancies, metabolic diseases and common MRS findings.
Awards
Identified for RadioGraphics

Participants
Cristian j. Garcia, santiago, Chile (Abstract Co-Author) Nothing to Disclose
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Macarena Lizama, santiago, Chile (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To review the wide spectrum of radiological findings of Down syndrome, including cardiovascular, bronchopulmonary, neurological, gastrointestinal, genitourinary and musculoskeletal abnormalities.
2. To discuss the use of the different imaging techniques in the study of patients with Down syndrome.
3. To discuss the meaning of imaging findings and their impact in clinical and surgical management of Down syndrome.

TABLE OF CONTENTS/OUTLINE
- Pathophysiology and clinical manifestations of Down syndrome
- The use of different imaging techniques in the study of patients with Down syndrome, including plain films, contrast studies, Ultrasonography, CT, MRI.
- Review of imaging findings in cardiovascular, bronchopulmonary, neurological, gastrointestinal, genitourinary and musculoskeletal abnormalities of Down syndrome and their relevance in patient management.
- Summary
Participants
Matthew B. Moss, MD, Gainesville, FL (Abstract Co-Author) Nothing to Disclose
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Robbie Slater, MD, Hahira, GA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The simulation exam is an innovative assessment tool to test the competency levels of residents as it pertains to readiness for night call. Using a DICOM enabled PACS/RIS, 127 R1 and R2 residents from 16 institutions evaluated a mixture of normal and abnormal multimodality exams. Non-accidental trauma (NAT) was one of the most frequently missed diagnosis with 75% of the residents either calling the study normal (observational error) or giving an incorrect diagnosis (cognitive error) with no significant difference between R1 and R2 residents with an average scores of 17 versus 25% respectively.

TABLE OF CONTENTS/OUTLINE
Pediatric Upper Cervical Spinal Injury—An Overview of Anatomy and Mechanism of Injury Involving the Pediatric Spine

All Day Room: PD Community, Learning Center

Participants
Travis Harris, MD, Gainesville, FL (Abstract Co-Author) Nothing to Disclose
Nupur Verma, MD, Gainesville, FL (Abstract Co-Author) Nothing to Disclose
Dhanashree Rajderkar, MD, Gainesville, FL (Presenter) Nothing to Disclose

TEACHING POINTS
Review pediatric cervical spine anatomy, congenital conditions and predisposition to the injuries. Access through case examples the injuries most often seen in pediatric cervical spine trauma, with emphasis on the greater propensity for ligamentous injuries, with appropriate use of MRI.

TABLE OF CONTENTS/OUTLINE
Pediatric trauma to the spine is uncommon and the mechanism of injury to the pediatric patient differs. Diagnosis of injury can be challenging in these patients secondary to decreased cooperation, associated congenital conditions, poor ability to localize pain or participate in evaluation for neurological sequel. We discuss propensity for injury by age and mechanism and discuss mimics of the injury. Majority of injuries in the pediatric population occur in the upper cervical spine in the setting of major trauma. Computer tomographic imaging of the head may be extended to include the upper cervical region (C0 through C3). Radiography is often limited by positioning in pediatric patients but may also offer an initial imaging starting point for evaluating the cervical spine. Trauma may not be detected on radiography and on CT.
Pediatric Ovarian Torsion—Spectrum of Imaging Findings

All Day Room: PD Community, Learning Center

Awards
Identified for RadioGraphics

Participants
Akosua Sintim-Damo, MD, Memphis, TN (Presenter) Nothing to Disclose
Anand Majmudar, MD, Memphis, TN (Abstract Co-Author) Nothing to Disclose
Harris L. Cohen, MD, Memphis, TN (Abstract Co-Author) Nothing to Disclose
Louis S. Parvey, MD, Memphis, TN (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Diagnosis of ovarian torsion can be challenging and requires synthesis of both clinical and radiographic information.
2. Ultrasound is the primary imaging modality in the diagnosis of ovarian torsion with CT and MRI being useful adjuncts.
3. There is a spectrum of imaging findings from neonatal to adolescent life. Knowledge of the varied imaging appearances can provide an accurate and timely diagnosis of ovarian torsion.

TABLE OF CONTENTS/OUTLINE
1. Review of normal ovarian embryology and anatomy
2. Pathophysiology of ovarian torsion
3. Imaging patterns in fetal/neonatal ovarian torsion—review of 6 cases Large cyst with fluid/fluid level Large cystic mass with multiple mesh-like septations Solid mass with peripheral cysts Mass with variable positions on imaging Thick-walled cystic structure Evolving appearance over time
4. Imaging spectrum in the child and adolescent—review of 27 cases Enlarged ovary in comparison to contralateral side Solid mass Solid mass with peripheral cysts Primarily cystic mass Normal/absent/reduced/high resistance color Doppler with spectral waveforms Contained masses - Simple cysts and dermoid cysts

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/

Harris L. Cohen, MD - 2016 Honored Educator
Fetal and Neonatal Ovarian Torsion: A Pictorial Review

All Day Room: PD Community, Learning Center

Participants
Yasmin Mekhall, MD, Tampa, FL (Presenter) Nothing to Disclose
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Felice Baron, MD, Sarasota, FL (Abstract Co-Author) Nothing to Disclose
Jennifer N. Kucera, MD, MS, St. Petersburg, FL (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To review the pathophysiology of in utero and neonatal ovarian cyst formation and the development of ovarian torsion To discuss the key fetal and neonatal MRI and ultrasound features of ovarian torsion To explore potential complications of fetal and neonatal ovarian torsion To review the literature regarding imaging of fetal and neonatal ovarian torsion

TABLE OF CONTENTS/OUTLINE
Pathophysiology of ovarian torsion in the fetus and neonate Maternal hormonal impact on ovarian cyst formation Mechanisms of ovarian torsion Imaging features of in utero ovarian torsion Imaging features of neonatal ovarian torsion Complications of in utero and neonatal ovarian torsion including bowel obstruction, infection, and peritonitis Description of an interesting case of in utero ovarian torsion in a twin pregnancy which resulted in a neonatal bowel obstruction Imaging features from fetal ultrasound, fetal MRI, postnatal ultrasound, and abdominal radiograph will be shown Gross pathology and histopathology images of the torsed ovary and the obstructed small bowel will be presented Surgical and conservative management of ovarian torsion in fetuses and neonates
Imaging the Pediatric Intervertebral Disc: Normal Development, Congenital Anomalies and Acquired Disc Pathology

All Day Room: PD Community, Learning Center

Participants
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TEACHING POINTS
After reviewing the exhibit, the learner will be able to:
1. Describe the normal appearance of the intervertebral discs in children at various ages, on radiographs, CT and MRI.
2. Recognize the typical imaging appearance of disc pathologies specific to children including congenital anomalies and various acquired disc pathologies.

TABLE OF CONTENTS/OUTLINE
1. Normal intervertebral disc appearance in newborns, infants, children and adolescents in radiographs, ultrasound, CT and MRI including normal variants.
3. Acquired Disc abnormalities: a) Pyogenic discitis b) Tuberculous discitis/Potts disease c) Disc herniation causing posterior ring apophysis fracture d) Acute Shmorl's node e) Idiopathic intervertebral disc calcification f) Scheuermann's disease g) Juvenile Idiopathic Arthritis h) Neoplastic invasion (Osteoblastoma)
Uncommon Tumors and Pseudotumors of the Pancreas in Pediatric Patients

Participants
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TEACHING POINTS
Pancreatic neoplasms are rare in pediatric patients. Several conditions and diseases in pediatric patients present as pseudo-tumors and may mimic pancreatic neoplasms. This exhibit aims to review the epidemiology and image appearance of rare pancreatic neoplasms in CT and MRI and discuss the imaging features and potential diagnostic clues for non-neoplastic pancreatic pseudo-tumors and pseudolesions mimicking neoplasms in children.

TABLE OF CONTENTS/OUTLINE
Review of the epidemiology of common and uncommon pancreatic neoplasms in pediatric patients and the role of radiologic imaging in diagnosis and staging. Examples of uncommon pediatric pancreatic neoplasms and their image appearance in CT and MRI. Overview over potential pitfalls and rare pseudotumors of the pancreas in pediatric patients including focal pancreatitis, autoimmune pancreatitis, splenules, metastases and others. Examples of pancreatic pseudotumors and pseudolesions and their image appearance with focus on MRI. Potential diagnostic clues to distinguish true neoplasms from other disease conditions.
Imaging of Thyroid Nodules in Children
All Day Room: PD Community, Learning Center

Awards
Identified for RadioGraphics

Participants
Peter Joyce, Orlando, FL (Presenter) Nothing to Disclose
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TEACHING POINTS
The prevalence of pediatric thyroid nodules is lower compared to adults, but their presence is substantially more alarming. In the pediatric population, 25% of thyroid nodules are later determined malignant. Advances in imaging have resulted in increased encounters of incidental abnormalities which mimic malignancy. Physical examination is first line in detection, but ultrasound is essential for precise diagnostic evaluation. Ultrasound findings help predict malignancy and direct the clinical course. Current studies aim to determine significance of sonographic features that might aid physicians in prediction of malignancy and differentiation from pseudolesions. While studies suggest these criterions in segregation are poor predictors of malignancy, their predictive sensitivity increases in combination. Pseudolesions, mimickers of malignancy and other benign incidental thyroid abnormalities also contain their own unique sonographic findings, which can aid in accurate diagnosis and prevention of unnecessary investigations. Sonographic features that differentiate benign and malignant nodules are vital to recognize in order to outline the most efficient and accurate follow up care for pediatric thyroid nodules.

TABLE OF CONTENTS/OUTLINE
Epidemiology & DifferentialFindings Suggestive of MalignancyMimics & PseudolesionsSummary
Challenge Associated with Half-dose Pediatric Head CT Protocol for Selected Patients: Effectiveness of Dose Optimization in Large Children's Hospital

All Day Room: PD Community, Learning Center

Participants
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TEACHING POINTS
The purpose of this exhibit is to introduce the half-dose method (HDM) head CT and evaluate the dose reduction ratio under the influence of HDM from several viewpoints. Three categories of patient status were selected for the HDM study: 1) follow-up of hydrocephalus, 2) post-operative follow-up of craniosynostosis, and 3) CT cisternography. The local diagnostic reference level (DRL) after HDM introduction was compared with the domestic 2015 DRL of Japan and previously published DRLs of other countries. HDM with the appropriate indications may affect the total CT dose reduction in a large children's hospital.

TABLE OF CONTENTS/OUTLINE
We compared CT dose index volume (CTDVol) and dose length product (DLP) before (n = 403) and after (n = 414) the introduction of HDM (median: 3 years). In total, 116 of 414 (28%) patients underwent HDM CT during November and December 2015. The average CTDVol after the introduction of HDM was 20 mGy (dose reduction ratio, 88%; p < 0.01). The average DLP was 424 mGy·cm (dose reduction ratio, 84%; p < 0.01) in all patients. The dose reduction ratio on the CT scan ordered by the neurosurgery department (n = 208) was 76% (p < 0.01) for both CTDVol and DLP. After the HDM introduction, local DRLs were equal to approximately 45% of domestic DRL and 53%–90% of DRLs of other countries.
Awards
Identified for RadioGraphics

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TEACHING POINTS
To review how to perform color Doppler sonography (CDS)To describe the US features of normal colonTo propose a systematic US approach of colitisTo present three distinctive US patterns and their histosonographic correlationsTo discuss etiologies of each pattern

TABLE OF CONTENTS/OUTLINE
TEACHING POINTS

Developmental malformations of the müllerian duct system represent a very interesting spectrum of variation in the formation and fusion of the primordial anlage of the female reproductive system, ranging from agenesis to duplication of the uterus and the vagina. Often, they coexist with anomalies in the development of the renal and skeletal system. Female genital system can be explored with several modalities. However, complex müllerian duct anomalies are mapped in detail with combination of hysterosalpingography (HSG) and MRI. Conventional HSG is a more invasive method that is not very popular in the younger female population, despite being the gold standard.

TABLE OF CONTENTS/OUTLINE

The purpose of this presentation is to correlate the imaging findings of conventional HSG and MRI in adolescents and young women with Müllerian duct anomalies. HSGs were performed in a pulsed radiation fluoroscopy machine and MRIs in a 1.0-Tesla open scanner. The spectrum of congenital müllerian duct anomalies is presented; typical diagnostic findings are highlighted and correlated between the two modalities. Case presentation is based on the American Society for Reproductive Medicine classification system with reference to the ESHRE/ESGE consensus. Additional MRI findings are outlined.
Urosonography: Experience and Difficulties in Its Introduction to Our Hospital

All Day Room: PD Community, Learning Center

Awards
Cum Laude

Participants
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TEACHING POINTS
To present our experience and difficulties to set in motion the pediatric serial voiding urosonography (VUS) in our hospital. The implementation of the VUS is not easy, requires good equipment and a proper steady teamwork. The absence of irradiation prolongs the scan time and allows achieve correct and complete studies.

TABLE OF CONTENTS/OUTLINE
1. INTRODUCTION Technique description and findings
2. PROCEDURE DETAILS Implementing VUS led to some problems that we have progressively dealt with.- Problems related with ultrasound equipment - Problems related with the premature breakage of microbubbles - Problems related with preparing the contrast material
3. CONCLUSION
TEACHING POINTS

To understand the current ISSVA definition and classification of vascular malformations
To determine the role of each MRI sequence in the assessment of vascular malformations
To acknowledge the advantages of 4D dynamic contrast enhanced MRA
To develop a roadmap to use while reading MRI studies of vascular malformations

TABLE OF CONTENTS/OUTLINE

Definition and classification of vascular malformations
Approaching MRI study of vascular malformation
STIR sequence: Extension of the lesion pre and post contrast T1W sequence: vascular components of the lesion
Dynamic contrast enhanced 4D MRA sequence: flow dynamics
Pitfalls to be aware of while reading the study
Points to include in your report
Abnormalities of the Atlanto-Axial Joint in Pediatrics-Instability and Its Consequences

All Day Room: PD Community, Learning Center

Participants
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Manraj K. Heran, MD, Delta, BC (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
- The atlanto-axial joint is a complex joint able to flex, extend, pivot and rotate.
- Atlanto-axial instability can lead to serious mechanical and neurologic consequences.
- Ligamentous laxity and increased incidence of bony anomalies at the atlanto-axial joint in children with Down Syndrome places them at increased risk of developing upper cervical myelopathy. The best screening is close attention to myelopathic symptoms and a thorough physical exam. American Academy of Pediatrics no longer recommends radiographic screening of asymptomatic children with Down Syndrome.

TABLE OF CONTENTS/OUTLINE
Anatomy, embryology and biomechanics of the atlanto-axial joint and the major and minor osseous and ligamentous stabilizers. Techniques and measurements for radiographic assessment of atlanto-axial instability. Etiologies of atlanto-axial instability in children, including congenital, traumatic, neoplastic and inflammatory. Case examples of the severe neurologic complications that may result from atlanto-axial instability. Current recommendations from the American Association of Pediatrics regarding radiographic screening for atlanto-axial instability in children with Down Syndrome.
Imaging of Paediatric Mediastinal Masses: How Can a Radiologist Contribute to the Effective Management?

All Day Room: PD Community, Learning Center

Participants
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TEACHING POINTS
Common paediatric mediastinal masses and the characteristic imaging features that can help to distinguish them. To learn about the clinical management of these tumours - so that relevant information is reported on imaging.

TABLE OF CONTENTS/OUTLINE
DISCUSSION: Imaging features of common mediastinal masses with classical examples. Brief understanding of the management of common mediastinal masses to aid in effective reporting. Best approach for confirming the diagnosis and for staging of the common mediastinal masses. A check-list for reporting the mediastinal masses.
TEACHING POINTS

The presentation of pediatric spinal cord disorders secondary to infectious or inflammatory causes ranges from vague, non-specific symptoms to emergent paralysis and rarely, cord compression. These disorders require prompt diagnosis and treatment to prevent permanent morbidity and mortality. Because treatment is most often based on clinical and imaging findings alone, rather than biopsy, radiologists must be aware of key imaging features that allow the creation of a limited, if not specific differential diagnosis. This exhibit will use an image rich case-based approach to infectious and inflammatory pediatric spinal cord disorders emphasizing pertinent epidemiology, clinical history, and key imaging findings. Learners will be able to: (1) describe how to approach infectious and inflammatory disorders of the pediatric spinal cord, (2) list the various types of pediatric infectious or inflammatory disorders, (3) state key imaging features useful to distinguish among these disorders in order to arrive at a specific diagnosis.

TABLE OF CONTENTS/OUTLINE

Image rich, case-based approach to pediatric infectious and inflammatory spinal pathologies including transverse myelitis, multiple sclerosis, acute disseminated encephalomyelitis, neuromyelitis optica, acute inflammatory demyelinating polyradiculoneuropathy, and hereditary polyneuropathies.
Interrupted Aortic Arch

All Day Room: PD Community, Learning Center

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TEACHING POINTS

Explain the definition and characterization of interrupted aortic arch (IAA) with background information on etiology. To show the usefulness of CT in preoperative diagnosis of IAA. Discuss the classification of IAA and list the associated anomalies, and their findings at CT.

TABLE OF CONTENTS/OUTLINE

Review normal anatomy of the aortic arch and embryology of the IAA. To discuss the low dose CT examination protocols in children and the technique of intravenous contrast material administration. Describe classic CT appearances that aid in IAA characterization and associated anomalies. Discuss the role of CT in surgical planning and interpretation including pitfalls that may lead to misdiagnosis. Show the surgical repair of IAA and subsequent follow-up.
Radiologic ECMO Catheter Positioning—Can You Relate Once They Cannulate?

All Day Room: PD Community, Learning Center

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TEACHING POINTS
1. List the clinical situations in which Extracorporeal Membrane Oxygenation is frequently used in the critically ill pediatric population
2. Discuss the advantages and pitfalls of different ECMO cannulation options
3. Describe the role Radiology plays in evaluating for contraindications to ECMO, cannula positioning and complications occurring secondary to ECMO therapy
4. Review radiographic appearance of a variety of ECMO cannulas used in the pediatric population

TABLE OF CONTENTS/OUTLINE
1. Introduction on Extracorporeal Membrane Oxygenation (ECMO), review the clinical indications for initiating ECMO in the pediatric population, and discuss the differences in veno-venous (VV) ECMO and veno-arterial (VA) ECMO
2. Review the appearance of a variety of ECMO cannulas used in the pediatric population with photographs of the equipment alongside the corresponding imaging
3. Imaging review of cannula positioning
4. Imaging review of malpositioned cannulas and complications secondary to ECMO therapy
5. Review of a single institutional data
The Spectrum of Holoprosencephaly and Common Mimics as Evaluated by Prenatal US, Fetal MRI, and Post-natal Imaging

Participants
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TEACHING POINTS
To review the embryology of the central nervous system and the errors in development thought to result in the abnormalities seen in the holoprosencephaly spectrum.
To discuss imaging strategies used in the prenatal evaluation of CNS abnormalities.
To provide an overview of the spectrum of holoprosencephaly using case examples seen on prenatal ultrasound, fetal MRI, and post-natal/pediatric imaging.
To discuss common prenatal mimics of holoprosencephaly on ultrasound and the use of fetal MR and post-natal imaging to further evaluate potential abnormalities using case examples.

TABLE OF CONTENTS/OUTLINE
Embryology
  - Overview of the embryology of the CNS
  - Discussion of the genetic background and risk factors felt to lead to the abnormalities seen along the holoprosencephaly spectrum
Prenatal Imaging
  - Prenatal US and its use in evaluation of the fetal brain
  - Fetal MRI: How it's performed, safety in pregnancy, and indications for use
Case examples using prenatal US, fetal MRI, and post-natal/pediatric imaging
  - Including alobar, semi-lobar, lobar, syntelencephaly, and septo-optic dysplasia
Common mimics
  - Mimics seen on prenatal US, including false positives, isolated absence of the septum pellucidum, ventriculomegaly/hydrocephalus, and hydranencephaly
  - Further workup of prenatally discovered abnormalities using both fetal MRI and post-natal imaging using case examples
All of the Above: Pediatric Supratentorial Brain Tumors with Clinical, Radiologic, Intra-operative, and Pathologic Correlation

All Day Room: PD Community, Learning Center

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TEACHING POINTS
1. To use case examples to discuss common and uncommon supratentorial brain tumors in pediatric patients and the imaging characteristics of each lesion.
2. To provide clinical, intra-operative, and pathologic correlation for each lesion as well as management strategies for each case.

TABLE OF CONTENTS/OUTLINE
Cases will include:

Low-Grade: Dysembryoplastic neuroepithelial tumor, Ganglioglioma, Pilocytic astrocytoma (grade I), diffuse thalamic astrocytoma (grade II), Desmoplastic infantile astrocytoma-ganglioglioma, Atypical central neurocytoma, subependymal giant cell astrocytoma

High-Grade: Atypical teratoid/rhabdoid tumor, Primitive neuroectodermal tumor, Glioblastoma Multiforme (intraventricular and intraparenchymal), Anaplastic Ependymoma, metastatic choroid plexus carcinoma

Each case will include the clinical presentation of the patient, classic features of the diagnosis on imaging, intra-operative images during tumor resection, and correlation with the pathologic findings.
Fetal Posterior Fossa Anatomy and Abnormalities: A Comparison between 3T and 1.5T MRI

All Day Room: PD Community, Learning Center

FDA Discussions may include off-label uses.

Participants
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TEACHING POINTS
1. Illustrate normal fetal posterior fossa (fPF) anatomy and MRI landmarks
2. Illustrate the most common fPF abnormalities (fPFA)
3. Demonstrate differences, advantages and disadvantages of fPF images obtained in a 3T vs 1.5T magnet

TABLE OF CONTENTS/OUTLINE
1. Normal development and anatomy of the fPF
2. Fetal MRI landmarks used to evaluate the fPF
3. Qualitative comparison of fetal 3T vs. 1.5T of normal fPF anatomy and fPFA in age matched fetuses
4. Conclusion
Fetal MRI is crucial in the prenatal evaluation of fPF abnormalities. Knowledge of the normal cerebellar development and the MRI landmarks of the developing cerebellum are essential for an adequate fPF assessment. fPFAs include a heterogeneous group of relatively frequent (1 in 5000 live births) conditions: Dandy–Walker malformation, vermian hypogenesis/hypoplasia, and mega cisterna magna among others. Higher field magnetic resonance (3T) has already been used to improve spatial resolution of normal structures in other areas of imaging. This educational exhibit compares the normal anatomy and most frequent fPFA in fetal MRIs performed on a 3T and on a 1.5T magnet, showing the differences, advantages and disadvantages of each technique and its possible inference in the diagnostic process.
Ultrasound of Neonatal and Infant Breast Enlargement

All Day Room: PD Community, Learning Center

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TEACHING POINTS
Understand the normal appearance of the neonatal and infant breast on ultrasound Provide a comprehensive ultrasound predominant imaging review of entities causing neonatal and infant breast enlargement Offer a discussion for each entity including relevant clinical information

TABLE OF CONTENTS/OUTLINE
Background Brief review of breast embryology and anatomy Indications for neonatal/infant breast imaging Overview of sonographic technique Diagram and ultrasound imaging of normal breast tissue in neonates and infants with comparison to the adult breast configuration Entities will be discussed including abscess, cellulitis, galactocele, gynecomastia, mastitis, and physiologic enlargement (mæstauxe) Discussion for each entity including relevant information about prevalence/epidemiology, pathophysiology, clinical presentation, treatment/outcome, and key teaching points
When the Pediatric Dermatologist Calls: A Collaborative Guide to Dermatologic Diagnoses that Require Imaging

All Day Room: PD Community, Learning Center

Awards
Certificate of Merit
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TEACHING POINTS
Teaching Points: 1. Most congenital dermatologic diseases are evaluated with ultrasound (brain, spine or body), followed by MRI for definitive characterization. 2. Multisystem diseases require imaging symptomatic organs AND whole body imaging (i.e. skeletal survey, bone scan, MRI). 3. Working knowledge of dermatologic findings requiring imaging allows radiologists to recommend additional testing and create contributive reports.

TABLE OF CONTENTS/OUTLINE
Discoid Meniscus in the Pediatric Population

All Day Room: PD Community, Learning Center

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TEACHING POINTS
Diagnosing discoid meniscus (DM) on MRI has clinical and surgical implications. When diagnosing a DM on MRI, identification of tears and signs of instability is of utmost importance. The literature has focused on the diagnosis of DM based on morphology as complete, incomplete and the Wrisberg type; the latter lacking posterior attachments (i.e. popliteo-meniscal fascicles). More recent updates of the classification have described additional patterns of peripheral rim instability (anterior, middle, posterior) found during arthroscopy with nominal reference to suggestive MRI signs. Our exhibit will focus on depicting a series of MRI findings/signs that aided in the prospective identification of DM instability such as crimped meniscus, meniscal infolding, pseudo-bucket handle tear, parameniscal edema and giant meniscal horn.

TABLE OF CONTENTS/OUTLINE
Within our presentation, we will initially review the normal meniscal anatomy, the demographics and clinical presentation of DM as well as all DM classifications including the original Watanabe classification and its later modifications. Additionally, we will describe the MRI findings of DM types while focusing on the signs suggestive of peripheral rim instability with arthroscopic correlation. All tear patterns associated with discoid meniscus will be depicted as well.
Pediatric Thyroid Cancer: Clinical and Imaging Findings

All Day Room: PD Community, Learning Center

Awards
Identified for RadioGraphics

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TEACHING POINTS
- Pediatric thyroid cancer is different from adult thyroid cancer in many ways. While less common, it tends to present in more advanced stages. A thyroid nodule in a child or adolescent has a greater chance of being malignant. However, the prognosis is better than in the adult population.
- Sonographic features that portend malignancy include solid component, hypoechogenicity, irregular margins, hypervascularity, and microcalcifications. Multiple features indicate a higher risk. Lack of these features cannot differentiate a benign and malignant nodule.
- Any solid nodule larger than 1 cm needs to be biopsied in the pediatric population. Regional lymph nodes should be assessed.

TABLE OF CONTENTS/OUTLINE
1. Overview of Thyroid Nodules
2. Pediatric Thyroid CA Epidemiology
   a. Demographics
   b. Risk factors
      i. Radiation
      ii. Autoimmune disorders
      iii. Dys hormonogenesis
      iv. Hereditary syndromes
   c. Histologic types
3. Ultrasound
   a. Composition
   b. Size
   c. Calcifications
4. CT
   a. Composition
   b. Size
   c. Calcification
5. MRI
   a. T1
   b. T2
   c. Enhancement
**TEACHING POINTS**

The viewer will review the anatomy of the inner ear with emphasis on the embryological development and hence understanding the spectrum of congenital ear anomalies. A simple step by step approach to evaluating the inner ear anomalies will be presented with pictorial review of all the anomalies.

**TABLE OF CONTENTS/OUTLINE**

Radiological anatomy of the inner ear and evaluation on CT and MRI. Embryological development of the inner ear. Algorithm to evaluate inner ear anomalies. Pictorial review and classification of the inner ear anomalies including:
- Complete labyrinthine aplasia
- Cochlear Anomalies
  - Complete cochlear aplasia
  - Common cavity-type 1 and 2 incomplete partition
- Cochlear Hypoplasia
- Labyrinthine anomalies
- Vestibular aqueduct anomalies
- Inner auditory canal anomalies
- Associated malformations of the brain
Myocardial T1 Mapping in Children—Principles, Clinical Applications and Pitfalls

All Day Room: PD Community, Learning Center

Participants
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Prabhakar Rajiah, MD, FRCR, Dallas, TX (Presenter) Institutional Research Grant, Koninklijke Philips NV; Speaker, Koninklijke Philips NV

TEACHING POINTS
The purpose of this exhibit is To review the physics and principles of myocardial T1 mapping To discuss the utility of T1 mapping in children To illustrate the T1 mapping abnormalities in several myocardial pathologies in children To understand the clinical significance of abnormal T1 values in several disorders To discuss the pitfalls in T1 mapping

TABLE OF CONTENTS/OUTLINE
1. Introduction
2. Physics and principles of T1 mapping
3. T1 mapping sequences (MOLLI, ShMOLLI, SASHA, SARC, SAPPHIRE)
4. Establishing T1-mapping protocol in pediatric practice
5. Techniques- Native non-contrast, Post contrast, Extracellular volume measurement
6. Normal T1 values in children- Pre and post contrast
7. Clinical Applications- Discussion, literature review and illustration of the following cases
   - Hypertrophic cardiomyopathy
   - Dilated cardiomyopathy
   - Congenital aortic stenosis
   - Iron overload
   - Chemotherapy induced toxicity
   - Congenital heart diseases, especially post-surgical- Tetralogy of Fallot, tranpositions, septal defect, Fontan circulation etc
   - Anderson-Fabry disease
   - Other storage disorders
   - Hypertension
   - Sarcoidosis
   - Ischemic disorders
7. Pitfalls
8. Future directions

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/

Prabhakar Rajiah, MD, FRCR - 2014 Honored Educator
Radiologic-Pathologic Correlation of Magnetic Resonance Enterography for Evaluation of Pediatric Inflammatory Bowel, Benign and Malignant Diseases

All Day Room: PD Community, Learning Center

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Clara L. Ortiz, MD, Red Deer, AB (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To explain the utility of MR enterography in the diagnosis of inflammatory bowel, benign and malignant diseases in pediatric population. To correlate the MR enterography findings with pathology results in the diagnosis of inflammatory bowel, benign and malignant diseases in pediatric population.

TABLE OF CONTENTS/OUTLINE
Overview of MR enterography Over review of inflammatory bowel disease, benign and malignant disease of gastrointestinal disease Case examples to shows pathology correlation with MR enterography Future Implication
Awards
Certificate of Merit

Participants
Aashim Bhatia, MD, MS, Nashville, TN (Presenter) Nothing to Disclose
Hansel J. Otero, MD, Silver Spring, MD (Abstract Co-Author) Nothing to Disclose
G. Stefania Colafati, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Judyta Loomis, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Chiara Carducci, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Ashishkumar K. Parikh, MD, Nashville, TN (Abstract Co-Author) Nothing to Disclose
Matt Whitehead, MD, Washington, DC (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. Neuroimaging of pediatric central nervous infections remains a challenging and ever expanding field with uncommon viral pathogens and evolving infectious agents. Although many imaging findings are nonspecific in CNS infection, further advancement in our imaging tools has allowed for greater characterization of the involvement within the CNS, which can suggest certain diagnoses. Up to date knowledge of imaging findings in ongoing regional and global outbreaks facilitates diagnosis of emerging diseases.

TABLE OF CONTENTS/OUTLINE

TEACHING POINTS

1. To review the Sylvian aqueduct anatomy.
2. To show the Sylvian aqueduct’s role in the CSF dynamics.
3. To analyze the spectrum of pathologies related to the disturbances in the anatomy and function of the Sylvian aqueduct.

TABLE OF CONTENTS/OUTLINE

Anatomy of the Sylvian aqueduct and correlation with MRI imaging.
Function and physics of the Sylvian aqueduct.
Review of the different pathologies in and around the Sylvian aqueduct: congenital, hemorrhagic, infectious, neoplastic, trauma, and other secondary conditions that affect this location.
Imaging Pearls and Mysteries of Pediatric Behçet's Disease

All Day Room: PD Community, Learning Center

Participants
O. Melih Topcuoglu, MD, Istanbul, Turkey (Presenter) Nothing to Disclose
Elif Dilara Topcuoglu, Istanbul, Turkey (Abstract Co-Author) Nothing to Disclose
Cetin Murat Altay, Ankara, Turkey (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. To emphasize the diverse diagnostic imaging findings of pediatric Behçet's disease.
2. To define the fundamental imaging clues for pulmonary, vascular and central nervous system involvements of Behçet's disease in pediatric age group.
3. To demonstrate the main complications of pediatric Behçet's disease with illustrative cases.
4. To list the major imaging differences of Behçet's disease in childhood and adulthood.

TABLE OF CONTENTS/OUTLINE

1. Epidemiology and overview of pediatric Behçet's disease.
2. Radiologic evaluation of pediatric Behçet's disease (X-ray, CT, MRI).
3. Imaging clues and differential diagnosis in pediatric Behçet's disease with pulmonary, cardiovascular, gastrointestinal and central nervous system involvements. - Sample cases and differentials
4. Conclusion.
US Approach of Small Bowel Thickening in Children

Awards
Cum Laude
Identified for RadioGraphics

Participants
Julie Bolivar, MD, Montpellier Cedex 5, France (Presenter) Nothing to Disclose
Magali Saguintaah, MD, Montpellier, France (Abstract Co-Author) Nothing to Disclose
Olivier Prodhonne, MD, Montpellier, France (Abstract Co-Author) Nothing to Disclose
Ikram Taleb Arrada, Montpellier Cedex5, France (Abstract Co-Author) Nothing to Disclose
Stephanie David, MD, Montpellier, France (Abstract Co-Author) Nothing to Disclose
Catherine Baud, MD, Montpellier, France (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To review how to perform color Doppler sonography (CDS)
To describe the US features of normal small bowel (SB)
To propose a systematic US approach of SB thickening
To present the 3 distinctive US patterns and their histosonographic correlations
To discuss etiologies of each pattern

TABLE OF CONTENTS/OUTLINE
1. CDS technique: graded compression, high frequency
2. Normal SB: location, content, mural folds, stratification, peristalsis
3. SB thickening: distribution, stratification, valvular pattern, vascularization, mesentery, lymph nodes, colonic involvement
4. The 3 US patterns: stratified thickening due to mucosal inflammation, nonstratified with thumbprinting related to submucosal infiltrate, nonstratified with hyperplastic folds specific of lymphoid hyperplasia
5. Stratified thickening: infectious ileitis, advanced appendicitis, early Crohn's disease, graft vs host disease
7. Nonstratified thickening with hyperplastic folds: infectious lymphoid hyperplasia

Outline
CDS is accurate to diagnose SB diseases. Knowledge of the 3 distinctive US patterns and their histopathological changes, correlated with the clinical and laboratory findings usually allows to make the correct diagnosis.
MR Imaging Advances in the Management and Monitoring of High Grade Central Nervous System Tumors in Children

All Day Room: PD Community, Learning Center

Participants
Angel Sanchez-Montanez, MD, Barcelona, Spain (Presenter) Nothing to Disclose
Ignacio Delgado, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Elena Martinez, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
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Anna Llort, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
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Monica Ramos Albic, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Elida Vazquez, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To emphasize the relative weaknesses of conventional MRI and highlight the importance of advanced techniques

TABLE OF CONTENTS/OUTLINE
When dealing with CNS tumors in children we should perform PWI, MRS, DTI in all the infratentorial tumors. Functional-MRI has been also done when supratentorial tumors. Spine imaging is made in all suspected high grade tumors with both postcontrast T1-weighted image and DWI in sagittal plane. We recommend to do follow-up MRI in the first 72 hours after surgery. Grade tumor cellularity inversely correlates with ADC value. However, there is some overlap between high and low grade tumors. ADC is also useful to evaluate the therapeutic response. High Cho/NAA and Cho/Cr ratios are usually associated with fast growth and high grade. Lipids reflect tumor necrosis and aggressiveness, almost exclusively of High-Grade gliomas. Choline reduction has been observed after chemotherapy treatment. ASL, DSC and DCE are the perfusion techniques. Increased tumor vascularisation is not synonymous with malignancy. In the follow-up of these tumors, PWI helps differentiating radionecrosis from tumor recurrence. DTI, MRS and fMRI may serve as a surgical guide to biopsy. Integration of anatomical and advanced MRI techniques is the best approach in high grade CNS children's tumors’ management and monitoring.
Participants
Yurany M. Ochoa Santiago, MD, Valencia, Spain (Presenter) Nothing to Disclose
Cinta Sanguesa Nebot, MD, Valencia, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To describe the spectrum of the imaging and clinical findings of epithelial and nonepithelial pediatric pancreatic lesions for making the correct diagnosis. To report cases of a child with tumoral pancreatic lesions in our hospital. Pediatric pancreatic neoplasms (PPN) are rare and diverse entities, clinical symptoms are often non-specific and presentation may be late. PPN can be divided into epithelial that are most common, include solid pseudopapillary tumor, pancreatoblastoma, islet cell neoplasms and cystic lesions; and nonepithelial types which include benign entities such as lymphatic malformations, malignant neoplasms such as lymphoma, and intermediate lesions. Eight patients were identified with, serous cystadenomas, solid-pseudopapillary tumor, acinar cell carcinoma, lymphomas, intrapancreatic cystic spleen and other cystic lesions which can mimic tumors.

TABLE OF CONTENTS/OUTLINE
Learning objectives Background Review of imaging and clinical findings Pancreatoblastoma Solid pancreatic pseudopapillary tumor Acinar cell carcinoma Serous cystadenoma Cystic pancreatic lesions Lymphoma Intrapancreatic accessory spleen Sample cases and mimics
Conjoined Twins: We Need to Separate What is Important

All Day Room: PD Community, Learning Center

Participants
Alexandre F. Kanas, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Vitor C. Zanetta, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Mauro M. Hanaoka, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Yuri C. Neves, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Sergio Kobayashi, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Lisa Suzuki, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Introduce the concept and the pathophysiology of conjoined twins; Describe the main types of involvement; Discuss the main imaging findings that should be described on the radiological report.

TABLE OF CONTENTS/OUTLINE
Epidemiology of conjoined twins; Pathophysiology and main types of conjoined twins; Case series of the last 15 years from a quaternary hospital, emphasizing findings from radiography, computed tomography and obstetric ultrasound; Highlights of the main complications that should be observed and reported; Summary and conclusion.
Pediatric Mesenteric Lesions: the Common and the Less Common Lesions

Participants
Alaa N. Al Sharief, MBBS, Halifax, NS (Presenter) Nothing to Disclose
Pierre Schmit, MD, Halifax, NS (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To review the cystic and solid lesions that can arise from the mesentery in pediatric age group according to their frequency of occurrence. To discuss the imaging features as well as the associated clinical and imaging findings with each lesion.

TABLE OF CONTENTS/OUTLINE
**Puzzles of the Pediatric Pancreas: A Pictorial Review of Pediatric Pancreatic Masses**

All Day Room: PD Community, Learning Center

**Participants**

Priya G. Sharma, MD, Gainesville, FL (Presenter) Nothing to Disclose
Dhanashree Rajderkar, MD, Gainesville, FL (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**

Demonstrate the imaging findings of pancreatic masses in pediatric patients using a multi-modality approach with ultrasound (US), computed tomography (CT) and magnetic resonance imaging (MRI) Discuss the differential diagnosis and key imaging features that allow differentiation of these pathologies Describe the pathologic basis of these features and management of these pancreatic lesions

**TABLE OF CONTENTS/OUTLINE**

Pancreatic pathologies are rare in the pediatric population and have clinical courses which are distinct from their adult counterparts. Fortunately, pediatric pancreatic tumors generally have a better prognosis. Pediatric pancreatic lesions can be divided into neoplastic and non-neoplastic categories.

- **Neoplastic**
  - Epithelial Origin Pancreatoblastoma Solid-Pseudopapillary Tumor
  - Endocrine Derived Tumors including Nesidioblastosis
  - Non-epithelial Origin Lymphoma Leukemia Mesenchymal Tumors Non-Neoplastic

- **Pancreatic Pseudocyst**
- Multiple Cysts – Syndromic associations such as Von-Hippel Lindau, Beckwith-Wiedemann, Cystic Fibrosis
- Autoimmune Pancreatitis
- Intra-pancreatic Splenule

Distinct imaging features and clinical presentations allow the radiologist to accurately identify pediatric pancreatic pathology thus preventing unnecessary investigations and assisting clinicians with appropriate management.
Escherichia Coli Infections in Children: Imaging Perspective

All Day Room: PD Community, Learning Center

Participants
Kamaldine Oudjhane, MD, MSc, Toronto, ON (Presenter) Nothing to Disclose
Jehan Al-Rayahi, MD, Toronto, ON (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Knowledge of the structural and toxicogenic characteristics of virulent Escherichia coli helps recognize the types of organ involvement and facilitates the imaging diagnosis of the infections caused by these agents. 2. Diarrheal disease in the form of hemorrhagic colitis is linked to Shigatoxin-secreting E coli. 3. Hemolytic uremic syndrome is related to 0157:H7 serotype of E coli. 4. Uropathogenic E coli is involved in some nosocomial-acquired and in most of community-acquired urinary tract infections. 4. E coli strains with K1 capsular polysaccharide antigen are at the origin of neonatal septicemia and meningitis. 5. Immuno-compromised patients with neutropenia and intestinal mucositis are susceptible for E coli bacteremia with infection at various anatomical sites.

TABLE OF CONTENTS/OUTLINE
Malrotation and its Mimickers: Problem Solving Approach When Faced with the Dilemma of the Equivocal Case

All Day Room: PD Community, Learning Center

Participants
Gaurav M. Saigal, MBBS, Miami, FL (Presenter) Nothing to Disclose
Umanaheswari C. Mukkamalla, MD, Miami, FL (Abstract Co-Author) Nothing to Disclose
George Abdenour, MD, Miami, FL (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Diagnosis of Malrotation and its mimickers 2. Recognition of normal anatomic variations and certain conditions/situations where malrotation might be mimicked 3. Problem solving approach to such conditions as well as the equivocal case of malrotation

TABLE OF CONTENTS/OUTLINE
Embryology
• Normal rotation of bowel
• Malrotation
• Volvulus
• Non rotation
• Mimicker- Distended stomach
  - Redundant duodenum
  - Duodenum inversum
  - Splenomegaly
  - Rotated chest/abdomen
  - Duodenal stenosis
  - Post liver transplant
  - Masses/splenomegaly

PROBLEM SOLVING APPROACH
MRI of Pediatric Chest Wall Masses

All Day Room: PD Community, Learning Center

FDA Discussions may include off-label uses.

Participants
Zehour E. Alsabban, MBBS, Toronto, ON (Presenter) Nothing to Disclose
Oscar M. Navarro, MD, Toronto, ON (Abstract Co-Author) Nothing to Disclose
Marta Tijerin Bueno, MD, Toronto, Spain (Abstract Co-Author) Nothing to Disclose
Govind B. Chavhan, MD, Toronto, ON (Abstract Co-Author) Nothing to Disclose
David E. Manson, MD, Toronto, ON (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Explain the utility of MRI in diagnosing pediatric chest wall masses
List the differential diagnosis of pediatric chest wall masses
Review the MRI features of benign and malignant pediatric chest wall masses

TABLE OF CONTENTS/OUTLINE
Chest wall structure/anatomy
Review the utility of different imaging modalities in diagnosing chest wall lesions in children (Radiographs, US, CT and MRI)
MRI vs CT in diagnosing chest wall masses
MRI technique in chest wall imaging
Illustrate the spectrum of benign and malignant pediatric masses on MRI
Summary
Participants
Ting Y. Tao, MD, PhD, Saint Louis, MO (Presenter) Nothing to Disclose
Luke L. Linscott, MD, Cincinnati, OH (Abstract Co-Author) Nothing to Disclose
Karen A. Caudill, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Asef B. Khwaja, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Jie C. Nguyen, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Shannon Farmakis, MD, Saint Louis, MO (Abstract Co-Author) Research Grant, General Electric Company; Research Grant, Guerbet SA

TEACHING POINTS
1) Recognize the importance of a multimodality approach in imaging pediatric patients. 2) Form appropriate differential diagnoses based on clinical information and imaging findings. 3) Recognize the clinical implications of diagnoses.
LEARNING OBJECTIVES

At the conclusion of this lecture, the attendee should know the following:

A. Types of brain injury that occur in prematurely born babies
B. What imaging modalities are appropriate and inappropriate for neonatal imaging
C. Which modalities and (when appropriate) imaging sequences should be obtained for the necessary results
D. Imaging manifestations of each type of injury
E. Clinical consequences of the different types of injury

ABSTRACT

Premature birth is a major cause of infant death and childhood morbidity throughout the world, occurring in 11.1% of all births worldwide in 2010 and in 11.4% of births in the United States in 2013. Of babies born prematurely, the 5% born before 28 weeks (extremely premature) and the ~10% born from 28-32 weeks are at highest risk; many die in the first few postnatal months, close to 10% of survivors have significant neurologic impairments, and 40% have neurodevelopmental disability. Those with neurodevelopmental disability have a very high incidence of neuroimaging abnormalities, which will be the subject of this lecture.

Sonography via the anterior fontanelle and the posterolateral fontanelle is the primary neuroimaging study, as it can be performed in the Intensive Care Nursery and is sensitive to moderate and large hemorrhages, significant white matter lesions and can be used (with Doppler) to assess flow in the major cerebral arteries. Although MRI requires transportation of these (often unstable) neonates, it is more sensitive and specific than sonography: it allows differentiation of echogenic germinal matrix from small hemorrhages, detection of subtle white matter injuries, small cerebellar hemorrhages, and more sensitive assessment of the cerebral vasculature. In this lecture, the various types of cerebral injury associated with premature birth will be discussed, along with the optimal way to image the child, when MRI is indicated, and how to safely perform and interpret these images.
We prospectively enrolled PT infants < 32 weeks gestational age (GA) and <1500 grams using conventional MRI and Arterial spin labeling (ASL) to evaluate cerebral perfusion (1). This was done to better understand how cerebral perfusion is perturbed by preterm birth and brain injury. The MRI and ASL were done at 30 to 36 weeks GA or 14 to 28 days after birth. The ASL was done on a 3T scanner and the MRI on a variety of 1.5T and 3T scanners. The ASL was done on the third trimester of pregnancy and during the neonatal period. The MRI was done at 30 to 40 weeks GA and at 14 to 28 days after birth. The ASL and MRI were done on the same day. The ASL was done with a double inversion time (600 ms) to evaluate both large and small vessels. The MRI was done with a T1-weighted and a T2-weighted sequence. The ASL was done with a T1-weighted sequence. The MRI was done with a T2-weighted sequence. The ASL was done with a T2-weighted sequence. The MRI was done with a T1-weighted sequence.

METHOD AND MATERIALS

The mean of cognitive Bayley in patients without PLIC sign was 80 (95% CI 71 to 88) and 93 (95% CI 88 to 98), p=0.09, and of motor was 78 (95% CI 71 to 86) and 91 (95% CI 71 to 86), p=0.05, respectively. The mean of language Bayley for patients with cortical lesions was 79 (95% CI 68 to 90) and 91 (95% CI 86 to 97) for patients without the lesion, p=0.04. The mean of motor Bayley for patients with basal ganglions lesion were 81 (95% CI 71 to 89) and 92 (95% CI 84 to 101) for patients without the lesion, p=0.09.

CONCLUSION

The absence of PLIC sign seems to be the most important predictor in the neurodevelopment impairment, even in a cohort of patients assignment to whole-body cooling.

CLINICAL RELEVANCE/APPLICATION

Hypoxic-ischemic encephalopathy after perinatal asphyxia is an important cause of mortality and morbidity in newborns. The whole-body cooling would be associated with a reduction in cerebral lesions.

Ultrasound elastography can show tissue elasticity. Our aim was to determine the US elasticity of brain in neonates.

METHOD AND MATERIALS

Ultrasound elastography was obtained in 21 neonates without brain abnormality (10 males, 11 females; mean gestational age: 34 weeks, range: 28 - 40 weeks). By two radiologists, elastography scores were assigned to each following brain structure using five-point color scale (1-5; most soft to most hard); ventricle, periventricular white matter (WM), caudate, subcortical WM, cortical gray matter (GM), and subdural space. Elastography score of each structure was compared and correlation analysis with gestational age (GA) and birth weight was done. Inter-observer variability between the radiologists was calculated.

RESULTS

Ventricle and subdural space showed elastography score of 1 in all patients. Elastography score of other regions were as follows (median, 1st quartile-3rd quartile); periventricular WM (4.0, 3.0-4.0), caudate (4.3, 3.7-4.7); subcortical WM (4.0, 4.0-4.0), and cortical GM (3.0, 2.3-3.3). Caudate was significantly harder than periventricular WM (P = 0.004) and cortical GM (P < 0.001). Cortical GM was significantly softer than periventricular WM (P < 0.001) and subcortical WM (P < 0.001). Periventricular WM was significantly softer than subcortical WM (P = 0.001). Elastography score of caudate showed negative relationship with gestational age (y = -0.433, P = 0.050) and birth weight (y = -0.472, P = 0.031). Inter-observer variability was moderate to almost perfect (k = 0.53-0.89).

CONCLUSION

Ultrasound elastography allowed elasticity assessment in neonate intracranial structures. In normal neonates, caudate was significantly harder than most of the other brain regions. Cortical GM and periventricular WM were significantly softer than subcortical WM. Caudate became softer with increasing GA and birth weight.

CLINICAL RELEVANCE/APPLICATION

Normal elasticity of neonate brain can be evaluated with US elastography. Knowing the normal elasticity of neonate brain with US can be applied to future studies of hypoxic ischemic injury.

Cerebral Perfusion is Perturbed by Preterm Birth and Brain Injury

Sunday, Nov. 27 11:35AM - 11:45AM Room: S100AB

Awards

Trainee Research Prize - Fellow

Participants

Eman S. Mahdi, MD, MBChB, Washington, DC (Presenter) Nothing to Disclose
Marine Bouyssi-Kobar, Washington, DC (Abstract Co-Author) Nothing to Disclose
Jonathan G. Murnick, MD, PhD, Washington, DC (Abstract Co-Author) Nothing to Disclose
Caitlyn Loucas, Washington, DC (Abstract Co-Author) Nothing to Disclose
Taeyang Ha, MD, Suwon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

METHOD AND MATERIALS

We prospectively enrolled PT infants < 32 weeks gestational age (GA) and <1500 grams using conventional MRI and Arterial spin labeling (ASL) to evaluate cerebral perfusion (1). This was done to better understand how cerebral perfusion is perturbed by preterm birth and brain injury. The MRI and ASL were done at 30 to 36 weeks GA or 14 to 28 days after birth. The ASL was done on a 3T scanner and the MRI on a variety of 1.5T and 3T scanners. The ASL was done on the third trimester of pregnancy and during the neonatal period. The MRI was done at 30 to 40 weeks GA and at 14 to 28 days after birth. The ASL and MRI were done on the same day. The ASL was done with a double inversion time (600 ms) to evaluate both large and small vessels. The MRI was done with a T1-weighted and a T2-weighted sequence. The ASL was done with a T1-weighted sequence. The MRI was done with a T2-weighted sequence. The ASL was done with a T2-weighted sequence. The MRI was done with a T1-weighted sequence.

The extent to which cerebral blood flow (CBF) is perturbed by preterm birth is unknown. Our objective was to compare global and regional CBF in preterm (PT) infants with and without brain injury on conventional MRI over the third trimester of pregnancy.
PURPOSE

Using a middle cerebral artery (MCA) occlusion model, researchers at our institution have yielded preliminary data that suggest juvenile mice have mechanisms of post-stroke recovery in the hippocampus that are not found in adult mice. We examined the clinical significance of these findings by measuring hippocampal volume (HCV) changes in a cohort of children with unilateral arterial ischemic stroke (AIS) in the MCA territory, hypothesizing that children with AIS occurring before age 9 will lose less HCV than children with comparable stroke at age 9 or older.

METHOD AND MATERIALS

The medical records of 149 children treated for AIS at a children's hospital were retrospectively reviewed to identify a subset of patients with unilateral MCA-territory stroke (n=60). Cases without 3D T1-weighted, high-resolution (1 mm voxel size) MRI scans at both acute (<72 hours since diagnosis) and chronic (>90 days since diagnosis) time periods were excluded (n=41). Manual segmentation was performed on each scan to measure bilateral HCV, total brain volume (TBV), and infarct volume (IV). HCV measurements were converted into hippocampal volume ratios (HCVR, stroke-side HCV/contralateral HCV) to adjust for individual brain size differences. Patients were divided into two age-at-stroke groups: younger (<9 years old) and older (9-18 years old). The difference between acute and chronic HCVR was calculated, and then compared between groups via t-test.

RESULTS

We studied 78 PT infants [31 without brain injury; 47 with brain injury: 29 mild/19 moderate-severe] with a mean GA of 27.2±2.7 weeks at birth, and 0.96±0.3kg birthweight. Mean postconceptional age (PCA) in days was 44.7±18.75. Global CBF decreased as a function of increasing PCA (p<0.04) and was significantly reduced in PT infants with brain injury (p<0.04). Similarly, regional CBF was significantly lower in the thalamus and pons (p=0.006) in those with vs without injury, controlling for GA at MRI. Regional CBF in PT infants with moderate/severe injury was significantly lower in the primary motor, mid-temporal, thalamus, pons and anterior vermis regions compared to PT infants that were brain injury free (p<0.01, for all).

CONCLUSION

We report for the first time early disturbances in global and regional CBF in PT infants following brain injury. Regional cerebral perfusion alterations were evident in the thalamus and pons suggesting regional vulnerability of the developing cerebro-cerebellar circuitry.

CLINICAL RELEVANCE/APPLICATION

ASL may provide a useful non-invasive tool for identifying early cerebral perfusion abnormalities in preterm infants and assist in identifying future targets for therapeutic interventions.

VSPD11-06 Age-associated Hippocampal Volume Changes in Pediatric Arterial Ischemic Stroke

Sunday, Nov. 27 11:45AM - 12:15PM Room: S100AB

Awards

Trainee Research Prize - Medical Student

Participants

Zak Ritchey, Aurora, CO (Presenter) Nothing to Disclose
Nicholas V. Stence, MD, Aurora, CO (Abstract Co-Author) Nothing to Disclose
David M. Minsky, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Sean Deoni, PhD, Aurora, CO (Abstract Co-Author) Nothing to Disclose
Timothy Bernard, MD, Aurora, CO (Abstract Co-Author) Nothing to Disclose
David Weitzenkamp, PhD, Aurora, CO (Abstract Co-Author) Nothing to Disclose
Paco Herson, PhD, Aurora, CO (Abstract Co-Author) Nothing to Disclose

Purpose

We studied 78 PT infants [31 without brain injury; 47 with brain injury: 29 mild/19 moderate-severe] with a mean GA of 27.2±2.7 weeks at birth, and 0.96±0.3kg birthweight. Mean postconceptional age (PCA) in days was 44.7±18.75. Global CBF decreased as a function of increasing PCA (p<0.04) and was significantly reduced in PT infants with brain injury (p<0.04). Similarly, regional CBF was significantly lower in the thalamus and pons (p=0.006) in those with vs without injury, controlling for GA at MRI. Regional CBF in PT infants with moderate/severe injury was significantly lower in the primary motor, mid-temporal, thalamus, pons and anterior vermis regions compared to PT infants that were brain injury free (p<0.01, for all).

CONCLUSION

We report for the first time early disturbances in global and regional CBF in PT infants following brain injury. Regional cerebral perfusion alterations were evident in the thalamus and pons suggesting regional vulnerability of the developing cerebro-cerebellar circuitry.

CLINICAL RELEVANCE/APPLICATION

ASL may provide a useful non-invasive tool for identifying early cerebral perfusion abnormalities in preterm infants and assist in identifying future targets for therapeutic interventions.

VSPD11-07 Arterial Ischemic Stroke in Children

Sunday, Nov. 27 11:55AM - 12:15PM Room: S100AB

Participants

Manohar M. Shroff, MD, Toronto, ON, (manohar.shroff@sickkids.ca) (Presenter) Consultant, Guerbet SA;

LEARNING OBJECTIVES
1) To discuss differences compared to adult stroke and illustrate etiologies of childhood Arterial Ischemic Stroke (AIS). 2) To discuss acute stroke protocol and role of various imaging techniques in childhood AIS. 3) To illustrate cases showing the value of vessel wall imaging in childhood AIS. 4) To discuss emerging treatment pathways for childhood AIS.

ABSTRACT

Stroke is traditionally classified into ischemic and hemorrhagic subtypes and is among the top 10 causes of death in children and a significant cause of long-term morbidity. This presentation focuses on pediatric arterial ischemic stroke (AIS) only. AIS occurs with a frequency of 2 to 3/100,000 children per year. The incidence is higher in neonates, approximately 1 in 4000 live births. Pediatric AIS differs from adult AIS in that it is uncommon, has a subtler clinical presentation, and is caused by a wide number of causes including genetic, cardiac, thrombotic and vasculopathies. The risk factors are often age-dependent across childhood. Imaging appearances of the young brain are very different from an adult and imaging often requires sedation. This presentation will review the various imaging features and appearances of pediatric AIS. Strokes recur in one-fifth of later childhood AIS and recurrence is rare after perinatal stroke. In later childhood AIS recurrence occurs within five years in two-thirds of children whose vascular imaging studies identified abnormalities. It is hence important to image suspect vessels with as much detail as possible. This presentation will review vessel wall imaging and its importance in the diagnosis of vasculitis and dissection. Imaging findings can contribute further to the understanding of outcomes in children and can provide evidence supporting specific treatments. A brief discussion of relatively new treatment possibilities will also be discussed.
Common Findings on Head Computed Tomography in Neonates with Confirmed Congenital Zika Syndrome

Station #1

Participants
George S. Bisset III, MD, Houston, TX (Moderator) Nothing to Disclose

Sub-Events

PD200-SD-SUA1

PURPOSE
Describe central nervous system (CNS) computed tomography (CT) findings in neonates with congenital microcephaly associated with the presence of Zika virus in cerebral spinal fluid.

METHOD AND MATERIALS
A series of 14 newborns with congenital microcephaly who exhibited abnormality findings on brain CT without contrast as part of the protocol established by the health ministry during outbreak of Zika, from October to December 2015. These infants had negative IgM serology for toxoplasmosis, rubella, cytomegalovirus and syphilis, and IgM negative for dengue virus and positive for ZIKA virus by ELISA in the CSF. All CT scans were performed in multislice CT scanner and analyzed by the same radiologist.

RESULTS
We reported findings of cranial CT of 14 newborns, 9 male and 5 female. Gestational age ranged from 31 to 40, weight at birth from 810 to 3,840 grams and head circumference from 23 to 33 centimeters. Calcification in the central nervous system (CNS) were seen in all patients, being punctiform in 8 (57.1%) and coarsely in 6 (42.8%). 13 neonates (92.8%) showed calcification in the cortico-medullary junction, 3 (21.4%) in thalamus and 1 (7.1%) in midbrain. The cortico-medullary junction calcifications were located mainly at frontal (92.8%) and parietal lobes (78.5%) and less often at occipital (35.7%) and temporal lobes (28.5%). Global hypogyration of the cerebral cortex was seen in 11 (78.5%) infants. In 13 (92.8%) neonates ventriculomegaly was present. Cerebellar hypoplasia was seen in 4 patients (28.5%). Prominent occipital bone was identified in 9 patients (64.2%), which can be associated with fetal brain disruption sequence, characterized by severe microcephaly, overlapping sutures, scalp rugae and marked neurological impairment, reflecting important intrauterine brain damage.

CONCLUSION
There is a pattern of tomographic findings in central nervous system of neonates with microcephaly and Zika virus infection. Although the etiopathogenesis and associated risk factors have not yet been well established these data strongly suggest that Zika virus can cause microcephaly.

CLINICAL RELEVANCE/APPLICATION
There is a pattern of tomographic findings in central nervous system associated with the microcephaly outbreak that suggest a new etiology. In face of the increase of microcephaly cases, and the possibility of global dissemination of Zika virus, its necessary to recognize these radiologic findings.

Conquering Cavernous Transformation of the Portal Vein

Station #2

Awards
Student Travel Stipend Award

Participants
Whitney L. Shofner-Michalsky, MD, Seattle, WA (Presenter) Nothing to Disclose
Eric J. Monroe, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the efficacy of direct and transjugular intrahepatic portosystemic shunt placement in the treatment of pediatric portal vein thrombosis with cavernous transformation.

METHOD AND MATERIALS
In this retrospective review, a list of patients was generated who underwent direct and transjugular intrahepatic portosystemic...
shunt placement for the treatment of cavernous transformation of the portal vein from 2014-2016. Medical records and imaging were reviewed to assess treatment outcomes and evaluate for any complications. Procedural success was defined by normalization of portosystemic pressures.

RESULTS
It was determined that three patients underwent TIPS/DIPS for the treatment of portal vein thrombosis with cavernous transformation from 2014-2016. The indication for portosystemic shunt included GI bleeding as a complication related to portal hypertension in all cases. Average portosystemic pressures prior to shunting were 19 compared to 4 after the procedure. One case was complicated by thrombosis of the shunt which resulted in a recurrent gastrointestinal bleed at day 2. This was successfully treated with lysis of the thrombus without further complications at the five month follow up. No recurrent gastrointestinal hemorrhage or other complications were encountered in the two other patients post shunting, and ultrasound follow up confirmed patency of the shunt in each of these cases at 5 months and 22 months respectively. Spleen size decreased in two patients post treatment, and one patient was status post splenectomy.

CONCLUSION
Direct or transjugular intrahepatic portosystemic shunt placement should be considered in select patients with complications related to portal hypertension in the setting of cavernous transformation of the portal vein to decrease portal pressures and decrease the risk of recurrent GI bleeding.

CLINICAL RELEVANCE/APPLICATION
These results will allow us to critically review the role of interventional radiology in the management of pediatric portal vein thrombosis with cavernous transformation.

PURPOSE
To show our own made rear-projection audiovisual systemTo divulge the necessity of distractors instruments to achieve children co-operation and immobility

METHOD AND MATERIALS
Two low-cost rear-projection audiovisual systems were settled in a 1,5T and 3T magnets consisting on a DVD player, a projector (both outside the room), a mobile screen with rails (in the room) and a game mirrors (incorporated in the head coil). This simple device does not require special training or complex installation because it uses a commercial material with which both the staff and the children are familiar with.

The patient is placed supine comfortably viewing the film projected from the outside to the screen. The system was used in all of the pediatric population examined to increase comfort and reduce anxiety during the test with special attention to children between 2 and 5 years where we pursued further in order to avoid sedation.

RESULTS
The use of our own low-cost rear-projection audiovisual system (RPAVS) reduced the need for sedation in patients between 2 and 5 years under MRI in more than 30%. This percentage is even higher in females and in older children. The percentage reduction was constant for these more than two years experience. Avoiding sedation in around 400 infants and reducing the scan time has enabled the realization of a 27% more of patients with the consequent reduction of the waiting list. RPAVS has proven to be a useful tool in reducing patient’s anxiety to the test, increasing comfort and minimizing the feeling of claustrophobia within the machine. Reducing the amount of sedation also shortens the time of the scan allowing the realization of a greater number of patients in the same time slot which is a real cost saving test.

The simplicity of the system, as well as the price (around thousand euros), make this device suitable for introduction into any environment including developing countries.

CONCLUSION
The rear-projection audiovisual system applied to the MR has reduced the number of children who require sedation, has improved patient’s safety and satisfaction and, has reduced the emotional impact of the disease on the child and their environment.

CLINICAL RELEVANCE/APPLICATION
Low-cost rear-projection audiovisual system is an easy and cheap tool when performing MRI in children that reduces the number of sedations among other benefits.
To investigate the role of magnetic resonance imaging (MRI) as a complement to ultrasound (US) in the evaluation of fetal lymphatic malformations.

METHOD AND MATERIALS

The prenatal US and MRI data of 40 fetuses with lymphatic malformations between June 2005 and December 2015 were reviewed. The malformations were confirmed by postnatal imaging or operation. MRI was performed using a 1.5T unit. Imaging sequences included steady-state free-precession (SSFP), single-shot turbo spin echo (SSTSE) and T1-weighted fast inversion recovery motion insensitive (FIRM) sequences. MRI evaluation included: number, size and signal intensities of the lesions; thickness of the septa; configuration of the margins; exact expansion of the lesions to the adjacent anatomical structures.

RESULTS

Twenty-seven cervical, four occipital, four abdominal wall, one axillary, one mediastinal, one antebrachial, one thoraco-abdominal wall and dorsal, and one coxal lymphatic malformations were included. All lesions consisted of multi-septated macrocysts. The diagnostic sensitivity of US for these lymphatic malformations was 67.5% (27/40). Fetal MRI yielded the same diagnosis as postnatal findings in 97.5% (39/40) of patients. The agreement of Fetal MRI with postpartum imaging was excellent.

CONCLUSION

Prenatal MRI is valuable in the assessment of fetal lymphatic malformations with excellent diagnostic accuracy.

CLINICAL RELEVANCE/APPLICATION

Prenatal MRI can accurately evaluate the locations, the sizes, the extents, the correlations with peripheral anatomic structures and the tissue characteristics of fetal lymphatic malformations and this exam is recommended after fetal US.

PD101-ED-SUA6
Primovist/Eovist in Pediatrics: When and How?
Station #6

Awards
Certificate of Merit

Participants
Alaa W. Elmanzalawy, FRCR, Calgary, (Presenter) Nothing to Disclose
Xing-Chang Wei, MD, FRCPC, Calgary, AB (Abstract Co-Author) Nothing to Disclose
Seemab Haider, MD, Calgary, AB (Abstract Co-Author) Nothing to Disclose
Samarjeet K. Bhandal, MBBS, MD, Ludhiana, India (Abstract Co-Author) Nothing to Disclose
Ibtisam H. al-Shuaili, MD, Calgary, AB (Abstract Co-Author) Nothing to Disclose
Clara L. Ortiz, MD, Red Deer, AB (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Describe the mechanism of action of Primovist/Eovist as a hepatocellular selective MRI contrast agent. Recognize the clinical indication of Primovist/Eovist in liver lesions detection and characterization in pediatric population. Discuss key concepts for optimization of MR exam technique to maximize contrast and avoid common pitfalls when using hepatocellular selective contrast agent.

TABLE OF CONTENTS/OUTLINE


PD140-ED-SUA7
Voiding Uretrosonography (Ce-US) in Vesical Reflux in Children
Station #7

Awards
Identified for RadioGraphics

Participants
Carmina Duran, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Carles G. Zaragoza, MD, Sabadell, Spain (Presenter) Nothing to Disclose
Carlota C. Rodriguez, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Maria Magdalena Serra Salas, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Viviana P. Beltran Salazar, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

To illustrate the study of the urinary tract, including the urethra, with 2nd generation contrast agents To demonstrate the high quality of the images obtained with this procedure To show that Ce-VUS can diagnose the most prevalent urethral pathologies

TABLE OF CONTENTS/OUTLINE

Contrast enhanced voiding urethrosenography (Ce-VUS) has proved to be a reliable method for the identification and grading of VUR. It enables high quality morphologic studies of both the upper and lower urinary tract with no ionizing radiation, wich is a great advantage compared to voiding cystourethrography (VCUG).In this review the following examples are shown: Grading of vesicoureteral reflux based on international classification (II to V) Complete and incomplete duplex collecting system Ectopicoureter in duplexcollecting system Bladder diverticula Posterior urethral valves (PUV) Congenital urethral stricture Urinary stenosis Anterior urethral valves Diverticulum of the anterior urethra Ventral urethral ectasia Diverticulum of the prostaticuctricule Ectopic intravesical
TEACHING POINTS
The purpose of this exhibit is: To review the embryology of the tracheobronchial tree. To illustrate common and uncommon congenital anomalies of the pediatric tracheobronchial tree. To discuss the imaging pitfalls and differential diagnosis. To emphasize the utility of a systematic imaging approach to imaging the airway.

TABLE OF CONTENTS/OUTLINE
Embryology of the tracheobronchial tree Questions to be addressed at imaging Plain radiography / Fluoroscopy Static cross-sectional Imaging (CT/MRI) Dynamic CT and MR Imaging Classification of congenital disorders causing tracheobronchial airway compromise with illustrated case examples. Extrinsic: Vascular rings and slings, bronchopulmonary foregut malformations, vascular malformations. Intrinsic: Bronchopulmonary foregut malformations, bronchial atresia, tracheal stenosis, cartilage hypoplasia, tracheobronchomalacia, tracheobronchial branching anomalies.
Breast Masses in Adolescents: Keep Calm & Ultrasound

**Method and Materials**
We retrospectively studied the patients aged 11 to 16 years who underwent breast ultrasonography in the radiology department between January 2005 and September 2015. Of these patients, we included those in whom ultrasonography detected a solid mass. We analyzed the location, multiplicity, size, and ultrasonographic appearance of each lesion. Moreover, we analyzed the treatment of these lesions and their outcome.

**Results**
We studied 230 patients and we included those in whom ultrasonography detected a solid mass: 40 patients. Of the 40 patients studied, 31 had a single lesion and 9 had multiple lesions, of which 4 were bilateral. A total of 51 lesions were studied. The typical ultrasound findings were a single nodule (n=31), hypo or isoechoic (n=50), homogeneous (n=50), and well-defined margins (n=51). Of the 51 nodules, 37 had the typical characteristics of fibroadenomas and required only periodic clinical and radiological follow-up. In the 14 remaining lesions, patients were referred to the breast imaging department for biopsy because they had large (>3cm), fast-growing, and/or atypical appearing lesions; 13 lesions underwent core biopsy and 1 fine-needle aspiration cytology. Two lesions was also studied with elastography. Histological study found 12 fibroadenomas, 1 low grade borderline phyllodes tumor (in the youngest girl) and 1 hamartoma. 10 patients underwent tumorectomy; the rest were followed up periodically (mean, 13 months).

**Conclusion**
Breast masses in pediatric patients are uncommon and generally benign. Ultrasound is the first choice imaging technique. Most of these lesions can be managed conservatively, and biopsy is unnecessary in most cases.

**Clinical Relevance/Application**
In pediatrics, US is the first choice imaging technique for breast masses, and their management is fundamentally conservative with close follow-up. We should not extrapolate the BI-RADS classification to pediatric patients.

**MRi in Pregnancies at Risk for Joubert Syndrome: A Series of 34 Cases**

**Method and Materials**
In this institutional ethics approved study between 2003 and 2016, we prospectively performed cranial and body MRI for 34 pregnancies (average GA 21 weeks; SD 2.7) at recurrence risk for JSRD. Family diagnoses were: classic Joubert Syndrome (n=31), Joubert syndrome with renal disease (n=2), and Joubert Syndrome with hepatic fibrosis (n=1). We correlated fetal MR findings with
RESULTS

Outcome measures identified 15 cases as JSRD-affected and 19 as normal. MRI confidently reached the correct diagnosis in 29 pregnancies (85.2%) at 21w SD3 and missed a JSRD-affected fetus at 17w. In the 4 remaining fetuses, initial MRI study (at average 22w SD3) was inconclusive for JSRD; follow up MRI after 2 weeks correctly suggested 3 JSRD-affected fetuses and 1 normal. The most common MRI findings in JSRD-affected fetuses were reduced transverse cerebellar diameter at 50th percentile or less (n=15), vermian hypoplasia (buttok sign) (n=13), (MTS) (n=10), and enlarged cisterna magna (n=9). Associated abnormalities included cerebral ventriculomegaly (n=2), posterior encephalocele (n=1), kinked brainstem (n=1), and bilateral cystic kidneys (n=3). MRI identified MTS between 16–24 weeks of gestation at an average 19w SD 2. Fetal MRI findings supported prenatal counseling and pregnancy management.

CONCLUSION

MRI is a valuable tool for early prenatal diagnosis of JSRD in pregnancies at high risk of recurrence.

CLINICAL RELEVANCE/APPLICATION

Fetal MRI helps in prenatal counseling for families at high risk for JSRD recurrence through accurate early prenatal confirmation or exclusion of JSRD affection.

Omental Disease: An Often Forgotten Cause of Acute Abdomen in Children

US is the initial imaging study in pediatric patients with acute abdominal pain. Omental disease is a rare cause of acute abdominal pain. The differential diagnosis centers on the most prevalent causes (appendicitis and intussusception) but includes less common entities (e.g., cholecystitis and ovarian torsion). The omentum serves to contain inflammatory and traumatic processes in the abdomen. Since in normal conditions imaging techniques cannot distinguish this organ from other abdominal structures and omental disease is uncommon, it is often omitted from the differential diagnosis. Primary and secondary causes have been described. In our experience, primary causes are more common than reported. In this review we have included the following cases: Primary omental infarction/torsion, Primary epiploic appendagitis, Omental involvement in appendicular phlegmon, Omental involvement in cholecystitis, Omental involvement in tuberculosis, Omental and renal infarction secondary to septic emboli, Omental involvement in lymphoma.

Appendicitis and Beyond: A Case-based Review of Gastrointestinal Pathology in Pediatric Patients Undergoing Ultrasound Evaluation of Acute Abdominal Pain

TEACHING POINTS

1. Discuss ultrasound protocol optimization for evaluation of gastrointestinal pathology in pediatric patients presenting to the emergency department with acute abdominal pain.
2. Provide technical and practical tips for radiologists interpreting and often performing such examinations in real time.
3. Review in a case-based format the ultrasound findings of various etiologies that can present as right lower quadrant pain.
4. Delineate for the learner when findings on ultrasound alone can be diagnostic and when additional studies such as CT or MRI may be indicated.

Current and Future Directions in Pediatric PET/MRI

TABLE OF CONTENTS/OUTLINE

TEACHING POINTS

1. Combination of functional PET data with anatomic and functional information from MRI allows for improved local and distant staging in pediatric solid tumors.
2. Preliminary data shows good correlation between standardized uptake value estimated by PET/CT and PET/MRI.
3. PET/MRI provides significant reduction in radiation dose in pediatric patients undergoing serial examinations.
4. For pediatric patients who require both PET and MR imaging but need sedation/anesthesia for imaging, simultaneous PET/MRI helps decrease the duration and number of sedation sessions.
5. Advanced MRI techniques combined with new PET tracers and multiparametric analysis have great potential to increase the diagnostic utility of this hybrid imaging modality.

TABLE OF CONTENTS/OUTLINE

Overview of PET/MRI for pediatric applications Examples of pediatric PET/MRI including:
- Lymphoma
- Pediatric solid tumors (Ewing Sarcoma, Neuroblastoma) (Figure 1-2)
- Neuro-oncology [F-18]FDOPA-PET/MRI in recurrent brain tumors (Figure 5) Pharyngeal Rhabdomyosarcoma (Figure 3)- Epilepsy interictal FDG-PET/MRI detection (Figure 4)
Summary and future directions
Congenital Diaphragmatic Hernia Imaging

**LEARNING OBJECTIVES**

1. Distinguish the various subtypes of diaphragmatic hernia on fetal ultrasound and MRI. 2. Learn to measure lung-head ratio, total fetal lung volume and liver herniation and apply the values to define prognosis. 3. Utilize fetal imaging to prepare the multidisciplinary team for potential fetal and post-natal therapies for diaphragmatic hernia.

**ABSTRACT**

**PURPOSE**

Intrauterine growth restriction is associated with an increased perinatal mortality and morbidity and is associated with a decreased oxygen delivery to the fetus. With the relationship between T2 relaxation time and oxygen saturation (sO2), magnetic resonance oximetry represents a valuable method for a direct noninvasive determination of fetal oxygen saturation. The purpose of this work was to investigate a relationship between fetal sO2 and T2 relaxation time using in-vitro fetal blood samples. Parameters describing the T2 relaxation of fetal blood were consecutively validated in-vivo in one fetus.

**METHOD AND MATERIALS**

A balanced steady-state free precession (SSFP) sequence in combination with T2 preparation pulses was applied at 1.5 Tesla (Achieva, Philips Healthcare, Best, The Netherlands) for T2 determination. Fetal blood for in-vitro measurements was derived from the umbilical cord during abdominal delivery from 9 different fetuses. The blood from each fetus was heparinized and divided into 5 samples with different oxygen saturation levels (30 % to 100%). The relationship between T2 and sO2 was fitted based on the Luz and Meiboom model using measured signal intensities and sO2 values measured using a blood gas analyzer. Consecutively, the fitted parameters (T20, tex and a) were compared between each fetal blood sample and applied to T2 measurements in the left ventricle in one fetus (34 gestation week) using the same SSFP sequence.

**RESULTS**

Mean parameters of the blood samples were 160±10 ms (T20), 4.5 ms±1.2 (tex) and 0.032±0.002 103sec-1 (a). The mean parameters were retrospectively used to calculate the sO2 for each sample for verification (r = 0.9). Results of measured signal intensities in the left fetal ventricle using the mean calculated parameters resulted in a sO2 value of 98 %.

**CONCLUSION**

In vitro parameters to calculate blood sO2 were similar for fetal cord blood samples compared to measured sO2 values and measurements were successfully evaluated in-vivo. In conclusion, MR oximetry is a promising method for a noninvasively determination of fetal oxygen saturation. In future, the calculated parameters have to be validated in a larger fetal population.

**CLINICAL RELEVANCE/APPLICATION**

In vivo MR oximetry within the fetal heart could help in the diagnosis of fetal hypoxia and associated growth abnormalities.
Fetal CMR can accurately diagnose persistent LSVC, especially in situations that limit echocardiography.

**PURPOSE**

To compare conventional and virtual autopsy (post-mortem MRI) in the phenotypic characterization of stillbirths

**METHOD AND MATERIALS**

Initial recruitment in this ethically approved study included 63 stillborn foetuses over two year period, including all still births 20 weeks and above. Consent for both conventional autopsy and MRI was available in 52 (82.5%) cases; out of which 9 cases were excluded from final recruitment because of maternal causes of fetal demise (n=2) and extensive autolysis precluding conventional autopsy (n=7). After detailed history taking, clinical examination, clinical photographs and whole body infantogram; fetus was transported to MRI room (in 10% formalin). Whole body MRI at 1.5T scanner was performed using 3D DRIVE for brain, spine, heart, abdomen, axial T2W TSE for brain, and axial single shot TSE for chest and abdomen. Conventional autopsy was performed as per standard protocol. Both radiologists and pathologists were blinded for each other’s findings. Individual malformations detected based on conventional autopsy and postmortem MRI were compared. Diagnosis based on autopsy and MRI findings were made separately and were compared with the clinical diagnosis.

**RESULTS**

Virtual autopsy had an overall sensitivity and specificity of 77.7% and 99.8% respectively for the detection of malformations. Sensitivity was better for brain and spinal cord (93.1%), renal (96.1%) and pulmonary (91.1%) malformations and relatively poor for cardiovascular (60.9%), musculoskeletal (66.8%) and gastrointestinal (80.6%) malformations. Post-mortem MRI provided additional information over a conventional autopsy in brain and spinal cord malformations in 5 cases. Clinical diagnosis was revised after virtual autopsy in 14 cases (32.5%) and after conventional autopsy in 18 cases (41.8%). In 35 (81.4%) out of 43 cases, final diagnosis based on virtual autopsy was concordant with that of conventional autopsy.

**CONCLUSION**

Virtual autopsy using post-mortem MRI can be an acceptable alternative to conventional autopsy when refused. Post-mortem MRI allows in situ evaluation of brain and may even give additive value over a conventional autopsy.

**CLINICAL RELEVANCE/APPLICATION**

Post mortem MRI of still born fetus should be done for genetic counselling and prognostication, when conventional autopsy is refused for any reasons in the evaluation of stillbirths, especially if brain and spinal cord malformations are found on antenatal ultrasonogram.

**RC113-04 Cardiovascular Magnetic Resonance of Fetal Persistent Left Superior Vena Cava in Chinese**

**METHOD AND MATERIALS**

The prenatal echocardiography (and/or ultrasound) and CMR data of 44 fetuses with persistent LSVC, which confirmed by postnatal diagnoses between January 2010 and June 2015 were reviewed retrospectively. All prenatal CMR was performed at 1.5 T. Imaging sequences included steady-state free-precession (SSFP) sequences, real-time SSFP, single-shot turbo spin echo (SSTSE) and T1-weighted turbo field echo (T1W_TFE) sequences. The images were mostly acquired along the transverse view of the fetal thorax, the four-chamber, short-axis, coronal and oblique sagittal planes of the fetal heart.

**RESULTS**

All the 44 cases of fetal persistent (LSVC) were correctly diagnosed by fetal CMR, but only 32 cases (72.7%) were correctly diagnosed by first fetal US and/or echocardiography before fetal CMR. 32 cases were associated with other cardiovascular abnormalities and 6 cases with extracardiac abnormalities, 6 cases had no associated condition. Among the 32 fetuses, the congenital cardiovascular abnormalities included heterotaxy syndromes (n = 8) (7 cases of asplenia and 1 case of polysplenia) , tricuspid atresia (n = 1), ventricular septal defects (VSD, n = 5), double outlet right ventricle (DORV, n = 2), complete transposition of great arteries (TGA, n = 2), coarctation of the aorta (CoA, n = 5), double aortic arch (n=1), right aortic arch (RAoA) with vascular ring ( n = 3), pulmonary atresia with ventricular septal defect (PA/VSD) (n = 1), tetralogy of Fallot (TOF, n = 2), hypoplastic left heart syndrome (HLHS, n=2). 39 (88.6%) cases the innominate vein were absent, 5 (11.4%) cases had the innominate vein. Approximately 15.9% of patients (7 cases) the fetal persistent LSVC drains directly into the atrium, 37 (84.1%) cases drains into the coronary sinus.

**CONCLUSION**

Fetal CMR can accurately diagnose persistent LSVC, especially in situations that limit echocardiography.
CLINICAL RELEVANCE/APPLICATION
Fetal CMR can accurately diagnose persistent LSVC, especially in situations that limit echocardiography. Fetal CMR can also display the innominate vein between the bilateral superior vena cava.

RC113-05  Cardiac MR Imaging of Fetal Congenital Non-Obstructive Aortic Arch Anomalies
Sunday, Nov. 27 2:50PM - 3:00PM Room: S102AB

Participants
Su-Zhen Dong, MD, Shanghai, China (Presenter) Nothing to Disclose
Ming Zhu, Shanghai, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To illustrate the appearance of fetal non-obstructive aortic arch anomalies at prenatal cardiac magnetic resonance imaging

METHOD AND MATERIALS
Between June 2005 and October 2015, 92 fetuses with congenital non-obstructive aortic arch anomalies which confirmed by postnatal imaging were evaluated using fetal echocardiography and cardiac MRI in our hospital. Cardiac MRI was performed using 1.5T unit. Among the 92 cases, fetal cardiac MRI was performed at 20 to 33 weeks’ gestation (mean 24.5 weeks). Imaging sequences included steady-state free-precession (SSFP), real-time SSFP and single-shot turbo spin echo (SSTSE) sequences. The images were mostly acquired along the transverse view of the fetal thorax, the four-chamber, short-axis, coronal and oblique sagittal planes of the fetal heart.

RESULTS
The 92 cases of fetal congenital non-obstructive aortic arch anomalies included double aortic arch (n=26), right aortic arch with aberrant left subclavian artery (n=31), right aortic arch with mirror image branching (n=25), right aortic arch with right ductus arteriosus (n=2), right aortic arch with mirror image branching with retroesophageal ductus (n=3), left aortic arch with aberrant right subclavian artery (n=2) and cervical aortic arch (n=3). The fetal congenital non-obstructive aortic arch anomalies formed vascular ring can be correctly diagnosed using fetal cardiac MRI by experienced doctors; Only 69 cases (75%) were correctly diagnosed as congenital non-obstructive aortic arch anomalies by fetal echocardiography.

CONCLUSION
Fetal cardiac MRI can provide diagnostic information for fetal congenital non-obstructive aortic arch anomalies. Fetal congenital non-obstructive aortic arch anomalies can easily get important clues at the transverse view of aortic arch.

CLINICAL RELEVANCE/APPLICATION
Fetal cardiac MRI can provide accurate diagnostic information for fetal congenital non-obstructive aortic arch anomalies and is recommended as an adjunct to fetal echocardiography.

RC113-06  Maternal-Fetal Attachment in Blind Women Using Physical Model from Three-dimensional Ultrasound and Magnetic Resonance Scan Data: Six Serious Cases
Sunday, Nov. 27 3:00PM - 3:10PM Room: S102AB

Participants
Heron Werner, MD, Rio de Janeiro, Brazil (Presenter) Nothing to Disclose
Bianca Guedes Ribeiro, MD, Rio de Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Pedro Daltro, MD, Rio De Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Tatiana M. Fazecas, MD, Rio de Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Renata A. Nogueira, MD, Rio De Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Leise Rodrigues, Rio De Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose

PURPOSE
The objective of this study is to assess the maternal–fetal attachment (MFA) in six blind pregnant women by means three-dimensional (3D) physical models from 3D ultrasound and magnetic resonance imaging (MRI) scan data.

METHOD AND MATERIALS
We performed a prospective observational cross-sectional study with six blind pregnant women who performed 3D ultrasound and MRI exams to build 3D physical models for their fetuses. The MFA was assessed quantitatively by means a questionnaire of three questions, each one with a score ranging from 0 to 3. We considered MFA values > 7 to each pregnant woman. The descriptive data were expressed by mean ± standard deviation (SD). The pregnant women were included to this study after providing informed consent.

RESULTS
The mean (±SD) maternal age was 32 ± 2.7 years. The mean gestational age at 3DUS and MRI exams were 23.1 ± 3.7 and 21.3 ± 0.9 weeks, respectively. The mean of gestational age at delivery was 36.5 ± 4.7 weeks and all of them were cesarean sections. The mean newborn weight was 2615.8 ± 871.9 g and the gender was 50% both female and male. The MFA was quantitatively observed in all pregnant women, with maximum value (9) in all of them.

CONCLUSION
The MFA was quantitatively observed in all blind pregnant women using 3D physical models.

CLINICAL RELEVANCE/APPLICATION
The three-dimensional (3D) physical models from 3D ultrasound and magnetic resonance imaging (MRI) scan data were designed to
improve the maternal-fetal attachment (MFA) in blind pregnant women. The techniques described in this study can be applied at different stages of pregnancy and constitute an innovative contribution to research on fetal abnormalities. We believe that physical models will help in the tactile and interactive study of complex abnormalities in multiple disciplines. They may also be useful for prospective parents because a 3D physical model with the characteristics of the fetus should allow a more direct emotional connection to their unborn child.

**RC113-07 Perinatal Imaging of the Airway: Prenatal Imaging, with Postnatal Correlation, Including a Discussion of the EXIT (Ex-Utero-Intrapartum-Treatment) Procedure**

Sunday, Nov. 27 3:10PM - 3:30PM Room: S102AB

Participants
Carol E. Barnewolt, MD, Boston, MA (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand how to approach imaging of the fetal airway, using both sonography and MRI when pathology such as cervical teratomas, mediastinal masses, and tracheal atresia are expected to adversely effect airway development and function. 2) Learn how the imager can provide critical imaging support before, during, and after specialized deliveries, particularly the so-called EXIT (ex-utero-intra-partum treatment) delivery.

**ABSTRACT**
Sunday Afternoon Plenary Session

Sunday, Nov. 27 4:00PM - 5:45PM Room: Arie Crown Theater

Participants
Richard L. Baron, MD, Chicago, IL (Presenter) Nothing to Disclose

Sub-Events

PS12A  Report of the RSNA Research and Education Foundation

Participants
Burton P. Drayer, MD, New York, NY (Presenter) Advisor, Hologic, Inc

Abstract
The R&E Foundation exemplifies the 2016 Annual Meeting theme “Beyond the Image” as each and every year, R&E grant recipients pursue projects that go beyond radiologic sciences and touch every area of healthcare delivery and discovery. In the annual address of the R&E Foundation, Board of Trustees Chairman Burton P. Drayer, MD will report on this year’s record funding of 101 research and education awards totaling over $4 million, and why the need to support the Foundation is greater than ever. With a 30% funding rate of its applicants, the RSNA R&E Foundation provides a critical source of early support for so many young investigators and educators. It is through their awards that these individuals become engaged in research and excited about the prospect of pursuing a career in academic radiology. R&E grant recipients are poised to lead research efforts in the future that will extend beyond radiology into every area of patient care. To support these efforts and continue forth on this path, the Foundation launched Inspire – Innovate – Invest: The Campaign for Funding Radiology’s Future at RSNA 2014. The Campaign is moving steadily toward the Campaign goal of $17.5 million with the support of individuals, private practice groups and our corporate colleagues. For the future of radiologic research to belong to the next generation of radiologists, the specialty must put its financial support squarely behind its Foundation—our Foundation. During the meeting week, please take time to visit the R&E Foundation Booth, located on Level 3 of Lakeside Center to learn more about the 2016 grant recipients, their innovative projects and the many available opportunities to support the Foundation through our Campaign.

PS12B  Image Interpretation Session

Participants
Ronald J. Zagoria, MD, San Francisco, CA, (ron.zagoria@ucsf.edu) (Presenter) Nothing to Disclose
John Eng, MD, Cockeysville, MD (Presenter) Nothing to Disclose
Ellen M. Chung, MD, Bethesda, MD (Presenter) Nothing to Disclose
Nancy J. Fischbein, MD, Stanford, CA, (fischbein@stanford.edu) (Presenter) Nothing to Disclose
Christian W. Pfirrmann, MD, MBA, Forch, Switzerland (Presenter) Nothing to Disclose
Gautham P. Reddy, MD, Seattle, WA (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/

Gautham P. Reddy, MD - 2014 Honored Educator
Pediatric Monday Case of the Day

Monday, Nov. 28 7:00AM - 11:59PM Room: Case of Day, Learning Center

Participants
Ting Y. Tao, MD, PhD, Saint Louis, MO (Presenter) Nothing to Disclose
Luke L. Linscott, MD, Cincinnati, OH (Abstract Co-Author) Nothing to Disclose
Karen A. Caudill, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Asef B. Khwaja, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Jie C. Nguyen, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Shannon Farmakis, MD, Saint Louis, MO (Abstract Co-Author) Research Grant, General Electric Company; Research Grant, Guerbet

TEACHING POINTS
1) Recognize the importance of a multimodality approach in imaging pediatric patients. 2) Form appropriate differential diagnoses based on clinical information and imaging findings. 3) Recognize the clinical implications of diagnoses.
**LEARNING OBJECTIVES**

1) To describe the Zika epidemic spread. 2) To illustrate the appearance of congenital Zika both prenatal and postnatal using ultrasound, MRI, and CT. 3) To discuss developments from the infectious disease perspectives, including vaccine development.

**URL**

http://pubs.rsna.org/doi/full/10.1148/radiol.2016161584

**Participants**

Richard L. Robertson, MD, Boston, MA *(Moderator)* Nothing to Disclose

**Sub-Events**

**SPSH21A Introduction: Why is Zika from an Imaging Perspective So Different from other Congenital Infections**

Participants

Richard L. Robertson, MD, Boston, MA *(Presenter)* Nothing to Disclose

**SPSH21B Facing the Zika Epidemic in Brazil: The Epidemiology and the Role of the Radiologist**

Participants

Jacob Szejnfeld, MD, Sao Paulo, Brazil, (jacob.cura@gmail.com) *(Presenter)* Nothing to Disclose

Handout: Jacob Szejnfeld


**SPSH21C Multidomality Prenatal Imaging Findings of Congenital Zika Infection**

Participants

Patricia Oliveira-Szejnfeld, MD, Sao Paulo, Brazil, (patricia.fetal@gmail.com) *(Presenter)* Nothing to Disclose

**ABSTRACT**

**SPSH21D New Insights on Imaging and Pathological Correlations on Zika Infection**

Participants

Fernanda Tovar-Moll, MD, PhD, Rio de Janeiro, Brazil *(Presenter)* Nothing to Disclose

**SPSH21E Controlling Zika Virus: Update on Prevention Strategies and Vaccination**

Participants

Andrew Hale, MD, Boston, MA *(Presenter)* Nothing to Disclose

**SPSH21F Panel Discussion**

Participants
**RC213 - Overuse Injuries in the Pediatric Athlete**

Monday, Nov. 28 8:30AM - 8:50AM Room: N230B

Participants
Andrea S. Doria, MD, Toronto, ON (Moderator) Research Grant, Bayer AG; Research Grant, Novo Nordisk AS; Jennifer Stimec, MD, Toronto, ON (Moderator) Nothing to Disclose
Sarah D. Bixby, MD, Boston, MA (Moderator) Nothing to Disclose
Lynn A. Fordham, MD, Chapel Hill, NC, (fdh@med.unc.edu) (Moderator) Nothing to Disclose

**Sub-Events**

**RC213-01 Overuse Injuries in the Pediatric Athlete**

Monday, Nov. 28 8:30AM - 8:50AM Room: N230B

Participants
Jennifer Stimec, MD, Toronto, ON (Presenter) Nothing to Disclose

**RC213-02 Novel MRI Techniques for Early Detection of Stress Injury of the Distal Radial Physis in Young Gymnasts**

Monday, Nov. 28 8:50AM - 9:00AM Room: N230B

Participants
Laura S. Kox, MD, Amsterdam, Netherlands (Presenter) Nothing to Disclose
Valentina Mazzoli, MSc, Amsterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Aart N. Nederveen, PhD, Amsterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Jos Oudeman, MD, Amsterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Anne M. Mol, Amsterdam, Netherlands (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To improve the early detection of radial physeal stress injury using MRI and to provide quantitative measures useful for classification and prognosis.

**METHOD AND MATERIALS**
15 gymnasts (10 with wrist pain and 5 without wrist pain) and 1 non-gymnast control, aged 12-17 years, were included for the first analysis of this ongoing study. All participants underwent radiography and MRI of the wrist. MRI was performed on a 3T scanner and included coronal PD images with and without fat saturation, as well as 3D WATSc and T1-weighted and T2-weighted Dixon series. Besides evaluation of appearance of the physis by an experienced musculoskeletal radiologist, 3D reconstructions of the physis were created using ITK-SNAP. The water fraction in the adjacent metaphyseal bone was quantified using Dixon water-only images. MR images of symptomatic gymnasts were compared with those of asymptomatic gymnasts and of non-gymnast controls, matched on skeletal age and sex.

**RESULTS**
The median calendar ages and skeletal ages were 13 years (range 12-15 years) and 13 years (range 11.5-15 years) for symptomatic gymnasts and 15 years (range 12-17 years) and 14 years (range 11.5-18 years) for asymptomatic gymnasts, respectively. The initial results show that the median volume of the physis was 1216 mm³ (range 680-3045 mm³) in symptomatic gymnasts and 1199 mm³ (range 616-2370 mm³) in asymptomatic gymnasts (p>0.05). The median water fraction in the metaphysis was 40% (range 21-56%) in symptomatic gymnasts and 33% (range 10-49%) in asymptomatic gymnasts (p>0.05). Various abnormalities were identified in both symptomatic and asymptomatic gymnast MR images, such as metaphyseal intrusions and disruption of the physeal layers, that were not recognized on radiographic images.

**CONCLUSION**
Subtle changes due to early physeal stress injury may be better visible on MRI. Initial results of this study show that physeal volume and metaphyseal water fraction measurement are promising and non-invasive methods to quantify physeal stress injury of the wrist.

**CLINICAL RELEVANCE/APPLICATION**
This study emphasizes the importance of MRI in the early diagnosis of physeal stress injury and shows the utility of a broadly applicable, easy to implement MRI protocol in this diagnostic process.

**RC213-03 Ultrasound Assessment of Adaptive and Overuse Changes in the Fingers of Adolescent Competitive Rock Climbers**

Monday, Nov. 28 9:00AM - 9:10AM Room: N230B

Participants
Kathryn Garcia, Los Altos, CA (Presenter) Nothing to Disclose
Karim Kuhn, MD, Stanford, CA (Abstract Co-Author) Nothing to Disclose
Diego Jaramillo, MD, MPH, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Erika Rubesova, MD, MSc, Stanford, CA (Abstract Co-Author) Researcher, Siemens AG
Skeletal Maturation and Stress Injury of the Growth Plate at the Base of the Coracoid Process: MRI Features

PURPOSE
Assess, utilizing MRI, the normal maturation and stress injury to the coracoid process and bipolar growth plate, at the interface with the underlying scapula. To the best of our knowledge this has not yet been described in the literature.

METHOD AND MATERIALS
The study was divided into 2 parts: A. Maturation of the coracoid process and bipolar growth plate. Retrospective review of 182 consecutive shoulder MRIs in 160 children without clinical or MRI evidence of coracoid pathology (107 boys, 53 girls, ages 0 to <5, n=36, 5 to <10, n=25, 10 to <15, n=67, and 15 to 18, n=54). The studies were reviewed with special attention to the development and fusion of the coracoid to the scapula, via the bipolar growth plate. B. Growth plate injuries. Retrospective review of shoulder MRIs with coracoid growth plate disturbance (7 boys, 1 girl, mean age 15).

RESULTS
A. Maturation of the coracoid process and bipolar growth plate. At 0 to < 5 years the cartilaginous coracoid precursor conformed to the shape of a mature coracoid process, with a small oval primary ossification center within it. The bony margins at the coracoid-scalapular interface transformed from smooth to irregular with advancing age. At 5 to < 10 years of age, a more distinct, undulating, bipolar growth plate developed. Complete closure of the bipolar plate was observed as early as 11 years of age and was noted in 41% of patients by age 14 and in 86% of 15 to 18 year olds. B. Growth plate injuries. The 8 patients with growth plate stress injuries included 2 patients with neuromuscular disorders and 6 patients with sports related symptoms. The growth plate demonstrated widening, irregularity and increased signal, with surrounding soft tissue and opposing bony marrow edema and hypertrophy.

CONCLUSION
MR imaging of normal maturation as well as stress injury of the base of the coracoid is crucial for accurate imaging diagnosis. Injury to the base of the coracoid, while uncommon, should be considered when assessing adolescents with shoulder symptomatology.

CLINICAL RELEVANCE/APPLICATION
Radiologists should be aware of the normal MRI appearance of coracoid maturation and coracoid stress injury to differentiate between normal development and pathology.

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/
PURPOSE

Our previous study has clarified injury of the medial collateral ligament (MCL), which does not frequently occur in youth baseball players showed unexpectedly high at 41.9% in MRI elbow screening for healthy youth baseball players. The purpose of this study was to clarify the clinical interpretation of 'asymptomatic MCL injury of the elbow in youth baseball players observed on MRI' by comparing the results of standard clinical orthopedic examinations including palpation and US.

METHOD AND MATERIALS

62 players from 9 to 13 years were recruited. MRI was performed using a 0.2 T open-type MRI. MCL injury was diagnosed by criterion 1-6. The laterality of the joint space opening by valgus stress (laterality of cleft between articulars) was calculated by US, which represented MCL function. MCL tenderness, Moving valgus test, and Milking test were also performed as physical examinations. The laterality of the joint space opening was compared between subjects with MCL injury on MRI and subjects without MCL injury by using t-test. MRI findings and physical findings were analyzed with the χ2 and Fisher's exact test.

RESULTS

34 subjects (53.1%) were diagnosed as MCL injury on MRI. The mean laterality of the cleft between articulations was 0.29 mm in the subjects with MCL injury and 0.08 mm in the subjects without MCL injury on MRI without statistical differences (P=0.16). As for the coefficient between MRI findings and physical findings, Milking test and Criterion 1 (Φ coefficient=0.27, P=0.048) and 4 (Φ coefficient=0.39, P=0.004) showed a weak correlation.

CONCLUSION

'Adaptation' refers to normal MCL thickening on MRI in a baseball player after epiphyseal closing. We hypothesized asymptomatic MCL injury in youth baseball players on MRI might represent the transition period to adaptation because ligament function was normal. However, some subjects showed weak correlations between positive physical findings and positive MCL injury on MRI. These might become a 'symptomatic' MCL injury in the near future. We conclude 'asymptomatic MCL injury in youth baseball players on MRI' includes the group of changing to adaptation, and the group of changing to symptomatic MCL injury (pre-injury) group (Fig).

CLINICAL RELEVANCE/APPLICATION

'asymptomatic MCL injury of the elbow in youth baseball players on MRI' is not always need to be treated but careful observation is needed.

PURPOSE

To evaluate ultrasonographic features of pediatric trigger fingers and classify the types based on the features.

METHOD AND MATERIALS

Between August 2014 and March 2016, 17 patients (age range, 10111 months) with clinical suspicion of pediatric trigger finger underwent ultrasound examination. (2 patients; both hands; 14 patients; unilateral hand [right: 13, left: 1]). Ultrasound images were evaluated for location, shape, echogenicity, discernibility of A1 pulley, thickness of flexor tendon and volar plate, thickness ratio (lesion/normal side), and dynamic study (gliding limitation). All lesions were compared with the other hand as a normal range. For statistical analysis, independent-sample t-test was performed.

RESULTS

There were 18 trigger fingers in 16 patients (1st finger: 16, 3rd finger: 2). Pediatric trigger finger was divided into two types depended on the location of abnormal tendon morphology by A1 pulley – proximal and distal type. There were 4 distal types (1st finger: 2, 3rd finger: 2) and 14 proximal types. The tendon showed wavy contour (type 1, 6 cases), focal thickening (type 2, 8 cases), or combined (type 3, 3 cases). In all cases, there was hypoechoic infiltration. A1 pulley was readily distinguishable in proximal type. But in distal type, it might be distinguishable or not. The mean thickness of tendon (2.74±0.4, 1.94±0.3 and 38±22%, p<0.000) and volar plate (1.54±0.3, 1.04±0.2 and 41±23%, p<0.002). During dynamic study, there were 3 poorly cooperative patients. 10 patients displayed severe gliding limitation and 3 patients displayed moderate.

CONCLUSION

Ultrasound is a useful modality to diagnose and classify the pediatric trigger fingers. The difference in the mean thickness of tendon of both hands was seen commonly. The pathophysiology of pediatric

Participants
Chun-Geun Lim, Daegu, Korea, Republic Of (Presenter) Nothing to Disclose
Jae Hyuck Yi, MD, Daegu, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
trigger fingers is not clear. But based on result from test, we presumed that the thickening of A1 pulley was causative of pediatric trigger fingers in distal type. In proximal type, the disproportionate growth of space including flexor tendon, volar plate and A1 pulley was postulated as the cause.

**CLINICAL RELEVANCE/APPLICATION**
Ultrasound may be instrumental in the diagnosis and classification of the pediatric trigger fingers and is recommended when the cause of contracture of fingers in pediatrics is uncertain.

**RC213-07  Imaging of Tarsal Coalition**

Monday, Nov. 28 9:40AM - 10:00AM Room: N230B

Participants
Sarah D. Bixby, MD, Boston, MA (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
1) Demonstration of the various types of tarsal coalition in children. 2) Discussion of the anatomy of the subtalar joint with respect to the location of various forms of subtalar coalition. 3) Description and demonstration of a variant of subtalar coalition, the posteromedial subtalar coalition, and discussion around its importance.

**ABSTRACT**

**RC213-08  Imaging of Osteochondritis Dissecans**

Monday, Nov. 28 10:20AM - 10:40AM Room: N230B

Participants
Jonathan D. Samet, MD, Chicago, IL, (jsamet@luriechildrens.org) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
1) Identify imaging features of osteochondritis dissecans (OCD), with a focus on MRI. 2) Recognize the spectrum of findings between stable and unstable lesions. 3) Identify the varying postoperative appearances after surgical intervention.

**RC213-09  Fishtail Deformity of the Distal Humerus; Be Aware of the Associated Osteochondritis Dissicans of the Capitellum**

Monday, Nov. 28 10:40AM - 10:50AM Room: N230B

Participants
Matthew R. Wanner, MD, Carmel, IN (Presenter) Nothing to Disclose
Boaz Karmazyn, MD, Indianapolis, IN (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To determine the association of osteochondritis dissicans of the capitellum in patients with fishtail deformity of the distal humerus (FTD).

**METHOD AND MATERIALS**
Using the radiology information system, we identified all patients (<18 years) with FTD (2002-2016). Imaging were reviewed for presence of OCD of the capitellum (OCD). Medical charts were reviewed for type of initial injury, time until presentation with FTD, and presenting symptoms.

**RESULTS**
We identified 7 cases of FTD (3 females). Age at diagnosis ranged from 9.7-14.4 years (mean 12.5 years). 5 patients had a known prior fracture, all supracondylar humerus fractures; type-3 (n=3) and type-1 (n=1). They presented on average 8 years (5.2- 10.9 years) after the fracture. Symptoms at diagnosis included either limited range of motion (n=2), pain (n=3), or both pain and limited range of motion (n=2). Five (71%, 5/7) of the patients were found to have OCD. Only 2 (40%, 2/5) cases were diagnosed with radiographs, 3 were diagnosed with MRI and 1 with CT. Two patients had surgery to treat the OCD; drilling (n=1) and osteoplasty, microfracture, and removal of loose body (n=1).

**CONCLUSION**
OCD of the capitellum is often present in patients with FTD, but may be occult on radiographs.

**CLINICAL RELEVANCE/APPLICATION**
Our series is the first to show a high prevalence of OCD of the capitellum in patients with fishtail deformity, suggesting MRI should be considered even in the absence of OCD on radiographs.

**RC213-10  MRI Findings in Non-traumatic Causes of Pediatric Knee Pain**

Monday, Nov. 28 10:50AM - 11:00AM Room: N230B

Participants
Sonja Kinner, MD, Madison, WI (Presenter) Nothing to Disclose
Richard Kijowski, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Jie C. Nguyen, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To determine the frequency and spectrum of knee joint pathology on MRI in pediatric patients with knee pain who have no history of acute trauma.
METHOD AND MATERIALS
A retrospective review of imaging archive and medical records systems was used to identify 150 consecutive patients between 6 and 18 years with knee pain who underwent a MRI study and had no history of acute trauma, arthritis, or neoplasm. All studies were retrospectively reviewed separately by a pediatric musculoskeletal radiologist and a musculoskeletal radiologist with any discrepancies settled through a consensus read. The frequency and spectrum of knee joint pathology was determined. T-tests were used to compare the age, body mass index (BMI) and referring physician with and without each type of knee joint pathology.

RESULTS
Knee joint pathology was present in only 69 of 150 patients (46%). Patients with no pathology were referred by an orthopedic specialist in 52% and primary care provider in 57%. The spectrum of pathology included effusion in 25, superior lateral Hoffa’s fat pad edema in 18, bone marrow edema lesion in 10, cartilage lesion in 10, Osgood-Schlatter disease in 8, osteochondritis dissecans (OCD) lesion in 7, patellar tendinopathy in 7, Baker’s cyst in 7, discoid meniscus in 5, meniscal tear in 5, and edematous bipartite patella in 2 patients. There was no significant difference for age and BMI with and without each type of knee joint pathology. Cartilage lesion, OCD lesion, and edematous bipartite patella were more likely to be referred from an orthopedic specialist. Otherwise, there is no difference in the positive knee pathology rates between those referred by orthopedic specialists and primary care providers (48% versus 43%, respectively). Seven patients (10%) underwent subsequent surgical intervention (3 with OCD lesions and 4 with meniscal tears).

CONCLUSION
Although almost half of the pediatric patients with knee pain and no history of acute trauma showed knee joint pathology on MRI, only 10% of them required subsequent surgical intervention. Our results raise questions regarding the need for immediate use of MRI for assessing knee pain in those patients.

CLINICAL RELEVANCE/APPLICATION
MRI in children with non-traumatic knee pain shows pathologies in less than half of the patients and only 10% of them require surgical intervention. MRI therefore might be overused for this indication.

RC213-11  Unexplained Fractures in Infants and Young Children: (Ir)relevance of Serum Vitamin D

Participants
Elaine Pang, Sheffield, United Kingdom (Abstract Co-Author) Nothing to Disclose
Sujatha Gopal, Sheffield, United Kingdom (Abstract Co-Author) Nothing to Disclose
Alan Spripp, MBChB, FRCR, Sheffield, United Kingdom (Abstract Co-Author) Nothing to Disclose
Amaka C. Offiah, MBBS, PhD, Sheffield, United Kingdom (Presenter) Speaker, Alexion Pharmaceuticals, Inc; Speaker, BioMarin Pharmaceutical Inc; Speaker, Informed Research and Training Ltd; Travel support, Alexion Pharmaceuticals, Inc; Travel support, BioMarin Pharmaceutical Inc; Travel support, Informed Research and Training Ltd; Director, OCIN Ltd

PURPOSE
To test the hypothesis that low serum total 25-hydroxyvitamin D (VitD) predisposes children aged ≤2 years to fractures, even when there is no overt rickets.

METHOD AND MATERIALS
A retrospective single centre study. The hospital database was interrogated for children ≤2 years who had VitD measured between 01/01/10 and 12/31/14 AND at least 1 skeletal radiograph within 2 weeks of this. Blinded to VitD, 2 observers independently scored the anonymised full skeletal surveys (SS) and individual radiographs (XR) for fracture (yes/no), bone density (reduced/normal) and rickets (Thacher score 0/≥1). Discrepancies were arbitrated by a third observer in a final consensus read. Analyses (SPSS V22.0 for Mac, p ≤ 0.05) included descriptive statistics (prevalence of clinical and radiographic parameters), Cohen’s kappa (interobserver reliability for radiographic parameters) and binomial logistic regression (likelihood of fracture based on VitD, bone density or Thacher score). Further analyses (calcium/phosphate/ethnicity/breast fed) are ongoing. Research and Development approval was granted; Ethics Committee approval was waived.

RESULTS
388 children, mean age 9 months (0-24), 167 SS and 239 XR were included. Mean VitD was 67nmol/L (<6-778nmol/L); 77 children (20%) were VitD deficient (<25nmol/L); 78 (20%) insufficient (25.1-50nmol/L); 69 (18%) had at least one fracture; 39 (10%) reduced bone density; 22 (6%) Thacher ≥1. Interobserver kappa was very high for fracture (0.915) and Thacher score (0.842) and good for bone density (0.706). Logistic regression (Table) showed that radiographic bone density was the only statistically significant variable predictive of presence of fracture, with an odds ratio of 4.61 (95%CI 2.05-10.38). The odds ratio for VitD level was 1.02 (0.99-1.06).

CONCLUSION
Observer reliability for diagnosing reduced bone density and rickets from radiographs ranges from good to very high. This study provides objective evidence to support mainstream thinking that in the absence of radiographic evidence of reduced bone density and/or rickets, a low VitD should not be interpreted as the cause of unexplained fractures in a child below 2 years of age.

CLINICAL RELEVANCE/APPLICATION
In children aged ≤2 years with unexplained fractures, whose radiographs reveal normal bone density and/or a Thacher score of zero, serum VitD level is irrelevant to the etiology of the fractures.

RC213-12  The Assessment of IDEAL-IQ Technique in Quantifying the Fatty Infiltration of Leg Muscles in Duchenne Muscular Dystrophy

Participants
Jing Du, MD, Beijing, China (Presenter) Nothing to Disclose
T2 mapping has the potential to monitor the progression of cartilage damage in hemophilia and help to improve future treatment options. So T2 mapping has the potential to monitor the progression of cartilage damage in hemophilia and help to improve future treatment options.

**CLINICAL RELEVANCE/APPLICATION**

T2 mapping has the ability of detecting early cartilage degeneration prior to morphologic changes in pediatric patients with hemophilia. So T2 mapping has the potential to monitor the progression of cartilage damage in hemophilia and help to improve future treatment options.

**Handout:** Ningning Zhang

**METHOD AND MATERIALS**

One hundred and seventy three boys (ranged from 2 to 13 years old, medium 6 years) with genetically confirmed DMD were recruited. Imaging was performed on a 3.0-T MR scanner. A quantitative water-fat separation method (IDEAL-IQ) was used to image leg muscles. Images of the IDEAL-IQ were processed on an GE ADW4.6 workstation to obtain the thigh muscle involvement pattern. Spearman correlation test was used to evaluate the correlation between FF and clinical data. The Kruskal-Wallis H test was used to compare the thigh muscle FF among three gene mutation groups.

**RESULTS**

The gluteus maximus was the most severely infiltrated muscle (the involvement frequency 100%, mean FF 28.6%±20.6%), followed by the adductor magnus (the involvement frequency 89%, mean FF 22.6%±22.5%). The least affected muscle were the adductor longus and gracilis, with the involvement frequency 10%-15%, mean FF less than 6.5%. FF value exhibited positive correlation with patients age (r=0.76, P<0.05). The FF value showed a significant positive correlation with the Brooke score (r=0.80, P<0.05). Negative correlation was obtained between FF value and muscle force (r=-0.68, P<0.05) and negative correlation was also obtained between FF value and CK values (r=-0.33, P<0.05). There was no significant differences of muscle fatty infiltration level among the three gene mutation forms.

**CONCLUSION**

IDEAL-IQ technique could be used to assess thigh muscle fatty infiltration level in DMD patients. The muscle fatty infiltration level evaluated by MRI was correlated with the clinical data.

**METHOD AND MATERIALS**

Fifteen clinically diagnosed hemophilia boys aged 8-17 years (12.2±3.5 years) with hemophilia A were involved in this study, with the approval of local IRB. Seven knee joints and eight ankles were scanned by a Philips Achieva TX 3.0T MR with a 8 channel knee coil and a head coil for ankle. Routine MR imaging protocol included T1W, T2W, T2/FFE, T2 SPAIR, PDW/TSE and T1 3D-WATS. The outline of cartilage was drawn manually by two experienced radiologists, then the area was divided into anterior(A), central(B) and posterior(C) regions automatically by the commercial software in the Intellispace portal. Statistical Package 17.0 was used for data analysis. The Kappa index (k) was calculated to test the degree of agreement between the two radiologists of the measurement results. Agreement was considered insignificant if k< 0.20, weak if between 0.21 and 0.40, moderate if between 0.41 and 0.60, strong if between 0.61 and 0.80 and very strong if ≥0.80. P ≤ 0.05 was considered significant

**RESULTS**

The cartilage of T2 relaxation time of distal femur cartilage, proximal tibia, distal tibia talus surface, and the average T2 relaxation time of whole layer cartilage and the normal reference, please see fig.1. The degree of correlation in the measurement of the two radiologists was very strong (k= 0.84, p<0.05). T2 relaxation time of both knee distal femur and proximal tibia articular cartilage were higher than those of healthy children (4).There were four morphologically normal joint cartilage in the routine MR protocol where their T2-mapping showed visible unevenness, out of these two cases were ankle (fig. 2) and the other two were knees.
**Non-Invasive Assessment of Synovitis in Juvenile Idiopathic Arthritis: DWI is Powerful as Potential Biomarker**

**Monday, Nov. 28 11:30AM - 11:40AM Room: N230B**

**Participants**
Anouk M. Barendregt, BSc, MSc, Amsterdam, Netherlands **(Presenter)** Nothing to Disclose  
Robert Hemke, MD, PhD, Amsterdam, Netherlands **(Abstract Co-Author)** Nothing to Disclose  
Charlotte M. Nusman, MSc, Amsterdam, Netherlands **(Abstract Co-Author)** Nothing to Disclose  
Cristina Lavini, DPhil, Amsterdam, Netherlands **(Abstract Co-Author)** Nothing to Disclose  
Taco Kuijpers, MD, PhD, Amsterdam, Netherlands **(Abstract Co-Author)** Nothing to Disclose  
Mario Maas, MD, PhD, Utrecht, Netherlands **(Abstract Co-Author)** Nothing to Disclose

**PURPOSE**
To compare two imaging biomarkers, the already established dynamic-contrast-enhanced MRI (DCE) and the new non-invasive diffusion-weighted imaging (DWI), in quantitatively assessing synovial inflammation in patients with juvenile idiopathic arthritis (JIA).

**METHOD AND MATERIALS**
35 JIA patients underwent MRI of the knee on a 1.0T scanner. In addition to standard sequences an axial T1W DCE and axial T2W SE EPI DWI (b-values 0, 50, 600) were acquired. DWI was post-processed into apparent diffusion coefficient (ADC)50-600 maps to eliminate signal intensity from vascular flow. To quantify signal from the synovium on DCE and DWI, regions of interest (ROI) were manually drawn in synovium on the DCE images and secondly on the ADC map using an in-house developed Matlab program (Dynamo). Collected DCE perfusion parameters include maximum enhancement (ME), slope of enhancement (slope), time-to-peak (TTP) and % of time-intensity curves (TIC) 2-5. A subset of patients (n=5) was measured twice to check consistency of ROI drawing. Patients were subdivided based on the validated JIA MRI score (JAMRIS), a score of 0 for synovial hypertrophy corresponds to inactive disease (n=16), a score ≥1 to active disease (n=19). Mann-Whitney U was used for testing DCE and DWI parameters between patients with active and inactive disease, the intraclass correlation coefficient (ICC) was used to assess reliability of ROI drawing and Spearman’s rank for correlation between DCE and DWI parameters.

**RESULTS**
High correlations for all parameters (ICCs 0.89-0.99, p<0.05) were found when assessing the twofold ROI placements. Correlation between ME and ADC was good (r 0.62, p=0.000), other correlations were not significant. ME, slope, TTP, % TIC 2-5 (all p<0.05) as well as ADC were significantly different in the active vs. the inactive patients with median ADC-active 1.49x10^-3 mm^2/sec, median ADC-inactive 1.26 x10^-3 mm^2/sec, p=0.003.

**CONCLUSION**
Similar to DCE parameters, non-invasive DWI-derived ADC can differentiate active JIA from inactive JIA in the knee using a ROI drawing method that proved to be uniform. Diffusion in inflamed synovium is increased compared to non-inflamed synovium.

**CLINICAL RELEVANCE/APPLICATION**
Active JIA could be differentiated from inactive JIA with DWI; this could make contrast-enhanced MRI superfluous in the future, making MRI more patient-friendly and feasible in this young population.

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**Pediatric Temporomandibular Joint Imaging**

**Monday, Nov. 28 11:40AM - 12:00PM Room: N230B**

**Participants**
Arthur B. Meyers, MD, Orlando, FL **(Presenter) Author with royalties, Reed Elsevier**

**Active Handout:** Arthur Benjamin Meyers  

**LEARNING OBJECTIVES**
1) List pathology that occurs in the pediatric temporomandibular joint. 2) Identify the normal anatomy of the temporomandibular joint on MRI. 3) Detect and describe pathology in the temporomandibular joint on MRI.
**Fetal MRI Findings of Congenital Diaphragmatic Hernia Suggestive of a Hernia Sac: Preliminary Observations**

**PURPOSE**
The prognosis for congenital diaphragmatic hernia (CDH) is highly variable; it may be better for CDH with a hernia sac. No diagnostic criteria for the identification of a sac by prenatal MRI have been established. We studied prenatal MR findings suggestive of a hernia sac in fetuses with CDH.

**METHOD AND MATERIALS**
This study included 14 pregnant women who underwent fetal MRI during the last 4 years because fetal ultrasound suggested CDH. The mean gestational age was 34.8 weeks (range 32 - 40 weeks). Two board-certified radiologists visually evaluated the affected side of the lung on fetal MRI scans and assigned a grade by consensus (grade A = more than 50% of the thoracic cavity is occupied by the lung, grade B = more than 50% of the thoracic cavity is occupied by the hernia, grade C = no lung is identified in the thoracic cavity). They also recorded the boundary line between the affected side of the lung and the hernia as smooth or rough. We recorded the presence of a hernia sac and cranial migration of the liver and of survival and death using postnatal reports.

**RESULTS**
Of 14 fetuses, 2 were with- and 12 without a hernia sac; 8 were with- and 6 without cranial liver migration. Seven survived including both with CDH and hernia sac. The grade was A and the boundary lines were smooth. Five fetuses without a hernia sac survived. The grade was B (n=5) or C (n=7), and the boundary was rough. All fetuses with grade C died (n=7). Of the 8 fetuses with cranial migration of the liver, only one fetus with a hernia sac survived.

**CONCLUSION**
In fetuses with MRI findings of CDH with a hernia sac the volume on the affected side of the lung was larger and the boundary between the affected side and the hernia was smooth.

**CLINICAL RELEVANCE/APPLICATION**
In fetuses with CDH, a large volume on the affected side of the lung and a smooth boundary with the hernia on fetal MRI scans suggests the presence of a hernia sac and a better prognosis.
patterns were subdivided into eleven subgroups. The anatomic classification of coronary arteries in complete transposition of great arteries were recorded, and the ratio of descriptive statistics was used according to categorical variable data.

**RESULTS**

All the origin and course of the coronary arteries could be clearly displayed on MSCT. Of 367 patients with D-TGA, 209 cases (56.95%) were normal course (type I), 138 cases (37.60%) were looping course (type II), 16 cases (4.36%) were intramural course (type III), and 4 cases (1.09%) were miscellaneous course (type IV). In looping course, the posterior looping (type IIA), anterior looping (type IIB) and double looping (type IIC) were found in 63 cases (17.17%), 30 cases (8.17%) and 45 cases (12.26%), respectively. The ratios of the anatomic classification of looping courses were IIA-1 44(11.99%), IIA-2 19(5.18%), IIB-1 12(3.27%), IIB-2 8(2.18%), IIB-3 10(2.72%), IIC-1 25(6.61%), IIC-2 17(4.63%), IIC-3 3(0.82%)

**CONCLUSION**

MSCT is an effective technique to visualize and classify the coronary arteries in patients with D-TGA. And it is helpful for successful transfer of the coronary arteries and reducing the rate of coronary events after operation.

**CLINICAL RELEVANCE/APPLICATION**

MSCT is an effective technique to visualize and classify the coronary arteries in patients with D-TGA, and it is helpful for successful transfer of the coronary arteries and reducing the rate of coronary events after operation.

**PD212-SD-MOA3**  
**Assessment of Kinetic Energy and Vorticity in the Pulmonary Artery in Pediatric Patients with Repaired Tetralogy of Fallot Using 4D Flow MRI**

**Participants**

Julio Garcia, BEng, PhD, Calgary, AB (Presenter) Nothing to Disclose
Silvia Hidalgo-Tobon, PhD, Mexico City, Mexico (Abstract Co-Author) Nothing to Disclose
Benito de Celis Alonso, PhD, Puebla, Mexico (Abstract Co-Author) Nothing to Disclose
Manuel Obregon, MD, Mexico City, Mexico (Abstract Co-Author) Nothing to Disclose
Porfirio Ibanez, MD, Mexico City, Mexico (Abstract Co-Author) Nothing to Disclose
Julio Erdmenger, MD, Mexico City, Mexico (Abstract Co-Author) Nothing to Disclose
Pilar Des-Suarez, MD, Mexico City, Mexico (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Flow alterations in the pulmonary artery (PA) of patients with repaired tetralogy of Fallot (rTOF) may be linked with the expending of kinetic energy (KE) and vortical flow patterns as measured by 4D flow MRI. The aim was to investigate the impact of flow alterations in the PA and its association with KE and vorticity.

**METHOD AND MATERIALS**

15 patients with rTF (age=9±6 yrs, 6 females) underwent thoracic 4D flow MRI. PA was segmented from the 4D flow derived angiogram to mask the velocity field (v) which was used to calculate KE (KE=1/2×rho×v2, rho=1.06 g/mL), and vorticity (ω=curl(v)). Maximum intensity projection (MIP) was calculated for flow velocity, KE, and vorticity. Peak velocity (PV), maximal flow (Qmax), and mean flow (Qmean) were extracted from the main (MPA), right (RPA), and left (LPA) PA. Volumetric median of KE was used to divide the cohort into low and elevated KE. The association of KE at MPA, RPA, and LPA with other flow parameters was assessed by Pearson's correlation. Comparison between KE groups was performed by Mann-Whitney test.

**RESULTS**

Maximal and mean KE in the PA showed a correlation with PV (r=0.47,p<0.05; r=0.38,p<0.05), Qmax (r=0.49,p<0.05; r=0.45,p<0.05), and Qmean (r=0.49,p<0.05; r=0.44,p<0.05). Both maximal and mean KE were originated from the RPA where associations with PV (r=0.87,p<0.001; r=0.84,p<0.001), Qmax (r=0.77,p<0.001; r=0.75,p<0.001), and Qmean (r=0.69,p<0.05; r=0.69,p<0.05) were more important. Maximal KE was 59% higher in the MPA than in the RPA, as well as mean KE with 33% increment. Velocity, KE, and vorticity MIPs (Fig 1) showed elevated KE and vortical flow at the pulmonary bifurcation. PA mean and median KE were associated with mean vorticity (r=0.78,p<0.001 and r=0.44,p<0.001). Low and elevated KE differences were found for mean KE (0.029±0.019 mJ vs. 0.047±0.022 mJ,p=0.02), median KE (0.041±0.012 mJ vs. 0.07±0.02 mJ,p<0.001), and mean vorticity (0.032±0.008 1/s vs. 0.037±0.006 1/s,p<0.05).

**CONCLUSION**

Maximal and mean KE in the RPA were associated with flow hemodynamic parameters, whereas in the MPA and LPA were not. This was explained by flow distribution within the PA and the elevated energy dissipation at PA bifurcation.

**CLINICAL RELEVANCE/APPLICATION**

The flow distribution in the pulmonary artery of patients with repaired tetralogy of Fallot may be linked with the expend of kinetic energy and vorticity. Alterations in flow, kinetic energy, and vorticity may guide the clinical survey of this population.

**PD213-SD-MOA4**  
**MRI and Clinical Assessment in Juvenile Idiopathic Arthritis: The Discrepancy Explored: Looking into the Confusing Group of Clinically Inactive Patients with Synovitis on MRI**

**Participants**

Charlotte van Gulik, MD,MSc, Amsterdam, Netherlands (Presenter) Nothing to Disclose
Mindy Welsink-Karskies, Haarlem, Netherlands (Abstract Co-Author) Nothing to Disclose
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Dieneke Schonenberg-Meijema, Amsterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Merijn van den Berg, Amsterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Mario Maas, MD, PhD, Utrecht, Netherlands (Abstract Co-Author) Nothing to Disclose
Taco Kuipers, MD, PhD, Amsterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
PURPOSE

Synovitis, as a sign of active, ongoing disease activity, is seen on MRI in up to 50% of clinically inactive Juvenile Idiopathic Arthritis (JIA) patients. This study evaluates patient characteristics and disease activity parameters in a cohort of clinically inactive JIA patients, both with and without synovitis seen on MRI, in order to get more insight in the observed discrepancy.

METHOD AND MATERIALS

We prospectively enrolled 52 clinically inactive JIA patients (median age 13.3 years, 63.5% female). Patients were divided into two groups; 1: clinically inactive disease without synovitis on MRI and 2: clinically inactive patients with synovitis on MRI. The Juvenile Arthritis MRI Scoring (JAMRIS) system was used to evaluate synovial thickening. A JAMRIS score of > 0 is interpreted as synovitis. Patient characteristics and disease activity parameters (physical and laboratory examination) were gathered to determine clinical inactivity. Patient characteristics and disease activity parameters were compared between both groups.

RESULTS

Subclinical synovitis on MRI was present in 18 clinically inactive patients (34.6%). The age was significantly lower for the patients with subclinical synovitis versus patients without subclinical synovitis (p=0.008, median 10.75 versus 14.40). Concerning other patient characteristics and disease activity parameters, no significant differences were observed between both groups.

CONCLUSION

Subclinical synovitis on MRI was present in nearly 35% of the clinically inactive JIA patients. These patients were significantly younger than patients without subclinical synovitis. To not underestimate this alarming signal of synovitis in young children, younger patients could benefit from frequent monitoring of disease activity using MRI.

CLINICAL RELEVANCE/APPLICATION

In clinically inactive JIA patients synovitis is often seen on MRI, especially in younger patients. To optimize treatment regimens, frequent monitoring of synovitis using MRI is recommended.

TEACHING POINTS

Ultrasound is preferred initial imaging modality for the evaluation of neonatal adrenal lesions. Horseshoe adrenal is associated with asplenia (most common), neural tube defects and renal anomalies. Discoid adrenal is typically associated with absent kidneys. Adrenal hemorrhage maybe secondary to trauma or renal vein thrombosis (typically in neonate). Follow up is essential to exclude adrenal neuroblastoma. "Cerebriform morphology" characterized by abnormal contour and thickness of adrenal glands is specific for congenital adrenal hyperplasia. It may be difficult to distinguish between ganglioneuroma from neuroblastoma on imaging, in absence of metastatic disease.

TABLE OF CONTENTS/OUTLINE


TEACHING POINTS

1. Recognizing the spectrum of cloacal malformation in children2. Understanding the characteristic imaging and best way to approach to differentiate types of cloacal malformation.

TABLE OF CONTENTS/OUTLINE

1. Introduction
   _ Clinical findings: incidence and symptoms
   _ Normal Anatomy: embryology
   _ Classification
   _ Associated anomalies
2. Management of Cloacal Malformation
   - Type of malformation
   - Imaging techniques
   - Management strategies
   - Treatment methods
3. Various Cases
   A. Long common channel
   B. Short common channel
   C. Urogenital sinus anomaly

SUMMARY
Cloacal malformation is a congenital anomaly in pediatric patients that presents various anatomical dysarrangements. The prompt surgical correction is necessary for improving clinical outcomes, and the complex anatomy could be well demonstrated by the imaging modalities; voiding cystourethrogram, colostogram, ultrasound, computed tomography, and magnetic resonance imaging. Because the management for each lesion is different, the imaging findings of various conditions could be valuable information to make an accurate management. In this presentation, imaging findings and diagnostic strategies for cloacal malformation will be demonstrated.

TEACHING POINTS
Given the paucity of research on this field, a diagnostic approach to vascular anomalies may become a challenge for many physicians. Therefore, the aim of this work is to propose a practical diagnostic decision guide to pediatric vascular anomalies, based on the current ISSVA Classification and by illustrating with clinical cases from our radiology department.

TABLE OF CONTENTS/OUTLINE
Twenty vascular anomalies clinical cases & differential diagnosis flow chart.
Lunch & Learn: Transitioning to DR, Clinical and Financial Benefits Beyond Preventing Reimbursement Penalties: Supported by Fujifilm (invite-only)

Monday, Nov. 28 12:30PM - 1:30PM Room: S403B

Participants

PARTICIPANTS

Jerry Thomas, MS, FAAPM, DABR, CHP, DABSNM Wichita, KS
William Tobin BS, Tyler, TX

PROGRAM INFORMATION

This course does not offer CME credit.
Intra-venous and Intra-cavitary Contrast-enhanced Ultrasound (CEUS): How Can It Help in Complicated Pediatric Pneumonia?

**PURPOSE**

The purpose of this work-in-progress report is to investigate the application of contrast-enhanced Ultrasound (CEUS) in the diagnosis and management of complicated pediatric pneumonia.

**METHOD AND MATERIALS**

Ten children (mean age 4.1 years, range 1-12 years) with complicated pneumonia were initially evaluated with chest x-ray and grey-scale ultrasound (US). CEUS (intravenous, intra-cavitary) was then performed for further evaluation addressing specific management demands. Kappa coefficient was used to investigate the inter-observer agreement of US and CEUS for the diagnosis of necrotizing pneumonia. Chi-squared test was used to evaluate whether CEUS clearly demarcated the lung border more often than US; the Mann-Whitney test was used for comparison of US and CEUS diagnostic confidence for the diagnosis of necrotizing pneumonia.

**RESULTS**

US identified consolidation in 5/10 patients, empyema in 6/10 and pleural effusion in 2/10. In 7/10 patients, US could not address management demands related to the presence of lung necrosis (2/7), differentiation of empyema and necrotizing pneumonia (2/7), position of chest drainage catheter (2/7) and identification of residual empyema (1/7). Intra-cavitary CEUS (2/10) could identify the chest drainage catheter, facilitating use of fibrinolytic therapy. The inter-observer agreement for the diagnosis of necrotizing pneumonia was better with CEUS than US (kappa 0.8 vs 0.048, proportion of agreement 0.9 vs 0.7), CEUS more often clearly demarcated the lung border (p=0.001) and provided greater diagnostic confidence for the diagnosis of necrotizing pneumonia (p<0.001).

**CONCLUSION**

Intravenous use of CEUS provides significantly better delineation of the pleural space and consolidated lung providing increased diagnostic confidence for necrotizing pneumonia and clearly demonstrates pleural fluid extent. Intracavitary CEUS helps identify the chest drainage catheter and highlights the need for fibrinolytic therapy, guiding patient management.

**CLINICAL RELEVANCE/APPLICATION**

CEUS can be used in children with complicated pneumonia for necrotizing pneumonia diagnosis, clear delineation of lung border and pleural effusion and guiding treatment with fibrinolytic therapy.

Reduced FOV Diffusion Tensor MR Imaging and Fiber Tractography of the Pediatric Cervical Spinal Cord

(a) evaluate the feasibility of generating diffusion tensor tractography (DTT) images of the cervical spinal cord in children using a deterministic method, (b) to measure the DTI indices as well as tract specific information using regions of interest (ROIs) generated...
at every axial slice location along the entire cervical spinal cord based on DTT images, and (c) to investigate if there are differences in these values between the typically development (TD) subjects and patient group with SCI.

METHOD AND MATERIALS

A total of 20 pediatric subjects included 10 healthy subjects (with the age of 15.13±3.51 (mean ±standard deviation) and age range of 11-21) and 10 subjects with SCI in the cervical area (with the age of 13.8±3.26 (mean ±standard deviation) and age range of 8-20) were recruited and scanned using 3.0T Siemens Verio MR scanner with 4-channel neck matrix and 8-channel spine matrix coils. The DTI parameters used were: number of directions=20, b=1000s/mm2, voxel size=1.2×1.2×3.0mm3, matrix size=36×208, axial slices=35-45, TR=6100-8000ms, TE=115ms, number of averages=3 and acquisition time=7min. The fiber tracks generated based on pre-defined upper and lower FA thresholds (0.30 and 0.15 for all TD and SCI patients, respectively) were constrained within the limits of these thresholds as well as when the fiber track turns by more than a particular angle threshold in this case 70 degrees. Also, a lower track length threshold of 4.8mm was set to eliminate fiber fragments caused by noise within the tract reconstruction.

RESULTS

The mean FA values in the controls and patients were 0.6±0.13 and 0.45±0.14, respectively. FA values were significantly decreased in the patients with SCI (p=0.0238). ADC values in the controls and patients were 7.38±1.81×10-4mm2/sec and 7.67±2.37×10-4mm2/sec, respectively. However they were not statistically significant. The mean number of fiber tracks in the controls and patients were 1157±156.1 and 750±259.4, respectively and was significantly decreased in the SCI group (p=0.0005). However, the mean length of fiber tracks (24.30±15.85mm and 23.06±15.11mm in the controls and patients, respectively) did not show significant differences.

CONCLUSION

DTI and DTT could be used a surrogate marker for quantification and visualization of the injured spinal cord.

CLINICAL RELEVANCE/APPLICATION

DTT can be used to demonstrate three dimensional structures of white matter tracts in the brain and spinal cord.

PD219-SD-MOB5 Body Composition Predictors of Trabecular and Cortical Microarchitecture in Adolescents with Morbid Obesity

Participants

Fatima C. Stanford, Boston, MA (Abstract Co-Author) Nothing to Disclose
Vibha Singhal, Boston, MA (Abstract Co-Author) Nothing to Disclose
Stijn A. Bos, Boston, MA (Abstract Co-Author) Nothing to Disclose
Ryan Woolley, Boston, MA (Abstract Co-Author) Nothing to Disclose
Alexander Toth, Boston, MA (Abstract Co-Author) Nothing to Disclose
Madhusmita Misra, MD, MPH, Boston, MA (Abstract Co-Author) Research Grant, F. Hoffmann-La Roche Ltd Consultant, Advance Medical Author, UpToDate, Inc Speaker, JCR Pharmaceuticals Co, Ltd
Miriam A. Bredella, MD, Boston, MA (Presenter) Nothing to Disclose

PURPOSE

Obesity was believed to be protective for bone health; however, recent studies have shown that childhood obesity is associated with a higher incidence of forearm fractures. The purpose of our study was to determine predictors of trabecular and cortical microarchitecture of the distal radius in adolescents with morbid obesity. We hypothesized that lean mass would be positively, and visceral adiposity negatively, associated with bone microarchitecture in this population.

METHOD AND MATERIALS

Our study was IRB approved and HIPAA compliant. Written informed consent was obtained. We recruited 11 adolescents (mean age: 16±4 yrs, 9 f, 2 m – recruitment is ongoing) with morbid obesity (mean BMI:42±6 kg/m2). 3D HR-pQCT of the distal radius was performed with an isotropic voxel size of 82 μm (Xtreme CT, Scanco Medical, Basserdorf, Switzerland) to assess cortical and trabecular microarchitecture, including individual trabecular segmentation (ITS), which models the trabecular region as a lattice of individual plates and rods. Body composition, including estimated visceral adipose tissue (VAT) mass was determined by DXA (Discovery A; Hologic, Bedford, MA, USA). Non-parametric linear regression analysis was performed to determine body composition predictors of bone microarchitecture.

RESULTS

Two subjects were unable to undergo HR-pQCT due to body size. BMI was positively associated with cortical thickness (r=0.82, p=0.007) and cortical area (r=0.68, p=0.04). Lean mass was positively associated with trabecular density and volume (r=0.77, p=0.02 for both correlations), and measures of trabecular integrity by ITS (r=0.72 to 0.83, p=0.04 to 0.003). VAT mass was positively associated with cortical porosity (r=0.73, p=0.02).

CONCLUSION

Lean mass is a positive predictor of measures of trabecular integrity, whereas VAT is a negative predictor of cortical integrity in adolescents with morbid obesity.

CLINICAL RELEVANCE/APPLICATION

High VAT mass and low lean mass are risk factors for skeletal dysregulation in adolescents with morbid obesity.

PD143-ED-MOB6 Pediatric Liver Transplantation—Techniques and Complications

Awards

Identified for RadioGraphics
ZIKV infection.

Microcephaly associated with Zika virus antenatal infection. Small anterior fontanel with premature closure sutures are also seen. Multifocal dystrophic calcifications have cortical distribution and mainly subcortical, an aspect that has been repeated in all of our cases with postnatal CT and MRI evaluation. Small anterior fontanel with premature closure sutures are also seen on postnatal ultrasound.

The CNS Intrauterine Zika Virus Infection Manual: Perinatal US, MR an CT Imaging Findings

- To review the main techniques used in liver transplantation.
- To discuss the role of radiologists in the pre- and postoperative evaluation.
- To discuss the imaging features of the various early and late complications after liver transplantation illustrated by sample cases from our hospital.

**TEACHING POINTS**

1. The learner will understand the pathogenesis of congenital adrenal hyperplasia, including genetic and hormonal contributions.
2. The learner will become familiar with the characteristic prenatal imaging findings in CAH in both male and female fetuses, as well as those in the growing child and adolescent.
3. CAH is a chronic disease with life-long sequelae and variable effects on fertility, morbidity (including physical and psychosocial) in both male and female patients.

**TABLE OF CONTENTS/OUPLINE**

- Epidemiology of the pediatric liver transplantation
- Techniques of liver transplantation
- Normal appearance of the liver parenchyma and of the vascular and biliary anastomosis after liver transplantation on US, CT and MRI
- Vascular, biliary and parenchymal complications after liver transplantation
- Posttransplantation lymphoproliferative disorder

**PD156-ED-MOB7**

**Congenital Adrenal Hyperplasia: Fetal and Pediatric Imaging Findings and Management**

**AWARDS**

*Certificate of Merit*

**Participants**

Petra Vajtai, MD, Portland, OR (Presenter) Nothing to Disclose
Kyle Jensen, MD, Portland, OR (Abstract Co-Author) Nothing to Disclose
Chelsea Pyle, MD, Portland, OR (Abstract Co-Author) Nothing to Disclose
Roya Sohaey, MD, Portland, OR (Abstract Co-Author) Nothing to Disclose
Karen Y. Oh, MD, Portland, OR (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**

- Definition of CAH: autosomal recessive disorder of cortisol production; two subtypes a) virilizing b) salt-wasting.
- Fetal imaging findings in a) female patients: virilization of genitalia including clitoromegaly and enlarged/fused labia; b) male patients: normal genitalia;
- Both sexes: adrenal glands can be enlarged, sometimes asymmetrically.
- Imaging recommendations: in cases where sex is unclear, ultrasound the genital ridge sagitally or use 3D US. Use MRI for better resolution of suprarenal "mass/enlarged adrenal gland.
- Differentiation: other disorders of sexual development and other etiologies for suprarenal masses.
- Pathology: 95% from mutation in CYP21A2 gene.
- Presentation and demographics.
- Natural history, prognosis and treatment including imaging follow-up.

**PD192-ED-MOB8**

**The CNS Intrauterine Zika Virus Infection Manual: Perinatal US, MR an CT Imaging Findings**

**AWARDS**

*Magna Cum Laude*

**Identified for Radiographics**

**Participants**

Bianca Guedes Ribeiro, MD, Rio de Janeiro, Brazil (Presenter) Nothing to Disclose
Heron Werner, MD, Rio de Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Luiz Celso H. Da Cruz, MD, Rio De Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
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Renata A. Nogueira, MD, Rio De Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Leise Rodrigues, Rio De Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Taisa D. Gasparetto, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Anne S. Pecanha, MD, Rio De Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**

Congenital infections involving the brain are caused by relatively few agents, but Zika virus (ZIKV) infection is relatively increasing around the world, particularly in South America and it is related with common findings to congenital infections on CNS and the severely increased rate of microcephaly. Ultrasound remains the method of choice to the fetal evaluation of congenital infection and should be complemented by magnetic resonance (MR) imaging for a better evaluation of lesions extent. Postnatal CT and MRI can also add many extra findings of the CNS involvement, such as microcephaly with almost complete agyria, hydrocephalus, and multifocal dystrophic calcifications in the cortex and subcortical white matter, with associated cortical displacement. The calcifications have cortical distribution and mainly subcortical, an aspect that has been repeated in all of our cases with microcephaly associated with Zika virus antenatal infection. Small anterior fontanel with premature closure sutures are also seen on ZIKV infection.
# Table of Contents/Outline

1. Etiology and pathophysiology of ZIKV infection
2. Manifestations / Clinical Presentation
3. Fetal US and MRI Findings
4. Postnatal Brain CT and MRI Findings
5. Differential Diagnosis of Imaging Findings - CMV, Toxoplasmosis, Rubella
6. Follow-up and Prognosis
### SSE20

**Science Session with Keynote: Pediatrics (Neuroradiology)**

Monday, Nov. 28 3:00PM - 4:00PM Room: S102AB

**Participants**
- Susan Palasis, MD, Atlanta, GA (*Moderator*) Nothing to Disclose
- Jeremy Y. Jones, MD, Bellaire, TX (*Moderator*) Nothing to Disclose

**Sub-Events**

#### SSE20-01 Pediatrics Keynote Speaker: Brain and Spine Trauma in Children

Participants
- Jeremy Y. Jones, MD, Bellaire, TX (*Presenter*) Nothing to Disclose

#### SSE20-02 Relationship between MEG and Diffusion Imaging Measured Changes over a Season of High School Football

Participants
- Elizabeth M. Davenport, PhD, Dallas, TX (*Presenter*) Nothing to Disclose
- Jillian Urban, Winston-Salem, NC (*Abstract Co-Author*) Nothing to Disclose
- Ben Wagner, BS, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
- Mark A. Espeland, PhD, Winston-Salem, NC (*Abstract Co-Author*) Nothing to Disclose
- Christopher T. Whitlow, MD, PhD, Winston-Salem, NC (*Abstract Co-Author*) Nothing to Disclose
- Joel Stitzel, Winston-Salem, NC (*Abstract Co-Author*) Nothing to Disclose
- Joseph A. Maldjian, MD, Winston-Salem, NC (*Abstract Co-Author*) Nothing to Disclose

**PURPOSE**

The purpose of this study is to characterize associations between Diffusion Tensor Imaging (DTI), Diffusion Kurtosis Imaging (DKI), and magnetoencephalographic (MEG) measured delta waves over a season of high school football in the absence of clinical concussion.

**METHOD AND MATERIALS**

Twenty-four players from a high school football team (mean age=16.9; no history of concussion) were instrumented with the Head Impact Telemetry System (HITs) during all practices and games. The biomechanical metric Risk Weighted cumulative Exposure (RWE) was computed. All players received pre- and post-season MRI. Whole-brain DTI images were acquired using a 2D single-shot EPI sequence. DTI-derived metrics were calculated using DTI-TK. DKI-derived metrics were computed using the Diffusional Kurtosis Estimator. Eight minutes of eyes-open, resting-state MEG data were acquired pre- and post-season for each subject and brain space delta-wave power was computed. Changes (post- minus pre-season) of each metric were computed for each subject and then used to determine the total number of abnormal voxels (2 standard deviations above or below the group mean). We have previously shown changes in select DTI, DKI, and MEG metrics to correlate with RWE. Spearman’s rank correlation analyses were performed to examine the relationships between MEG, DTI, and DKI data.

**RESULTS**

Spearman’s rank correlation analyses revealed a statistically significant association between the number of abnormal DKI Tortuosity voxels and abnormally increased MEG delta power voxels. There was also a strong correlation between DTI mean diffusivity (MD) and MEG delta power, as well as DKI axonal water fraction (AWF) and MEG delta power.

**CONCLUSION**

We demonstrate a significant correlation between the changes in tortuosity and MEG delta power over a season of high school football in the absence of clinical concussion. Fractional anisotropy (FA) was not significant, possibly because it is a less specific measurement. Tortuosity is expected to be sensitive to the myelinated axonal fraction where FA is a measure of general anisotropy. The relationship of Tortuosity with delta waves may indicate a correlation between the number of myelinated axons and delta waves.

**CLINICAL RELEVANCE/APPLICATION**

Both DKI and MEG may be more sensitive than current conventional imaging and they may provide information regarding physiological changes mediating subconcussive and concussive injuries.

#### SSE20-03 Diffusion Tensor Imaging of the cervical and Thoracic Spinal Cord in Pediatric Subjects Using an Inner FOV 2D RF Pulse Sequence

**Participants**
- Sona Saksena, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
- Devon M. Middleton, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
- Laura Kriss, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
- Pallav N. Shah, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
15 patients with abnormal perfusion, 5 underwent follow up MRI including ASL; the perfusion abnormalities were improved in all.

Of the 44 patients, 15 (34%) exhibited perfusion abnormalities. One had mild hyperperfusion (score +1), 10 had mild hypoperfusion (topography of perfusion abnormalities on 3D ASL at 3T in pediatric and adolescent patients with migraine.)

METHOD AND MATERIALS

The prevalence and topography of perfusion abnormalities on 3D arterial spin labeling (ASL) at 3T in pediatric and adolescent patients with migraine have not been systematically investigated. The purpose of this study was to determine the prevalence and topography of perfusion abnormalities on 3D ASL at 3T in pediatric and adolescent patients with migraine.

METHOD AND MATERIALS

The prevalence and topography of perfusion abnormalities on 3D arterial spin labeling (ASL) at 3T in pediatric and adolescent patients with migraine have not been systematically investigated. The purpose of this study was to determine the prevalence and topography of perfusion abnormalities on 3D ASL at 3T in pediatric and adolescent patients with migraine.

METHOD AND MATERIALS

22 TD children without SC pathology and 15 patients with chronic SCI were recruited. Written informed child assent and parent consent were obtained under the protocol approved by IRB. ISNCSCI was used to define the clinical level and severity of injury in SCI patients. Subjects underwent 2 identical scans using 3T Siemens MR scanner. The protocol consisted of structural scans and axial DTI scans based on inner FOV sequence. DTI images were acquired axially using 2 overlapping slabs to cover the cervical (C1- upper thoracic region) and thoracic (upper thoracic-L1) SC. Imaging parameters included: 3 averages of 20 diffusion directions, 6 b0 acquisitions, b=800s/mm2, voxel size=0.8x0.8x6mm3, axial slices=40, TR=7900ms, TE=110ms, and TA=8:49min. Data Analysis: After postprocessing, ROIs were manually drawn on whole cord on FA maps at every axial slice along the cervical and thoracic SC for both scans. DTI parameters were quantified at each intervertebral disk level and mid-vertebral body level of the cervical and thoracic SC. Statistical Analysis: Analysis of covariance for repeated measures was performed to compare data from TD and SCI. Test-retest reliability was calculated using the intra-class correlation coefficient.

RESULTS

FA values were significantly lower while RD was significantly higher along the cervical and thoracic SC in SCI patients compared to TD. There was a strong reliability for all DTI parameters along the cervical and thoracic SC (ICC: 0.79-0.94). MD, AD and RD showed the greatest number of correlations with ISNCSCI followed by FA indicating that better neurological function is associated with greater unidirectional diffusion.

CONCLUSION

This study demonstrates that DTI has a potential to be used as an imaging biomarker for evaluating the extent of injury which may be useful to prognosticate and monitor patients with SCI.

CLINICAL RELEVANCE/APPLICATION

DTI has the potential to be used as a diagnostic imaging tool for evaluating the severity of SCI in children using the inner FOV DTI technique.

SSE20-04 Perfusion Abnormalities on 3D Arterial Spin Labeling at 3T MR in Pediatric and Adolescent Patients with Migraine

The prevalence and topography of perfusion abnormalities on 3D arterial spin labeling (ASL) at 3T in pediatric and adolescent patients with migraine have not been systematically investigated. The purpose of this study was to determine the prevalence and topography of perfusion abnormalities on 3D ASL at 3T in pediatric and adolescent patients with migraine.

METHOD AND MATERIALS

The study subjects were 44 consecutive patients (20 women, 24 men; age range, 3-18 years; mean age, 11 years) with migraine. All were diagnosed based on criteria of the International Classification of Headache Disorders, third edition (ICHD-III) and all underwent 3T MRI including 3D ASL. We retrospectively reviewed 3D ASL, diffusion weighted images (DWI), T2 weighted images (T2WI), T1 weighted images (T1WI), T2* weighted images, FLAIR, and MR angiography (MRA). Abnormal perfusion on 3D ASL was qualitatively evaluated using a 5-point grading system from score -2 (moderate to severe hyperperfusion compared to the normal appearing region) to score +2 (moderate to severe hyperperfusion), and was correlated with conventional MR images and MRA.

RESULTS

Of the 44 patients, 15 (34%) exhibited perfusion abnormalities. One had mild hyperperfusion (score +1), 10 had mild hypoperfusion (score -1), and 4 had moderate to severe hyperperfusion (score -2). In 8 of these 15 patients (53%) the occipital lobe was the most frequent site with perfusion abnormalities. One patient with sporadic hemiplegic migraine manifested vasoconstriction of the left middle and posterior cerebral artery on MRA, and prominent hypointense cortical and medullary veins in the area corresponding to the vasoconstriction on T2* weighted image. DWI, T1WI, T2WI, and FLAIR showed no abnormality in any of the patients. Of the 15 patients with abnormal perfusion, 5 underwent follow up MRI including ASL; the perfusion abnormalities were improved in all.
CONCLUSION

In patients with pediatric and adolescent migraine, 3T ASL showed a high prevalence of abnormal perfusion especially in the occipital lobe.

CLINICAL RELEVANCE/APPLICATION

ASL may be a noninvasive imaging tool to evaluate and monitor cerebral perfusion in pediatric and adolescent patients with migraine.

SSE20-05  First Order Texture Analysis of Typically Development Pediatric Spinal Cord MR Images

Monday, Nov. 28 3:40PM - 3:50PM Room: S102AB

Participants
Mahdi Alizadeh, Philadelphia, PA (Presenter) Nothing to Disclose
Chris Conklin, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Devon M. Middleton, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Sona Saksena, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Scott H. Faro, MD, Haddonfield, NJ (Abstract Co-Author) Nothing to Disclose
Laura Krska, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
M. J Mulcahey, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Feroze B. Mohamed, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

PURPOSE

Identify and evaluate the patterns of texture features as a measure of tissue integrity and its potential clinical relevance in typically development (TD) pediatric spinal cord MR images.

METHOD AND MATERIALS

A total of 11 healthy subjects who had no evidence of spinal cord injury (SCI) or pathology with the age of 12.083±2.598 years (mean±standard deviation) (range 6-15 years) were recruited and scanned using a 3.0T Siemens Verio MR scanner. The axial T2-weighted-GRE scan was prescribed from the sagittal T2-weighted image to cover the entire spinal cord (C1-T12-L1 levels). The imaging parameters included: voxel size=0.42×0.42×6.0mm3, matrix size=384×384, TR=878ms, TE=7.8ms, slice thickness=6mm, flip angle=25°, number of averages=1 and acquisition time=156s. The method consists of three main stages, namely, normalization, manual segmentation and feature extraction. After image normalization, histogram based texture features were calculated using region of interest (ROI) manually drawn at every axial T2-weighted-GRE image along the spinal cord (C1-T12-L1). Histogram based descriptors were included entropy (measures the randomness of the intensity distribution), mean (measure of brightness), variance (variation of voxel intensity from mean), skewness (measure of histogram symmetry) and kurtosis (measures of the tail of the histogram).

RESULTS

The subjects showed the following texture features averaged across all subjects: entropy=4.95±0.314, mean=0.372±0.081, variance=0.034±0.016, kurtosis=4.802±4.826, and skewness=0.551±1.04. The mean± standard deviation of each texture feature, as a function of cord level was calculated as well. It shows that entropy and mean values are consistent between subjects along spinal cord. The averaged 95% confidence interval (CI) across all subjects was: entropy= (4.762–5.133), mean= (0.324–0.42), variance= (0.024–0.043), kurtosis= (4.802–7.063), and skewness= (-1.166–0.064). Also, 95% CI was calculated as a function of spinal cord level in this study.

CONCLUSION

Texture descriptors could be used as a surrogate marker for quantification and visualization of the spinal cord and has the potential to improve our understanding of damage and recovery in diseased states of the spinal cord.

CLINICAL RELEVANCE/APPLICATION

Consistent information from routine conventional pediatric spinal cord MRI can be extracted using texture analysis.

SSE20-06  Reduced FOV Diffusion Tensor MR Imaging and Fiber Tractography of the Pediatric Cervical Spinal Cord

Monday, Nov. 28 3:50PM - 4:00PM Room: S102AB

Participants
Mahdi Alizadeh, Philadelphia, PA (Presenter) Nothing to Disclose
Alani Intintolo, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Devon M. Middleton, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Chris Conklin, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Scott H. Faro, MD, Haddonfield, NJ (Abstract Co-Author) Nothing to Disclose
M. J Mulcahey, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Feroze B. Mohamed, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

PURPOSE

(a) evaluate the feasibility of generating diffusion tensor tractography (DTT) images of the cervical spinal cord in children using a deterministic method, (b) to measure the DTI indices as well as tract specific information using regions of interest (ROIs) generated at every axial slice location along the entire cervical spinal cord based on DTT images, and (c) to investigate if there are differences in these values between the typically development (TD) subjects and patient group with SCI.

METHOD AND MATERIALS

A total of 20 pediatric subjects included 10 healthy subjects (with the age of 15.13±3.51 (mean ±standard deviation) and age range of 11-21) and 10 subjects with SCI in the cervical area (with the age of 13.8±3.26 (mean ±standard deviation) and age range of 8-20) were recruited and scanned using 3.0T Siemens Verio MR scanner with 4-channel neck matrix and 8-channel spine
matrix coils. The DTI parameters used were: number of directions=20, b=1000s/mm², voxel size=1.2×1.2×3.0mm³, matrix size=36×208, axial slices=35-45, TR=6100-8000ms, TE=115ms, number of averages=3 and acquisition time=7min. The fiber tracks generated based on pre-defined upper and lower FA thresholds (0.30 and 0.15 for all TD and SCI patients, respectively) were constrained within the limits of these thresholds as well as when the fiber track turns by more than a particular angle threshold in this case 70 degrees. Also, a lower track length threshold of 4.8mm was set to eliminate fiber fragments caused by noise within the tract reconstruction.

RESULTS

The mean FA values in the controls and patients were 0.6±0.13 and 0.45±0.14, respectively. FA values were significantly decreased in the patients with SCI (p=0.0238). ADC values in the controls and patients were 7.38±1.81×10⁻⁴mm²/sec and 7.67±2.37×10⁻⁴mm²/sec, respectively. However they were not statistically significant. The mean number of fiber tracks in the controls and patients were 1157±156.1 and 750±259.4, respectively and was significantly decreased in the SCI group (p=0.0005). However, the mean length of fiber tracks (24.30±15.85mm and 23.06±15.11mm in the controls and patients, respectively) did not show significant differences.

CONCLUSION

DTI and DTT could be used a surrogate marker for quantification and visualization of the injured spinal cord.

CLINICAL RELEVANCE/APPLICATION

DTT can be used to demonstrate three dimensional structures of white matter tracts in the brain and spinal cord.
Pediatric Tuesday Case of the Day

Tuesday, Nov. 29 7:00AM - 11:59PM Room: Case of Day, Learning Center

Participants
Ting Y. Tao, MD, PhD, Saint Louis, MO (Presenter) Nothing to Disclose
Luke L. Linscott, MD, Cincinnati, OH (Abstract Co-Author) Nothing to Disclose
Karen A. Caudill, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Asef B. Khwaja, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Jie C. Nguyen, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Shannon Farmakis, MD, Saint Louis, MO (Abstract Co-Author) Research Grant, General Electric Company; Research Grant, Guerbet SA

TEACHING POINTS
1) Recognize the importance of a multimodality approach in imaging pediatric patients. 2) Form appropriate differential diagnoses based on clinical information and imaging findings. 3) Recognize the clinical implications of diagnoses.
Controversy Session: A New Perspective on Radiation and Sedation Risk in Children: Should ALARA be as 'Low' or as 'Light' as Reasonably Achievable?

Tuesday, Nov. 29 7:15AM - 8:15AM Room: E451A

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Donald P. Frush, MD, Durham, NC, (donald.frush@duke.edu) (Moderator) Nothing to Disclose
Shreyas S. Vasanawala, MD, PhD, Stanford, CA (Presenter) Research collaboration, General Electric Company; Consultant, Arterys Inc; Research Grant, Bayer AG;
 Randall Flick, MD, Rochester, MN (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Briefly review current state of low level radiation and risk in children. 2) Emphasize value of non-ionizing radiation MR. 3) Highlight current fast techniques for children. 4) Outline current status of sedation and cognitive impact in children. 5) Provide strategies for team work between anesthesiology and radiology to minimize these risks.

ABSTRACT
The pediatric population is particularly sensitive to the risk of radiation, and radiation risk from CT is estimated as approximately 1/10000 fatal cancers per mSv of radiation. Thus alternative imaging techniques should be utilized when possible, including MRI. However, MRI often requires sedation or general anesthesia for age groups and indications for which CT does not. Though risks of immediate complications from anesthesia or sedation are generally well appreciated, there is a growing concern of the potential risks related to neurotoxicity of anesthetic agents. This toxicity it thought to carry greatest risk when anesthesia is performed at a particularly young age, for prolonged times, and for repeated procedures. Thus, overall risks to the patient for imaging must be considered in holistic fashion, balancing ionizing radiation against that of anesthesia. Methods to shift this risk profile in a favorable fashion include targetted MR imaging protocols, free-breathing techniques, and volumetric acquisitions.
**Pediatric Series: CV/Chest**

**Tuesday, Nov. 29 8:30AM - 12:00PM Room: N228**

**RC313-01 Imaging of Childhood Interstitial Lung Disease**

**Participants**
- Catherine M. Owens, MD, London, United Kingdom (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
1) To understand and define the Childhood Interstitial Lung disease ChILD classification. 2) To illustrate examples within this classification. 3) To update on more recent additions with clinicopathological examples.

**ABSTRACT**

**RC313-02 Radiologic Evaluation of Drug-Induced Pneumonitis following Carmustine (BCNU)-Based Preparative Regimens in Children**

**Participants**
- Yu Jin Kim, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
- Woo Sun Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
- Young Hun Choi, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
- Jung-Eun Cheon, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
- In-One Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
- Young Jin Ryu, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To describe radiologic findings of drug-induced pneumonitis following carmustine (BCNU)-based preparative regimens for autologous peripheral blood stem cell transplantation (aPBSCT) in children.

**METHOD AND MATERIALS**
From 2010 through 2014 in our institution, among 35 patients who received carmustine-based preparative regimens for aPBSCT, 9 patients (6 boys and 3 girls; 3-17 years, mean 10 years; 7 lymphoma and 2 leukemia patients) presented respiratory symptoms and radiologic abnormalities. They had no evidence of infection, cardiogenic edema, and other explainable causes. The chief complaints were fever (n=8, 89%), dyspnea (n=4, 44%), and cough (n=2, 22%). The symptoms developed at 40th day on average (range 34-51 days) after receiving carmustine-based preparative regimens. Chest radiographs and CT scans performed under the impression of infection at the first of respiratory symptoms were reviewed by 2 pediatric radiologists who reached consensus in analyzing the presence and distribution of ground-glass opacity (GGO), consolidation, septal thickening and other various patterns of interstitial pneumonitis, and pleural effusion.

**RESULTS**
Radiographic findings were bilateral patchy GGO (n=9, 100%) combined with consolidation (n=3, 33%) and septal thickening (n=6, 67%). Pleural effusion were noted in 5 patients (56%). CT findings were patchy GGO (n=9, 100%), localized consolidations (n=4, 44%) and septal thickening (n=7, 78%). The distribution of lesions were bilateral (n=9, 100%) and lower lobar predominant (n=6, 67%). There was no central/peripheral, or anterior/posterior predilection. Pleural effusion was seen in 6 patients (67%) at CT scans and was bilateral in all.

**CONCLUSION**
Bilateral patchy GGO combined with or without consolidation, septal thickening and bilateral pleural effusion were common radiologic findings in drug-induced pneumonitis following carmustine-based preparative regimens. It should be differentiated from pulmonary infection which is critical and frequently encountered in oncologic patients.

**CLINICAL RELEVANCE/APPLICATION**
Carmustine can cause pneumonitis. Common radiologic findings of this pneumonitis were bilateral patchy GGO combined with or without consolidation, septal thickening and bilateral pleural effusion.
Tuesday, Nov. 29 9:00AM - 9:10AM Room: N228

Participants
Suonita Khung, MD, Lille, France (Abstract Co-Author) Nothing to Disclose
Nicolas Lasalle, Lille, France (Abstract Co-Author) Nothing to Disclose
Younes Arous, MD, Lille, France (Abstract Co-Author) Nothing to Disclose
Antoine Deschildre, Lille, France (Abstract Co-Author) Nothing to Disclose
Jacques Remy, MD, Mouvaux, France (Abstract Co-Author) Research Consultant, Siemens AG
Martine J. Remy-Jardin, MD, PhD, Lille, France (Abstract Co-Author) Research Grant, Siemens AG
Antoine Hutt, MD, Lille, France (Presenter) Nothing to Disclose

PURPOSE
To evaluate the frequency and severity of motion artifacts on chest CT examinations acquired without sedation nor general anesthesia in infants and children younger than 5 years.

METHOD AND MATERIALS
The study population included all consecutively registered infants and young children (age <5 years) who had been referred for a standard chest CT examination on a third-generation, dual-source CT system. The examinations were obtained with a high-pitch and high-temporal resolution protocol (pitch: 3.0; rotation time: 250 ms). Children were scanned while freely breathing, without sedation or general anesthesia. In order to scan quiet children, each examination was supervised by a paediatric nurse practitioner. For each examination, we recorded (a) the number of acquisitions necessary to reach a diagnostic image quality, (b) the frequency and severity of motion artifacts in the upper, mid and lower lung zones using a 4-point scale (0 : no artifact ; 1 : mild; 2 : moderate; 3 : severe) and (c) the diagnostic value of each acquisition.

RESULTS
The study population comprised 343 patients (mean age: 14.92 months) who underwent a contrast (n=240) or noncontrast (n=103) chest CT examinations; the mean duration of data acquisition was 0.23 ± 0.05 s (range: 0.11 – 0.52). For 330 patients (96.2%), the investigation comprised a single acquisition which was rated as follows: (a) no motion artifact over the entire thorax (n=193); (b) presence of motion artifacts that did not affect the overall diagnostic value of the examination (n=137) with a mean score of artifact of 0.72 (median: 0.67; range: 0.33 – 2.33). In 13 patients (3.8%): (a) the acquisition was rated as nondiagnostic due to the presence of severe artifacts (mean score: 1.62; range: : 1.67-2.67); (b) a second acquisition was then performed, rated as diagnostic in 13 cases (mean score of artifact: 0.47; median: 0.17; range: 0-2) and nondiagnostic in 1 patient.

CONCLUSION
Diagnostic image quality is obtained with a single examination in 96.2% of children scanned while freely breathing.

CLINICAL RELEVANCE/APPLICATION
High-quality chest CTA can be routinely obtained in freely-breathing infants and young children when evaluated with high-temporal resolution, making sedation and anesthesia unnecessary.

RC313-05 Correlation of High Resolution Computed Tomography Findings and Clinical Severity of Bronchopulmonary Dysplasia

Tuesday, Nov. 29 9:10AM - 9:20AM Room: N228

Participants
Min Yeong Kim, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose

PURPOSE
To analyze high resolution computed tomography (HRCT) findings in neonate with bronchopulmonary dysplasia (BPD). To evaluate correlation between HRCT findings and clinical severity.

METHOD AND MATERIALS
From 2008 to 2015, fifty very low birth weight infants with BPD underwent HRCT exams at the mean postmenstrual age of 38.7 weeks. HRCT findings were classified as two categories and 7 findings: 1) hyperaeration; area of decreased lung attenuation, mosaic attenuation, bulla/bleb and 2) parenchymal lesions; linear lesions, consolidation, bronchial wall thickening, bronchiectasis. These HRCT findings were recorded in each lobe of lungs. Clinical severity was graded as mild, moderate and severe. Each HRCT finding, sum of hyperaeration scores, sum of parenchymal lesion scores and total scores of HRCT findings were analyzed for correlation with clinical severity of BPD.

RESULTS
The total scores of HRCT findings were significantly correlated with clinical severity of BPD (r>0.6, p=0.03). Parenchymal lesion scores were well correlated with clinical severity of BPD while hyperaeration scores were not significantly correlated with clinical severity of BPD. The best correlated HRCT finding is consolidation (p=0.006). Area of decreased lung attenuation was frequent findings regardless of clinical severity of BPD.

CONCLUSION
Total scores of HRCT findings are correlated with clinical severity of BPD and parenchymal lesion scores have a key part, especially consolidation. Unlike previous reports about HRCT of BPD, hyperaeration scores are not correlated with clinical severity of BPD.

CLINICAL RELEVANCE/APPLICATION
On HRCT of infants with BPD, hyperaeration is not specific for clinical severity of BPD but consolidation is predictive findings of that of BPD.

RC313-05 Assessment of the Severity of Disease in Patients with Cystic Fibrosis using MRI of the Lung: Signal Intensity and Lung Volumes Compared to the Lung-Clearance-Index and Forced Expiratory-Volume-in-1-Second

Tuesday, Nov. 29 9:10AM - 9:20AM Room: N228

Participants
Min Yeong Kim, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose

PURPOSE
To analyze high resolution computed tomography (HRCT) findings in neonate with bronchopulmonary dysplasia (BPD). To evaluate correlation between HRCT findings and clinical severity.

METHOD AND MATERIALS
From 2008 to 2015, fifty very low birth weight infants with BPD underwent HRCT exams at the mean postmenstrual age of 38.7 weeks. HRCT findings were classified as two categories and 7 findings: 1) hyperaeration; area of decreased lung attenuation, mosaic attenuation, bulla/bleb and 2) parenchymal lesions; linear lesions, consolidation, bronchial wall thickening, bronchiectasis. These HRCT findings were recorded in each lobe of lungs. Clinical severity was graded as mild, moderate and severe. Each HRCT finding, sum of hyperaeration scores, sum of parenchymal lesion scores and total scores of HRCT findings were analyzed for correlation with clinical severity of BPD.

RESULTS
The total scores of HRCT findings were significantly correlated with clinical severity of BPD (r>0.6, p=0.03). Parenchymal lesion scores were well correlated with clinical severity of BPD while hyperaeration scores were not significantly correlated with clinical severity of BPD. The best correlated HRCT finding is consolidation (p=0.006). Area of decreased lung attenuation was frequent findings regardless of clinical severity of BPD.

CONCLUSION
Total scores of HRCT findings are correlated with clinical severity of BPD and parenchymal lesion scores have a key part, especially consolidation. Unlike previous reports about HRCT of BPD, hyperaeration scores are not correlated with clinical severity of BPD.

CLINICAL RELEVANCE/APPLICATION
On HRCT of infants with BPD, hyperaeration is not specific for clinical severity of BPD but consolidation is predictive findings of that of BPD.
Participants
Sabrina Fleischer, MD, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Ilia Tsiflikas, MD, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Verena Langlois, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Matthias Teufel, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Ute Graeper-Mainka, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Joachim Reithmuller, MD, Tubingen, Germany (Abstract Co-Author) Nothing to Disclose
Andreas Hector, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Konstantin Nikolau, MD, Tuebingen, Germany (Abstract Co-Author) Speakers Bureau, Siemens AG; Speakers Bureau, Bracco Group; Speakers Bureau, Bayer AG
Juergen F. Schaefer, MD, Tuebingen, Germany (Presenter) Nothing to Disclose

PURPOSE
Morphological assessment of lung damage is already part of diagnostic work-up in cystic fibrosis (CF). Imaging biomarkers as lung volume (Vol) or signal intensity (SI) can be calculated at baseline and in follow-up. Aim of this study was to correlate MR values of regional pulmonary function with lung clearance index (LCI) and forced expiratory volume in 1 second (FEV1) as the most important parameter for the monitoring the disease.

METHOD AND MATERIALS
IRB waived informed consent and approved this retrospective, HIPAA-compliant study. 49 consecutive CF-patients (23 f, 26 m) mean age 17 +/- 7 y (7-40y) received MRI at 1.5 T of the lung as standard of care in our institution. In this protocol, a 2D GRE sequence with very-short echo time was applied in submaximal inspiration as well as expiration. Semi-automated segmentation of ventilated areas was performed. Absolute Vol and SI values at in- and expiration, relative differences (Vol_Delta and SI_Delta) and cumulative histograms for relative SI values across entire lung volume were computed.

RESULTS
Strong correlation between Vol_Delta and SI_Delta was found (R=0.86; P<0.0001). Individual Vol-SI-curves created by cumulative histograms allowed visually the differentiation between clinically minimal and strongly affected patients (LCI > 10). The expiratory volume at a relative SI of 100% correlated significantly with LCI and FEV1 (R=0.63 and R=0.81; P<0.0001).

CONCLUSION
A close relation of pulmonary volume and SI during respiration was observed. Individual Vol-SI-curves were suitable to estimate the severity of disease clinically assessed by LCI. The cross correlation with LCI and FEV1 might be promising for the quantification of areas with low SI values due to air trapping.

CLINICAL RELEVANCE/APPLICATION
Cumulative histograms for relative SI values across lung volume by unenhanced MRI offer information of regional ventilation and can estimate the severity of disease in CF.

RC313-06 Characterization of All-Terrain Vehicle-Related Chest Injury Patterns in Children

Tuesday, Nov. 29 9:30AM - 9:40AM Room: N228

Participants
Kelly N. Hagedorn, MD, Houston, TX (Presenter) Nothing to Disclose
Jennifer H. Johnston, MD, Cerritos, CA (Abstract Co-Author) Nothing to Disclose
Sean K. Johnston, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Nagaramesh Chinapuvvula, MBBS, Houston, TX (Abstract Co-Author) Nothing to Disclose
Chunyai Cai, Houston, TX (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate chest injury patterns in pediatric patients involved in all-terrain vehicle (ATV) accidents.

METHOD AND MATERIALS
A retrospective review of the trauma registry at a level I trauma institution from 1992-2013 was performed for patients between 0-18 years admitted after ATV-related incidents. Only patients with chest imaging were included. Type of chest injuries, mechanism of injury, driver/passenger status and demographic data were recorded. Clinical data such as length of hospital stay and intensive care unit (ICU) admission were documented. Comparison of demographic data and clinical data between patients with and without chest injury was conducted using the Chi-square test for categorical variables and two-sample t test for continuous variables.

RESULTS
A total of 455 pediatric patients were admitted after an ATV injury during the study period. Of these, 102 patients (22%) had a chest injury. Most injuries occurred due to a rollover (44/102, 43%), collision with landscape (20/102, 20%) or falls (16/102, 16%). The patient was the driver in 41 (40%) and passenger in 33 (32%) cases (others unknown). Patients with chest injuries were older (13 vs 11 years, P 0.0027), taller (157 cm vs 148 cm, P 0.0012), and heavier (57 kg vs 48 kg, P 0.0006) than those without chest injury. Most injuries occurred due to a rollover (44/102, 43%), collision with landscape (20/102, 20%) or falls (16/102, 16%). The patient was the driver in 41 (40%) and passenger in 33 (32%) cases (others unknown). Patients with chest injuries were older (13 vs 11 years, P 0.0027), taller (157 cm vs 148 cm, P 0.0012), and heavier (57 kg vs 48 kg, P 0.0006) than those without chest injury. The most common injury was pulmonary contusion (62/102, 61%), followed by pneumothorax (46/102, 45%) and non-flail rib fracture(s) (35/102, 34%). There were no cardiac, esophageal, or airway injuries, and no vascular injury other than a case of subclavian artery transection. Patients with chest injury more often required ICU care (41/102, 40%, compared to 77/353, 22%, P 0.0002) and had longer median hospital stay (3 days vs 2 days, P 0.0054) compared to patients without chest injury. Eight patients with chest injury died (8%).

CONCLUSION
Chest injuries are a relatively common occurrence in children following ATV accidents, which remain a significant public health issue in terms of morbidity and mortality. Patients with chest injuries were more likely to require ICU care and to have a longer hospital
stay.

CLINICAL RELEVANCE/APPLICATION

Chest injuries following ATV accidents in the pediatric population are common and increased public awareness of these potentially devastating injuries is needed.

RC313-07 Does a Normal Chest X-ray Obviate the Need for Thoracic CT Scanning in Pediatric Trauma?

Tuesday, Nov. 29 9:40AM - 9:50AM Room: N228

Participants
Mohammed F. Mohammed, MBBS, Vancouver, BC (Presenter) Nothing to Disclose
Reem S. Zakzouk, MD, Riyadh, Saudi Arabia (Abstract Co-Author) Nothing to Disclose
Nizar Bhulani, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Hesham M. Ablaalan, MD, Toronto, ON (Abstract Co-Author) Nothing to Disclose
Amna A. Kashgari, MD, Halifax, NS (Abstract Co-Author) Nothing to Disclose

PURPOSE

Motor vehicle collisions and road traffic related injuries constitute one of the leading causes of premature death worldwide. In children with multiple injuries, the presence of chest trauma increases the mortality rate by 20 times. Whole-body CT has become the mainstay in assessment of patients involved in traumas of various causes. The drawback has been an increase in exposure to medical imaging. Pediatric patients are more sensitive to the negative effects of ionizing radiation, and minimizing exposure is a priority. We assess the role of a negative chest x-ray in obviating the need for further chest CT in stable pediatric patients that have sustained trauma in an attempt to reduce unnecessary imaging.

METHOD AND MATERIALS

A retrospective study was carried out on all patients under 14 years of age that presented to our institution, a level 1 trauma center, from 2010 to 2013. A total of 304 patients received whole-body trauma CT and had received chest x-rays within 30 minutes of the CT. The chest x-rays and thoracic CT scans were independently reviewed by two radiologists who were blinded to the clinical outcome. The presence of pulmonary contusions/consolidations, pneumothorax, pneumomediastinum, subcutaneous emphysema, pleural effusion and fractures was recorded.

RESULTS

165 (54.3%) of the chest x-rays were normal. Of these, 41 (24.8%) demonstrated minimal airspace opacity on CT. These were confined to one lobe and were small. They did not warrant further management in all 41 patients. 2 out of the 41 patients had tiny pneumothoraces on CT which did not require further follow up or intervention. The remaining 139 chest x-rays had at least 1 positive finding and demonstrated good correlation to significant CT findings that required further intervention and management (p <0.01). The likelihood of significant CT findings was greater when pleural effusion was present on the x-ray or when 2 or more findings were positive on the chest x-ray.

CONCLUSION

A normal chest x-ray virtually excludes the presence of significant findings on the thoracic CT scan; however, if the chest x-ray demonstrates any pathology, particularly pleural effusion, a chest CT is required to exclude significant findings which may require immediate intervention.

CLINICAL RELEVANCE/APPLICATION

In a stable, assessable pediatric patient with a low suspicion mechanism of injury, a normal chest x-ray likely obviates the need for further assessment or intervention.

RC313-08 Imaging of Vascular Rings

Tuesday, Nov. 29 9:50AM - 10:10AM Room: N228

Participants
Elizabeth F. Sheybani, MD, Saint Louis, MO, (elizabeth.sheybani@wustl.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the presentation and clinical significance and developmental anatomy of vascular rings. 2) Identify major findings indicative of vascular rings on multiple modalities including radiography, fluoroscopy, CT and MRI. 3) Classify vascular rings and identify key features on cross-sectional imaging for surgical planning. 4) Compare available modalities and optimize evaluation of vascular rings.

ABSTRACT

RC313-09 Imaging of Tetralogy of Fallot

Tuesday, Nov. 29 10:30AM - 10:50AM Room: N228

Participants
Taylor Chung, MD, Oakland, CA, (tchung@mail.cho.org) (Presenter) Travel support, Koninklijke Philips NV;

Active Handout: Taylor Chung


LEARNING OBJECTIVES

1) Understand the clinical indications therefore imaging goals for post-operative imaging of patients with tetralogy of Fallot. 2) Review practical clinical MR protocol for post-operative imaging of patients with tetralogy of Fallot.
Assessment of the Reliability of Ventricular Function and Flow Evaluation for Repaired Tetralogy of Fallot with 4D Flow MRI

Tuesday, Nov. 29 10:50AM - 11:00AM Room: N228

Participants
Qiong Yao, MD, Shanghai, China (Presenter) Nothing to Disclose
Michael A. Kadoch, MD, Stanford, CA (Abstract Co-Author) Nothing to Disclose
Floris-Jan S. Ridderbos, BSC, Stanford, CA (Abstract Co-Author) Nothing to Disclose
Shreyas S. Vasaneawala, MD, PhD, Stanford, CA (Abstract Co-Author) Research collaboration, General Electric Company; Consultant, Arterys Inc; Research Grant, Bayer AG;
Francesca P. Chan, MD, PhD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose

PURPOSE
Patients with repaired tetralogy of Fallot (rTOF) require regular monitoring by MRI to assess for right ventricular enlargement and pulmonary regurgitation. 4D flow, a time-resolved, volumetric, accelerated phase contrast technique, may efficiently acquire this information in 10 minutes. We evaluate (1) the consistency between ventricular volumes and flows within 4D flow data and (2) the agreement of these parameters with conventional 2D SSFP-cine and 2D phase contrast acquisitions in patients with rTOF.

METHOD AND MATERIALS
Following IRB approval, patients diagnosed with uncomplicated rTOF who underwent combined 2D and 4D flow MRI studies were identified. Patients with residual shunts, pulmonary conduits, pulmonary stenosis, and/or significant non-pulmonary valvular regurgitation were excluded. Using post-processing software (Arterys for 4D data, Medis for 2D data), pulmonary and systemic flows (Qp, Qs), pulmonary regurgitant volume (PRV), and left/right diastolic/systolic ventricular volumes (LVEDV, RVEDV, LVESV and RVESV) were quantified. From these measurements, stroke volumes (LVSV, RVSV), ejection fractions (LVEF, RVEF), pulmonary regurgitant fraction (PRF), and left/right ventricular outputs (LVO, RVO) were calculated. Internal consistency between Qp and Qs as well as between PRV and RVO-LVO difference was measured using intra-class correlation (ICC). Agreement with 2D data was measured using Pearson correlation and Bland-Altman plot.

RESULTS
24 patients (10 males, 6.4 ± 4.8 years) were identified. For 4D MRI, Qp and Qs had good agreement (ICC 0.446–0.866) as did PRV with RVO-LVO difference (ICC 0.315–0.820). 4D and 2D results were well correlated (r = 0.885 for LVEDV, 0.974 for RVEDV, 0.898 for LVESV, 0.980 for RVESV, 0.863 for EFl, 0.925 for EFr, 0.447 for Qp/Qs and 0.764 for PRF). Bland-Altman analysis showed wider limits of agreement for flow relative to ventricular function.

CONCLUSION
Ventricular function and flow measurements can be accomplished with 4D flow MRI and are consistent with 2D results.

CLINICAL RELEVANCE/APPLICATION
Monitoring of patients with uncomplicated rTOF can be achieved in under 10 minutes with an MRI protocol consisting of a single 4D flow sequence, improving patient experience and reducing costs.

A Prospective Evaluation of Contrast and Radiation Dose and Image Quality in Cardiac CT in Children with Complex Congenital Heart Disease using Low-Concentration Iodinated Contrast Agent and Low Tube Voltage and Current

Tuesday, Nov. 29 11:00AM - 11:10AM Room: N228

Participants
Qiaoru Hou, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Li Wei Hu, DiplDipl, MENG, Pudong, China (Abstract Co-Author) Nothing to Disclose
Haisheng Qiu, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Yumin Zhong, MD, Shanghai, China (Presenter) Nothing to Disclose

PURPOSE
To assess image quality and contrast and radiation dose in cardiac CT in children with congenital heart disease using low-concentration iodinated contrast agent and low tube voltage and tube current.

METHOD AND MATERIALS
110 consecutive patients (54 male, 56 female, 5 kg)

RESULTS
There was no difference in age, weight between the two groups (all p>0.05). The iodine load in Group A was 30% lower than in Group B (3.98±0.75gI vs. 5.76±1.02gI, p<0.001). And CTDIvol, DLP and ED in Group A (1.35mGy, 15.29±1.91mGy/cm and 0.60±0.07mSv) were lower than in Group B (1.81 mGy, 20.11±2.12mGy/cm and 0.77±0.10 mSv) (all p<0.001). However, the mean CT value, noise, CNR and SNR for Group A and Group B were similar (all p>0.05), and the mean image quality score for Group A and Group B was also similar with good agreement between the two observers. Comparing to the surgery results (n=26 in Group A and n=38 in Group B), Group A was 96% accurate in the diagnosis for extracardiac defects and 92% accurate for intracardiac defects, while Group B was 95% accurate in the diagnosis for extracardiac defects and 93% accurate for intracardiac defects.

CONCLUSION
The scanning protocol using low tube voltage (80kVp), low tube current (120mA) and low-concentration iodinated contrast agent (270mgI/mL) enables reduction in iodine load and radiation dose while maintaining compatible image quality.

CLINICAL RELEVANCE/APPLICATION
Low tube voltage (80kVp), low tube current (120mA) and low-concentration iodinated contrast agent (270mgI/mL) may be used...
Effectively to examine complex congenital heart disease in infants.


Tuesday, Nov. 29 11:10AM - 11:20AM Room: N228

Participants
Ramy El Jalbout, MD, Montreal, QC (Presenter) Nothing to Disclose
Guy Cloutier, PhD, Montreal, QC (Abstract Co-Author) Nothing to Disclose
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Gilles P. Soulez, MD, Montreal, QC (Abstract Co-Author) Speaker, Bracco Group Speaker, Siemens AG Research Grant, Siemens AG Research Grant, Bracco Group Research Grant, Cook Group Incorporated Research Grant, Object Research Systems Inc
Josee Dubois, MD, Montreal, QC (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To compare IMT measurements in children according to three different techniques: Math’s system software, radiofrequency generated ultrasound sequences and NIVE software. To compare IMT measurements between two groups of normal and overweight/obese children using 3 different techniques.

**METHOD AND MATERIALS**

Children aged between 8 and 10 years (n=120) were randomly chosen such that 60 children were of normal weight (group A) and 60 children were overweight (group B). We compared 3 methods of IMT measurement of the far away common carotid artery wall relative to the transcutaneously placed linear ultrasound probe. The first used a dedicated software Math’s system allowing an automated measurement of IMT on B-mode ultrasound images. The second measured IMT automatically using an echotracking system based on the amplitude of radiofrequency (RF) signal. The third used a semi automated segmentation analysis generated by the NIVE platform of video sequences obtained with radiofrequency ultrasound.

**RESULTS**

There is no significant correlation between any of the three different techniques neither in group A nor in group B. In group A, the interclass correlation coefficients were as follows: IMT B-mode-IMT RF ICC=0.010 (p=0.28), IMT B-mode-IMT NIVE ICC=0.003 (p=0.45), IMT RF-IMT NIVE ICC=0.0006 (p=0.52). In group B, IMT B-mode-IMT RF ICC=0.003 (p=0.42), IMT B-mode-IMT NIVE ICC=0.005 (p=0.43) and IMT RF-IMT NIVE ICC=0.002 (p=0.42). Each technique has its limitations in the pediatric population. However, when comparing IMT values across weight, IMT was significantly lower for normal weight youth using all 3 techniques: using B-mode (0.553 mm versus 0.573 mm for groups A and B respectively; p=0.026); using RF (0.457 mm for group A vs 0.489 mm for group B; p=0.031 and using NIVE algorithm (0.325 mm vs 0.355 mm for groups A and B; p=0.010).

**CONCLUSION**

Significant IMT measurement variation was observed between the different techniques. However, overweight children tend to have higher IMT values regardless of the method used. There is no gold standard technique and future studies are needed to validate our results.

**CLINICAL RELEVANCE/APPLICATION**

Risk factors for atherosclerosis begin in childhood. IMT using the same technique can be used to target children at risk and follow them in time until one technique proves to be the gold standard.

**RC313-13 Utility of 1.5-T Three-dimensional Steady-State Free Precession Whole-heart MRI in the Assessment of Coronary Artery Anatomy with and without Contrast Enhancement in Children**

Tuesday, Nov. 29 11:20AM - 11:30AM Room: N228

Participants
Quanli Shen, Shanghai, China (Presenter) Nothing to Disclose
Xihong Hu, PhD, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Qiong Yao, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To compare the performance of a contrast-enhanced with a noncontrast 1.5-T three-dimensional (3D) steady-state free precession (SSFP) sequence for magnetic resonance coronary angiography (MRCA) in children.

**METHOD AND MATERIALS**

The study was approved by the institutional review board. Seventy-nine children in the age range of 1 month to 18 years were enrolled in this study. They were classified into three groups according to the age: group 1 = patients 2 years or younger (n = 19), group 2 = patients older than 2 years to 5 years (n = 17), group 3 = patients older than 5 years (n = 43). A free-breathing, navigator-gated, 3D SSFP whole-heart protocol at 1.5-T was used before and after injection of Gadolinium-DTPA. The image quality, vessel length, signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) of the left main trunk (LMT), left anterior descending coronary artery (LAD), left circumflex coronary artery (LCX), and right coronary artery (RCA) were assessed by using Wilcoxon signed-rank test.

**RESULTS**

The application of Gadolinium-DTPA improved the image quality of all the coronary arteries in group 1 (P<0.05). Contrast-enhanced 3D SSFP sequence revealed longer length for LAD and LCX in group 1, and LCX in group 2 (P<0.05). SNR and CNR of all the coronary arteries in group 1 and 2, and the LCX and RCA in group 3 increased after application of Gadolinium-DTPA (P<0.05).

**CONCLUSION**

Contrast-enhanced 3D SSFP whole-heart MRCA at 1.5-T significantly improves the image performance in young children. but the
### Feasibility of Low Iodine Containing Iodixanol 270 Contrast Media for Cardiac Computed Tomography Angiography Using a Peak Tube Voltage of 80kV in Neonates and Infants

**Tuesday, Nov. 29 11:30AM - 11:40AM Room: N228**

**Participants**

Ki Seok Choo, MD, Yangsan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose  
Jae-Yeon Hwang, MD, Yangsan-si, Korea, Republic Of (Abstract Co-Author) Research Grant, Bayer AG; Research Grant, Guerbet SA  
Jin Hyeok Kim, MD, Yangsan-si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose  
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Hwaseong Ryu, Yangsan-si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose  
Junhee Han, Yangsan-si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose  
Jeongmin Lee, MD, Pusan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose  
Hwaseong Ryu, Yangsan-si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose  
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Jeongmin Lee, MD, Pusan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose  
Junhee Han, Yangsan-si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Contrast media (CM) of different concentrations are widely used for pediatric cardiac computed tomography angiography (CCTA). However, lower concentration < 300 mgI/ml CM is not routinely used in CTA due to concerns of suboptimal enhancement of cardiac structures and smaller vessels. The aim of the present study was to evaluate the feasibility of using iso-osmolar CM containing a low iodine dose for CCTA in neonates and infants.

**METHOD AND MATERIALS**

The iodixanol 270 group consisted of 79 CT scans and the iopromide 370 group of 62 CT scans in patients less than one old year. Radiation dose, volume of contrast media, and total iodine dose were retrospectively reviewed. Regarding objective measurements, enhancement and image noise of the ascending aorta (AA), main pulmonary artery (MPA), descending aorta (DA), and left ventricle (LV) were analyzed and contrast-to-noise ratios (CNRs) of the AA and LV were calculated. Regarding subjective measurement, a visual analytic scoring system was devised to evaluate degrees of contrast enhancement, image noise, motion artifact, and overall image quality of each image set. Reader performance for correctly differentiating iodixanol 270 and iopromide 370 by visual assessment was evaluated.

**RESULTS**

No significant intergroup differences were found between radiation doses or volumes of contrast media. However, iodine doses differed in the two groups (2.1 ± 0.94 g in the iodixanol 270 group and 2.94 ± 1.3 g in iopromide 370 group, P< .001). Group objective and subjective measurements were non-significantly different. Overall sensitivity, specificity, positive predictive value, and negative predictive value for correctly differentiating iodixanol 270 and iopromide 370 by visual assessment were 44.3 %, 57.3 %, 57.8 %, and 43.8 %. Overall area under the curve was 0.51.

**CONCLUSION**

In conclusion, the application of iodixanol 270 was found to be feasible for performing pediatric CCTA at 80 kVp in neonates and infants. Objective measurements of contrast enhancement and subjective image quality assessments were not statistically different in the iodixanol 270 and iopromide 370 groups.

**CLINICAL RELEVANCE/APPLICATION**

Low-iodine containing contrast media was not inferior to the high-iodine containing contrast media for cardiac CT angiography using 80 kVp in neonates and infants.

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### Coronary Artery Imaging in Children

**Tuesday, Nov. 29 11:40AM - 12:00PM Room: N228**

**Participants**

Lorna Browne, MD, FRCR, Aurora, CO (Presenter) Nothing to Disclose
Participants
Amy R. Mehollin-Ray, MD, Houston, TX (Moderator) Nothing to Disclose

Sub-Events
PD224-SD-TUA5 Optimal Method of Contrast-enhanced CT for Children with Congenital Heart Disease after Fontan Operation
Station #5

Participants
Motoo Nakagawa, MD, Nagoya, Japan (Presenter) Nothing to Disclose
Yoshiyuki Ozawa, MD, PhD, Nagoya, Japan (Abstract Co-Author) Nothing to Disclose
Yuta Shibamoto, MD, PhD, Nagoya, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE
Children with congenital heart disease (CHD) after Fontan operation need follow-up with contrast-enhanced CT because complications such as occlusion of conduits and systemic venous to pulmonary venous collaterals (V-V collaterals) can occur. However, CT protocol should be refined not to deliver excessive radiation doses. The purpose of this study is to optimize contrast-enhanced CT protocol for children after Fontan operation.

METHOD AND MATERIALS
Between Nov. 2013 and Jan. 2016, 23 patients with CHD after Fontan operation (aged 2 to 10 years, median 5 years) were analyzed using dual source CT with ECG-triggered high-pitch spiral acquisition (Flash Spiral Cardio mode). CT scans were performed at 80 kV. The tube current was adjusted using automodulation. A non-iodinated contrast medium (300 mgI/ml, 2 ml/kg, body weight x 0.1 ml/sec) was injected through the dorsum manus vein. Scanning was began at 20 sec after non-iodinated contrast medium injection started and thereafter a delayed phase scan was obtained. Start of the delayed phase was randomly chosen to be 60 sec in 14 cases or 70 sec in 9 cases. We evaluated 1) enhancement of conduits of Fontan operation at delayed phases of 60 or 70 sec and 2) detectability of the V-V collateral in image findings of the early phase (20 sec). For evaluating enhancement of conduits, a region of interest was placed on conduits and CT values of 60- and 70-sec images were measured. We compared these CT values and evaluated whether conduits were enhanced homogeneously or heterogeneously.

RESULTS
Enhancement of conduits at 60 and 70 sec were 185±46 H.U. and 161±33 H.U., respectively. Enhancement of conduits were homogeneous in 12/14 (86%) and 9/9 (100%) for the 60-sec and 70-sec groups, respectively. 2) In the early phase, CT image revealed a V-V collateral in 5/23 (22%) children after Fontan operation. These V-V collaterals were more clearly depicted in the early phase than in the delayed phase.

CONCLUSION
For contrast-enhanced CT for children after Fontan operation, both of the delayed phases (60 sec and 70 sec) were optimal for evaluation of intra-conduit patency. The early phase is also useful for detecting V-V collaterals in children after Fontan operation.

CLINICAL RELEVANCE/APPLICATION
This study revealed optimal scan delay time for evaluating patency of Fontan conduit and detecting V-V shunt. Therefore, we can prevent excess irradiation for failure of CT scan for children after Fontan operation.
TABLE OF CONTENTS/OUTLINE

Classification of organic acidemias and aminoacidopathies in children.

Characterization of organic acidemias and aminoacidopathies in children based on 1) age at presentation and 2) clinical features. We will 1) classify the diseases based on neonatal, early infantile, late infantile, and juvenile presentation and 2) highlight specific clinical symptoms/findings that may point out a particular organic acidemia or aminoacidopathy.

Review of neuroimaging findings. We will review/illustrate conventional and advanced (e.g. DWI/DTI, MRS) neuroimaging findings of the diseases.

Neuroimaging-based pattern-recognition approach. We will propose a neuroimaging-based pattern-recognition approach that should help the diagnosis of organic acidemias and aminoacidopathies in children.

Take-home messages.

Low Dose CT-guided 3D-printed Models for the Diagnosis and Management of Double Outlet Right Ventricle

Station #7

Participants
Li Wei Hu, DIPLENG, MENG, Pudong, China (Presenter) Nothing to Disclose
Ai-Min Sun, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Qian Wang, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Haisheng Qiu, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Yumin Zhong, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Present low dose cardiac CT protocol for diagnosing DORV
Illustrate how to print 3D cardiac models under CT
Discuss how to use models to classify DORV
Concept of 3D-printing for designing surgical planning

Not Every Pediatric Gastric Mass is a Stromal Tumor! A Pictorial Essay of Common and Uncommon Gastric Lesions Found in Pediatric Population

Station #8

Participants
Alexia Dabadie, MD, Vancouver, BC (Presenter) Nothing to Disclose
Helen R. Nadel, MD, Vancouver, BC (Abstract Co-Author) Nothing to Disclose
Heather J. Bray, MD, Vancouver, BC (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

To describe and review the radiological features of common and uncommon gastric lesions in children
To discuss the combined radiological/nuclear medicine strategy used to investigate a pediatric patient presenting with gastric mass
**Obstructive Reproductive Tract Anomalies in Pediatric Patients: Different Obstruction Sites by MR Imaging and its Role in Preoperative Evaluation**

**PURPOSE**

To outline the anatomic variations of Obstructive reproductive tract anomalies (ORTA) in MR imaging and its role in preoperative evaluation.

**METHOD AND MATERIALS**

The MR imaging and treatment of seventeen pediatric patients with this condition was reviewed and analyzed.

**RESULTS**

Patients presented in two distinct ways: primary amenorrhea with cyclic pelvic pain, or progressive dysmenorrhea. MR imaging showed hematocolpos, hematocervix, hematometra, and/or hematosalpinx; it also provided detailed information regarding uterine morphology, ipsilateral kidney absence and endometriosis. All the seventeen cases were complete or non-communicating ORTA. Obstruction occurred at different level of genital tract, and surgical treatment was given based on the obstruction sites. There was one case of imperforate hymen who had excision of hymenal tissue; four lower vagina atresia and one agenesis of vagina were treated with vaginoplasty; three Herlyn-Werner-Wunderlich syndrome (HWWS) had their vaginal septum resected, and the one with concurrent postpartum placenta implantation was treated accordingly; there were eight cases of cervical agenesis or cervico-vaginal dysgenesis, seven of which were complicated with uterine anomalies, and all cases had their uterus removed. Among the eight obstructive cervical anomalies, there were four cases of cervical agenesis, three cervical dysgenesis with obliterated cervical os, and one cervical dysgenesis with a fibrous stroma.

**CONCLUSION**

ORTA are usually complex female genital malformations which can not fit into single one category of any present classification. ORTA can occur from hymen to cervix, therefore, the preoperative evaluation with MR imaging is vital to guide proper surgery.

**CLINICAL RELEVANCE/APPLICATION**

MR imaging, with its advantages, is the imaging modality of choice to assess the obstruction sites and complicated anomalies of ORTA.
METHOD AND MATERIALS

We studied 13 children with blindness (N=9 boys) ages between 7-12 years old (mean=9.6±1.3), and 15 sighted controls (N=6 boys) (mean=10.3±1.4). Subjects were scanned on a 3T MRI scanner, acquiring BOLD and high-resolution 3D T1WI. Following pre-processing, whole brain weighted-degree functional connectivity and step-wise connectivity graph theory analyses were applied.

RESULTS

In weighted-degree analyses corrected for multiple comparisons, blind children exhibited enhanced connectivity in bilateral ventral premotor, middle cingulate cortex/supplementary motor area and right temporal parietal junction. Several of these connectivity changes positively correlated with age. Using step-wise connectivity analysis, blind children compared to controls demonstrated increased functional streams along certain multimodal integration regions such as the anterior insula and temporoparietal junction bilaterally and right lateral occipital cortex.

CONCLUSION

Blind children show increased functional connectivity in multimodal integration areas compared to controls, and older children showed greater increases within these regions.

CLINICAL RELEVANCE/APPLICATION

Understanding the changes in neuroplasticity developed by blind children, is critical for future clinical and neuroeducational interventions.

PURPOSE

Tourette syndrome (TS) is a childhood-onset chronic disorder characterized by the presence of multiple motor and vocal tics. This study investigated the alterations of spontaneous brain activities in the children with Tourette syndrome (TS) by resting-state functional magnetic resonance imaging (rs-fMRI).

METHOD AND MATERIALS

We obtained rs-fMRI scans from 29 drug-naïve TS children and 30 demographically matched healthy children. 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. We obtained rs-fMRI scans from 29 drug-naïve TS children and 30 demographically matched healthy children. 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.

RESULTS

After assessing the between-group differences of ALFF/fALFF and ReHo, we found the significantly decreased ALFF/fALFF in the bilateral paracingulate gyrus, left insular cortex, and the CSTC circuit including right putamen, the thalamus, and the orbito-frontal cortex, of TS patients. Increased fALFF/ReHo was found in the precuneus cortex, the intracalcarine cortex, and the cuneal cortex of patients. We also found decreased ReHo in the cerebellum. Through the further analysis of the relationship between abnormal brain activities and tic severity scores, we found the significantly positive correlation relationship between the ALFF value of the right putamen and severity scores in TS patients.

CONCLUSION

Our study provides empirical evidence for abnormal spontaneous neuronal activity in TS patients, which may implicate the neurophysiological mechanism in TS children. Moreover, the right putamen can be potentially used as a biomarker of the pathophysiological pattern of early TS children.

CLINICAL RELEVANCE/APPLICATION

TS is a developmental neuropsychiatric disorder which begins at the age of 6 to 7 years. The study of brain changes is very important for the treatment. Previous study mainly focused on brain structure changes. We try to investigate the alterations of spontaneous brain activities in TS children with resting-state functional MRI.

PURPOSE

To investigate the utility of computed tomography (CT) based quantitative small airway and emphysema volume measurements for estimating pulmonary function in children with post-infectious bronchiolitis obliterans (PIBO).
METHOD AND MATERIALS
This retrospective study included 18 chest CT scans and pulmonary function tests (PFT) of 13 children diagnosed with PIBO. The quantitative analysis of segmental and subsegmental bronchi was performed on each chest CT scan measuring following parameters; wall thickness (WT), wall area (WA), lumen average diameter (LAD), lumen area (LA), WA/LA ratio, airway average diameter (AAD), and airway area (AA). The emphysema volume (EV), which was defined as the volume of area showing lower attenuation than the mean attenuation of normal and air trapping areas, was also measured in each lobe. The ratio of emphysema volume to total lung volume (emphysema ratio, ER) was then calculated. The PFT values included forced vital capacity (FVC), forced expiratory volume in one second (FEV1) and FEV1/FVC. Comparison analyses between CT based parameters and PFT results were made with Pearson correlation.

RESULTS
The patients were aged between 4-17 years with the mean of 9.9 ± 4.6 years. A total of 297 segmental bronchi and 235 subsegmental bronchi were analyzed. Among the measured airway parameters, WA, AAD and AA showed significant negative correlation with FEV1 in both pulmonary lobes. Especially in the left lower lobe (LLL), WA, LAD, LA, AAD, and AA showed strong negative correlation with both FEV1 and FEV1/FVC. The volume measurement showed that both EV and ER had significant negative correlations with FEV1 and FEV1/FVC, especially in LLL. In particular, EV showed stronger correlation than ER in both lungs.

CONCLUSION
Quantitative small airway measurement and emphysema volume assessment on chest CT can demonstrate lung function in pediatric PIBO patients. Our results suggest the airway and emphysema parameters measured in LLL may represent the severity of disease and functional impairment in these children, in spite of regional inhomogeneity of PIBO.

CLINICAL RELEVANCE/APPLICATION
Quantitative small airway and emphysema volume measurements based on chest CT can estimate the severity of disease regarding pulmonary function in children with post-infectious bronchiolitis obliterans, whose pulmonary function test may be uneasy to perform due to limited compliance.

Awards
Student Travel Stipend Award

Participants
Bo Ram Kim, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Young Hun Choi, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To assess the image quality and radiation dose of pediatric liver CT acquired at 70kVp during the hepatic arterial phase in comparison with standard scanning at 80-100kVp

METHOD AND MATERIALS
From April 2015 to September 2015, 19 cases of pediatric liver CT were performed in 15 children (mean age 50.5 months, mean BMI 20.9) with a fixed tube potential of 70kVp and a reference tube current of 700mAs during the hepatic arterial phase (AP) (group A) and the portal venous phase (PP) was obtained with the standard protocol using the automatic tube voltage selection and current modulation (reference tube voltage, 120 kV; reference tube current, 150mAs). 25 cases of liver CT in 18 children (mean age 39.3 months, mean BMI 20.6) where both the AP and PP were obtained with the same standard protocol were included for comparison (group B). For quantitative analysis, noise, signal to noise ratio (SNR) and contrast to noise ratio (CNR) were calculated. Subjective overall image quality, noise, visibility of main hepatic arteries and streaking artifacts were evaluated using a 3- or 5-point scoring system for qualitative comparison. Radiation dose reduction (%) of 70kVp scanning was calculated on the basis of the volume CT dose index (CTDIvol) during the AP divided by the CTDIvol during the PP.

RESULTS
Group A showed significantly higher noise and lower SNRs at the paraspinal muscle, liver than group B. Liver-to-muscle and aorta-to-liver CNRs were similar in both groups (group A vs group B, 1.62 vs 1.61 and 13.86 vs 13.30 ± 0.97, respectively, all P > 0.05). Scores for overall image quality, visibility of main hepatic arteries and artifacts showed no significant difference between two groups (overall image quality score, 3.78 vs. 4.12; visibility of main hepatic arteries, 4.33 vs. 4.56 ; artifacts, 1.94 vs. 2.00; all P > 0.05), while subjective noise was significantly more in group A (3.05 vs. 3.92, P=.002). The average percentage radiation dose reduction with 70kVp scanning was 25%.

CONCLUSION
Low kilovoltage arterial phase liver CT at 70kVp provided comparable image quality and reduced radiation dose by 25%, compared with the standard protocol at 80-100kVp

CLINICAL RELEVANCE/APPLICATION
The use of 70kVp in the arterial phase liver CT can be an effective strategy for reducing radiation dose in children, while maintaining image quality.
EMI Todorovic, Vancouver, BC (Abstract Co-Author) Nothing to Disclose
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Heather J. Bray, MD, Vancouver, BC (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To review the latest classification of Childhood Interstitial Lung Disease (chILD) provided by the American Thoracic Society and discuss its strengths and weaknesses. To illustrate this classification with imaging features of some common or specific diagnoses of chILD and to correlate with pathologic findings on lung biopsy when available. To discuss the role of the chest High-Resolution (HR) CT in the diagnostic strategy of chILD

TABLE OF CONTENTS/OUTLINE
Review the clinical definition and epidemiology of chILD
Review the American Thoracic Society classification and discuss its strengths and weaknesses:
- From a radiological point of view
- From a clinical point of view
- From a pathological point of view
Review, with illustrative cases, the radiologic manifestations of common and/or specific diagnoses of chILD, with pathological correlation when available
Discuss the indications for and technical parameters of chest HRCT in the diagnostic workup of chILD

PD114-ED-TUB7 Imaging Signs in the Diagnosis of Acute Appendicitis in Children using Magnetic Resonance Imaging
Station #7

Participants
Larry A. Kramer, MD, Houston, TX (Presenter) Nothing to Disclose
Steven S. Chua, MD, PhD, Houston, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
MR imaging without oral or intravenous contrast material has rapidly replaced computed tomography at our institution in ultrasound equivocal cases of acute appendicitis in children. Similar to all modalities, early appendicitis can be challenging to diagnose. There are imaging signs that can be employed to improve the likelihood of efficient and accurate interpretation. The teaching objectives of this exhibit are as follows: 1. To identify the appendix as reliably and quickly as possible. 2. To recognize subtle changes of early appendicitis. 3. To diagnose perforated appendicitis and abdominal/peritoneal abscess. 4. To identify other causes of acute abdominal pain in children. 5. To learn how to apply DWI in the acute abdomen.

TABLE OF CONTENTS/OUTLINE
Outline:
1. Comprehensive description of the rapid free breathing MRI protocol.
2. Role of MR imaging in the workup of acute appendicitis.
3. Novel descriptors in the evaluation of acute appendicitis that are useful to quickly identify and characterize the appendix (i.e. the spectacle, ring and the dripping candle wax signs).
4. Description of MR imaging signs of ruptured appendicitis (i.e. morel mushroom and fecalith signs).
5. Application of diffusion weighted imaging in the acute abdomen.
6. Examples of other causes of acute abdominal pain in children.

PD114-ED-TUB8 Multi-slice Computed Tomography Assessment of Tracheobronchial Patterns in Partial Anomalous Left Pulmonary Artery
Station #8

Participants
Shiyu Wang, MD, Shanghai, China (Presenter) Nothing to Disclose
Li Wei Hu, DIPLENG, MENG, Pudong, China (Abstract Co-Author) Nothing to Disclose
Haisheng Qiu, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Yumin Zhong, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Illustrate the definition of partial anomalous left pulmonary artery (PALPA) Demonstrate the relationship between PALPA and tracheobronchial tree Illustrate the pros and cons

TABLE OF CONTENTS/OUTLINE
Outline:
1. The definition and clinical features of PALPA One of left pulmonary arterial branch arises from the right pulmonary artery
2. Tracheobronchial abnormalities Kabuki syndrome
3. The relationship between PALPA and tracheobronchial patterns Formed a pulmonary sling with a long segment trachea stenosis Passed below the level of carina and coursed inferior-anterior to the left bronchus with or without causing bronchial compression
4. Three patterns of tracheobronchial tree in PALPA A normal tracheobronchial branch A normal tracheobronchial branch with right tracheal bronchus A bridging bronchus. 4. The pros and cons of MSCT to assess PALPA and airway Low dose 3D reconstruction Light sedation or no sedation Identify the cardiovascular and tracheal anomalies and lung lesions simultaneously
Summary PALPA can potentially cause tracheobronchial anomalies Noninvasive imaging modalities such as MSCT can be helpful for accurate diagnosis and will be helpful for making further management decisions.
Participants
Young Hun Choi, MD, Seoul, Korea, Republic Of (Moderator) Nothing to Disclose
Geetika Khanna, MD, MS, Iowa City, IA (Moderator) Nothing to Disclose
Ethan A. Smith, MD, Saline, MI (Moderator) Nothing to Disclose
Shunsuke Nosaka, MD, Tokyo, Japan (Moderator) Nothing to Disclose
Jonathan R. Dillman, MD, Cincinnati, IA (Moderator) Research Grant, Siemens AG; Research Grant, Guerbet SA; Travel support, Koninklijke Philips NV; Research Grant, Toshiba

LEARNING OBJECTIVES
1) To understand state-of-the-art pediatric MR urography techniques. 2) To become familiar with common MRU applications in children and adolescents. 3) To comprehend how MRU can provide added value to the evaluation of the pediatric kidney and urinary tract.

ABSTRACT
MRI of the kidneys and urinary tract, or MR urography (MRU), is a very useful imaging tool in a subset of the pediatric population when standard imaging evaluation (e.g., ultrasound, voiding cystourethrography, renal scintigraphy) is inadequate or unrevealing. This single imaging test can be used to thoroughly assess renal and urinary tract anatomy, differential renal function, and urinary tract drainage. This educational course will present state-of-the-art MRU techniques that can be used in children and adolescents. Additionally, common as well as uncommon clinical applications will be discussed using a case-based approach.

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/

Jonathan R. Dillman, MD - 2016 Honored Educator

PURPOSE
In children with kidney transplants, rejection is the major cause of allograft failure. There is currently no diagnostic tool capable of detecting rejection in vivo. The purpose of this study was to develop a non-invasive imaging test for detection of allograft rejection in pediatric patients.

METHOD AND MATERIALS
The approach relies on administration of the ultrasmall superparamagnetic iron oxide nanoparticle ferumoxytol, with long lasting blood half-life which is phagocytosed by macrophages causing significant signal effects on T2*-weighted MR images. In an IRB-approved single center prospective clinical trial, patients ranging between 10 to 26 years with acute transplant rejection (n = 4), non-rejecting allografts (n = 15) and normal native kidneys (n = 9) underwent multi-echo T2* fast spoiled gradient-echo (FSPGR) MR imaging at 1-14 days post intravenous injection (p.i.) of Smg Fe/kg ferumoxytol. T2* relaxation times of renal allografts were correlated with the presence or absence of rejection using standard pathology criteria and macrophage semi-quantitative scoring by immunohistology.

RESULTS

Allografts with acute rejection showed prolonged T2* relaxation times compared to normal allografts at 1-24 p.i. (normal: T2* = 8.01 ms, rejection: T2* = 37.88 ms, p < 0.001) and, to a lesser extend, at 1-14 days p.i. (normal: 20.97 ms, rejection: 38.92 ms, p = 0.005). Histological analyses revealed edema and compressed microvessels of allografts undergoing rejection leading to decreased ferumoxytol enhancement. Allografts with or without acute rejection did not show significant differences in macrophage content on histopathology (p = 0.44).

CONCLUSION

A longer T2* on ferumoxytol-enhanced MR images was seen in patients with acute rejection compared with normal transplants. This may be attributable to reduced allograft perfusion and increased edema in rejected transplants as seen on histopathology. While further work is needed to decouple the confounding effects on MR imaging, this study suggests that a change in baseline MR imaging is a promising non-invasive tool for identifying allografts at high risk of rejection.

CLINICAL RELEVANCE/APPLICATION

A non-invasive diagnostic test enabling allograft rejection to be visualized and monitored directly and longitudinally in vivo could reduce anesthesia, invasive biopsies, and associated complications and costs. Further studies are ongoing to integrate this technique into clinical care.

RC413-03 Quantitative 3D Ultrasound Imaging in Pediatric Hydronephrosis

Tuesday, Nov. 29 3:25PM - 3:35PM Room: S102AB

Participants

Juan Cerrolaza, PhD, Washington, DC (Abstract Co-Author) Nothing to Disclose
Hansel J. Otero, MD, Silver Spring, MD (Abstract Co-Author) Nothing to Disclose
Elijah Biggs, BS, Washington, DC (Abstract Co-Author) Nothing to Disclose
Amanda M. George, RT, Springfield, VA (Abstract Co-Author) Nothing to Disclose
Peter H. Yao, BS, Washington, DC, (Abstract Co-Author) Nothing to Disclose
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Craig A. Peters, MD, Washington, DC (Abstract Co-Author) Nothing to Disclose
Marius G. Linguraru, DPhil, MS, Washington, DC (Presenter) Nothing to Disclose

PURPOSE

After proof of concept in 2DUS, we create the first 3DUS-based computer-aided diagnostic (CAD) tool for the assessment of pediatric hydronephrosis (HN), aiming to identify 3D ultrasound (US)-based thresholds for hydrenephrotic kidneys where diuretic nuclear renography (DR) could be safely avoided.

METHOD AND MATERIALS

The retrospective dataset (IRB approved) consists of 20 patients (mean age 10.93 months; range 0-84 months) of variable severity (grade 1 to 4 according to the Society for Fetal Urology HN scale) with concurrent renal 2D, 3DUS and DR (MAG-3) imaging. Mean washout half time (T1/2) was: 16 min. (range 2 to >100 min.). For each volume, segmentation of renal parenchyma (RP) and collecting system (CS) was obtained using a minimally-interactive segmentation tool. A set of 90 3D morphological parameters (including descriptors of the RP and CS size and shape) were automatically extracted using quantitative imaging (QI) analysis techniques. Machine learning theory was used to identify critical cases whose T1/2 was higher than clinically relevant thresholds (20 and 30 min). A best-fit model was derived for each threshold using optimal morphological parameters to categorize the kidneys and receiver operating characteristic curve analysis was performed. For comparison, a similar study was performed using 2DUS-based analysis.

RESULTS

Operating at the optimal point with 100% sensitivity, the accuracy, specificity and area under the curve for the 3DUS-based system were 100%, 100% and 100% for T1/2=20min, and 93%, 67% and 93% for T1/2=30min. This new 3DCAD tool significantly outperformed (p<0.05 using McNemar's statistical test) the original 2D system, whose performance on the same data was 65%, 57%, and 86% for T1/2=20min, and 65%, 53% and 93% for T1/2=30min, respectively.

CONCLUSION

QI analysis of renal 3DUS provides accurate and reliable assessment of pediatric HN, identifying T1/2 thresholds non-invasively. This new 3DUS-based technology shows a higher diagnostic power than a previous 2DUS-based version.

CLINICAL RELEVANCE/APPLICATION

QI analysis of the 3D anatomy of the kidney has the potential to provide robust assessment of HN, avoiding unnecessary MAG-3 DR and its associated radiation and clinical cost.

RC413-04 Not Reported Limitations of Contrast-enhanced Voiding Urosonography Due to Premature Destruction of Second-generation Ultrasound Contrast Agents

Tuesday, Nov. 29 3:35PM - 3:45PM Room: S102AB

Participants
PURPOSE
Evaluation of contrast-enhanced voiding urosonography (ce-VUS) limitations due to premature destruction of second-generation ultrasound contrast agents (UCA).

METHOD AND MATERIALS
161 children were enrolled in the study (71 female and 90 male), the mean age of 3.5 years (range 4 weeks - 16.0 years) who underwent ce-VUS examination between 2011 and 2015.

RESULTS
In 13 children (8%) who underwent ce-VUS we observed the premature destruction of the microbubbles in the urinary bladder, significant for examination efficiency. In all these cases the voiding phase of ce-VUS examination was impossible to be set correctly because of destroyed UCA microbubbles. The phenomenon occurred exclusively in anxious, crying infants and children with restricted voiding.

CONCLUSION
The premature destruction of ultrasound contrast agent is a major factor limiting the efficiency of ce-VUS since applicable voiding phase cannot be reached. Acknowledgments: The study was financed from the means of the National Science Centre granted on the basis of the decision No DEC-2012/05/B/NS5/01554.

CLINICAL RELEVANCE/APPLICATION
The premature destruction of ultrasound contrast agent during ce-VUS is a significant limitation since it prevents applicable ce-VUS voiding phase evaluation and establishing the vesico-ureteric reflux (VUR) diagnosis. Therefore, the usefulness of ce-VUS with second generation UCA needs to be reevaluated, and special attention must be taken for anxious, constantly crying infants and children with possible voiding problems.

PURPOSE
Functional MR urography (fMRU) has established as a comprehensive imaging tool in evaluating malformations of kidneys and urinary tract. However, the utilization of fMRU is limited because of the need for sedation or even general anesthesia in infants, since there are great concerns regarding a possible injury of the developing brain by anesthesia. Therefore, we evaluated the feasibility of fMRU in feed-and-sleep technique.

METHOD AND MATERIALS
We performed feed-and-sleep fMRU in 25 infants (11 boys, median age 104 days, range 37-277 days) with a duplex kidney. Examinations were performed using an optimized MRI-protocol including T2-weighted Half-Fourier-acquisition single-shot turbo spin-echo (HASTE) sequences in transversal, coronal and sagittal plane for morphological imaging and a 15-min dynamic post-contrast scan (50 coronal 3-D-fat-saturated T1-weighted gradient recalled echo (GRE) volumetric interpolated breath-hold examination (VIBE) series. The image quality of examinations was analyzed by two raters in consensus regarding moving artifacts of morphological sequences (1=no; 2=moderate, 3=severe) and visualization of anatomical details of the kidneys and urinary tract (1=high; 2=reduced; 3=no). Further, we analyzed the evaluability of the dynamic urographic sequences with a free available software.

RESULTS
In 22 infants fMRU was performed successfully including evaluation of dynamic urography. Only in 3 infants abortion of examination was necessary due to a severe motion. In 8 infants there were no artifacts observed in transversal and sagittal planes. In the remaining patients, moderate artifacts were noted. Anatomical details of kidneys were visualized with high details in 20/23 infants, whereas only in 3 patients there was no visualization of ureters and ureter ostia possible.

CONCLUSION
We could demonstrate that the feed-and-sleep technique is feasible for fMRU in infants.

CLINICAL RELEVANCE/APPLICATION
Functional MR urography is an important diagnostic tool in CAKUT. Fast sequences offer the possibility of performing this examination in the feed-and-sleep technique.
PURPOSE
To evaluate the CT features of adnexal torsion in the pediatric patients and compared those features between two groups, whether hemorrhagic infarction exist or not.

METHOD AND MATERIALS
Total 31 consecutive pediatric patients (mean age, 12.1 years) were included. The presence of an abnormally located ovary, non-enhancement, hemorrhage, the string of pearls sign, protrusion, eccentric wall thickening, volume of the ipsi- and contralateral ovaries including the volume ratio, and the presence of preexisting lesions were evaluated. The presence of uterine deviation, fallopian tube thickening or dilatation, engorged vessels and vascular knots were evaluated for the CT features of the fallopian tube and uterus. The presence of ascites or hemoperitoneum and peritoneal fat infiltration were recorded for the peritoneal changes.

RESULTS
Among the parameters related with ovary itself, non-enhancement of the involved ovary, hemorrhage, string of pears sign, protrusion of the torsed mass was noted significantly more frequent in hemorrhagic infarction group than non hemorrhagic infarction group (All p < 0.05). Mean volume of the ipsilateral ovary or contralateral ovary didn’t show significant difference, but mean ratio of the volume of ovaries noted significantly larger in hemorrhagic infarction group (36.6, p =0.032). The presence of uterine deviation toward the torsed side, fallopian tube thickening was noted significantly more frequent in hemorrhagic infarction group than non hemorrhagic infarction group (All p < 0.05).

CONCLUSION
Since the primary signs were not well visualized on the CT scan of pediatric patients, secondary signs including non-enhancement of the twisted ovary with hemorrhage, string of pearls sign, protrusion of the torsed mass, increased volume ratio, uterine deviation, fallopian tube thickening could be helpful enough for diagnosis the adnexal torsion in pediatric patients.

CLINICAL RELEVANCE/APPLICATION
Although CT is usually the initial diagnostic tool through which it may be possible to detect adnexal torsion, to our knowledge, only a few reports concerning the CT features of adnexal torsion have been published (and fewer still have been published on pediatric patients). And often misdiagnosis was made and misinterpretation of imaging results in adnexal torsion is commonplace. Therefore, this study might be helpful for improving the imaging diagnosis of adnexal torsion in pediatric patients.

PURPOSE
MR Elastography in Children
Tuesday, Nov. 29 4:05PM - 4:20PM Room: S102AB

Participants
Andrew T. Trout, MD, Cincinnati, OH, (andrew.trout@cchmc.org) (Presenter) Advisory Board, Koninklijke Philips NV; Travel support, Koninklijke Philips NV; Author, Reed Elsevier; Research Grant, Siemens AG

LEARNING OBJECTIVES
1) Explain the basics of MR elastography technique. 2) Describe the current evidence for use of MR elastography in children and young adults. 3) Identify potential opportunities to apply MR elastography in clinical practice.

ABSTRACT
This activity will review the basics of performing and interpreting MR elastography (MRE) examinations in pediatric and young adult patients, in the context of disease processes relevant to these populations. Physics of MRE technique will be briefly reviewed and current evidence supporting use of MRE both in adult and pediatric and young adult patients will be discussed. Advanced and research MRE techniques will also be briefly reviewed in regard to potential advantages in the pediatric and young adult population.

PURPOSE
Pediatric Hepatobiliary Imaging
Tuesday, Nov. 29 4:30PM - 4:45PM Room: S102AB

Participants
Shunsuke Nosaka, MD, Tokyo, Japan, (nosaka-s@ncchd.go.jp) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify the imaging spectrum of hepatobiliary pathology in the pediatric population. 2) Discuss differential diagnosis based on imaging findings.

ABSTRACT
Diagnostic imaging of pediatric hepatobiliary system is usually started with ultrasound (US). US provides fine details of hepatobiliary system when precisely performed. Based on US findings, further imaging study such as hepatobiliary scintigraphy, MRCP, and/or CT will be indicated. An invasive procedure such as percutaneous transhepatic cholangiography is reserved for therapeutic purpose. This educational course will cover a variety of congenital as well as acquired diseases affecting the pediatric hepatobiliary system. In addition, imaging characteristics of common diseases with atypical presentations will be covered.
**PURPOSE**

To evaluate interobserver variation in liver stiffness (LS) measurement by Shear-wave elastography (SWE) and to assess effect of respiration on LS measurement in children with liver diseases.

**METHOD AND MATERIALS**

This retrospective study was approved by our institutional review board, and written informed consent was waived. A total of 66 children who underwent SWE for LS measurement by two radiologists between April 2015 and August 2015 were included. Two operators (operator 1 and 2) were independently measured LS values from the same location of the liver more than three measurements in each patient. Operator 2 performed LS measurements during free breathing and breath-hold states in each patient. Median LS value of three measurements (LSMED3), four measurements (LSMED4), and five measurements (LSMED5) were calculated in two operators. Reproducibility of the LS measurement and interobserver agreement were determined by using 95% Bland-Altman limits of agreement and intraclass correlation coefficients (ICCs). The effect of the respiration on reproducibility of the LS values was assessed by using the paired t-test.

**RESULTS**

Interobserver agreement between LSMED3 performed by two radiologists showed ICC value of 0.909 (95% confidence interval (CI), 0.859-0.943). The 95% limit of agreement between LSMED3 measured by two operators was 3.85 kPa (16.1% of mean LS value). ICC among LSMED3, LSMED4, and LSMED5 was 0.988 (95% CI, 0.981-0.992) in the operator 1 and 0.990 (95% CI, 0.985-0.994) in the operator 2. There was a significant difference between LS values measured during breath hold status and free breathing status (P < .001). The Bland–Altman plot for LS measurements showed mean differences between breath hold and free breathing of -13.1 kPa.

**CONCLUSION**

LS measured by SWE showed almost perfect agreement between two operators and the measurement error was ranged from 3.3-4.4 kPa. Free breathing technique significantly underestimated LS value compared with breath hold technique.

**CLINICAL RELEVANCE/APPLICATION**

When LS measurements are used for monitoring liver diseases, changes in median LS of 16% or greater should be considered to be beyond the range of measurement error and constant breathing technique should be applied.

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**PURPOSE**

To investigate the minimum optimal acquisition number of hepatic shear wave velocities (SWVs) on ultrasound elastography in children with free breathing.

**METHOD AND MATERIALS**

We prospectively performed hepatic ultrasound elastography (supersonic shear wave imaging, SSI) in healthy children with free breathing. SWVs were measured fifteen times for each child at 4 cm depth of the right lobe using a 1-6 MHz convex transducer. Mean SWVs from the three, five, and seven acquisitions were compared to the mean SWV from fifteen measurements, with the intraclass correlation coefficient (ICC) analyzed with the 1,000 times bootstrap method.

**RESULTS**

Twenty-two healthy children were included. Nine patients were boys and the age range was 5-10 years with a mean of 7 ± 1.3 years. The mean SWVs from the three (ICC 0.863), five (ICC 0.888) and seven (ICC 0.922) acquisitions demonstrated almost perfect agreement with the reference of fifteen acquisitions (mean, 6.2 ± 1.8 kPa). In m/sec units, the three (ICC 0.870), five (ICC 0.876) and seven (ICC 0.911) acquisitions also demonstrated almost perfect agreement with the fifteen acquisitions (mean, 1.4 ± 0.2 m/sec).

**CONCLUSION**

Three acquisitions can be enough to measure the hepatic SWVs in children with regular free breathing status using SSI.
Magnetic resonance enterography (MRE) has become the primary imaging modality for evaluating disease activity in pediatric Crohn’s disease (CD) patients. Typical standard of practice involves imaging patients when they become symptomatic; the significance of MRE for surveillance of asymptomatic CD patients is not known. The purpose of this study is to analyze MRE studies performed on asymptomatic young CD patients and to identify MRE imaging features associated with future clinical recurrence.

**METHOD AND MATERIALS**

A retrospective search was performed to identify patients 18 years of age or under with known CD who had MRE performed while asymptomatic on anti-TNFa therapy. All MRE studies were reviewed by an experienced pediatric radiologist blinded to clinical data for presence or absence of four imaging features of activity: wall thickening, T2 hyperintensity, mural hyperenhancement, and vasa recta engorgement (Comb sign), as well as overall assessment of presence of absence of active disease. Two pediatric gastroenterologists reviewed the electronic records of all patients to evaluate for future clinical recurrence, defined as CD-related hospital admission, surgery, or treatment escalation.

**RESULTS**

37 MRE studies performed in 36 asymptomatic patients were identified, with 10 patients demonstrating clinical recurrence within 6 months of MRE. Overall assessment of disease activity by MRE was observed in a higher proportion of patients with clinical recurrence within 6 months (80%) compared to patients without recurrence (29.6%), a statistically significant association (p=0.01, Fisher’s Exact Test). Among individual MRE features, mural hyperenhancement demonstrated the highest accuracy (76%) and was observed in 80% of patients with 6 month clinical recurrence vs 26% without (p=0.01).

**CONCLUSION**

MRE evidence of active inflammation in asymptomatic CD patients on biologic therapy is associated with future clinical recurrence, with mural hyperenhancement having a statistically significant association with clinical recurrence within 6 months. These results suggest a role for imaging in routine surveillance of pediatric CD patients on treatment.

**CLINICAL RELEVANCE/APPLICATION**

Imaging may play a role in the routine surveillance of asymptomatic pediatric Crohn’s disease patients in order to predict future recurrence and provide a temporal window for therapy modification before clinical symptoms recur.

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Magnetic resonance enterography (MRE) is increasingly performed pre-colectomy in pediatric inflammatory bowel disease (IBD)-related colitis, helping distinguish ulcerative colitis (UC) and Crohn’s disease, aiding operative planning. While targeting small intestine, MRE provides opportunity to evaluate the colon. The purpose of the study was to assess the accuracy of MRE in detecting colonic disease in PIBD compared with post-colectomy histopathology.

**METHOD AND MATERIALS**

Research and ethics board approved, clinico-pathologic data were captured by retrospective chart review of patients 2-18 years who underwent colectomy for PIBD from 2000-2014. Preoperative MRE were independently reviewed by two pediatric radiologists, with a consensus read, blinded to reports and clinico-pathologic data. Subset colonic MRE findings recorded included: disease location and extent, wall thickness, wall T2 signal, enhancement degree and pattern, restricted diffusion, stricture presence and length. These were compared with post-colectomy histopathology reports and final diagnosis incorporating ileocolonoscopy data.

**RESULTS**

The reduced number of SWV acquisitions could shorten examination times and make examinations easier for children without the need for breath-holding, thus resulting in wider application of ultrasound elastography in children.
Colectomies were performed in 68 patients (36 male, 32 female), with median age at diagnosis 11 years (range 2-17) and 14 years (range 3-17) at colectomy. Preoperative MRE occurred in 23 patients, with average time to surgery < 1 year. Disease presence and location correlated well with histopathology in 16/23 (70%) MRE, was underestimated in 6 (26%) MRE, with 1 (4%) normal MRE showing UC on histopathology, surgery 1 year post-MRE. In 7 MRE, colonic strictures were reported in various locations, 4 (57%) with fibrotic strictures and 3 (43%) with severe active inflammation but no strictures/fibrosis on histopathology. Limitations related to time between MRE and surgery, and reliability localizing MRE findings with surgical and histopathology specimens, with presence or grade of fibrosis not always recorded on pathology.

**CONCLUSION**

MRE permits detection and localization of colonic IBD, delineating strictures variably. Minor modification such as rectally-instilled contrast may improve this. By correlating MRE with post-colectomy histopathology, there is opportunity to improve our understanding of PIBD on MRI.

**CLINICAL RELEVANCE/APPLICATION**

MRE allows us to assess the colon, with minor technique modification likely needed to optimize this, and correlation with post-colectomy histopathology improves our understanding of PIBD on MRI.

**PURPOSE**

To evaluate the effects of adaptive statistical iterative reconstruction V technique (ASIR-V) on radiation dose reduction and image quality in pediatric abdominal CT.

**METHOD AND MATERIALS**

Sixty children were randomized into three groups, 20 cases each. All children were scanned at 9HU (5mm slice thickness) noise index levels of automatic current modulation with 100 kV on 256-row CT scanner. The rotation time was 0.3s and detector width was 120-160mm. The presetting ASIR-V percentage was 30%, 50% and 70% in Group A, Group B and Group C, respectively. The CT number and standard deviation (SD) were measured on t upper abdominal slice, middle abdominal slice and lower abdominal slice. The dose-length product (DLP) was recorded and effective dose (ED) was computed. Statistical analyses were performed using independent sample t test and ANOVA.

**RESULTS**

In Group A, B and C, SD was 10.28 ± 1.03HU, 11.34 ± 0.82HU and 9.34 ± 1.67HU, respectively. And there was no statistically significant difference among three groups (P>0.05); SD in the three groups was similar to presetting noise index. DLP (mGy·cm) was 3.69 ± 17.55, 55.73 ± 10.62 and 37.65 ± 10.01, respectively; ED (mSv) was 2.57 ± 0.43, 1.78 ± 0.76 and 1.28 ± 0.75, respectively. ED was declining with ASIR-V percentage increasing, and the difference between any two groups was statistically significant (P<0.01).

**CONCLUSION**

ASIR-V technique can effectively reduce the radiation dose without increasing objective image noise, and is of important value in low-dose pediatric abdominal examination.

**CLINICAL RELEVANCE/APPLICATION**

Since children are more radio-sensitive than adults, there is a need to utilize adaptive statistical iterative reconstruction V to minimize radiation exposure without sacrificing image quality during CT exams.

**PURPOSE**

To attempt a quantitative analysis of fatty pancreas by transabdominal ultrasound and evaluate its correlation with metabolic syndrome and HOMA-IR.

**METHOD AND MATERIALS**

This retrospective study included 135 obese children who underwent transabdominal ultrasound between January and December 2015. Fatty pancreas was quantitatively analyzed by pancreato-perihepatic fat index (PPHFI) on transabdominal ultrasound. Associations between PPHFI and components of metabolic syndrome, and correlation between PPHFI and HOMA-IR were analyzed. Multivariate logistic regression analysis was used to identify factors independently correlated with metabolic syndrome. The optimal
RESULTS

PPHFI and HOMA-IR were significantly higher in the group with metabolic syndrome than those in the group of non-metabolic syndrome (p<0.0001). Each component of metabolic syndrome except fasting glucose level revealed a statistically significant association with PPHFI. PPHFI also showed a strong association with HOMA-IR (r=0.70; p<0.0001). PPHFI was an independent factor to predict metabolic syndrome (odd ratio, 3.322; p=0.023), and the best cutoff value of PPHFI to predict metabolic syndrome was 2.34 with high sensitivity of 0.93.

CONCLUSION

Sonographic fatty pancreas which was analyzed by PPHFI may represent a meaningful factor to predict metabolic syndrome and insulin resistance in obese children.

CLINICAL RELEVANCE/APPLICATION

Ultrasonographic quantitative analysis of fatty pancreas might be used as a predictor of metabolic syndrome in obese children.

ABSTRACT

1) Identify causes of pancreatitis and focal pancreatic lesions in children and adolescents. 2) Define the role of imaging in diagnosis and characterization of pancreatic pathology in the pediatric population.
Pediatric Wednesday Case of the Day

Wednesday, Nov. 30 7:00AM - 11:59PM Room: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants
Ting Y. Tao, MD, PhD, Saint Louis, MO (Presenter) Nothing to Disclose
Luke L. Linscott, MD, Cincinnati, OH (Abstract Co-Author) Nothing to Disclose
Karen A. Caudill, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Asef B. Khwaja, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Jie C. Nguyen, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Shannon Farmakis, MD, Saint Louis, MO (Abstract Co-Author) Research Grant, General Electric Company; Research Grant, Guerbet SA

TEACHING POINTS

1) Recognize the importance of a multimodality approach in imaging pediatric patients. 2) Form appropriate differential diagnoses based on clinical information and imaging findings. 3) Recognize the clinical implications of diagnoses.
### MSCP41

**Case-Based Review of Pediatric Radiology (An Interactive Session)**

**Wednesday, Nov. 30 8:30AM - 10:00AM Room: S406A**

**AMA PRA Category 1 Credits™:** 1.50  
**ARRT Category A+ Credits:** 1.50  
**FDA**  
**Discussions may include off-label uses.**

#### Participants
- **Ricardo Restrepo, MD, Miami, FL** (Director)  
  Nothing to Disclose

#### Sub-Events

**MSCP41A  Pediatric Brain and Spine Disorders**

Participants
- **Thierry Huisman, MD, Baltimore, MD**  
  (thuisma1@jhmi.edu) (Presenter)  
  Nothing to Disclose

**LEARNING OBJECTIVES**

1) Correlate imaging findings with clinical symptoms and age/gender demographics to narrow down differential diagnosis of pediatric neurological diseases. 2) Use a pattern recognition approach for identifying various metabolic disorders and its differentials. 3) Apply conventional and advanced neuroimaging for differentiation between tumors and tumor mimickers.

**ABSTRACT**

Based on a series of common and rare pediatric neurological cases various tools will be discussed how to narrow down differential diagnosis in children with neurological diseases. By combining the clinical symptoms as well as the age and gender of a patient many diseases can be excluded. Furthermore a detailed analysis of the distribution and quality of imaging findings as noted on conventional and advanced neuroimaging may further facilitate final diagnosis. In the current session various illustrative cases will be shown.

**MSCP41B  Pediatric Head and Neck Disorders**

Participants
- **Amy F. Juliano, MD, Boston, MA**  
  (amy_juliano@meei.harvard.edu) (Presenter)  
  Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify the major types of congenital lesions, inflammatory and infectious processes, and tumors in the head and neck region in the pediatric population. 2) Recognize the clinical presentations and imaging features of these lesions. 3) Provide differential diagnoses based on imaging appearance and location.

**ABSTRACT**

**MSCP41C  Pediatric Genitourinary Disorders**

Participants
- **Harriet J. Paltiel, MD, Boston, MA** (Presenter)  
  Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify the most appropriate radiological examinations to evaluate children with a variety of genitourinary symptoms. 2) Describe the diagnostic imaging features of important pediatric genitourinary abnormalities. 3) Discuss the application of new techniques of potential benefit in pediatric genitourinary imaging, including ultrasound contrast and dual source CT.

**ABSTRACT**
**Management of Pediatric Thyroid Nodules**

Wednesday, Nov. 30 8:30AM - 8:50AM Room: E352

Heike E. Daldrup-Link, MD, Palo Alto, CA, (heiked@stanford.edu) (Moderator) Nothing to Disclose
Susan E. Sharp, MD, Cincinnati, OH (Moderator) Nothing to Disclose
Marguerite T. Parisi, MD, MSED, Seattle, WA (Moderator) Nothing to Disclose
Robert Orth, MD, PhD, Houston, TX, (rcorth@texaschildrens.org) (Moderator) Research support, General Electric Company;
Victor J. Seghers, MD, PhD, Houston, TX (Moderator) Nothing to Disclose

**Learning Objectives**

1) Review the etiologies and imaging appearances of thyroid nodules in children. 2) Discuss the management of thyroid nodules and differentiated thyroid cancer in children and how this management differs from that in adults.

**Abstract**

Awards

*Student Travel Stipend Award*

Participants
Marguerite T. Parisi, MD, MSED, Seattle, WA, (meg.parisi@seattlechildren’s.org) (Presenter) Nothing to Disclose

PURPOSE

To comparatively evaluate the new Korean Thyroid Imaging Reporting and Data System (K-TIRADS) and conventional Korean Society of Thyroid Radiology (KSThR) guidelines regarding the malignancy risk stratification of thyroid nodules in children.

**Method and Materials**

From January 2011 to February 2016, a total of 50 thyroid nodules in 46 children (mean age, 13.6 years, range 4-18 years) with final diagnoses through a fine needle aspiration or operation were included in this study. Ultrasonographic features of 50 nodules including solidity, echogenicity, shape, orientation, margin and presence of calcifications were retrospectively assessed and each nodule was classified according to the K-TIRADS (five categories from 1 to 5) and KSThR (three categories; probably benign, indeterminate, suspicious malignancy). The malignancy risks of the thyroid nodules were assessed according to each category, respectively.

**Results**

Of the 50 thyroid nodules, 29 (58%) were benign and 21 (42%) were malignant. The probably benign nodules on KSThR guidelines (n=5) were all categorized into K-TIRADS category 2. Among the indeterminate nodules (n=25), 20 nodules were assigned to K-TIRADS 3 and 5 nodules were assigned to K-TIRADS 4. Suspicious malignant nodules (n=20) were classified to K-TIRADS 4 (n=6) or 5 (n=14). The malignancy rates with KSThR guidelines were 0% (0 of 5 nodules) for probably benign nodules, 16% (4 of 25 nodules) for indeterminate nodules and 85% (17 of 20 nodules) for suspicious malignancy, while the malignancy rates of K-TIRADS category 2, 3, 4, 5 nodules were 0% (0 of 5 nodules), 10% (2 of 20 nodules), 63.6% (7 of 11 nodules) and 85.7% (12 of 14 nodules), respectively. The area under the ROC curve (AUC) of K-TIRADS was slightly higher than that of KSThR (AUC = 0.885 and 0.869, respectively) without a significant difference (P=.608). Six nodules of 1 to 1.5 cm in diameter which belong to the indeterminate category on KSThR and to category 3 on K-TIRADS were all confirmed as benign nodules and would have avoided a fine needle aspiration if K-TIRADS had been applied.

**Conclusion**

Application of K-TIRADS to thyroid nodules of children was feasible and resulted in more detailed stratification of thyroid nodules than KSThR guidelines. Introduction of K-TIRADS may reduce an unnecessary fine needle aspiration.
Application of K-TIRADS may decrease needless aspiration by providing more specific malignancy risk stratification.

**RCS13-03 Ultrasound Risk Stratification Using the 2015 American Thyroid Association Guidelines for Children with Thyroid Nodules**

Wednesday, Nov. 30 9:00AM - 9:10AM Room: E352

Participants
Iclal Erdem Toslak, MD, Chicago, IL (Presenter) Nothing to Disclose
Khali Alababan, MBBS, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Amany Aziz, MBCh, Maywood, IL (Abstract Co-Author) Nothing to Disclose
Jennifer E. Lim-Dunham, MD, Maywood, IL (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To determine accuracy of categorization of nodule malignancy when applying risk stratification criteria from the 2015 American Thyroid Association (ATA) Guidelines for Children with Thyroid Nodules.

**METHOD AND MATERIALS**
Thirty-nine thyroid nodules of 33 pediatric patients (28 female and 5 male, with age range 14-18 years) with histopathologically proven diagnosis were retrospectively reviewed. Two radiologists independently rated the ultrasound images according to 2015 ATA Guideline criteria (composition, echogenicity, shape, size, margins, and echogenic foci) which were used to stratify nodules for risk of malignancy, ranging from very low to high suspicion. Vascularity was also assessed. In cases where the observers disagreed, consensus rating was performed. Multivariate analysis was used to measure performance of individual parameters in predicting malignancy. Kappa coefficients were calculated to measure inter-observer agreements for individual parameters.

**RESULTS**
Twenty seven nodules were benign and 12 malignant (10 papillary carcinoma, 2 follicular carcinoma).  In 27 lesions, there was agreement between ultrasound risk stratification and pathology. Overall accuracy of risk stratification was 69.23%, with sensitivity of 100%, specificity of 56 %, and area under the ROC curve of .79. Individual features which were best predictors of malignancy were irregular/lobulated margins (55 times as likely to be malignant), hypoechochogenicity (6 times) and taller than wide shape (3 times). Inter-observer agreement for individual parameters were as follows: almost perfect for overall level of suspicion (k=0.83); substantial for nodule composition (k=0.80), echogenic foci (k=0.77), and vascularity (k=0.76); moderate for margins (k= 0.60); and fair for shape (k= 0.29).

**CONCLUSION**
ATA Guideline ultrasound parameters allow for appropriate stratification of malignancy risk for thyroid nodules in children prior to tissue diagnosis. Addition of vascularity may contribute to the accuracy.

**CLINICAL RELEVANCE/APPLICATION**
ATA Guideline ultrasound criteria are useful for directing management and fine needle aspiration recommendations for pediatric thyroid nodules.

**RCS13-04 Papillary Thyroid Carcinoma Arising in Children and Adolescent Hashimoto’s Thyroiditis: Ultrasonographic and Pathologic Findings**

Wednesday, Nov. 30 9:10AM - 9:20AM Room: E352

Participants
Sun Hye Jeong, MD, Bucheon-si, Korea, Republic Of (Presenter) Nothing to Disclose
Eun Hye Lee, MD, Bucheon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hyun-Sook Hong, MD, PhD, Bucheon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jeong Ja Kwak, Bucheon-si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
We compared the ultrasonography and pathology features of papillary thyroid carcinoma (PTC) in pediatric and adolescents with Hashimoto's thyroiditis (HT) with those of non-HT patients.

**METHOD AND MATERIALS**
Eleven patients who were surgically confirmed to have pediatric or adolescent PTC from2006 to 2014 were included in this study. We retrospectively analyzed the preoperative ultrasonography and pathology features of PTC arising in HT and non-HT patients.

**RESULTS**
On ultrasonography, thyroid gland was lobulated and enlarged, with many scattered microcalcifications in four of five HT patients. Four of six non-HT patients had suspicious masses with calcifications. The diffuse sclerosing variant of PTC (DSVPTC) was found in three of five HT patients, but none in non-HT patients. Macroscopic or microscopic extrathyroidal extension was evident in all of the HT patients and four of the non-HT patients. Neck lymph node metastases were in all HT patients and five of non-HT patients.

**CONCLUSION**
Three of five PTCs in pediatric and adolescent HT patients were DSVPTC, whereas all PTCs of the non-HT patients were classic type. On ultrasonography, thyroid gland was diffusely enlarged with scattered microcalcifications in four of five HT patients. All five HT cases had aggressive disease, including extrathyroidal extension and cervical lymph node metastases.

**CLINICAL RELEVANCE/APPLICATION**
Some evidence suggests that HT patients are at an increased risk of PTC compared to the general population. However, as PTC is
There are 61 statistically significant pairwise correlations between MRI-defined computational features and medulloblastoma. Using the Pearson correlation metric, we reported significantly correlated features using P-values and False Discovery Rate (FDR) to control for multiple testing.

We performed feature association between molecular subtypes and computational image features. In each case, we identified a molecular subtype (of the four previously described subtypes: WNT, SHH, Subgroup3, and Subgroup4) was identified. We extracted 249-dimensional image features capturing a variety of tumor phenotypic characteristics including tumor intensity, histogram, gabor filters, shape, and edge sharpness. In addition, a molecular subtype (of the four previously described subtypes: WNT, SHH, Subgroup3, and Subgroup4) was identified. We performed feature association between molecular subtypes and computational image features using the Pearson correlation metric and reported significantly correlated features using P-values and False Discovery Rate (FDR) to control for multiple testing.

### RESULTS

Performing CT textural analysis on lymph nodes in a pediatric patient cohort can reliably differentiate between benign and malignant lymphadenopathy.

### CLINICAL RELEVANCE/APPLICATION

Addition of CT textural analysis may reduce the potential risks associated with serial CT imaging or tissue sampling for enlarged lymph nodes identified in pediatric patients.

### METHOD AND MATERIALS

In this HIPAA compliant, IRB approved single institution retrospective study, a radiology report database identified pediatric patients <18 years old who had contrast-enhanced CT studies performed from 2005-2015. CT images and electronic records were reviewed to identify lymph nodes 10-20mm in short axis and confirm final diagnosis (lymphoma, metastasis from other primary, or inflammation from Crohn’s disease or appendicitis). CT textural analysis (CTTA) was performed using a commercially available research software program (TexRAD). This applies a filtration-histogram technique to characterize tumor heterogeneity. The filtration step selectively filters and extracts texture features at different anatomical scales varying from 2mm (fine features) to 6mm (coarse features). Receiver operating characteristic (ROC) analysis was performed to identify optimum threshold values for differentiating benign and malignant lymph nodes and test performance characteristics were calculated.

### CONCLUSION

Performing CT textural analysis on lymph nodes in a pediatric patient cohort can reliably differentiate between benign and malignant lymphadenopathy.

### METHOD AND MATERIALS

In this IRB-approved study, we included 29 children with medulloblastoma who had preoperative MRIs with T2-weighted images and tumor tissue specimens collected at an academic medical center. Three radiologists delineated tumor boundaries on multiple contiguous T2-weighted images of each tumor. We developed a computational framework to extract 249-dimensional image features capturing a variety of tumor phenotypic characteristics including tumor intensity, histogram, gabor filters, shape, and edge sharpness features. In addition, a molecular subtype (of the four previously described subtypes: WNT, SHH, Subgroup3, and Subgroup4) was identified in each case. We performed feature association between molecular subtypes and computational image features using the Pearson correlation metric and reported significantly correlated features using P-values and False Discovery Rate (FDR) to control for multiple testing.

### RESULTS

There are 61 statistically significant pairwise correlations between MRI-defined computational features and medulloblastoma.
molecular subtypes (P-value<0.05 and FDR<0.01). A majority of image features reflecting molecular subtypes (up to 96.72%) belonged to four feature types: intensity histogram (n=10), edge sharpness (n=4), daube texture (n=37), and edge shape/Local Area Integral Invariant (LAI) (n=8). In the category of edge sharpness, for example, two features of scale median (P-value=0.036) and window histogram (P-value=0.032) were correlated to the molecular subtypes in medulloblastoma. Shape compactness, another descriptor defining tumor sphericity, was also found to correlate with molecular classes (P-value=0.03). The most significant image feature was the skewness of Local Area Integral Invariant (LAI) that measured the local shape variance of tumor (P-value=0.005), suggesting its strong association with molecular subtypes in medulloblastoma.

CONCLUSION
MRI-defined computational image features, specifically tumor shape, can be used to predict molecularly-defined subtypes of medulloblastoma.

CLINICAL RELEVANCE/APPLICATION
Computational image features on MRI are associated with molecular subtypes of medulloblastoma, allowing for non-invasive assessment of molecular signatures in this malignant childhood brain tumor.

RC513-07 Pediatric Solid Tumors: Image Based Therapy Decisions
Wednesday, Nov. 30 9:40AM - 10:00AM Room: E352

Participants
Ethan A. Smith, MD, Saline, MI, (ethans@med.umich.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) To review the staging systems of common pediatric solid tumors, including Wilms tumor, neuroblastoma, hepatoblastoma and lymphoma. 2) To understand the imaging findings which correspond to critical branch points in treatment algorithms and which will change clinical management in pediatric solid tumor patients.

ABSTRACT

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

Ethan A. Smith, MD - 2016 Honored Educator

RC513-08 Optimization of Pediatric PET-CT
Wednesday, Nov. 30 10:20AM - 10:40AM Room: E352

Participants
Susan E. Sharp, MD, Cincinnati, OH (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Discuss preventable PET/CT artifacts common in pediatric patients. 2) Discuss protocol options for optimizing radiation dose during pediatric PET/CT imaging.

ABSTRACT

PURPOSE
Simultaneous 18F-FDG-PET/MRI is a promising modality for staging and response imaging in solid malignancies especially in pediatric patients. However, there is a need for evidence when using PET/MRI as standard method. The aim of this study was to assess the diagnostic performance of 18F-FDG PET/MRI compared to conventional imaging modalities (CIM) in a pediatric oncologic population.

METHOD AND MATERIALS
This prospective monocentric trial was approved by the local IRB. All parents gave their informed consent. 56 whole-body 18F-FDG-PET/MR examinations were performed in 28 patients (16 female, 13±5 years; the baseline and the first response control in each patient) with solid tumors (13 Hodgkin lymphoma, 4 NHL, 10 sarcoma, 1 adrenal carcinoma). Reading was performed by a radiologist
and a nuclear medicine physician in consensus. A maximum of one target lesion was recorded for each anatomical region. Lesions were interpreted by classification into 3 classes (benign – unclear – malignant). Histopathological results and follow-up examinations were used to define the gold standard for lesion interpretation. PET/MR findings were compared to findings reported in the otherwise available CIM, mainly consisting of ultrasound, plain radiographs and CT or MRI.

RESULTS
A total of 253 target lesions were detected in the baseline examination. 3% (7/253) of these lesions were only detected in PET/MRI; 1 lung lesion was only detected by CIM. In 85% (207/245) of lesions, CIM and PET/MRI showed concordant results concerning lesion interpretation; In 12%/3% of lesions, PET/MRI led to downgrading/upgrading of lesion interpretation. 175 lesions were detected in response control. Response assessment was concordant between PET/MRI and CIM in 63%; in 2%/35 of lesions, PET/MRI led to an upgrading/downgrading.

CONCLUSION
PET/MR allows for comprehensive oncologic imaging in pediatric oncology with possible advantages over CIM.

CLINICAL RELEVANCE/APPLICATION
The use of PET/MR may improve diagnostic specificity in pediatric oncology, especially for response assessment under therapy.

RC513-10 Tumor Textural Features in Baseline FDG PET Predicts Survival in Pediatric Osteosarcoma: A Prospective Study

Wednesday, Nov. 30 10:50AM - 11:00AM Room: E352

Participants
Hyung-Jun Im, MD, Madison, WI (Presenter) Nothing to Disclose
Chihwa Song, PhD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Yi Zhang, Madison, WI (Abstract Co-Author) Nothing to Disclose
Huiyun Wu, Memphis, TN (Abstract Co-Author) Nothing to Disclose
Jianrong Wu, Memphis, WI (Abstract Co-Author) Nothing to Disclose
Barry L. Shulkin, MD, MBA, Memphis, TN (Abstract Co-Author) Nothing to Disclose
Steve Cho, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose

PURPOSE
In this study, we evaluated the prognostic value of tumor textural features of the baseline FDG PET scan in pediatric patients with osteosarcoma.

METHOD AND MATERIALS
Thirty-four patients with osteosarcoma were enrolled prospectively and underwent baseline FDG PET/CT. The patients received neoadjuvant chemotherapy (CTX), and subsequent surgical resection. Metabolic tumor volume (MTV) of the primary tumor, a previously reported prognostic factor in osteosarcoma, was measured using a standardized uptake value (SUV) threshold of 2.5. Thirty-nine different FDG PET tumor textural features were analyzed for all primary tumor volumes. Histological response after tumor resection was evaluated. Each parameter was divided into two groups using an optimal cut off defined by ROC analysis. Association of baseline FDG PET textural features with histologic response, tumor recurrence, event free survival (EFS), and overall survival (OS) were evaluated.

RESULTS
Among 34 enrolled patients, 15 were classified as responders after CTX, 15 experienced recurrences, and 10 died during the follow up period. Neither the FDG PET/CT textural features nor MTV were associated with histologic response. Four textural features (energy, gray-level nonuniformity (GLN), maximum probability (MP), and run percentage (RP)) and MTV were associated with tumor recurrence (Wilcoxon test, \( P = 0.035, 0.016, 0.0025, 0.013 \) and \( 0.01 \)) and predictive of EFS (log rank test, \( P = 0.022, 0.003, 0.0004, 0.001, \) and \( 0.002 \)). Six textural features (area under curve (AUC), correlation, GLN, MP, run-length nonuniformity (RLN), and RP) and MTV were associated with survival (Wilcoxon test, \( P = 0.014, 0.011, 0.0005, 0.011, 0.004, 0.0005 \) and \( 0.0006 \)) and predictive of OS (log rank test, \( P = 0.005, 0.006, 0.0002, 0.006, 0.0001, 0.0003, \) and \( 0.001 \)). On multivariable Cox regression analysis, only MP was an independent prognostic factor for EFS (\( P = 0.025 \)) and none of the textural features was an independent factor for OS.

CONCLUSION
FDG PET osteosarcoma textural features at baseline were predictive of EFS and OS. MP was an independent prognostic factor for EFS on multivariate analysis.

CLINICAL RELEVANCE/APPLICATION
Baseline FDG PET textural features may be an important parameter for risk stratification of pediatric patients with osteosarcoma, requiring further validation.

RC513-11 Whole Body Functional and Anatomical MRI: Accuracy in Staging and Treatment Response Monitoring in Childhood and Adolescent Hodgkin’s Lymphoma Compared to Conventional Multimodality Imaging

Wednesday, Nov. 30 11:00AM - 11:10AM Room: E352

Participants
Stuart A. Taylor, MBBS, London, United Kingdom (Abstract Co-Author) Research Consultant, Robarts Clinical Trials, Inc
Shonik Punwani, MBBS, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Arash Shonit, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Paul D. Humphries, MBBS, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Leon J. Menezes, FRCR, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Deena Neriman, MD, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Stephen Daw, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Ananth Shankar, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
To compare whole body MRI (WB-MRI) & conventional investigations for staging & treatment response monitoring in childhood Hodgkin’s lymphoma

Whole-body MRI for Staging, Therapy Monitoring and Follow-up of Pediatric Malignancies-Comparison with Established Imaging Methods

Wednesday, Nov. 30 11:10AM - 11:20AM Room: E352

Participants
Guenther K. Schneider, MD, PhD, Homburg, Germany (Presenter) Research Grant, Siemens AG; Speakers Bureau, Siemens AG; Speakers Bureau, Bracco Group; Research Grant, Bracco Group; Jonas Streufer, MD, Homburg, Germany (Abstract Co-Author) Nothing to Disclose
Philippe Jagoda, MD, Homburg/Saar, Germany (Abstract Co-Author) Nothing to Disclose
Paul S. Raczeck, MD, Homburg, Germany (Abstract Co-Author) Nothing to Disclose
Arno Buecker, MD, Homburg, Germany (Abstract Co-Author) Research Grant, Siemens AG; Consultant, Bracco Group; Speaker, Bracco Group; Constanze, Medtronic plc; Research Grant, Medtronic plc; Research Grant, GlaxoSmithKline plc; Research Grant, Bioteo AG; Research Grant, Oncogenex Pharmaceuticals, Inc; Research Grant, Bristol-Myers Squibb Company; Research Grant, Eli Lilly & Company; Research Grant, Pfizer Inc; Research Grant, Hoffmann-La Roche Ltd; Research Grant, sanofi-aventis Group; Research Grant, Merrimack Pharmaceuticals, Inc; Research Grant, Sirtex Medical Ltd; Research Grant, Concordia Healthcare Corp; Research Grant, Abbvie Inc; Research Grant, Takeda Pharmaceutical Company Limited; Research Grant, Merck & Co, Inc; Research Grant, Affirmed NV; Research Grant, Bayer AG; Research Grant, Johnson & Johnson; Research Grant, Seattle Genetics, Inc; Research Grant, Onyx Pharmaceuticals, Inc; Research Grant, Synta Pharmaceuticals Corp; Research Grant, Siemens AG; Research Grant, iSYMED Gmbh; Research Grant, St. Jude Medical, Inc; Co-founder, Aachen Resonance GmbH;

PURPOSE
In 68 pediatric patients with malignant tumors whole body MRI was performed and evaluated as the sole staging and follow-up procedure during and post therapy including evaluation of the lungs. Results were compared with established staging procedures as PET, MIBG or bone scintigraphy, CT and ultrasound.

METHOD AND MATERIALS
A total of 321 whole body examinations were performed for staging and follow-up of different malignant tumors, including 21 lymphoma, 31 solid tumors (neuro-, nephro- and hepatoblastoma) as well as 16 pts. with different types of sarcoma. The MR protocol incl. T1w dynamic CE GRE sequences of the abdomen post CM injection (0,05 mmol/kg BW Gd-BOPTA / Multihance) and during the liver specific phase. DWI (free breathing) and transversal T2w TSE sequences with navigator triggering and a composed whole-body STIR-sequence in coronal orientation completed the imaging protocol. Depending on findings in this basic protocol, additional sequences for example for localization of soft-tissue or bone-tumors were performed.

RESULTS
Differences between MRI and CT were seen regarding the number of detected small lung mets (< 3mm), however relevant lesions for staging were correctly diagnosed. Advantages for WB-MRI were seen in follow-up of diffuse T-cell Lymphoma, in which MRI could show residual disease under chemotherapy, although PET imaging showed complete metabolic response. Further advantages could be demonstrated in local staging of sarcoma, but also in initial staging of Ewing sarcoma, in which small lesions missed on PET imaging and confirmed by MR-guided biopsy could be detected. Due to the possibility to repeat MRI in shorter intervals in follow-up, recurrent disease in two cases of Hodgkin- and 3 cases of Non-Hodgkin-Lymphoma were diagnosed primarily by WB-MRI. Similarly

CONCLUSION
WB-MRI holds promise as an alternative to conventional staging modalities using ionising radiation, but levels of discordance suggest it is not ready to fully replace them

CLINICAL RELEVANCE/APPLICATION
WB-MRI is attractive as a staging modality for paediatric lymphoma but disagreement with standard modalities suggests caution must be applied before introducing into staging algorithm

Wednesday, Nov. 30 11:10AM - 11:20AM Room: E352
CONCLUSION

Whole body imaging can correctly stage and diagnose a variety of malignant tumors in pediatric patients and allows for accurate patient management during therapy and follow-up. Advantages of established imaging methods were only seen for detection of small lung metastases on pulmonary CT, however differences seen did not result in a change of patient management.

CLINICAL RELEVANCE/APPLICATION

This study demonstrates the potential of whole body MRI for initial diagnosis, therapy monitoring and follow-up of pediatric malignancies.

PURPOSE

To evaluate diffusion-weighted MRI (DWI) as a complementary prognostic marker in comparison to established semiquantitative metaiodobenzylguanidine (mIBG) scoring methods in patients with stage 4 neuroblastoma.

METHOD AND MATERIALS

IRB waived informed consent and approved this retrospective, HIPAA-compliant study. 17 patients (13 boys, age 5 ± 3 years; range 10 months – 12 years) with stage 4 neuroblastoma were examined with whole-body MRI including whole-body DWI as baseline and/or for follow-up between January 2010 and April 2015. All patients received also a mIBG scan within +/- 30 days. In all patients we performed established CURIE and SIOPEN scoring for mIBG scans and also adapted the scoring for DWI.

RESULTS

In total there were 52 matched examinations of DWI and mIBG scan. 2 examinations were at baseline, 43 examinations in follow-up during/after therapy and 7 examinations at recurrence. Assessed Curie and SIOPEN scores showed excellent correlation for DWI and mIBG scans (r=0.91; r=0.76) in baseline and recurrence examinations. In contrast in interim examinations there was only a poor correlation for DWI and mIBG scans (Curie score r=0.18; SIOPEN score r=0.25).

CONCLUSION

DWI could serve as a complementary prognostic marker in baseline and recurrence examination of neuroblastoma. Poor correlation of DWI and mIBG scans in interim examinations could be an expression of different aspects of tumor biology and should be further evaluated.

CLINICAL RELEVANCE/APPLICATION

DWI can play an important role as a complementary prognostic marker in stage 4 neuroblastoma.

PURPOSE

We present the possible application of contrast enhanced ultrasound (CEUS) in pediatric patients with solid tumors based on single-center experience. We would like to underline advantages and disadvantages of CEUS in comparison to the imagining modalities like magnetic resonance imaging (MRI), computed tomography (CT), b-mode ultrasound throughout the initial diagnosis, treatment, monitoring the therapy and monitoring of residual tumor tissue after the treatment of children solid tumors.

METHOD AND MATERIALS

Between November 1st, 2011 and October, 31st, 2015, 152 children (range ten days -16.0 years) underwent CEUS and were consequently enroll to the prospective study according to the protocol. From the study cohort, we selected group of 20 children with solid tumors. There were cases with the following diagnoses: nephroblastoma, neuroblastoma, mesenteric fibromatosis, osteosarcoma, rhabdomyosarcoma, ganglioneuroma, lipoblastoma, adrenal hematoma. CEUS examinations were performed for distinguishing benign masses from malignant, evaluating the malignant tumor vasculature, monitoring vasculature changes during the treatment, and assessment the residual lesions. The correlation between CEUS and MRI/CT/b-mode ultrasound was performed (if applicable).

RESULTS

In all cases, CEUS examination obtained relevant from the clinical point of view information. In comparison to MRI/CT imaging, CEUS
reveals in real time additional features like tumor vascularity/supplying vessels what was crucial to established initial diagnosis. In the case of biopsy, CEUS proved high accuracy in estimating areas of necrosis. The quantitative assessment of tumor vascularity changes during treatment and monitoring of residual tumor tissue after the treatment was also possible. In 8 cases, CEUS allowed abandoning MRI/CT scans.

**CONCLUSION**

The results of our study are suggestive of the increasing significance of CEUS exams in the initial diagnosis and treatment monitoring of solid tumors in children. Additional data about tumor vascularity could shorten the diagnostic imaging process. Moreover, the lack of nephrotoxicity, ionizing radiation and no need for general anesthesia is especially advantageous in children. The study was financed from the means of the National Science Centre granted on the basis of the decision No DEC-2012/05/B/NZ5/01554.

**CLINICAL RELEVANCE/APPLICATION**

The CEUS could reduce the number of X-ray examination in children with solid tumors.

**RC513-15 Abdominal Complications of Pediatric Cancer Therapy**

**Wednesday, Nov. 30 11:40AM - 12:00PM Room: E352**

**Participants**

M. Beth McCarville, MD, Memphis, TN (*Presenter*) Consultant, General Electric Company

**LEARNING OBJECTIVES**

1) The benefits of ultrasound for the evaluation of the colon in children with suspected neutropenic typhilitis/colitis. 2) Imaging features of sinusoidal-obstruction-syndrome. 3) Imaging features of hemorrhagic cystitis.

**ABSTRACT**
Participants
Keith J. Strauss, FAAPM, FACR, Cincinnati, OH, (keith.strauss@cchmc.org) (Presenter) Research Consultant, Koninklijke Philips NV; Speakers Bureau, Koninklijke Philips NV

LEARNING OBJECTIVES

1) Understand why the thickness of the patient irradiated during an x-ray exam is a better indicator of the required radiographic technique than the patient’s age, weight, or BMI. 2) Better understand the growth patterns of children from newborns to adults. 3) Learn simple techniques to use to obtain the patient thickness either before or after the examination. 4) Understand basic dose indices of CT and how to use these to manage patient dose from newborns to adult sized patients. 5) Understand basic dose indices for radiographic/fluoroscopic exams and how to use these to manage patient dose from newborns to adult sized patients.

ABSTRACT

Purpose: To assist radiologic technologists in the process of obtaining the correct radiographic technique for CT, radiographic, or fluoroscopic exams of children regardless of their size or age. Organization of Content: Radiologic technologists need accurate knowledge of the thickness of the pediatric or adult patient to best select the proper radiographic technique for all exams using x-rays. The different rates of growth of the different body parts of the pediatric patient will be investigated. Simple tools and techniques to quickly determine the thickness of the body part imaged will be presented. Armed with the patient size of the body part to be imaged, the radiologic technologist can use available published data to adjust CT technique factors to obtain the desired Size Specific Dose Estimate (SSDE) regardless of the patient's size or age. The size of the patient also determines the proper radiologic techniques for radiographic/fluoroscopic dose management for direct radiography, computed radiography, general fluoroscopy, or interventional fluoroscopy. Dose indices of air kerma and kerma area product will be discussed along with methods to manage radiation dose to the patient during these exams.
**Participan**ts
Ricardo Restrepo, MD, Miami, FL (*Director*) Nothing to Disclose

**Sub-Events**

**MSCP42A  Pediatric Abdominal Disorders**

Participants
Kate A. Feinstein, MD, Chicago, IL, (kfeinstein@radiology.bsd.uchicago.edu) (*Presenter*) Nothing to Disclose

**LEARNING OBJECTIVES**
1) Recommend the most appropriate radiological exam for a pediatric patient with a suspected abdominal disorder. 2) Compare strategies for evaluating the acute abdomen in different age groups. 3) Assemble differential diagnoses to enhance clinical management strategies.

**MSCP42B  Pediatric Musculoskeletal Disorders**

Participants
Robert Orth, MD,PhD, Houston, TX, (rcorth@texaschildrens.org) (*Presenter*) Research support, General Electric Company;

**LEARNING OBJECTIVES**
1) Identify various musculoskeletal disorders that occur in children. 2) Apply the most appropriate imaging modality for evaluating pediatric musculoskeletal disorders. 3) Describe characteristic imaging findings of various pediatric musculoskeletal disorders.

**MSCP42C  Pediatric Interventional Cases**

Participants
Ricardo Restrepo, MD, Miami, FL (*Presenter*) Nothing to Disclose

**LEARNING OBJECTIVES**
1) Learn the differential diagnosis of some vascular anomalies in children and their treatment. 2) Recognize some arterial and venous pathologies in children and their treatment. 3) Recognize benign and malignant features of thyroid nodules in children and be familiar with the guidelines for thyroid nodule biopsy in pediatric patients. 4) Be familiar with complications associated with acute pancreatitis in pediatric patients including the proper terminology and indications for treatment.

**ABSTRACT**
**PD235-SD-WEA1**

External and Intraoral-External Hybrid B0 Field Correction Devices for Decreasing Magnetic Susceptibility Artifacts on Brain MRI Induced by Stainless Steel Orthodontic Appliances

**Participants**
- Pilar Des-Suarez, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose
- Silvia Hidalgo-Tobon, PhD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
- Benito De Celis IV, Puebla, Mexico (*Abstract Co-Author*) Nothing to Disclose
- Cora Guerrero, Mexico, Mexico (*Abstract Co-Author*) Nothing to Disclose
- Eduardo Castro Sierra, Mexico, Mexico (*Abstract Co-Author*) Nothing to Disclose

**PURPOSE**

Music modulates structural and functional changes in the brain, which promotes cognitive, motor, sensory, emotional and even social processes. The maturation of tracts and connections between motor, auditory and other modalities areas, allow the development of cognitive functions during the course of life, including musical skills.

**METHOD AND MATERIALS**

15 pediatric healthy subjects between 5 and 6 years old were recruited for this study. All subjects were: right handed, and had no antecedents of sensory, perception or neurological disorders. All volunteers had not been trained in the past in any kind of artistic discipline. Volunteers were healthy during the study protocol. Scanning was performed in a 1.5 T Philips-InteraAchieva scanner (Philips). Children received musical training for 9 months. Diffusion tensor imaging (DTI) data were acquired using a SE-EPI sequence. Diffusion weighted gradients were applied along 15 non-collinear directions with a b-value = 800 s/mm². High resolution images were acquired using 3D T1. The diffusion tensor was fitted with linear least-square after a preprocessing step correcting for head movements and eddy currents was applied by registering all volumes. Finally, using MedINRI, diffusion tensors were calculated to obtain Fractional Anisotropy (FA) with FA threshold of 0.2 and Mean Diffusivity values. Segmentation of the cerebellum CB was manually drawn on midline sagittal 3D-T1 images.

**RESULTS**

It shows that there was an increase in fiber length of minor forceps, which involves fibers interconnecting the front regions and some axons of the cingulate cortex rostral anterior and medial and ventral prefrontal cortex via the knee and face of the corpus callosum, which could be caused by music instruction and demand required to perform certain activities that are within the training, such as imitate coordinated movements.

**CONCLUSION**

We show the plastic effects that can provide music instruction to extend axons of the fibers, especially in the minor forceps are evident. This may have occurred because of the need to create more connection between the two hemispheres to run more efficiently the tasks required for musical training.

**CLINICAL RELEVANCE/APPLICATION**

Musical training might be an option for intervention to treat the disorders mentioned above, because although it is known that music can help patients with autism and ADHD, with the results shown in this paper, could create targeted strategies especially these pathologies.

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**PD231-SD-WEA2**

External and Intraoral-External Hybrid B0 Field Correction Devices for Decreasing Magnetic Susceptibility Artifacts on Brain MRI Induced by Stainless Steel Orthodontic Appliances

**Participants**
- Zhiyue J. Wang, PhD, Dallas, TX (*Presenter*) Nothing to Disclose
- Yong Jong Park, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
- Michael C. Morriss, MD, Pinehurst, TX (*Abstract Co-Author*) Nothing to Disclose
- Ramzi Hallac, PhD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
- Ana Nava, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
- Rajiv Chopra, PhD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
- Yonatan Chatzinoff, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
- Nancy K. Rollins, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose

**PURPOSE**

Susceptibility artifacts from orthodontia (braces) can interfere with brain MRI. It has been shown that an intraoral device containing permanent magnets drastically decreased the artifacts. However, variability of magnetic moments of molar and incisor orthodontic brackets in different braces limits the effectiveness of intraoral devices. We investigated the feasibility of external
**METHOD AND MATERIALS**

The external device used a facemask allowing mounting correction magnets outside the mouth. Separate plastic strips embedding permanent magnets were used for right and left molars and incisors. While an external device is more flexible, intraoral device allows closer proximity between brackets and correction magnets. Hybrid intraoral and external devices may be combined for best results; a variety of plastic strips and intraoral devices with different magnetic moments allow customization for individual patients. Image quality with and without the external device were compared in 4 patients with ferromagnetic braces undergoing MRI for headache/seizure in 2, optic nerve tumor in 1, and thalamic tumor in 1. The device was assembled based on a calibration B0 mapping. The study was IRB approved with informed consent. A 3D printed brain phantom was filled with agar gel and mounted with a dental model for evaluating B0 homogeneity using the hybrid device. Dental models of three sizes (average size, 8.5% smaller or bigger) were bonded with stainless steel orthodontic brackets (0.022, American Orthodontics) and guide-wires (0.016”, Class One). We investigated whether a one-size hybrid device kit will work for different arch sizes.

**RESULTS**

The external device was well tolerated by all patients and improved the quality of orbital, sub-frontal, and anterior temporal MRI, in particular DWI. In phantom studies, whole brain B0 peak-to-peak and S.D. values (in ppm) were 13.8 and 0.40 (baseline), 28.7 to 32.2 and 3.0 to 3.1 (with braces), and 12.7 to 17.3 and 0.64 to 0.76 (braces and correction device).

**CONCLUSION**

The external field correction device is feasible in clinical studies. A single sized hybrid device can be used for different maxillary/mandibular arch sizes.

**CLINICAL RELEVANCE/APPLICATION**

The study may lead to a device kit that enables diagnostic quality MR examinations for patients with difference maxillary/mandibular arch sizes wearing a variety of orthodontic appliances.

**PD232-SD-WEA3 Essentials of Intrauterine Zika Virus Infection: Pre and Postnatal CNS Findings**

**Station #3**

**Participants**

Heron Werner, MD, Rio de Janeiro, Brazil *(Presenter)* Nothing to Disclose

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Tatiana M. Fazecas, MD, Rio De Janeiro, Brazil *(Abstract Co-Author)* Nothing to Disclose

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Jorge Lopes, Rio de Janeiro, Brazil *(Abstract Co-Author)* Nothing to Disclose

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**PURPOSE**

Zika virus (ZIKV) owns to the family of flavivirus and as for dengue and chikungunya infections may recognized Ae. Aegypti and Ae. Albopictus mosquitoes as transmission agents. This virus has tropism for the central nervous system (CNS) and has been strongly associated with common findings to congenital infections, with some features which are described in this presentation.

**METHOD AND MATERIALS**

We performed a prospective study with seven pregnant patients with ZIKV infection at different gestational ages. They were subjected to ultrasound and fetal MRI. After birth, the newborns performed transfontanellar US, CT and MRI of the head, with posterior 3D reconstructions of the skull. We compared the cases with and without CNS involvement in the patients with intrauterine ZIKV infection. We quantified and illustrated the most frequent findings in the patients who had changes in their CNS. The main findings of CNS abnormalities were reported and several specific findings were displayed on a chart, including microcephaly, and submitted to statistical analysis.

**RESULTS**

From the 7 cases of ZIKV infection, 4 showed brain abnormalities with microcephaly. Multiple calcifications with cortical and mainly subcortical distribution were seen in all of these 4 cases. Significant thinning of the brain parenchyma, which have extensive periventricular areas of hyperintensity on T2 MR-WI were reported in all of the 4 cases. Neuronal migration anomalies were reported in 3 cases. Dysgenesis of the corpus callosum and ventricular enlargement secondary to cortical/subcortical atrophy were also detected in all of these 4 cases. The cerebellum was affected only in 1 case. Brain stem was not affected on these 7 cases.

**CONCLUSION**

Microcephaly with almost complete agyria, hydrocephalus, and multifocal dystrophic calcifications in the cortex and subcortical white matter, with associated cortical displacement were the main findings on intrauterine ZIKV infection with CNS involvement.

**CLINICAL RELEVANCE/APPLICATION**

Brain calcifications detected prenatally was a finding suspicious with an intrauterine infection. Moreover, perinatal imaging by MRI and CT scan enabled diagnosis of pachygyria, corpus callosum dysgenesis, small anterior fontanel with premature closure of cranial sutures. All of these aspects are seen in the majority of the intrauterine ZIKV infection with CNS involvement and it can be considered on diagnosis criteria.

**PD233-SD-WEA4 Vessel wall changes and microbleeding after radiochemotherapy in a cohort of patients with pediatric medulloblastoma**

**Station #4**

**Participants**

Rodrigues, Rio De Janeiro, Brazil *(Presenter)* Nothing to Disclose

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Pecanha, MD, Rio De Janeiro, Brazil *(Abstract Co-Author)* Nothing to Disclose

**PURPOSE**

Vessel wall changes and microbleeding after radiochemotherapy in a cohort of patients with pediatric medulloblastoma.
Cervicofacial venous malformation (CVM) is a common vascular anomaly in children. It is composed of abnormally dilated venous components without cellular proliferation. The disease severity varies as well as their treatment options including surgery, laser therapy, and interventional sclerotherapy. There are numerous studies regarding the treatment CVM with absolute ethanol. However, risks factors associated with recurrence have not fully been addressed. The aim of this study was to investigate the therapeutic efficacy, complication, and associated risk factors in recurrence rates of absolute ethanol for the treatment of CVM.

**PURPOSE**

Medulloblastoma (MB) is a primitive neuroectodermal tumor, located in the midline of the cerebellum. MB cause 10% of all pediatric brain tumors. The imaging of the whole cerebrospinal axis is required. Treatment is: surgical resection and radio chemotherapy. As improvements in treatment have increased the survival rate, the sequelae of radio-chemotherapy gains in importance, regarding follow up examinations/preventive treatment. The aim of this study was to image asymptomatic cerebrovascular changes, such as micro bleedings/vessel wall changes with MRI and ultrasound.

**METHOD AND MATERIALS**

In this prospective study 26 former MB patients were enrolled (range 4.58-53.75 years, mean age 24.2 years). 26 SWI; 22 T1 (CE) weighted vessel-wall images (TE: 14, TR: 1270, TI: 850, 3 Tesla) and time of flight angiographies (TOF); 19 ultrasound images of the common carotid intima-media-thickness (IMT) were analyzed. SWI lesions for both hemispheres, divided into infra/supratentorial, classified into 3 groups: < 2 mm; ≥ 2 mm - 4 mm; ≥ 4 mm. The IMT was classified into: normal vessel wall < 0.45 mm; marginal/abnormal vessel wall: ≥ 0.45 mm ≤ 0.50 mm > 0.5 mm. Vessel wall images of the ICA were classified as abnormal if CE was seen in the vessel wall.

**RESULTS**

All patients showed SWI lesions (in total 1053 lesions, supratentorial right hemisphere: 461, left: 472; infratentorial right: 69; left: 51) 62% presented with lesions > 4 mm. The right (left) IMT was 0.46 mm ± 0.04 mm (0.45 mm ± 0.04 mm). Nine (47.36 %) patients revealed r IMT < 0.045 mm, 12 (63.16 %) l IMT < 0.45 mm; 7 (36.84 %) showed a r IMT ≥ 0.45 mm ≤ 0.50 mm; 5 (26.31 %) for the l IMT. 3 (15.78 %) showed a r IMT > 0.5 mm, two (10.52 %) for the IMT. In 45% of the patients a CE in the right and 59.1 % in the left ICA was found. In total 63.64 % presented vessel wall changes. In the TOF angiography no alteration of the ICA was found.

**CONCLUSION**

Cerebrovascular changes after radio chemotherapy gain in importance, as treatment for MB patients is improving and survivors get older. In this study vessel wall changes could be imaged with ultrasound and MRI in > 50 % patients; micro bleedings in even 100 % patients. Further studies are needed to image the progression and determine the time for a preventive treatment regarding vessel stenosis and cavernoma bleeding.

**CLINICAL RELEVANCE/APPLICATION**

MRI and ultrasound examinations should be used to analyze vessel wall changes in medulloblastoma survivors after radio chemotherapy.

**PD234-SD-WEAS**

**Recurrence Risk Factors in Cervicofacial Venous Malformation**

**Participants**

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**METHOD AND MATERIALS**

A total of 30 patients with CVM were treated with absolute ethanol (98%) from December 31, 2005 to January 1, 2014. The treatment outcome and complications were recorded and the therapeutic efficacy was classified as one of two categories: effective treatment without further intervention and ineffective treatment with further intervention(s). The therapeutic efficacy was analyzed from 1-24 months after treatment.

**RESULTS**

24 out of the 30 patients included in the study were females with an average age of 10.5 years-old (range: 2-27). 22 patients had more than one CVM lesion. The technical success was 100% and no major complication was observed. 57% of the patients required more than one treatment session to obtain an effective treatment. The predominant anatomic location of these CVM lesions were in the lips (53%) and cheek (31%). Recurrence was observed in 17 out of 30 patients. Higher rates of recurrence were observed in
patients with more than one treated CVM lesion and in patients treated after the age of 7 years-old (RR 2.727 (0.9-16.1), p<0.05; RR 2.727 (0.9-16.1), p<0.05).

CONCLUSION

Delayed treatment and multiplicity of cervicofacial venous malformations have higher rates of recurrence and decreased therapeutic efficacy after initial treatment with ethanol ablation.

CLINICAL RELEVANCE/APPLICATION

Cervicofacial venous malformations are a common vascular anomaly in pediatric patients. As such, targeted treatment with absolute ethanol is safe with a low complication risk and should be performed at an earlier age especially in patients with multiple lesions to increase therapeutic efficacy and decrease the rate of recurrence.

TEACHING POINTS

- Describe the normal MRI appearance of the ovary at different pediatric age groups, with cyclical variations.
- List the key clinical and MRI features of ovarian torsion and its mimics.
- Discuss role of MRI in guiding management with particular emphasis on assessing ovarian viability on imaging.

TABLE OF CONTENTS/OUTLINE

- A fast pediatric pelvic MRI technique that provides exquisite details of the uterus and adnexa will be described.
- Illustrate normal MRI appearance of ovaries with emphasis on normal follicles and stroma, and description of arterial/venous anatomy.
- Describe classic MRI findings in ovarian torsion. MR features that indicate viability of the ovary will be emphasized.
- Common and rare mimics of ovarian torsion in children will be discussed including simple ovarian cysts, hemorrhagic ovarian cysts, endometrioma, ruptured acute appendicitis, ruptured ovarian cysts, and ovarian neoplasms.

TEACHING POINTS

- To describe and illustrate imaging findings of congenital and developmental anomalies, infiltrative lesions and tumors of the hypothalamus-pituitary axis in children.
- To explain the clinical context and indications for imaging of the pediatric hypothalamic-pituitary axis.
Combination of Magnetic Resonance Imaging and Virtual Reality Systems to Generate Immersive Fetal 3D Visualizations

PURPOSE
Advances in image-scanning technology have led to vast improvements in medicine, especially in the diagnosis of fetal anomalies. In general, three main technologies are used to obtain images within the uterus during pregnancy i.e. Ultrasound (US), Magnetic Resonance Imaging (MRI) and Computed Tomography (CT). MRI offers high-resolution fetal images with excellent contrast that allow visualization of internal tissues. When US yields unexpected results, MRI is generally used, because it provides additional information about fetal abnormalities and conditions for which US cannot provide high-quality images.

METHOD AND MATERIALS
The construction process of the 3D accurate virtual model starts with the 3D modeling volume built through the MRI slices sequentially mounted, followed by the segmentation process where the Physician selects the important body parts to be analyzed that will be then reconstructed in 3D. Having the accurate 3D model (womb, umbilical, cord, placenta and fetus) the final stage is the programming of the virtual device (Oculus Rift 2), including the heartbeat sounds of the fetus to improve the immersive sensation. The navigation through internal paths can be pre-defined by the physician responsible for the patient in order to highlight the main subjects to be studied by the fetal medicine team as well for parents understanding.

RESULTS
Virtual reality fetal 3D models based on MRI were successfully generated. They were remarkably similar to the postnatal appearance of the newborn baby, especially in cases with pathology, increasing the possibilities of digital tools to help fetal medicine researches.

CONCLUSION
The use of MRI may improve our understanding of fetal anatomical characteristics, and can be used for educational purposes and as a method for parents to visualize their unborn baby. The images can be segmented and applied on virtual reality immersive technologies.

CLINICAL RELEVANCE/APPLICATION
We have demonstrated that MRI data can be used to create a 3D model, including of the respiratory tract in a normal fetus. We believe that this technique could become a useful tool for the assessment of fetal airway patency and for other possible applications.

MRI Characteristics of RELA-fused versus Other Pediatric Supratentorial Ependymomas

PURPOSE
Recently identified molecular entities of supratentorial ependymoma (ST-EPN) have shown potential for improved risk stratification and treatment. C11orf95-RELA fusion transcripts occur in more than 70% of pediatric ST-EPN and define a novel entity according to the upcoming WHO classification of brain tumors. In addition, CDKN2A deletions had been shown to correlate with poor prognosis. Imaging features of RELA-fused ependymomas have not yet been analyzed in comparison to other ST-EPN. In this study, we describe and compare MR imaging characteristics of pediatric ST-EPN.

METHOD AND MATERIALS
A cohort of 57 ST-EPN was obtained from our multi-center neuroimaging database. All cases were centrally reviewed for
neuropathology including mRNA analysis for RELA fusions, immunohistochemistry for p65RelA and genome-wide copy analysis by molecular inversion profiling. We analyzed the preoperative MR imaging according to 26 epidemiologic and imaging criteria. Paired comparison was performed for each category between i) RELA-fused/other ST-EPN, ii) ST-EPN with/without CDKN2A deletion, and iii) RELA-fused ST-EPN with/without CDKN2A deletion.

RESULTS

Highly-cellular hemispheric tumors with cystic and necrotic portions were distributed over all analyzed ST-EPN subgroups. Analysis revealed significant differences between RELA-fused and other ST-EPN with respect to peritumoral edema, cysts, T1 signal, tumor homogeneity and contrast enhancement parameters. Interestingly, diagnosis of tumors with CDKN2A deletion occurred at a significantly higher age in our cohort, as well as with different MR morphology regarding intratumoral hemorrhage and diffusion restriction. Within the group of RELA-fused ST-EPN, we found significant differences in terms of age at diagnosis and intratumoral hemorrhage, dependent on CDKN2A deletion status.

CONCLUSION

We identified imaging parameters that significantly differ between RELA-fused versus other pediatric ST-EPN. In addition, CDKN2A deletion may further influence signal characteristics of ST-EPN. However, a prediction of genetic markers by means of MRI might not be feasible in the individual case.

CLINICAL RELEVANCE/APPLICATION

This is the first study that describes detailed MR morphology of ST-EPN according to distinct molecular features. Further studies are needed in order to analyze potential differences between ST-EPN entities and to re-evaluate the role of MR imaging in ST-EPN diagnostics and therapy monitoring.

Participants

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PURPOSE

Tourette syndrome (TS) is a childhood-onset neurobehavioral disorder characterized by the presence of multiple motor and vocal tics. We integrated the diffusion MRI tractography method and graph theoretical analysis to reveal abnormal topological organization of whole-brain structural networks in TS children.

METHOD AND MATERIALS

We obtained diffusion tensor imaging (DTI) scans from 44 drug-naïve TS children (age: 8.98±3.11 years, range: 3–16 years; 11 female) and 48 age and sex matched healthy children. Following DTI acquisition, we used the FMRIB's Diffusion Toolbox (FDT2.0) within FSL v4.1 (http://www.fmrib.ox.ac.uk/fsl) for DTI processing.

RESULTS

Both TS and healthy children showed small-world properties of the white matter (WM) networks, characterized by high local clustering and short path length. Furthermore, TS children exhibited significant decreased nodal efficiency in inferior frontal gyrus, left parietal gyrus and hippocampus. Also, TS children exhibited decreased network connectivity in the occipital gyrus, superior parietal gyrus, cuneus, precuneus and lingual gyrus. Compared with healthy children, we found that, the most pronounced reduction network efficiency in TS, mainly were located in the sensorimotor, visual, default-mode, and language systems. We found that the connection strength of the right superior occipital gyrus linking the right superior parietal gyrus, the left middle occipital gyrus linking the left Superior parietal gyrus, were significantly positively correlated with the tic severity score (YGTSS) in the TS patients.

CONCLUSION

Thus, our results suggest a disrupted integrity in the large-scale brain systems in TS and provide structural insights into the brain networks of TS children. Our result also suggest that the topology-based brain network analysis can provide potential biomarkers for early-stage TS diagnosis, as well as the monitoring of the disease progression and the treatment effects for TS children.

CLINICAL RELEVANCE/APPLICATION

TS is a developmental neuropsychiatric disorder which begins at the age of 6 to 7 years. The study of brain changes is very important for the treatment. Previous study mainly focused on brain volume structure changes. We try to investigate the alterations of structural networks in TS children with DTI.

Participants

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PURPOSE

Abnormal Topological Organization of Structural Networks Revealed by Probabilistic Diffusion Tractography in Tourette Syndrome Children

Station #3

PURPOSE

Metastatic Pattern of Rhabdomyosarcoma in Children and Adolescent: Timing, Location, and Associated Factors

Station #4
Rhabdomyosarcoma (RMS) is the most common soft tissue sarcoma in children. The anatomic site of primary tumor, size, resectability, presence of metastases, regional lymph node (LN) involvement, and residual tumor after surgery are known as important prognostic factors. Therefore, careful imaging evaluation of not only the primary tumor but potential disease sites is mandatory for management of pediatric RMS. We investigated metastatic patterns of pediatric RMS including timing, location and associated factors.

METHOD AND MATERIALS
We performed a computerized search of our hospital’s data-base from 2000 to 2016 using codes for RMS and the demographic code for <20 years of age. We selected subjects who were histologically confirmed to have RMS. Clinical characteristics, imaging features of the primary tumor and distant metastasis at initial presentation and during follow-up were evaluated.

RESULTS
Nineteen of 69 patients had metastases at initial presentation and seven of 50 patients with localized disease at initial presentation had metastases during follow-up. Median time to first metastases was 14 months. Nine of 26 patients went on to develop metastases twice during follow-up and median time to secondary metastases was 9 months. The most common site of metastasis was bone (n=14), followed by lung (n=12) and LN (n=9). Bone (n=5) and lung (n=5) were the most common metastatic sites in patients with RMS originated from head and neck. In patients with trunk-origin RMSs, bone (n=8) was most commonly involved. LN metastases were more frequently observed in extremity-origin RMSs than in RMSs from other sites (p=0.002). On univariate analysis, age, histologic subtype, initial location of tumor, and involvement of regional LN at initial presentation were significant factors associated with development of distant metastasis.

CONCLUSION
RMS can metastasize variable sites throughout the body. The bone, lung and LN were the most frequent sites for metastasis. Extremity-origin RMSs tended to show predilection to metastasize to LN compared to RMSs originated from other sites. Age, histologic subtype, initial location of tumor, and regional LN involvement at initial presentation were significantly associated with development of distant metastases.

CLINICAL RELEVANCE/APPLICATION
By being familiar with metastatic patterns of RMSs, radiologists can play a crucial role in the multidisciplinary team for management of pediatric patients with RMSs.

PD239-SD-WEBS Ultrasound-Guided Percutaneous Renal Biopsy Performed by Interventional Radiology in a Pediatric Population: Comparing Complication Rates between the BioPince® Full-Core Biopsy Device with Quick-Core® Coaxial Biopsy Needle Set Cutting Cannula

Participants
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Shireen Hayatghaibi, MA, MPH, Houston, TX (Abstract Co-Author) Nothing to Disclose
Caleb Fortune, Houston, TX (Abstract Co-Author) Nothing to Disclose
Daniel J. Ashton, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose

PURPOSE
To compare ultrasound-guided percutaneous renal biopsy (UGPRB) complication rates between the BioPince® Full-Core Biopsy Device and Quick-Core® Coaxial Biopsy Needle Set Cutting Cannula in a pediatric cohort.

METHOD AND MATERIALS
215 non-targeted UGPRB performed by Interventional Radiology in a tertiary care pediatric facility between 01/01/2013 and 12/31/2015 (age range: 0-21, mean: 11.7) were identified retrospectively using EMR. Pertinent patient and procedure information was entered into a Research Electronic Data Capture. Patients were followed up to 30 days post procedure. Complications were categorized according to Society of Interventional Radiology (SIR) complications criteria by a fellowship trained Pediatric Interventional Radiologist and then compared with needle size and type using Fisher’s exact test in Minitab. Both biopsy needles price was also compared.

RESULTS
135 biopsies performed using a 16 gauge (G) or 18G BioPince®. 80 biopsies performed using a 16G or 18G Quick-Core®. 93 (43.26%) performed using a coaxial system. 36 complications detected (16.67%) in 215 renal biopsies. 30 (13.95%) small perinephric hematomas or hematuria complications categorized as SIR A (minor), 1 (.47%) subcapsular hematoma 15mm thick as SIR B (minor), 4 (1.86%) where blood products were given post procedure as SIR C (major) and 1 (.47%) pseudoaneurysm as SIR D (major). No significant difference in complications among needle sizes, 16G (8.37%) and 18G (5.58%) groups (p=0.27). No significant difference in the complications among needle types, 27 performed with BioPince® and 9 with Quick-Core® (p=0.074). A statistically significant difference observed in complications when comparing using a coaxial system verses only using the biopsy device. 9 (9.7%) complications with the use of a coaxial system and 27 (22%) complications without using a coaxial system (p=0.016). Both biopsy needle types were comparable in price. Median number of samples per biopsy was 2 with BioPince® and 3 with Quick-Core®. The mean hemoglobin value for the patients with complications was 12 (range: 8.1 – 16.9). The mean platelet count was 316.8 (minimum: 97).

CONCLUSION
In a cohort of pediatric patients undergoing UGPRB, the use of a coaxial system decreased the rate of minor complications regardless of the needle type or size.

CLINICAL RELEVANCE/APPLICATION
UGPRB is safe in pediatrics with regardless of needle size.

PD171-ED- Imaging Patterns of Liver Lesions in Children with Emphasis on Ultrasound
**TEACHING POINTS**

This presentation aims to exhibit the spectrum of ultrasound imaging findings of benign and malignant pediatric focal liver lesions, with computed tomography or magnetic resonance correlation. The knowledge of the US imaging findings in the detection, characterization and follow-up of liver lesions has a higher relevance in the pediatric population due to the absence of radiation exposure.

**TABLE OF CONTENTS/OUTLINE**

1. Overview of the classification of focal liver lesions in children
2. Review of US findings of benign and malignant pediatric focal liver lesions, some of which unique to the pediatric population, such as hemangioendotheliomas and mesenchymal hamartoma, hepatoblastoma, undifferentiated (embryonal) sarcoma, angiosarcoma and others more common in adults including hemangiomas, focal nodular hyperplasia, nodular regenerative hyperplasia and hepatocellular adenoma, fibrolamellar hepatocellular carcinoma, lymphoma. CT and MR images will be shown for correlation.

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**PD009-EB-WEB  Color Doppler Assessment of the Cerebrospinal Fluid Flux as a Prognostic Tool for Obstructive Hydrocephalus in Intraventricular Hemorrhage Papile Grades III and IV**

Hardcopy Backboard

**Participants**

Debora Tomazoni, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose  
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Miguel J. Neto, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose  
Marcelo B. Funari, MD, Ribeirao Pires, Brazil (Abstract Co-Author) Nothing to Disclose  
Yoshino T. Sameshima, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**

We describe a series of 7 cases of non-invasive technique of usage of color Doppler in the assessment of CSF flow as predictive factor for the onset of hydrocephalus in neonates with grades III and IV intraventricular hemorrhage. At the end of this presentation, the viewer will be able to explain the normal anatomy of the CSF flux related structures; to apply the Papile classification; to use the color Doppler assessment of the CSF flux as a prognostic tool in germinal matrix hemorrhage grades III and IV understanding its limitations.

**TABLE OF CONTENTS/OUTLINE**

A. Central nervous system anatomy  
B. Pathophysiology of germinal matrix hemorrhage  
C. Color Doppler assessment of cerebrospinal fluid flux through transfontanellar ultrasonography: technique and limitations  
D. Example cases  
E. Take-home messages
Participants

Sub-Events

MSES43A Controversies in Imaging Appendicitis

Participants
Alex Towbin, MD, Cincinnati, OH, (alexander.towbin@cchmc.org) (Presenter) Author, Reed Elsevier; Grant, Guerbet SA; Grant, Siemens AG;

LEARNING OBJECTIVES
1) Describe the clinical and imaging findings of appendicitis in children. 2) Describe the value of measurements of the appendix in making a diagnosis of appendicitis. 3) Describe the utility of structured reporting in the setting of appendicitis.

ABSTRACT

Honored Educators

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

Alex Towbin, MD - 2014 Honored Educator

MSES43B Imaging Children with Respiratory Distress

Participants
Edward Y. Lee, MD, MPH, Boston, MA, (Edward.Lee@childrens.harvard.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Discuss underlying causes of respiratory distress in children. 2) Review imaging modalities and techniques for evaluating respiratory distress in children. 3) Learn characteristic imaging findings of disorders causing respiratory distress in children.

MSES43C Imaging Child Abuse

Participants
Gael J. Lonergan, MD, Austin, TX, (lonergangmd@ausrad.com) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) The attendee will be able to recognize radiographic findings highly suspicious for child abuse. 2) The attendee will understand the imaging protocols for suspected child abuse. 3) The attendee will know the forensic significance of common inflicted childhood injuries.

Active Handout: Gael J. Lonergan

MSES43D Congenital Urinary Tract Malformations

Participants
Ethan A. Smith, MD, Saline, MI, (ethans@med.umich.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) To understand basic embryologic development of the kidney and how abnormalities of development lead to common congenital urinary tract abnormalities. 2) To be familiar with different imaging modalities used for the work up of congenital urinary tract malformations and to be able to recommend the appropriate "next step" for imaging of common conditions.

ABSTRACT

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/
PURPOSE
Peripherally inserted central venous catheters (PICCs) and Tunneled Central Venous Catheters (TCVCs) are frequently used in infants and children. Studies to assess infectious, thrombotic, and malfunction complication rates suffer from low sample sizes. The aim of this study is to define the incidence of PICC complications and identify associated patient specific characteristics associated with them in a large, single center hospital system.

METHOD AND MATERIALS
A retrospective surveillance study was conducted at a large children's hospital of the EMR and PACS. 2282 line insertions (age 0-18 years, average 6.5 years) were identified of patients undergoing image-guided PICC or TCVC placement from January 2014 through December 2015. Age of patient, weight, indication for line placement, line days, whether sedation was used, site of access, catheter size and number of lumens were recorded. Complication endpoints were infection, thrombosis, malposition, and line malfunction. Fisher's exact test was used to determine which characteristics were independent factors for complications.

RESULTS
Complication rate total was 16.5%. We stratified by age, 0-1 year (581), 1-3 years (371), 3-8 years (467), and 8-18 years (867). Complication rate increased in 0-1 year compared to 1-3 year (p=0.006), 1-3 year compared to >8 years (p=0.000), and 3-8 compared to >8 years (p=0.000). Catheter diameters included 1.9 Fr single lumen (SL) (8), 2.6 Fr double lumen (DL) (113), 3 Fr SL (1423), 4 Fr DL (551), 5 Fr DL (179), and 6 Fr DL (5), for a total of 1447 SL and 835 DL. A higher complication rate (p=0.000) was seen in DL catheters (212/835, 25%) compared to SL catheters (165/1447, 11%). There were also more infections (p=0.000) in DL catheters (75/835, 9%) versus SL catheters (36/1447, 2.5%) catheters.

CONCLUSION
Overall complication risk is increased with younger patient age. There is also an overall increase in all complication endpoints with increased lumens, specifically an increased risk for infections. Understanding this can help in decision making to promote patient safety in pediatric populations.

CLINICAL RELEVANCE/APPLICATION
Despite relatively low complication rates of PICC lines in children overall, there are multiple independent patient characteristics to consider when evaluating clinical need for long term vascular access.
PURPOSE
The purpose of the study was to evaluate central venous catheters (CVC) in children less than two years of age and determine if the vascular access location affected complication rates when comparing tunneled internal jugular (IJ) vein, tunneled femoral vein, and peripherally inserted central catheters (PICC).

METHOD AND MATERIALS
A total of 798 CVCs were performed by IR during the time frame. A retrospective cohort study was conducted on children less than two years of age who underwent CVC placement by Interventional Radiology (IR) from 01/01/2014 to 12/31/2015. The data was collected from EMR and PACS imaging system, then entered into REDCap database and analyzed with a Fisher's exact test. Information was gathered regarding patient demographics, technical details of the procedure, complications, and follow-up to catheter removal.

RESULTS
198 of the CVCs were placed via IJ with a greater rate of complications, 56(28%), compared to the 322 PICCs with 59(18%) complications (p=0.006). 278 CVCs were femoral with 37(13%) complications, which was not statistically different compared to PICCs (p=0.118). Of the complications, infections in the IJs accounted for 16(8.1%), femoral 10(3.6%), and PICCs 17(5.3%), with no statistically significant difference between the groups.116(58.6%) of the IJs were lumen size 3 French or less, compared to 245(88.1%) for femoral, and 273(95%) for PICCs. 82(41.4%) of IJs were 4 or 5 French, compared to 33(11.9%) femoral, and 48(15%) in PICCs. Oncology patients accounted for 51(25.6%) IJs, compared to 5(1.8%) femoral, and 40(12.5%) in PICCs.

CONCLUSION
In a cohort of pediatric patients less than two years of age, the CVC access site does affect complication rates. IJ CVCs had a greater overall complication rate when compared to PICCs. It is important to note that with an increased complication rate the IJ group also had a greater proportion of 4 and 5 French catheter lumens and Oncology patients, but without a significant difference in infection rates compared to PICCs. As an increasing number of IJs are being performed on this patient population by IR, it is important to understand the increased risk of complications when compared to PICCs.

CLINICAL RELEVANCE/APPLICATION
PICCs demonstrated a lower complication rate compared to tunneled IJ central catheters and are recommended as first-line, when appropriate, for central venous access in children less than two years of age.

SSM19-04 Timing of First Arteriovenous Fistula Cannulation in Children on Hemodialysis

Wednesday, Nov. 30 3:30PM - 3:40PM Room: S102AB

Participants
Susanne Regus, Erlangen, Germany (Presenter) Nothing to Disclose
Werner Lang, MD, Erlangen, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE
Due to reduced complication rates in comparison to central venous (CVC) or peritoneal catheters (PC), nowadays arteriovenous fistulas (AVFs) are the preferred hemodialysis access. Recommendations for the first access cannulation range from 6 to 12 weeks, which could lead to temporary or even permanent preference for CVC while awaiting the maturation of the newly created AVF. The aim of this study was to evaluate the influence of first cannulation of AVFs on primary (PP) and secondary (SP) patency rates in children on hemodialysis.

METHOD AND MATERIALS
This was a retrospective cohort study of 42 pediatric patients (21 endstage renal disease and 21 pre-emptive) with a median age of 14 years (7-17). All of them received an AVF between February 1993 and May 2014. The creation of all AVFs was performed at a single center by exclusively one vascular surgeon with many years of professional experience.

RESULTS
Primary failure was observed in 6 (14.3%) of 42 AVFs (all radiocephalic fistulas) at a mean time of 4.7 days (0-10) after creation. Excluding primary failures, the PP/SP at 1, 3, 6, 12, 18 and 24 month were 100%/100%, 91%/99%, 86%/98%, 76%/95%, 55%/85% and 44%/77%, respectively. There was a significant reduction in PP when first cannulation was performed within the first 30 days after creation compared to the first cannulation later than 30 days (p = 0.004). We observed no significant difference in the outcome of PP/SP comparing the first cannulations time dated within the first 45 days after creation to those beyond 45 days (p = 0.091/0.883).

CONCLUSION
Prolonged maturing times longer than 45 days seems to have no benefit on patency rates. Given these results CVC placement as bridging HD access while awaiting access usage of the AVF, does not seem necessary and should be avoided.

CLINICAL RELEVANCE/APPLICATION
is there a optimal maturing interval for arteriovenous forearm fistula in children?

SSM19-05 Lock, Stock and Coaxial: Effect of Needle Type on Complication Rates in Percutaneous Ultrasound-Guided Liver Biopsy

Wednesday, Nov. 30 3:40PM - 3:50PM Room: S102AB

Participants
Shireen Hayatghaibi, MA, MPH, Houston, TX (Abstract Co-Author) Nothing to Disclose
Daniel J. Ashton, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Heather Cleveland, BS, Houston, TX (Presenter) Nothing to Disclose
Kamlesh U. Kukreja, MD, Bellaire, TX (Abstract Co-Author) Nothing to Disclose
**PURPOSE**

To measure the effect of needle type on the rate of complications after percutaneous ultrasound-guided liver biopsy in children.

**METHOD AND MATERIALS**

Pediatric patients who underwent a non-targeted percutaneous ultrasound-guided liver biopsy were retrospectively identified from the electronic medical record. Relevant demographic, procedure note, post-procedure note and follow-up information were entered into a REDCap database (Vanderbilt, TN). Complications were categorized according to Society of Interventional Radiology (SIR) complication criteria by a pediatric interventional radiologist. Complication rates for the needle type and size were compared using Fisher's exact test in Minitab.

**RESULTS**

The final study population comprised 755 biopsies who underwent a non-targeted percutaneous ultrasound-guided liver biopsy between 01/01/2013 and 12/31/2015 (age range: 0 – 18 years, mean: 7.9 years). 436 biopsies were performed using a 16 gauge or 18 gauge BioPince needle (Plano, TX). 319 biopsies were performed using a 16 gauge or 18 gauge Quick-Core needle (Bloomington, IN). Overall, 44 complications were detected (5.8% of all biopsies) in 44 patients. 19 (43.2%) complications were categorized as SIR A (minor), 18 complications (40.9%) as SIR B (minor) and 7 complications (15.9%) as SIR C (major). There was no statistically significant difference in complication rates among needle sizes, 16 gauge (5.5%) and 18 gauge (6.3%) groups (p=0.639). There were less complications (p=0.004) according to needle type, 16 complications (3.7%) in the BioPince group and 28 complications (8.8%) in the Quick-Core group. This difference was further evident in the 16 gauge needle size group (p=0.002), there were 10 complications with the BioPince 16 gauge (3.2%) and 14 complications with the Quick-Core 16 gauge (11.4%). Median number of samples with BioPince was 2 samples per biopsy and 5 samples per biopsy with Quick-Core. Only one sample, taken with BioPince 16 gauge needle was categorized by pathology as insufficient for diagnostic yield.

**CONCLUSION**

In a cohort of pediatric patients undergoing percutaneous ultrasound-guided liver biopsy, needle type decreased the rate of complications due to a reduced number of samples taken per biopsy.

**CLINICAL RELEVANCE/APPLICATION**

Needle type is an important variable that can decrease the number of samples taken per biopsy, lessening complication rates for non-targeted percutaneous ultrasound-guided liver biopsies.

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**SSM19-06 Use of Alcohol As a Scolicidal and Sclerosing Agent In Percutaneous Treatment of Hydatid Liver Disease In Pediatric Patients: Mid-Long Term Results**

**Wednesday, Nov. 30 3:50PM - 4:00PM Room: S102AB**

Participants

Fatih Oncu, MD, Konya, Turkey (Presenter) Nothing to Disclose
Serdar Arslan, MD, Konya, Turkey (Abstract Co-Author) Nothing to Disclose
Suleyman Bakdak, Konya, Turkey (Abstract Co-Author) Nothing to Disclose
Ismet Tolu, KONYA, Turkey (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To evaluate safety and effectiveness of use of alcohol as a scolicidal and sclerosant agent and mid-term/long-term results of percutaneous treatment hydatid liver cysts in children

**METHOD AND MATERIALS**

Forty-four patients (22 female and 22 male patients; age range, 4-16 years; mean age, 12 years) with 85 liver hydatid cysts underwent percutaneous treatment with albendazole prophylaxis. There were 73 (85.9%) type I, 7 (8.2%) type II and 5 (5.9%) type III lesions according to the Gharbi classification. The cysts were treated with %98 ethanol as the cytotoxic and sclerosing agent by PAIR or catheterization methods under sonographic and fluoroscopic guidance. Follow-up sonography were performed every 3 months in the first year, every 6 months in the second year and in the following years carried out once a year.

**RESULTS**

The percutaneous procedures were completed with 100% technic success in all patients. Percutaneous treatment of hepatic hydatid disease was successful in 41 patients (93.1%). Two patients were refered for surgical treatment and one patient underwent additional percutaneous treatment. There were no major complications during or after the procedure. Minor complications (hypersensitivity reaction, fever) occurred in two (4.5%) patients. Total hospital stay was between 1 and 3 days. Follow-up period was 6-60 months (mean, 17.3 months).

**CONCLUSION**

Percutaneous treatment of hydatid liver cysts is an effective, safe and minimal invasive method in children. Furthermore use of alcohol alone as a scolicidal and sclerosing agent in hydatid liver cyst treatment provides sufficient radiological outcome.

**CLINICAL RELEVANCE/APPLICATION**

Percutaneous treatment of hydatid liver cysts is the best treatment option versus surgical procedure in children. Because of lower mortality, complication, recurrence rates and short hospital stay.
Pediatric Thursday Case of the Day
Thursday, Dec. 1 7:00AM - 11:59PM Room: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants
Ting Y. Tao, MD, PhD, Saint Louis, MO (Presenter) Nothing to Disclose
Luke L. Linscott, MD, Cincinnati, OH (Abstract Co-Author) Nothing to Disclose
Karen A. Caudill, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Asef B. Khwaja, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Jie C. Nguyen, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Shannon Farmakis, MD, Saint Louis, MO (Abstract Co-Author) Research Grant, General Electric Company; Research Grant, Guerbet

TEACHING POINTS
1) Recognize the importance of a multimodality approach in imaging pediatric patients. 2) Form appropriate differential diagnoses based on clinical information and imaging findings. 3) Recognize the clinical implications of diagnoses.
**RC613**

**Pediatric: MSK**

Thursday, Dec. 1 8:30AM - 10:00AM Room: S102AB

**RC613A  Imaging of Musculoskeletal Soft Tissue Masses**

Participants
Michele M. Walters, MD, Boston, MA *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) Classify vascular malformations and hemangiomas. 2) Explain the importance of clinical information in the diagnosis of pediatric vascular anomalies. 3) Describe most relevant sonographic and MR imaging features of pediatric vascular anomalies.

**RC613B  Imaging of Pediatric Vascular Anomalies**

Participants
Oscar M. Navarro, MD, Toronto, ON, (oscar.navarro@sickkids.ca) *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) Classify vascular malformations and hemangiomas. 2) Explain the importance of clinical information in the diagnosis of pediatric vascular anomalies. 3) Describe most relevant sonographic and MR imaging features of pediatric vascular anomalies.

**RC613C  Imaging of SCFE**

Participants
Delma Y. Jarrett, MD, Boston, MA *(Presenter)* Nothing to Disclose

**RC613D  Imaging of Pediatric Scoliosis**

Participants
Nancy A. Chauvin, MD, Philadelphia, PA, (chauvinn@email.chop.edu) *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe the types and patterns of scoliosis in children. 2) Develop an evidence based approach to imaging scoliosis in children. 3) Identify key imaging findings in pediatric scoliosis.

**ABSTRACT**
Case based Review of Neuroradiology (An Interactive Session)

Thursday, Dec. 1 10:30AM - 12:00PM Room: S100AB

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

**Participants**

Pina C. Sanelli, MD, Manhasset, NY *(Director)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) Provide a brief review of CNS pathology highlighting the key diagnostic features. 2) Review pertinent differential diagnoses of neuroimaging cases. 3) Provide important imaging pearls for differentiating CNS pathology.

**ABSTRACT**

Learning Objectives:

1. Provide a brief review of CNS pathology highlighting the key diagnostic features.

2. Review pertinent differential diagnoses of neuroimaging cases.

3. Provide important imaging pearls for differentiating CNS pathology.

**Sub-Events**

MSCN52A  **Pediatric Brain**

Participants

Pia C. Maly Sundgren, MD, PhD, Ann Arbor, MI *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify the key imaging features of various common pediatric brain diseases. 2) Identify the basic anatomic, physiologic and pathologic features of diseases affecting the pediatric brain. 3) Highlight primary imaging techniques used for the assessment, clinical practice, problem-solving and patient management.

**ABSTRACT**

Learning objectives:

1. Identify the key imaging features of various common pediatric brain diseases.

2. Identify the basic anatomic, physiologic and pathologic features of diseases affecting the pediatric brain.

3. Highlight primary imaging techniques used for assessment, clinical practice, problem-solving and patient management.

**Active Handout:** Pia C. Maly Sundgren


MSCN52B  **Pediatric Spine**

Participants

Tina Y. Poussaint, MD, Boston, MA, (tinayoung.poussaint@childrens.harvard.edu) *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify the key imaging features of various common pediatric spine diseases. 2) Identify the basic anatomic, physiologic and pathologic features of diseases affecting the pediatric spine. 3) Highlight primary imaging techniques used for assessment, clinical practice, problem-solving and patient management.

**ABSTRACT**

1) Identify the key imaging features of various common pediatric spine diseases.

2) Identify the basic anatomic, physiologic and pathologic features of diseases affecting the pediatric spine.

3) Highlight primary imaging techniques used for assessment, clinical practice, problem-solving and patient management.

MSCN52C  **Pediatric Head & Neck**

Participants

Korgun Koral, MD, MBA, Dallas, TX, (korgun.koral@utsouthwestern.edu) *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

1) Classify common vascular lesions of pediatric neck. 2) Detect normal variations of pediatric skull base. 3) Recommend appropriate imaging tests for common pediatric neck masses. 4) List clinically relevant observations on emergent pediatric neck CT.

**ABSTRACT**

n/a
SSQ16

Science Session with Keynote: Pediatrics (Radiation Dose Estimation and Optimization)

Thursday, Dec. 1 10:30AM - 12:00PM Room: S102AB

Participants
Michael J. Callahan, MD, Boston, MA (Moderator) Nothing to Disclose
R. Paul Guillerman, MD, Houston, TX (Moderator) Nothing to Disclose

Sub-Events

SSQ16-01 Pediatrics Keynote Speaker: Radiation Dose Optimization and Risk Assessment-Future Research Priorities

Thursday, Dec. 1 10:30AM - 10:40AM Room: S102AB

Participants
R. Paul Guillerman, MD, Houston, TX (Presenter) Nothing to Disclose

SSQ16-02 Major Indicators of Dose Development in Pediatric Chest Computed Tomography - An Analysis of 2138 CT Scans

Thursday, Dec. 1 10:40AM - 10:50AM Room: S102AB

Participants
Michael Esser, MD, Tuebingen, Germany (Presenter) Nothing to Disclose
Ilias Tsiflikas, MD, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Sabine Hess, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Matthias Teufel, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Konstantin Nikolau, MD, Tuebingen, Germany (Abstract Co-Author) Speakers Bureau, Siemens AG; Speakers Bureau, Bracco Group; Speakers Bureau, Bayer AG
Juergen F. Schaefer, MD, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE
To analyze possible influences of different methods of dose reduction on pediatric chest CT and to determine major indicators of dose development.

METHOD AND MATERIALS
In this retrospective observational study, 2138 chest CT examinations performed in the period from January 2007 to March 2014 in 1012 patients were analyzed (median age, 10 years; range, two days to 17.9 years). Patients were divided into six age groups according to diagnostic reference values. Volume CT dose index (CTDI) was recorded, effective dose (Eeff) and size-specific dose estimate (SSDE) were calculated for all scans. It was also recorded, if a dose modulation technique and/or high-pitch mode (pitch ≥ 3.0) were used. Multivariate analysis of variance was used to report correlation between variables.

RESULTS
Median CTDI of all 2138 scans was 1.79 mGy [95% CI, 2.9-3.2], Eeff was 1.76 mSv [2.8-3.1] and SSDE was 3.16 mGy [4.8-5.2]. Median dose-specific values decreased in all age groups within the observation time, whereas the number of scans and patient age did not change significantly. High-pitch mode (n=458) resulted in lower CTDI, Eeff and SSDE in all age groups (p<0.001), independent of contrast agent use. Non-enhanced scans with automatic exposure control (n=410) delivered median dose values up to twice as high as compared to those without dose modulation, even when the use of different CT devices was taken into consideration (p<0.001). When contrast agent was applied, the dose-related disadvantages using dose modulation were limited to infants and children up to 15 years.

CONCLUSION
Radiation dose in pediatric chest CT was considerably reduced in the last decade, while high-pitch scanning seems to essentially contribute to this development. However, the use of dose modulation technique should be considered according to patient age and depending on the examination protocol.

CLINICAL RELEVANCE/APPLICATION
High-pitch acquisition can significantly lower dose exposure in routine pediatric CT imaging. The use of a dose modulation technique is not always advantageous and should be considered individually.

SSQ16-03 Comparison of the Measured and Estimated Effective Dose in Pediatric CT Examination with Lower Tube Voltage Scan Settings: Phantom Study

Thursday, Dec. 1 10:50AM - 11:00AM Room: S102AB

Participants
Takanori Masuda, Hiroshima, Japan (Presenter) Nothing to Disclose
Yoshinori Funama, PhD, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose
Masao Kiguchi, RT, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Yukari Yamashita, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Naoyuki Imada, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
**Purpose**

The simplest method for estimating the effective dose (ED) in individual patients is by conversion from the dose-length product (DLP) displayed on the CT console using k-factors. We compared the estimated ED (e-ED) obtained with the DLP and k-factors with the actually measured ED (am-ED) recorded on radio-photoluminescence glass dosimeters (RPGDs) in 3 different anthropomorphic phantoms simulating pediatric subjects.

**Method and Materials**

We used 3 anthropomorphic phantoms simulating a newborn, a 1-year-old, and a 5-year-old child (phantoms A, B, and C, respectively) (ATOM Phantom, CIRS, Norfolk, VA, USA) and a 64-detector CT scanner (VCT, GE). The tube voltage was 80-, 100-, and 120 kVp, the tube current was set at noise index 12. We obtained the am-ED to organs for each phantom. We then recorded the DLP displayed on the CT console and calculated the e-ED using k-factors according to ICRP Publication 60, 102, 103. We defined the e-ED error rate (%) using the formula error rate = |(e-ED - am-ED / am-ED)| × 100%.

**Results**

The am-ED was 2.3, 2.5, and 2.6 mSv for phantom A; 2.4, 2.9, and 3.2 mSv for phantom B; and 2.6, 2.9, and 3.2 mSv for phantom C at 80-, 100-, and 120 kVp, respectively. The e-ED was 2.8, 2.8, and 3.0 mSv for phantom A; 2.3, 2.2, and 2.4 mSv for phantom B; and 3.0, 2.8, and 2.9 mSv phantom C at 80-, 100-, and 120 kVp, respectively. The error rate of e-ED was 21.7, 12.0, and 15.4% for phantom A; 0.1, 24.1, and 25.0% for phantom B, and 15.4, 0.1, and 0.1% for phantom C at 80-, 100-, and 120 kVp, respectively.

**Conclusion**

The error rate of e-ED ranged from 0.1% (min) to 25.0% (max) in our pediatric phantoms.

**Clinical Relevance/Application**

When calculating the estimated effective dose based on the DLP and k-factors in pediatric patients, a potential maximum error rate of 25% must be taken into account.

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**SSQ16-04 Automated Tube Current Selection Provides Consistent Relationship between Radiation Dose and Body Size in Pediatric Abdomen CT Scans**

**Participants**

Boaz Karmazyn, MD, Indianapolis, IN (Presenter) Nothing to Disclose
Huisi Ai, Indianapolis, IN (Abstract Co-Author) Nothing to Disclose
Elise Miller, MD, Indianapolis, IN (Abstract Co-Author) Nothing to Disclose
Fangquin Ouyang, Indianapolis, IN (Abstract Co-Author) Nothing to Disclose
Samuel G. Jennings, MD, Indianapolis, IN (Abstract Co-Author) Nothing to Disclose

**Purpose**

Body CT scan protocols in children are based on body size. We wanted to know if automated tube current selection can provide consistent relationship between body size and radiation dose in routine pediatric abdomen CT scans.

**Method and Materials**

A 1 year retrospective study on all consecutive non-repeated routine abdomen CT scans in children (age <18 years). Age, gender, body weight (BW) and CTDIvol (32cm) were registered for each study. SSDE was calculated using conversion factors derived from either the BW or mid scan length slice effective diameter. Pearson correlation coefficient was used to estimate strengths of correlations between body size (BW and ED) and dose (CTDIvol and SSDE).

**Results**

353 abdominal CT scans were included (53.5% males) with average age of 9.2 years (range 1 month to 18 years). There was a strong positive correlation between CTDIvol and BW and between CTDIvol and ED (r=0.84 and 0.82, respectively, p<0.0001). A quadratic equation best represent these relationship. There was moderate positive correlation between SSDE and BW and between SSDE and ED, (r=0.62 and 0.63, respectively, p=0.0001).

**Conclusion**

Use of automated tube current selection in pediatric patients provides a consistent relationship between CTDIvol and body size. The quadratic equation that best represents this relationship for our practice group preference of image quality can be used for quality assurance processes, and can be shared and compared between different institutions.

**Clinical Relevance/Application**

Automated tube current selection in pediatric patients provide a consistent relationship between body size and CT radiation dose which can be shared and compared between different institutions.
Dose optimization is a key aspect in pediatric radiology, in particular with patients receiving recurrent radiographs.

**CLINICAL RELEVANCE/APPLICATION**

Adding a 0.2 mm Cu filter and lowering tube intensity without loss of image quality. This study demonstrates that a lowered dose (45%) full spine radiograph can be performed in patients with idiopathic scoliosis by reducing image quality, interobserver variability, and radiation dose.

**CONCLUSION**

For protocol A, the mean tube intensity was 1.3 ± 0.4 mAs, the mean D was 5.0 ± 1.8 mGy and the mean DAP was 85.3 ± 32.7 µGy.m². With protocol B, exposure parameters reduced to: tube intensity 0.7 ± 0.4 mAs, the mean D was 5.0 ± 1.8 mGy and the mean DAP was 85.3 ± 32.7 µGy.m². With protocol B, exposure parameters reduced to: tube intensity 0.7 ± 0.4 mAs, the mean D was 5.0 ± 1.8 mGy and the mean DAP was 85.3 ± 32.7 µGy.m² (all p<0.05). Mean image quality score for protocol A was 28.1 ± 2.4 points (range 21-30), comparable to the mean total score of protocol B 27.9 ± 2.3 points (range 22-30). Interobserver agreement was excellent (ICC 0.92).

**RESULTS**

Arms down by the sides and presence of medical device as well as higher BMI were independent factors associated with the higher radiation dose in pediatric chest CT.

**CONCLUSION**

Changing positions of arm and device is the simple but important method to reduce radiation dose in the pediatric chest CT.

**SSQ16-06 Dose Optimization for Full Spine Radiographs in Idiopathic Scoliosis Patients**

**Thursday, Dec. 1 11:20AM - 11:30AM Room: S102AB**

Participants

Caroline Ernst, MD, Brussels, Belgium (Presenter) Nothing to Disclose  
Nico Buils, DSc, PhD, Jette, Belgium (Abstract Co-Author) Nothing to Disclose  
Armand Laumen, Brussels, Belgium (Abstract Co-Author) Nothing to Disclose  
Gert Van Gompel, PhD, Brussel, Belgium (Abstract Co-Author) Nothing to Disclose  
Filip Verhelle, MSc, Brussel, Belgium (Abstract Co-Author) Nothing to Disclose  
Johan De Mey, Jette, Belgium (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To evaluate factors associated with the higher SSDE in pediatric chest CT.

**METHOD AND MATERIALS**

From November 2013 to May 2015, 315 pediatric chest CT scans were obtained in one CT scanner and classified into five groups according to age (<3 years, n = 65; 3-5 years, n = 54; 6-10 years, n = 58; 11-15 years, n = 81; >15 years, n = 57). In each age group, chest CT scan were divided into two subgroups (Group A, greater than 75th percentile of the size-specific dose estimates (SSDE) for each age group, n = 77; Group B, less than 75th percentile, n = 238). All CT scans were performed with the same protocol using automatic tube voltage and current selection techniques (reference kV of 120 and reference mAs of 100). Sex ratio, age, tube current, weight, height, body mass index (BMI), anteroposterior (AP) body diameter, lateral diameter were compared between Group A and B. In addition, arm angles on scout coronal image and coronal reformatted image, presence of medical devices in the scan field and degree of off-centering within the CT gantry were also compared.

**RESULTS**

Group A showed significantly higher tube current, weight, BMI, and longer AP/lateral diameters (P <.001, P = .005, P <.001, P = .004, P = .006, respectively), compared with Group B. Narrower arm angles on scout coronal image and coronal reformatted image (P <.001, P <.001, respectively) and the presence of medical devices in the scanning filed (P = .018) were significantly associated with higher SSDE. There are no significant differences between two groups regarding sex ratio, age, height and degree of off-centering. In multivariate analysis, narrower arm angles and presence of device as well as higher BMI were independently associated with higher SSDE.

**CONCLUSION**

Arms down by the sides and presence of medical device as well as higher BMI were independent factors associated with the higher radiation dose in pediatric chest CT.

**CLINICAL RELEVANCE/APPLICATION**

Changing positions of arm and device is the simple but important method to reduce radiation dose in the pediatric chest CT.

**SSQ16-06 Dose Optimization for Full Spine Radiographs in Idiopathic Scoliosis Patients**

**Thursday, Dec. 1 11:20AM - 11:30AM Room: S102AB**

Participants

Caroline Ernst, MD, Brussels, Belgium (Presenter) Nothing to Disclose  
Nico Buils, DSc, PhD, Jette, Belgium (Abstract Co-Author) Nothing to Disclose  
Armand Laumen, Brussels, Belgium (Abstract Co-Author) Nothing to Disclose  
Gert Van Gompel, PhD, Brussel, Belgium (Abstract Co-Author) Nothing to Disclose  
Filip Verhelle, MSc, Brussel, Belgium (Abstract Co-Author) Nothing to Disclose  
Johan De Mey, Jette, Belgium (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To optimize our Full Spine Radiograph protocol used in the follow up of children with idiopathic scoliosis.

**METHOD AND MATERIALS**

We performed a lowered dose posterioranterior (PA) full spine radiograph in 40 patients (protocol B) with idiopathic scoliosis aged 10-16 years (28 males;32 females) on a Luminos dRF (Siemens). Dose reduction was achieved by adding a 0.2 mm copper filter and lowering the tube intensity. Radiographs were scored on 6 criteria (5-point Likert scale) by a pediatric radiologist and a pediatric orthopedist who were blinded to patient identity and clinical information. The scored criteria were bone/soft tissue contrast, bone sharpness, visibility of processus spinosis, delineation of the intervertebral spaces, assessment of the spinal curve and Risser grade, representing a total score between minimal 6 and maximal 30 points. These scores were compared to the scores of 40 PA full spine X-ray's performed in 2013 with our standard protocol (protocol A) again in patients aged between 10 and 16 years with idiopathic scoliosis (7 males;33 females). Tube intensity, entrance dose (D) and dose area product (DAP) were compared. Statistical analysis was performed using IBM SPSS (v23) and included assessment of DAP, D, tube intensity, image quality score and interobserver variability by intraclass correlation coefficients (ICC). A p value of less than 0.05 was considered significant.

**RESULTS**

Mean age was 13.3 ± 1.6 years for group A and 13.4 ± 1.7 years for group B. For protocol A the mean tube intensity was 1.3 ± 0.4 mAs, the mean D was 5.0 ± 1.8 mGy and the mean DAP was 85.3 ± 32.7 µGy.m². With protocol B, exposure parameters reduced to: tube intensity 0.7 ± 0.4 mAs, D 2.8 ± 1.3 mGy and DAP 47.0 ± 22.4 µGy.m² (all p<0.05). Mean image quality score for protocol A was 28.1 ± 2.4 points (range 21-30), comparable to the mean total score of protocol B 27.9 ± 2.3 points (range 22-30). Interobserver agreement was excellent (ICC 0.92).

**CONCLUSION**

This study demonstrates that a lowered dose (45%) full spine radiograph can be performed in patients with idiopathic scoliosis by adding a 0.2 mm Cu filter and lowering tube intensity without loss of image quality.

**CLINICAL RELEVANCE/APPLICATION**

Dose optimization is a key aspect in pediatric radiology, in particular with patients receiving recurrent radiographs.
Participants
Sunkyoung Jeon, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Young Hun Choi, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jung-Eun Cheon, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Woo Sun Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
In-One Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To compare the image quality and radiation dose of three scan modes (wide-volume, one-shot volume and helical scan modes) in 320-row multidetector CT for pediatric brain imaging

METHOD AND MATERIALS
Institutional review board approval was obtained with no informed consent required for this retrospective analysis. Fifty seven children (36 boys and 21 girls; mean age, 6.6 years; range, 2 months to 15 years) who underwent unenhanced brain CT using one of three scan modes (wide-volume, n=19; one-shot volume, n=20; helical scan, n=20) were included in this study. The same tube potential and effective tube current-time product according to the patient’s age (group A, 0–24 months; group B, 25 months–15 years) were applied to three scan modes. For qualitative analysis, we evaluated overall image quality, noise, gray matter(WM)-white matter(GM) differentiation and streak artifacts in the posterior fossa using a 5-point grading system. For quantitative analysis, noise, signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) between the GM and WM were calculated. As a measure of radiation dose, CT dose index per unit volume (CTDIfvol) and dose-length product (DLP) were compared among three scan modes.

RESULTS
Qualitatively, the wide-volume scan showed significantly better overall image quality and less artifacts in the posterior fossa, compared with the one-shot volume scan. The wide-volume scan was associated with less image noise and posterior fossa artifacts compared with the helical scan. The GM-WM differentiation was not significantly different among three scan modes. Regarding the quantitative analysis, the wide-volume and one-shot volume scans showed significantly less noise and higher GM and WM SNR than the helical scan. The CNR was significantly higher in the wide-volume scan followed by the one-shot volume and helical scans. The CTDIvol was significantly lower in the one-shot volume scan. The DLP was significantly lower in the wide-volume and one-shot volume scans compared with the helical scan.

CONCLUSION
As for unenhanced brain CT in children, both wide-volume and one-shot volume scans reduced radiation exposure compared with the helical scan, while the wide-volume scan showed better image quality with less posterior fossa artifacts than the one-shot volume scan.

CLINICAL RELEVANCE/APPLICATION
Application of wide-volume scan could decrease radiation exposure while improving the image quality in pediatric unenhanced brain CT.

Participants
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PURPOSE
Fluoroscopy studies are a significant source of radiation exposure children. Fluoroscopy time (FT) limits have been used to screen for high exposure cases, however this is an indirect metric that does not account for differences in technique such as pulsed imaging or collimation. Dose-area product (DAP) is a more accurate reflection of radiation exposure, but is heavily affected by patient size, making the development of DAP thresholds challenging in children of various ages.

METHOD AND MATERIALS
Dose data from fluoroscopic studies performed in a pediatric tertiary care hospital were prospectively collected over 16 months. Study type, FT, DAP, and patient weight were recorded. Patient weight and DAP were compared by linear regression. Thresholds were established based on 90th percentile of either FT or DAP. Agreement between FT and DAP thresholds for identifying high exposure cases was assessed using Cohen’s kappa.

RESULTS
A total of 391 cases, including 201 upper gastrointestinal studies (UGI), 114 voiding cystourethograms (VCUG), and 76 other studies (e.g., barium enema, esophagram), were collected. DAP correlated with patient weight (r2=0.46, p<0.001). For all studies, FT thresholds were: 174 s for 6-12 lbs, 177 s for 12-25 lbs, 165 s for 25-50 lbs, 191 s for 50-100 lbs, and 244 s for >100 lbs; DAP thresholds were: 11 µGy•m2, 23 µGy•m2, 33 µGy•m2, 167 µGy•m2, and 645 µGy•m2, respectively. Of the 36 cases which exceeded the 90th percentile for FT, and the 36 cases which exceeded the 90th percentile for DAP, 15 cases exceeded both (Cohen’s κ=0.36). Subgroup analysis demonstrated κ=0.27 for UGIs alone, and κ=0.45 for VCUGs alone.
CONCLUSION
DAP monitoring is a more direct measure of dose than FT, however its correlation with weight requires use of weight-stratified thresholds. We have calculated and applied both FT and DAP thresholds, and demonstrated poor overlap when comparing these two methods. Therefore, use of FT thresholds, an indirect measure of dose, may not adequately identify high exposure cases. Establishment and adoption of weight-based DAP thresholds should provide a more accurate method of dose monitoring.

CLINICAL RELEVANCE/APPLICATION
Fluoroscopy time is typically used to track radiation exposure in pediatric fluoroscopy, however adoption of weight based dose-area product thresholds should provide more accurate dose monitoring.

SSQ16-09 Evaluation of Contrast Dose, Radiation Dose and Image Quality in Contrast-Enhanced CT in Pediatric Abdomen using Low Tube Voltage and Low-Concentration Iodinated Contrast Agent

Thursday, Dec. 1 11:50AM - 12:00PM Room: S102AB

Participants
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Yumin Zhong, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To assess image quality, contrast dose and radiation dose in enhanced abdominal CT with low tube voltage and low-concentration iodinated contrast agent in children.

METHOD AND MATERIALS
Forty-eight patients were randomized to one of the two protocols: group A (n=24) and group B (n=24). Group A: tube voltage was 80 kVp, and contrast agent being Visipaque (270mg I/mL, GE Healthcare). Group B: tube voltage was 100 kVp, and contrast agent being Iopamiro (370mg I/mL, Bracco). The degree of enhancement and noises in the abdominal aorta and portal vein were measured in two groups; while signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) were calculated. A five point scale was used to subjectively evaluate image quality and image noise. DLP (mGy/cm) and CTDIvol (mGy) were recorded.

RESULTS
There was no significant difference in age, weight or BMI between the two groups (all p >0.5). The iodine load in Group A (5517.3±3197.2mgI) was 37% lower than that in Group B (8772.1±8474.6mgI). The DLP and CTDIvol values for Group A and Group B were similar (all p >0.05). The mean arterial and portal venous enhancement and the noises, CNRs and SNRs for Group A and Group B were similar (all p>0.05). The mean score on quality of arterial phase (AP) and portal venous phase (PVP) images in Group B had scores of 4.31±0.53 and 4.35±0.52, while scores of 4.29±0.51 and 4.25±0.51 were obtained in Group A, there was no statistically significant difference between the two groups.

CONCLUSION
The scanning protocol using low tube voltage (80kVp) and low-concentration iodinated contrast agent (270mgI/mL) enables 37% reduction in iodine load while maintaining compatible image quality, and effective radiation dose compared with the conventional scan protocol.

CLINICAL RELEVANCE/APPLICATION
The scanning protocol using low tube voltage (80kVp) and low-concentration iodinated contrast agent (270mgI/mL) with a high ASIR (70%) is appropriate for enhanced abdominal CT scanning of pediatric patients.
**Abdominal Computed Tomography in Pediatric Blunt Trauma: The Significance of Isolated Free Fluid**

**PURPOSE**
Computed tomography of the abdomen and pelvis (CTAP) is widely used by both trauma surgeons and Emergency Department physicians for the identification of intraabdominal injury in the pediatric trauma patient. Multidetector computed tomography (MDCT) is the mainstay of imaging these days and CTAP is the imaging workhorse for diagnostic evaluation of blunt abdominal trauma. Incidental finding of intraperitoneal free fluid in absence of identifiable injury, referred to as isolated free fluid (IFF), may create a clinical dilemma in the pediatric blunt trauma patient. The uncertainty of the significance of IFF may lead clinicians to manage the patient with in-house observation, potentially leading to increased hospital length of stay and unnecessary hospital costs. We hypothesize that the presence of IFF in the pediatric blunt trauma patient does not require further diagnostic workup and should not mandate additional care.

**METHOD AND MATERIALS**
A retrospective review of all pediatric trauma patients ≤18yrs with a blunt mechanism of injury who received a CTAP (2011-2015, n=671) was performed at our Level 1 Adult/Level 2 Pediatric Trauma Center. Admission radiology reports were collected and analyzed, while repeat scans during the same hospital stay were excluded. We defined IFF as simple free fluid with Hounsfield units of <20 along with the absence of identifiable injury in the abdomen and pelvis. Attending radiologist reports, age, gender, ISS, mechanism of injury, and clinical outcomes were analyzed using univariate Chi-square test. A p<0.05 was considered significant.

**RESULTS**
A total 671 patients ≤18years with a blunt mechanism of injury had a CTAP performed on admission to the trauma service during the study period. We found 120 (17.9%) patients had IFF as the only positive finding on CTAP scan. Females were more than twice as likely to have IFF than their male counterparts (29% v. 13%, p<0.05). No patients with IFF on CTAP developed intraabdominal pathology or required operative management of the abdomen.

**CONCLUSION**
The presence of IFF on CTAP in the pediatric trauma patient with blunt mechanism is not associated with any injuries that require operative management. The presence of IFF should not mandate additional clinical care in the pediatric blunt trauma patient.

**CLINICAL RELEVANCE/APPLICATION**
This research has clinical relevance to changing current management of pediatric trauma patients with blunt mechanism trauma.

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**Identification of Quality Improvement Areas in Pediatric MRI from Analysis of Patient Safety Reports**

**PURPOSE**
To estimate the rate of safety reports in pediatric MRI and determine risk factors associated with safety report frequency.

**METHOD AND MATERIALS**
In a retrospective HIPAA-compliant, IRB-approved study, the RIS was queried to identify MRI studies performed in pediatric patients (0-18 yrs) from 2010-2015 and then cross-matched with the institutional safety incident reporting system. Safety report (SR) severity was graded on a 5-point scale: did not reach/aff ect the patient, reached but did not aff ect the patient, caused mild harm, or death. Patient age, location, and the use of sedation/GA were recorded. Chi-square test was used to evaluate significance of differences between groups.

**RESULTS**

A total of 89 SR were identifi ed from a total of 16749 pediatric MRI studies, yielding a prevalence of 0.53%. In 15 reports (17%) the event did not reach and did not harm the patient, 39 (44%) reached the patient but caused no harm, 32 (36%) caused mild harm, and 3 (3%) caused major harm. There were no deaths. The two most common causes for SR were service coordination (n=32; 36%) and adverse drug reactions (n=17; 19%). 3482 (20.7%) MRIs involved sedation/GA. There was a signifi cantly increased SR rate in MRIs that used sedation/GA (0.8%) relative to awake MRI (0.46%), with an odds ratio (OR) of 1.75 (P<0.05). SR rate also varied signifi cantly by location (p<0.05), with a rate of 1.2% for inpatients, 0.6% for E.R. patients, and 0.4% for outpatients. Increased SR rates were seen in the younger age categories, with newborns (1.1%), infants (1.1%), and young children (0.9%) associated with SR rates signifi cantly higher than those in older children (P < 0.05). The odds ratio of younger children (<6 yrs) having a SR relative to older children (>6yr) was 2.2.

**CONCLUSION**

The prevalence of safety reports in MRI performed in children is increased relative to previously published data on adults. The majority of events caused no harm or only minor harm. The most common causes of SRs were service coordination and adverse drug reaction. Children below the age of 6 yrs, inpatients, and use of sedation/GA are all factors associated with higher SR rates and should be the focus of quality improvement strategies.

**CLINICAL RELEVANCE/APPLICATION**

Data on safety reports in pediatric MRI is sparse. Knowledge of safety profile of pediatric MRI can be used to guide evidence-based recommendations.

**SSQ17-03 Are Skull Radiographs Necessary in a Skeletal Survey for Abusive Trauma in Children if CT Head with 3D Surface Rendering is also performed?**

**Thursday, Dec. 1 10:50AM - 11:00AM Room: S102C**

Participants

Swati S. Mody, MD, Troy, MI (Presenter) Nothing to Disclose
Harutyun Haroyan, MD, Detroit, MI (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

The purpose of this study is to compare CT head with skull radiographs for evaluation of skull fractures, and based on the fi ndings, ascertain if skull radiographs are necessary in a skeletal survey if CT head with 3D rendering is also available.

**METHOD AND MATERIALS**

Skull radiographs from skeletal surveys and CT head performed at the same time for suspected abusive trauma in 122 patients (age range: 6 days to 71 weeks) over a one-year period were reviewed retrospectively for skull fractures. Both studies were independently read by two pediatric radiologists. The number of skull fractures, location and type of fracture were documented for each study. The radiologists assigned confi dence level for diagnosis of each fracture on Likert scale of 1 through 5, with 1 being least and 5, most confi dent. The skull radiographs consisted of at least AP and lateral views. Unenhanced CT head was obtained with images reformatted in 3 planes and 3D surface reconstructions.

**RESULTS**

Skull fractures were identified in 45.14% of patients on CT (n=37) compared to 35.38% on radiographs (n=29). 8 cases with fractures identifi ed on CT did not demonstrate fractures on skull radiographs. There was high confi dence level for diagnosis of fractures on CT in these patients, 4 in one and 5 in seven cases. In 1 patient, fracture was suspected on radiographs with low confi dence level of 1, and not confi rmed on CT. Overall, larger number of separate fractures were identifi ed with CT (n=54) compared to skull radiographs (n=45).

**CONCLUSION**

CT head is superior to skull radiographs for diagnosis of skull fractures in abusive head trauma. When CT head is also obtained with 3D surface reconstruction, the possibility of omitting skull radiographs from skeletal survey should be considered to diminish risk of generating contradictory reports and moreover, decrease radiation exposure in this vulnerable population.

**CLINICAL RELEVANCE/APPLICATION**

Abusive head trauma is the leading cause of death in infants and young children. Per ACR guidelines, skeletal survey for suspected abusive injury requires minimum AP and lateral radiographs of the skull. In addition to skeletal survey, majority of these children get CT head for workup. The purpose of this study is to compare CT head with skull radiograph for evaluation of skull fractures, and thereby, ascertain if skull radiographs can be omitted in a skeletal survey if CT head with 3D reconstructions is available to reduce radiation.

**SSQ17-04 Quantitative Shape Analysis of Skull Deformity on Head CT Images**

**Thursday, Dec. 1 11:00AM - 11:10AM Room: S102C**

Participants

Min Jin Lee, BS, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Helen Hong, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Kyu Won Shim, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Yong Dock Kim, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

The purpose of this study was to quantify the shape of the skull in infants and young children and determine the clinical relevance of these measurements. This was achieved by quantitatively analyzing the deformation of the skull on head CT images in infants and young children.
CONCLUSION
Our method is useful for the quantification of severity of skull deformity for diagnosis, prognosis and surgical planning of craniosynostosis.

Background
Craniosynostosis is the premature fusion of the one or more cranial sutures resulting in skull deformity. 3D CT is the most standard imaging for early diagnosis and surgical planning of craniosynostosis. Despite the advances of 3D CT, quantitative assessment of skull deformity remains highly dependent on clinician experience. We propose a quantitative shape analysis of skull deformity on head CT images and apply our method to the classification of craniosynostosis.

Evaluation
Our method was tested on dataset consisting of 45 deformity subjects with sagittal(S) and bicoronal(B) synostosis and 45 normal subjects. In deformity subjects, typical and mild deformities were included and the skull with mild deformity subject was similar shape with that of normal subject. To generate the representative planes which reflect skull deformity, the position of S- and B-planes was defined by the region of fused suture. To quantify the severity of skull deformity, shape features which reflect skull morphology were extracted in each S- and B-planes of segmented skull. A cranial index was calculated as the ratio of the width to the length of skull. A cranial radius index was determined by considering the position and degree of a prominent area such as bossing or narrowing of skull. To consider mild deformity subjects, a cranial partial slope index was determined by considering the slope of frontal skull. A cranial extreme spot and near cranial extreme spot indices were determined by considering the distribution of area which maximize the distance between cranial boundary points. For early diagnosis of craniosynostosis, support vector machine was trained with the training shape features and tested with five-fold cross validation. Our results were evaluated by sensitivity, specificity and accuracy of 86%, 95% and 92%, for sagittal, 100%, 98% and 98% for bicalvarial, respectively.

Discussion
Our method can provide a reliable quantification tool and identify suspected case as mild subjects for assessing the severity of skull deformity and diagnosis of craniosynostosis. This research was supported by the MISP(Ministry of Science, ICT & Future Planning), Korea, under the National Program for Excellence in SW)(R7719-16-1002) supervised by the IITP(Institute for Information & communications Technology Promotion)(R7719-16-1002)

SSQ17-05 Comparison of Image Quality between Conventional VIBE and Radial VIBE in Free-Breathing Pediatric Abdominal MRI

Participants
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Mi-Jung Lee, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hyun Gi Kim, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To compare the image quality between conventional volume interpolated breath-hold examination (VIBE) and radial VIBE in contrast-enhanced fat-suppressed T1-weighted images of pediatric abdominal MRI during free-breathing.

METHOD AND MATERIALS
We retrospectively reviewed the images from pediatric patients who underwent contrast-enhanced abdominal MRI with a 3.0 T magnet using conventional VIBE (conventional group) and radial VIBE (radial group) while freely breathing. For objective analysis, the mean values of noise and signal-to-noise ratio (SNR) in liver on contrast-enhanced fat-suppressed T1-weighted images were compared. For subjective analysis, overall image quality, respiratory motion, portal vein clarity, and hepatic margin sharpness were assessed by four point scales.

RESULTS
Nine patients (mean age of 2.8±2.3 years) in the conventional and 17 patients (mean age of 2.4±2.8 years) in the radial groups were included. By objective analysis, the noise was significantly lower and the SNR was significantly higher in the radial group than those in the conventional group (all, p<0.001). In the subjective analysis, overall image quality, respiratory motion, portal vein clarity, and hepatic margin sharpness were all significantly higher in the radial group (all, p<0.001).

CONCLUSION
Pediatric abdominal MR images with radial VIBE showed lower noise with higher SNR in objective analysis and higher image quality in subjective analysis, compared to conventional VIBE.

CLINICAL RELEVANCE/APPLICATION
By applying radial VIBE in contrast-enhanced abdominal MR acquisition, we can obtain better image quality even in infants and young children while freely breathing.

SSQ17-06 Pediatric MRI in the Emergency Department Over Five Years: An Analysis of Usage and Trends

Participants
Miriam Hulkower, MD, Bronx, NY (Presenter) Nothing to Disclose
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Meir H. Scheinfeld, MD, PhD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Michele J. Fagan, MD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
**PURPOSE**

Our institution as well as others have added 24/7 MRI availability for Pediatric Emergency Department (PED) patients. Our purpose was to evaluate MRI usage and trends among pediatric patients.

**METHOD AND MATERIALS**

IRB exemption was obtained. All MRI exams performed on PED patients from 2011 through 2015 were tabulated along with demographic data. PED triage volume data were also obtained to normalize MRI data. The z-test was used to compare MRI utilization in male and female patients. A Chi-squared test for trend in proportions was used to test for a trend in usage over the five year period. MRI utilization per ED visit versus patient age was tabulated and confidence intervals were calculated. MRI usage for each hour of the day was plotted to determine the hours with the highest volume.

**RESULTS**

There were a total of 997 MRI exams and 561,704 triages performed over the five year period. Regarding category of MRI exam, 57% were of the brain, 15% were of the spine, 13% were neurologic MRA exams, 6% were of the abdomen, 5% were of the face, 4% were musculoskeletal and 0.3% were of the chest. There was significantly higher MRI utilization for females (MRI performed during 0.21% of ED visits) compared to males (MRI performed during 0.14% of ED visits, p<0.001). There was a statistically significant increasing utilization trend over the five year period (p=0.001) with MRI being performed during 0.12% of visits in 2011 and 0.24% of visits during 2015. Utilization generally increased with patient age, with lowest utilization in 3 year olds (MRI during 0.0053% of visits) and highest utilization in 17 year olds (MRI during 0.54% of visits). Highest PED MRI volume was during the evening and early nighttime hours with peak volume occurring during the 10 PM hour when 8.2% of MRI exams were performed.

**CONCLUSION**

The most common exams performed in the PED were neurological. Utilization was higher in girls and in older children. Utilization progressively increased over the study period. Evening and early nighttime hours saw the greatest MRI usage.

**CLINICAL RELEVANCE/APPLICATION**

The data presented demonstrates that there is increasing PED MRI utilization, particularly of neurological studies, suggesting that off-hour resource availability during the evening and early nighttime hours would be well utilized.

**SSQ17-07 UltraFast™ Doppler Ultrasonography for Arterial Evaluation in Children: Comparison with Conventional Doppler Ultrasonography**

**Participants**

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Young Jin Ryu, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To evaluate the utility of UltraFast™ Doppler ultrasonography (US) for Doppler assessment of hepatic and renal arteries in children.

**METHOD AND MATERIALS**

From March through April 2016, Doppler US examinations for 25 arteries (15 hepatic arteries and 10 renal arteries) were performed in 12 patients (6 boys and 6 girls, mean age 7.2 years). Doppler assessment of each artery was performed under free breathing by using both UltraFast™ Doppler and conventional Doppler US techniques. Peak systolic velocity, end-diastolic velocity, and resistive index were compared between the two techniques. Doppler acquisition times were also evaluated.

**RESULTS**

The peak systolic velocity was significantly lower in the UltraFast™ Doppler than conventional Doppler US (36.54±12.80 cm/s vs. 38.80±12.51 cm/s, p=0.0007). The end-diastolic velocity showed no significant difference between the two techniques (11.69±4.35 cm/s vs. 11.54±4.01 cm/s, p=0.5987). UltraFast™ Doppler US showed lower resistive index values than conventional Doppler US (0.67±0.06 Vs. 0.69±0.07, p=0.0048). Regarding the acquisition time, conventional Doppler US required 85.2 sec on average (range 12-269 sec) while UltraFast™ Doppler was obtained in a fixed acquisition time of 4 sec.

**CONCLUSION**

When compared with the conventional Doppler US, UltraFast™ Doppler ultrasonography was associated with lower peak systolic velocity and resistive index values and a shorter acquisition time for arterial evaluation in children.

**CLINICAL RELEVANCE/APPLICATION**

UltraFast™ Doppler ultrasonography could be a good alternative to conventional Doppler ultrasonography for children who cannot hold their breath.

**SSQ17-08 Effect of Motion for Measurement of Tissue Stiffness on Ultrasound Elastography: A Moving Liver Fibrosis Phantom Study**

**Participants**

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Mi-Jung Lee, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
PURPOSE
To evaluate the effect of movement for measurement of tissue elasticity on ultrasound elastography using moving liver fibrosis phantoms.

METHOD AND MATERIALS
We used elasticity phantoms (Shear Wave Liver Fibrosis Phantom, model 039, CIRS) of custom-made stiffness of 3.0 and 16.9 kPa. For simulating regular movement, Orbital Shaker (FinePCR SH30) was used to make regular circular and horizontal motion for 35 and 60 times per minute. We used a supersonic shear wave imaging (SSI, Aixplorer, SuperSonic Imagine, Aix-en-Provence, France) with 1-6 MHz convex and 2-10 MHz linear transducers in abdominal settings, and acoustic radiation force impulse imaging (ARFI, ACUSON S3000, Siemens Healthcare, Erlangen, Germany) with 1-6 MHz convex transducer in routine abdominal setting and 4-9 MHz linear transducer in breast ARFI setting. The values were obtained twenty times at each depth of 2, 3, 4 and 5 cm and mean values in kPa were selected. The stiffness values between moving and static status were compared using paired t-test and Wilcoxon signed-rank test.

RESULTS
Using SSI, in the lower velocity movement, convex transducer using 3 kPa phantom was less affected by the movement, regardless of the acquisition depths and the directions of the movement. SSI showed a tendency of increased values during the movement, compared to the static status. In the higher velocity movement, most of the values were significantly different between moving and static status. Using ARFI, 2 cm depth using linear transducer with 3 kPa phantom was less affected by the movement, regardless of the velocities and the directions of the movement. During the lower velocity movement, 4 cm depth using convex transducer with 3 kPa phantom was less affected by the movement, regardless of the direction. ARFI showed higher failure rates during the measurement especially in moving status.

CONCLUSION
The effect of movement on the measurement of elasticity was different according to the machines, stiffness of the phantoms, acquisition depths, transducers, velocity and direction of the movement. We found out the conditions that were less affected by the movement in SSI and ARFI using elasticity phantoms.

CLINICAL RELEVANCE/APPLICATION
This attempt will lead wide application of ultrasound elastography in the patients who have difficulty in holding their breath during the examination, including pediatric population.

SSQ17-09  Gadolinium Deposition in Pediatric Brain: Findings After Multiple Exposures to Gadobenate Dimeglumine

Thursday, Dec. 1 11:50AM - 12:00PM Room: S102C

Participants
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Paul S. Raczeck, MD, Homburg, Germany (Presenter) Nothing to Disclose
Amo Buecker, MD, Homburg, Germany (Abstract Co-Author) Research Grant, Siemens AG; Consultant, Bracco Group; Speaker, Bracco Group; Consultant, Medtronic plc; Speaker, Medtronic plc; Research Grant, Novartis AG; Research Grant, GlaxoSmithKline plc; Research Grant, Biotest AG; Research Grant, Oncogenex Pharmaceuticals, Inc; Research Grant, Bristol-Myers Squibb Company; Research Grant, Eli Lilly & Company; Research Grant, Pfizer Inc; Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, sanofi-aventis Group; Research Grant, Menirhawk Pharmaceuticals, Inc; Research Grant, Sirtex Medical Ltd; Research Grant, Concordia Healthcare Corp; Research Grant, AbbVie Inc; Research Grant, Takeda Pharmaceutical Company Limited; Research Grant, Merck & Co, Inc; Research Grant, Affimed NV; Research Grant, Bayer AG; Research Grant, Johnson & Johnson; Research Grant, Seattle Genetics, Inc; Research Grant, Onyx Pharmaceuticals, Inc; Research Grant, Synta Pharmaceuticals Corp; Research Grant, Siemens AG; Research Grant, ISYMED GmbH; Research Grant, St. Jude Medical, Inc; Co-founder, Aachen Resonance GmbH; Jonas Stroeder, MD, Homburg, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE
The possibility of gadolinium (Gd) deposition in the pediatric brain following exposure to Gd-based contrast agents (GBCA) is an emotive and potentially serious issue. We sought to determine if T1-signal changes potentially indicative of Gd-deposition occur in pediatric brain structures after multiple exposures to gadobenate dimeglumine (MultiHance; Bracco).

METHOD AND MATERIALS
34 patients (Group 1; 17M/17F; mean age: 7.18 years; range: 9 months-17 years; mainly oncologic patients) that received between 5 and 15 injections (mean: 7.8 injections; each at 0.05 mmol/kg bw) of gadobenate over a mean of 2.24 years (range: 9 months-7 years) were compared with 24 control patients (Group 2; 16M/8F; mean age: 8.78 years; range: 7 months-17 years) that had never been exposed to any GBCA. Exposure to gadobenate was for diagnosis and for therapy monitoring. Two blinded readers independently determined the signal intensity (SI) at regions-of-interest placed in the dentate nucleus (DN), globus pallidus (GP), pons, and thalamus on unenhanced T1-weighted spin echo images from both groups. Unpaired t-tests were used to compare SI values and DN-to-pons and GP-to-thalamus SI ratios between Groups 1 and 2.

RESULTS
Mean SI values in the DN, GP, pons and thalamus were 366.4, 360.5, 370.5 and 360.3 (Group 1) and 374.3, 364.4, 377.0 and 363.2 (Group 2) for reader 1, and 367.8, 392.3, 373.6 and 370.5 (Group 1) and 370.9, 380.5, 381.9 and 373.3 (Group 2) for reader 2. No significant differences between groups 1 and 2 were noted by either reader for comparisons of SI values (p>0.5; all comparisons) or for comparisons of mean DN-to-pons and GP-to-thalamus SI ratios (0.989 vs. 0.993 [p=0.383] and 1.0 vs. 1.003 [p=0.572], respectively, for reader 1; 0.984 vs. 0.973 [p=0.217] and 1.06 vs. 1.049 [p=0.185], respectively, for reader 2). The number of exposures and the time between first and last exposures did not influence SI values among patients in group 1.

CONCLUSION
SI increases in the DN, GP, pons and thalamus that are potentially indicative of Gd-deposition are not seen in pediatric patients after multiple exposures to gadobenate dimeglumine, even in patients with 15 injections over a time interval of 6 years.
CLINICAL RELEVANCE/APPLICATION

Gadobenate-enhanced MRI of pediatric patients should not be avoided due to fears of Gd deposition.
PURPOSE

The clinical utility of wrist MRI has been extensively validated in adults as well as specific pediatric rheumatologic diseases. However, corresponding comprehensive evaluation in children remains lacking. With significantly increased emphasis on cost reduction and value added by imaging, determining the impact of wrist MRI in children on diagnosis and management is necessary.

METHOD AND MATERIALS

In an IRB approved retrospective study, patients over a four year period were evaluated. Radiological reports and clinic notes were reviewed prior to and after the MRI. Patient demographics, MRI diagnoses, and effect on clinical diagnoses and management were determined. These patients were divided into 4 groups: 1) change in both diagnosis and management, 2) change in diagnosis only, 3) change in management only and 4) no change in diagnosis or management. Statistical analysis of 95% confidence intervals was performed.

RESULTS

101 patients (69 female) with a mean age of 13.4 years (range 1-17) were included. A total of 176 separate MRI diagnoses were obtained. Ganglion cyst was the most commonly reported diagnosis in 22 cases, followed by contusion in 19 cases and fracture in 10 cases. Post-traumatic tenosynovitis, TFCC tear and scapholunate ligament tear were each diagnosed in 7 cases. Nineteen reports were normal. MRI changed both diagnosis and management in 41% (CI: 31-51%), diagnosis only in 5% (CI: 2-12%), management only in 46% (CI: 36-56%) and no change in either in 9% (CI: 4-17%). Overall, wrist MRI changed the management in 86% of cases (CI: 77-92%) and changed the diagnosis in 46% of cases (CI: 36-56%).

CONCLUSION

MRI of the wrist in children changes the clinical diagnosis in a substantial proportion and alters management in the vast majority of cases. MRI of the wrist in the pediatric patient is a study of excellent clinical utility.

CLINICAL RELEVANCE/APPLICATION

MRI of the wrist in children changes the clinical diagnosis in a substantial proportion and alters management in the vast majority of cases. MRI of the wrist in the pediatric patient is a study of excellent clinical utility.

PURPOSE

Assessment of malignant bone and soft tissue tumors treatment response to chemotherapy is vital prior to planning surgical resection to ensure adequate reduction in tumor extent. The objective of this study is to evaluate whether apparent diffusion coefficient (ADC) measurements derived from diffusion-weighted imaging provide information regarding tumor response to chemotherapy.

METHOD AND MATERIALS

Assessment of malignant bone and soft tissue tumors treatment response to chemotherapy is vital prior to planning surgical resection to ensure adequate reduction in tumor extent. The objective of this study is to evaluate whether apparent diffusion coefficient (ADC) measurements derived from diffusion-weighted imaging provide information regarding tumor response to chemotherapy.

Eleven cases of bone and soft tissue sarcomas with magnetic resonance (MR) imaging including diffusion-weighted images (DWI) were retrospectively reviewed following IRB approval. Six cases (three osteosarcomas and three Ewing sarcomas) were performed prior to initiation of chemotherapy, and five cases (two osteosarcomas, two Ewing sarcomas and one chondrosarcoma) were performed after chemotherapy.
performed following chemotherapy. Minimum, average, and maximum values of ADC of each tumor were obtained and compared between the pre-treatment and post-chemotherapy groups using the nonparametric Mann Whitney U test.

RESULTS
Treated sarcomas demonstrated significantly greater average, minimum and maximum ADC values compared to untreated tumors (ADC average: 2.16 vs. 1.2 × 10−3 mm²/s, p = 0.004; minimum 1.27 vs. 0.47 × 10−3 mm²/s, p = 0.030; maximum 3.14 vs. 2.23 × 10−3 mm²/s, p = 0.004). No significant gender, age, or volume differences between the groups were observed.

CONCLUSION
Sarcomas treated with chemotherapy demonstrated greater minimum, average, and maximum ADC values, implying increased cellular diffusivity after therapy presumably due to tumor necrosis compared with greater cellularity of untreated sarcomas with lower ADC values. ADC values may be useful for evaluating chemotherapeutic response of malignant sarcomas.

CLINICAL RELEVANCE/APPLICATION
ADC measurements of malignant sarcomas obtained using diffusion-weighted imaging showed significantly increased values following chemotherapy and may be useful for assessing treatment response.

PURPOSE
Currently the most common dose reduction techniques at CT are automatic tube current modulation (ATCM) and low tube voltage techniques. In general, the same tube voltage is used during scout view- and helical scanning. Optimal ATCM may not be achieved when the tube voltage differs during helical- and scout view scanning. The purpose of this study was to investigate the relationship between the tube voltage at scout view- and the ATCM during helical scanning.

METHOD AND MATERIALS
We performed helical scans of a phantom representing newborn and 5-year-old anthropomorphic phantoms (ATOM phantom e) using a 64-detector CT scanner (VCT, GE; rotation time 0.4 s, helical pitch 1.375). The tube voltage at scout view scanning was 120 kV; during helical scanning it was 80-, 100-, 120-, and 140 kV. The tube current during helical scanning was set based on a preset noise index (NI) of 12. We performed each scan 5 times. We measured the image noise (standard deviation [SD] of the CT number) in the phantoms and analyzed the relationship between the preset NI and the image noise on helical scans acquired with 4 tube voltages.

RESULTS
The mean image noise of the 5-year-old phantom was 13.7±2.4 (SD), 12.9±2.1, and 12.3±1.6 at 80-, 100-, and 120 kVp, respectively. For the newborn phantom it was 9.9±0.9, 9.1±0.8, and 8.7±0.8, respectively. The SD value at 80 kVp was significantly lower at 80- than that at 120 kVp (p<0.01).

CONCLUSION
The use of different tube voltages during scout view- and helical scanning resulted in suboptimal low tube voltage protocols. Difference of SD value is larger at 80kVp of the 5-year-old 20-cm phantom than at 80kVp of newborn phantom.

METHOD AND MATERIALS
We performed helical scans of a phantom representing newborn and 5-year-old anthropomorphic phantoms (ATOM phantom e) using a 64-detector CT scanner (VCT, GE; rotation time 0.4 s, helical pitch 1.375). The tube voltage at scout view scanning was 120 kV; during helical scanning it was 80-, 100-, 120-, and 140 kV. The tube current during helical scanning was set based on a preset noise index (NI) of 12. We performed each scan 5 times. We measured the image noise (standard deviation [SD] of the CT number) in the phantoms and analyzed the relationship between the preset NI and the image noise on helical scans acquired with 4 tube voltages.

RESULTS
The mean image noise of the 5-year-old phantom was 13.7±2.4 (SD), 12.9±2.1, and 12.3±1.6 at 80-, 100-, and 120 kVp, respectively. For the newborn phantom it was 9.9±0.9, 9.1±0.8, and 8.7±0.8, respectively. The SD value at 80 kVp was significantly lower at 80- than that at 120 kVp (p<0.01).

CONCLUSION
The use of different tube voltages during scout view- and helical scanning resulted in suboptimal low tube voltage protocols. Difference of SD value is larger at 80kVp of the 5-year-old 20-cm phantom than at 80kVp of newborn phantom.

CLINICAL RELEVANCE/APPLICATION
As an optimal SD value may not be obtained when different tube voltages are applied during scout view- and helical scanning, we recommend that the same tube voltage be applied during scout view- and helical scanning.

PURPOSE
Automatic exposure control technology (mA/kV modulation) has been widely adopted as a tool of minimizing the radiation dose of CT examinations. This technology has also turned localizer radiographs (topograms) into important tools of determining the dose distribution and image quality of the diagnostic scan series. The purpose of our work was to investigate the impact of topogram kV choice on total dose for pediatric CT examinations with automatic exposure control.

METHOD AND MATERIALS
CT scans were performed with a Siemens SOMATOM Definition Flash system (Siemens Medical Solutions, Germany) on pediatric and small adult/teenager anthropomorphic whole body phantoms (Kyoto Kagaku, Japan). The kV of the topogram was varied between 70-140kV, keeping mA constant at 35 as per default settings. Topograms were followed by pediatric diagnostic scan series (chest/abdomen) with automatic exposure control (kV and mA) and scanning parameters routinely used in our institution. Imaging was repeated by changing the automatic exposure setting (adaptation strength) of the diagnostic scan series to different levels (very weak/average/very strong modulation).

RESULTS
The dose of the diagnostic scan series remained effectively constant for topogram kV values equal to or greater than 100kV. For topogram kV values below 100kV, the dose of the diagnostic scan series increased, indicating that the automatic exposure control was not as efficient. However, the decrease in topogram dose at values lower than 100kV, could counter the dose increase in the diagnostic scan series of the exam, keeping the total examination dose approximately constant. Thus, the dose distribution changed when topogram kV values lower than 100kV were used, resulting in higher effective mA in the diagnostic scan series with a potential benefit to diagnostic image quality. The effect of topogram kV on total dose and dose distribution also showed a dependency on adaptation strength and anatomical area imaged.

CONCLUSION
Our work demonstrated that the topogram kV choice plays an important role in determining the dose of pediatric CT examinations using automatic exposure control. Further work should be pursued by the CT community and vendors to optimize CT topograms in conjunction with diagnostic exam series.

CLINICAL RELEVANCE/APPLICATION
Low topogram kV values are recommended for pediatric CT examinations using automatic exposure control.

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Sudha A. Anupindi, MD, Philadelphia, PA (Presenter) Nothing to Disclose
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TEACHING POINTS
Focal liver lesions are discovered incidentally while imaging children or during directed abdominal imaging for pain, abnormal liver function, trauma and tumor surveillance. Traditionally children are assessed using ultrasound which is complemented by contrast enhanced MRI. More recently there is impetus to perform contrast enhanced US (CEUS), particularly as these microbubble agents are now available in the United States and recently FDA approved for use in assessing liver lesions in children (Lumason®- a second generation US contrast). CEUS allows assessment of organ and lesion perfusion and can equate MRI and CT in detection and characterization of these lesions, obviating the need for invasive procedures. CEUS has the added benefits of no radiation or sedation, safe and easy to use, and decreased time to diagnosis. Purpose of this exhibit: Familiarize radiologists with the technique of CEUS for assessing focal liver lesions. Describe the practical points and advantages of using CEUS as a problem solving imaging modality. Illustrate examples from CEUS applications for the liver.

TABLE OF CONTENTS/OUTLINE
1. Introduction to CEUS 2. Technique 3. Review of applications of CEUS for the liver 4. Summary 5. Illustration of various cases

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Kassa Darge, MD, PhD - 2016 Honored Educator

Awards
Identified for RadioGraphics

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Govind B. Chavhan, MD, Toronto, ON (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Review the differential diagnoses of pediatric urinary bladder masses via a multimodality approach using examples from ultrasound, MRI, CT and fluoroscopy. 2. Presentation and discussion of pathological correlations of common bladder masses.
Examples of patients presenting to our institution with a variety of bladder pathologies will be demonstrated in a pictorial review format. The cases will include pathological correlation where available and diagnoses will include, but not limited to rhabdomyosarcoma, inflammatory myofibroblastic tumor, paraganglioma, papillary urothelial neoplasm of low malignant potential (PUNLMP) and eosinophilic cystitis. This will be followed by a review of our ultrasound and MRI imaging protocols for investigation of bladder lesions. We will also include examples of pitfalls in diagnoses including examples of misinterpretation of bladder debris as a mass, adnexal lesions and uterine impressions appearing as lesions on the bladder wall. Familiarity with the differential diagnoses can help prevent potential pitfalls in diagnosis and improve confidence in suggestion of follow-up techniques. Congenital deformities of the urogenital system will not be covered.
The Stability and Reliability of Subjective Semi-quantitative Grade Method and Objective Quantification Method for Evaluating Leg Muscle Fatty Infiltration in Dystrophinopathy

Station #1

Participants
Robert Orth, MD, PhD, Houston, TX (Moderator) Research support, General Electric Company;

Sub-Events
PD246-SD-THB1 The Stability and Reliability of Subjective Semi-quantitative Grade Method and Objective Quantification Method for Evaluating Leg Muscle Fatty Infiltration in Dystrophinopathy

Participants
Jing Du, MD, Beijing, China (Presenter) Nothing to Disclose
Jiangxi Xiao, Beijing, China (Abstract Co-Author) Nothing to Disclose
Ying Zhu, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To analyze the intra-observer and inter-observer agreement of the subjective semi-quantitative grade score method and the objective fat quantification method in the evaluation of leg muscle fatty infiltration in dystrophinopathy.

METHOD AND MATERIALS
One hundred and ninety-four boys with genetically confirmed dystrophinopathy were recruited. The axial T1-weighted images and IDEAL-IQ images were obtained. The axial T1-weighted images were visually evaluated by three observers for two times with an interval of one week. The muscle FF were measured by three observers twice based on the IDEAL-IQ images. The observers were blinded to the clinical diagnosis. The weighted kappa analysis was used to analyze the intra- and inter-observer agreement. The intra-class correlation coefficient (ICC) was calculated to assess the agreement of the objective muscle FF measured by three observers. The Bland-Altman map was used to show the intra- and inter-observer agreement. The Spearman correlation was used to compare the result of the subjective and the objective methods. Boxplot diagram was showed to visualize the differences between them.

RESULTS
The intra-observer agreement values for the 18 leg muscles were 0.73-0.92 (P<0.05), 0.41-0.84 (P<0.05) and 0.34-0.80 (P<0.05), respectively. The intra-observer agreement of the experienced radiologist was the highest. The inter-observer agreement values for all the muscles were 0.42-0.84 (P<0.05), 0.17-0.67 (P<0.05) and 0.21-0.58 (P<0.05), respectively. The ICC values of the intra-observer were 0.9914-0.9990, 0.9901-0.9992 and 0.9861-0.9996, respectively. The ICC values of the inter-observer were 0.9801-0.9985, 0.9936-0.9993 and 0.9837-0.9989, respectively. Significant positive correlation was found between subjective method and objective method for different muscles with the correlation coefficients varied from 0.73 to 0.92 (P<0.05). The fat infiltration level evaluated by the subjective semi-quantitative method was higher than FF measured by the objective method.

CONCLUSION
The reliability of the subjective method was correlated with observers’ experience in neuromuscular disorder. The results of the objective method were more reliable in evaluating leg muscle fatty infiltration level than the subjective method which tend to overestimate the fatty infiltration level.

CLINICAL RELEVANCE/APPLICATION
To find a better method to measure the muscle fatty infiltration level on MRI.

Comparative Outcomes of N-butyl Cyanoacrylate and Onyx Embolization in Intracranial Arteriovenous Malformations of Pediatric Patients

Station #2

Participants
Mark Le, MD, Detroit, MI (Presenter) Nothing to Disclose
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Terrence Metz, MD, Royal Oak, MI (Abstract Co-Author) Nothing to Disclose

PURPOSE
Staged preoperative embolization followed by surgical resection or gamma knife radiation may be used to manage intracranial arteriovenous malformations (AVMs) in pediatric patients. The two commonly used liquid embolic agents are N-butyl cyanoacrylate (nBCA) and Onyx. We sought to compare the outcomes of nBCA versus Onyx in pediatric intracranial AVM.

METHOD AND MATERIALS
All pediatric intracranial AVMs embolized with nBCA and Onyx at our institution from December 31, 2005 to January 1, 2014 were included in this study. Patients were stratified into two treatment groups: nBCA and Onyx. Chorts were compared by age, sex, BMI, Spetzler-Martin grade, and intra- and post-embolization complication prior to surgical resection or gamma knife radiation. Additionally, pre- and post- laboratory values were analyzed. Efficacy of the final treatment outcome was determined by post-procedural MR. 

RESULTS

10 out of the 21 patients were females with an average age of 11.7 years (range: 4-17). A total of 27 embolizations were performed (nBCA, 10 patients, 16 procedures; Onyx, 11 patients, 11 procedures). There were no significant differences in patient demographics and Spetzler-Martin grade. No major intra- and post-embolization complication prior to surgical resection or gamma knife radiation was observed. No significant differences in the pre- and post-laboratory values were noted for the following: hemoglobin, white blood cell, platelets, INR, PT, FTT, BUN, and Cr. Nineteen patients (90%) underwent surgical resection or gamma knife radiation to achieve complete AVM resection. No significant differences in complication rates were observed among the cohorts.

CONCLUSION

Staged preoperative embolization with nBCA or Onyx followed by surgical resection or gamma knife radiation showed no significant differences in the outcome of pediatric intracranial AVMs.

CLINICAL RELEVANCE/APPLICATION

Preoperative embolization of intracranial arteriovenous malformations has been showed to improve the outcome of surgical resection or gamma knife radiation. Two commonly used liquid embolic agents are nBCA and Onyx. There are limited studies comparing the outcomes and complication rates of these two embolic agents. Therefore, our study adds additional knowledge to the utilization of nBCA and Onyx for treatment of pediatric intracranial AVM.

PD248-SD-THB3  Adult PICC Device Provides Safe, Durable, Reliable Central Venous Access in Children

Awards

Student Travel Stipend Award

Participants

Brooke Lawson, MD, Dundee, United Kingdom (Presenter) Nothing to Disclose
Nicholas W. Dobbs, MBBS,FRCR, Nottingham, United Kingdom (Abstract Co-Author) Nothing to Disclose
Ian A. Zealley, MD, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose

PURPOSE

Conventional tunnelled central venous catheters (TCVCs) are larger than peripherally inserted central venous catheters (PICCs). Conventional TCVCs are used in pediatric patients which are associated with relatively high complication rates in smaller children (<1yr or <10kg). Our unit has developed a technique employing PICCs as TCVCs in small children. We set out to determine the success, safety and durability of this technique and to identify the rate of delayed complications. We describe the six-year experience in our unit.

METHOD AND MATERIALS

Institutional research approval was obtained and data gathered retrospectively. Electronic and paper medical records were reviewed for consecutive paediatric patients who had a PICC inserted as a TCVC over a 6-year period (September 2009 through July 2015). Data recorded included patient demographics, setting for PICC as TCVC insertion, use of ultrasound and fluoroscopy, PICC device type, delayed complications, date of and reason for removal, and laboratory-confirmed catheter related infections. Data was entered into an Excel spreadsheet and analysed using excel statistical tools.

RESULTS

Twenty-one PICCs were inserted as TCVCs in 19 children, all aged less than 10 years. Median patient age at time of insertion was 3.25 years (range 1.4 months - 9.6 years, five patients < 1year or <10kg). The total number of catheter-days was 853. Mean catheter life was 41 days. General anaesthesia and local anaesthesia was used for all placements (100%). Eighteen (86%) procedures were carried out under ultrasound and fluoroscopic guidance, and ultrasound only in 3 cases (14%). All insertions were successful with no immediate complications recorded. Non-elective removal was required in 1 case (5%) for suspected catheter-related infection. Dislodgement occurred in one case (5%). Nineteen of the 21 TCVCs (90%) lasted for the total intended duration of use.

CONCLUSION

Using a PICC as a TCVC in smaller children appears to be a safe and durable technique with an acceptable complication profile.

CLINICAL RELEVANCE/APPLICATION

Using a PICC device as a TCVC in children is a safe and durable option and avoids the higher complication rates associated with conventional TCVC devices in smaller children.

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Ian A. Zealley, MD - 2016 Honored Educator

PD249-SD-THB4  The Value of MRI in Evaluating the Efficacy and Complications of Intra-arterial Chemotherapy for the Treatment of Retinoblastoma

Awards

Student Travel Stipend Award

Participants

Brooke Lawson, MD, Dundee, United Kingdom (Presenter) Nothing to Disclose
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Participants
Shuxian / Chen JR, MMed, Shanghai City, China (Presenter) Nothing to Disclose
Yu Hua Li, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the value of MRI and ADC in assessing the efficacy and complications with the treatment of intra-arterial chemotherapy (IAC) for retinoblastoma (RB).

METHOD AND MATERIALS
Sixty patients with unilateral RB given primary treatment of IAC (average 3 cycles), were selected from 202 patients with RB in our hospital. MRI and DWI were performed with the same protocols before and after (in three months) the treatment of IAC. Comparison with the parameters, including tumor size, ADC value and enhancement pattern before and after IAC. All patients (median age, 22.5 months; group D (50, 83.3%), group E (10, 16.7%)) were followed up for more than 6 months.

RESULTS
Of all 60 eyes, tumor size obviously diminished, with the mean maximum diameter changing from 1.55±0.26cm to 0.66±0.36cm (p<0.001) and mean thickness changing from 1.41±0.34cm to 0.39±0.34cm (p<0.001); the mean ADC value increased significantly from 0.94±0.24×10-3mm2/s to 2.24±0.40×10-3mm2/s (p<0.001); the degree of enhancement of tumor changed from moderate enhancement to non-enhancement (n=55, 92.7%) or slight enhancement (n=5, 8.3%). Six (10%) affected eyes with enhancement of postlaminar optic nerve were not enhanced after treatment. Tumor control was achieved in 59 eyes (98.3%), but 1 eye was found recurrence in ninth month follow-up. The main complications in MRI findings before and after treatment included affected eyeball volume reduction (15% to 66.7%), retinal detachment with subretinal fluid (16.7% to 56.7%), subretinal hemorrhage (5% to 13.3%), vitreous hemorrhage (1.7% to 6.7%), vitreous opacity (3.3% to 5%), cataract lens (0 to 6.7%), extracocular muscle inflammation (0 to 8.3%), choroidal vascular ischemia (0 to 15%), vascular proliferation (0 to 15%) and extracocular invasion or metastasis (0).

CONCLUSION
MRI could well assess the activity of tumor of RB before and after treatment of IAC, and detect the associated complications of IAC. MRI could also monitor the risk factor of abnormal enhancement of postlaminar optic nerve avoiding unnecessary enucleation. IAC is an effective treatment for RB. At the same time IAC will cause some complications for affected eyeballs.

CLINICAL RELEVANCE/APPLICATION
MRI could well assess the activity of tumor of RB before and after treatment of IAC, and detect the associated complications of IAC.

PD250-SD-THB5
Reducing Radiation Dose and Contrast Dose with Low Tube Voltage Prospective ECG-triggering and Adaptive Statistic Iterative Reconstruction for Infants with Complex Congenital Heart Disease

Participants
Shiyu Wang, MD, Shanghai, China (Presenter) Nothing to Disclose
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Haisheng Qiu, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Yumin Zhong, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To demonstrate the clinical values of using low tube voltage, prospective ECG-triggering cardiac CT scan with adaptive statistic iterative reconstruction (ASIR) to reduce both radiation dose and contrast dose in examining infants with complex congenital heart disease.

METHOD AND MATERIALS
45 consecutive infant patients (20 male, 25 female, mean age: 8.20±4.37m, weight: 5-10kg, mean weight: 7.36±1.83kg) with complex congenital heart disease underwent prospective ECG-triggered low dose cardiac CT on a 64-slice high definition CT scanner. The tube voltage was 80kVp and tube current was 120mA and contrast agent was Visipaque (270mg I/mL, GE Healthcare). Cardiac CT images were reconstructed with 70% of ASIR. The quantitative CT image quality was assessed by measuring the image noise in erector spinae and aorta and the contrast-to-noise ratio (CNR) in aorta. The qualitative image analysis was performed on a 5-point grading scale by two independent reviewers and interobserver variability was calculated. The results of 26 CT examinations were also compared with the available surgical results for diagnostic accuracy evaluation.

RESULTS
The effective dose was 0.60±0.07mSv for the patient population. The iodine load was 3.98±0.75gI. Image noise in erector spinae was 12.28±1.23HU and CNR in aorta was 28.99±9.50. All images were acceptable for diagnosis with an average subjective image quality score of 4.75 with very good agreement between the reviewers (Kappa=0.75). Comparing to the surgery results in 26 cases, prospective ECG-triggered cardiac CT with ASIR was 96% accurate in the diagnosis for extracardiac defects and 92% accurate for intracardiac defects.

CONCLUSION
Prospective ECG-triggered cardiac CT using 80kVp, low-concentration iodinated contrast agent (270mgI/mL) and 70%ASIR reconstruction provides excellent image quality and accurate diagnosis for complex congenital heart disease in infants with reduced contrast dose, sub-mSv radiation dose.

CLINICAL RELEVANCE/APPLICATION
Prospective ECG-triggered cardiac CT with 70%ASIR and low-concentration iodinated contrast may be used to scan infants with
complex congenital heart disease to reduce radiation and contrast doses.

**PD251-SD-THB6**  
**Gadolinium Deposition in Globus Pallidus and Dentate Nucleus on Unenhanced T1-weighted Image in the Children is Dependent on the Type of Contrast Agent**  
Station #6

Participants  
Young Jin Ryu, MD, Seoul, Korea, Republic Of *(Presenter)* Nothing to Disclose  
Young Hun Choi, MD, Seoul, Korea, Republic Of *(Abstract Co-Author)* Nothing to Disclose  
Jung-Eun Cheon, MD, Seoul, Korea, Republic Of *(Abstract Co-Author)* Nothing to Disclose  
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Yu Jin Kim, MD, Seoul, Korea, Republic Of *(Abstract Co-Author)* Nothing to Disclose

**PURPOSE**  
To identify changes in signal intensity (SI) ratios of the dentate nucleus (DN) and the lobo pallidus (GP) to those of other structures on unenhanced T1-weighted MR images in children and compare between linear or macrocyclic gadolinium-based contrast agents (GBCAs).

**METHOD AND MATERIALS**  
By reviewing 31422 cases of MR examination performed in a tertiary children's hospital between 2006 and 2014, 18 children (mean age 9.2 ± 3.6, age range 2-14 year) who underwent at least four consecutive MR examinations with the exclusive use of linear GBCA (gadodiamide, group A, n = 8) or macrocyclic GBCA (gadoterate meglumine, group B, n = 10) were found. DN-to-pons SI ratio was calculated by dividing the mean signal intensity of the DN by the mean SI of the pons. GP-to-thalamus SI ratio was calculated by dividing the mean signal intensity of the GP by the mean SI of the thalamus. Differences in DN-to-pons and GP-to-thalamus SI ratios between the first and last MR imaging examinations were calculated. One-sample test and Mann-Whitney test were used to evaluate the difference in SI ratios for both groups.

**RESULTS**  
In group A, the SI ratio increased significantly between the first and last MR examinations (mean difference in SI ratio, DN-to-pons, 0.0486 ± 0.0471, P = .022; GP-to-thalamus, 0.0967 ± 0.0877, P = .017). In group B, the DN-to-pons SI ratio showed no significant difference between the first and last MR examinations (-0.0070 ± 0.0243, P = .384), while the GP-to-thalamus SI ratio decreased (-0.0383 ± 0.0365, P = .009). Differences in SI ratios were significantly larger in group A than in group B (DN-to-pons, P = .002; GP-to-thalamus P = .003). The interval between the first and the last MR examinations and number of MR scans did not differ between both groups (P = .083, .068).

**CONCLUSION**  
The signal intensities of the DN and GP on unenhanced T1-weighted images significantly increased after serial administration of linear GBCA gadodiamide but not by the macrocyclic GBCA gadoterate meglumine in children.

**CLINICAL RELEVANCE/APPLICATION**  
Even though the clinical implication of hyperintensity of DN and GP has not been known, the macrocyclic GBCAs should be applied carefully in the children as well as adult.

**PD137-ED-THB7**  
**Imaging of Cranial Nerve Pathologies in Pediatric Population**  
Station #7

Participants  
Vijay S. Pande, MD, Memphis, TN *(Presenter)* Nothing to Disclose  
Asim F. Choudhri, MD, Memphis, TN *(Abstract Co-Author)* Nothing to Disclose

**TEACHING POINTS**  
1) Imaging plays a pivotal role in evaluation of cranial nerves especially in pediatric age group when clinical examination is often difficult or inconclusive.  
2) A wide variety of etiologies affect cranial nerves in pediatric population ranging from congenital hypoplasia to involvement in infective, inflammatory and neoplastic etiologies.  
3) Early identification and appropriate treatment of cranial nerve deficits in children is of paramount importance for proper neuro-psychological development.

**TABLE OF CONTENTS/OUTLINE**  
1) Brief review of imaging anatomic features and pathways of cranial nerves.  
2) Discuss various MR sequences and there utility in evaluation of cranial nerves.  
3) Imaging role in syndromic and non-syndromic congenital abnormalities of cranial nerves.  
4) Imaging of neoplastic and non-neoplastic cranial nerve pathologies in pediatric age group.

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Asim F. Choudhri, MD - 2016 Honored Educator
"Wait! It's not Appendicitis?" Alternate MRI Diagnoses in Children with Right Lower Quadrant Abdominal Pain

Station #8

Participants
Haramrit Hansra, MD, Tucson, AZ (Presenter) Nothing to Disclose
Sarah M. Desoky, MD, Tucson, AZ (Abstract Co-Author) Nothing to Disclose
Dorothy L. Gilbertson-Dahdal, MD, Tucson, AZ (Abstract Co-Author) Nothing to Disclose
Bobby T. Kalb, MD, Tucson, AZ (Abstract Co-Author) Nothing to Disclose
Diego R. Martin, MD, PhD, Tucson, AZ (Abstract Co-Author) Nothing to Disclose
Unni K. Udayasankar, MD, FRCR, Tucson, AZ (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. Right lower quadrant pain is a common presenting symptom in the pediatric emergency department, which can be caused by myriad pathology.
2. The role of MRI is to characterize the underlying cause whether it be acute appendicitis or an alternative diagnosis.
3. Ultrasound is the current initial modality of choice in children with suspected acute appendicitis, however advances in MRI technology and speed allow for a more detailed evaluation.
4. Magnetic resonance imaging enhances prognostic outcomes without the use of ionizing radiation.

TABLE OF CONTENTS/OUTLINE

A fast non enhanced appendicitis MRI protocol will be discussed. Normal appendiceal MRI signal characteristics will be illustrated. The growing role of MRI use in the pediatric population will be described. A number of MRI cases that were ordered for acute appendicitis, but rather depicted alternative diagnoses will be examined. These cases include ovarian pathologies (torsion, complicated cysts, tumors and endometriomas), pyelonephritis, urinary calculi, acute enteritis/colitis, acute hepato-biliary pathologies, and Meckel's diverticulitis, among others. Experience from a large data base of appendicitis MRI performed at a tertiary care children's hospital will be shared.
RSNA Diagnosis Live™: Peds, IR, Potpourri

Thursday, Dec. 1 3:00PM - 4:00PM Room: E451B

AMA PRA Category 1 Credit™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Paul J. Chang, MD, Chicago, IL (Presenter) Co-founder, Stentor/Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Medical Advisory Board, lifeIMAGE Inc; Advisory Board, Bayer AG
Kate A. Feinstein, MD, Chicago, IL, (kfeinstein@radiology.bsd.uchicago.edu) (Presenter) Nothing to Disclose
Brian S. Funaki, MD, Riverside, IL (Presenter) Data Safety Monitoring Board, Novate Medical Ltd

LEARNING OBJECTIVES

1) The participant will be introduced to a series of radiology case studies via an interactive team game approach designed to encourage "active" consumption of educational content. 2) The participant will be able to use their mobile wireless device (tablet, phone, laptop) to electronically respond to various imaging case challenges; participants will be able to monitor their individual and team performance in real time. 3) The attendee will receive a personalized self-assessment report via email that will review the case material presented during the session, along with individual and team performance. This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.
Participants

Sub-Events

**RC713A** Fetal Imaging - Looking Outside the Fetus

Participants
Maria A. Calvo-Garcia, MD, Cincinnati, OH, (maria.calvo@cchmc.org) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) List frequent or important extrafetal conditions potentially encountered during fetal MRI examinations. 2) Apply pattern-recognition guide of these processes during imaging interpretation.

**ABSTRACT**

An adequate evaluation of the pregnancy with fetal MRI will include not only assessment of the fetus. Major structures that will be analyzed and that could clearly affect the outcome of the pregnancy include the cervix, the placenta and the umbilical cord. In addition, congenital and acquired uterine and other maternal conditions could be encountered. Along the course of this presentation we will review extrafetal anatomic variants and pathologic conditions following a case-based format.

**RC713B** Fetal GU Imaging

Participants
Ann M. Johnson, MD, Philadelphia, PA, (johnsona@email.chop.edu) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand MRI techniques to characterize complex GU abnormalities in the fetus. 2) Recognize patterns of abnormality to diagnose complex fetal GU abnormalities.

**RC713C** Fetal Chest Anomalies

Participants
Teresa Victoria, MD, PhD, Philadelphia, PA, (victoria@email.chop.edu) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) To discuss the most common fetal lung masses. 2) To identify imaging algorithms and patterns that can be helpful in reaching a diagnosis.

**ABSTRACT**
**Pediatric Neuro**

Friday, Dec. 2 8:30AM - 10:00AM Room: E450B

**AMa PRA Category 1 Credits**: 1.50
ARRT Category A+ Credits: 1.50

**Participants**

**Sub-Events**

RC813A  Imaging of Sensorineural Hearing Loss in Children

Participants
Maura E. Ryan, MD, Chicago, IL, (mryan@luriechildrens.org) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review pertinent anatomy of the inner ear structures. 2) Describe pathologic CT and MRI findings of the inner ear, membranous labyrinth and cochlear nerve associated with pediatric sensorineural hearing loss.

**ABSTRACT**

Active Handout: Maura E. Ryan


RC813B  Pediatric Posterior Fossa Tumors: Common Lesions and Mimics

Participants
Luke L. Linscott, MD, Cincinnati, OH, (luke.linscott@gmail.com) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Compare the salient imaging and clinical features of the 4 major posterior fossa masses in children. 2) Identify the less common tumors that mimic the 4 major pediatric posterior fossa tumors.

**ABSTRACT**

RC813C  Pattern Approach to Pediatric Neurometabolic Disorders

Participants
Bruno P. Soares, MD, Baltimore, MD, (bruno.soares@emory.edu) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Recognize normal myelin maturation. 2) Identify most common leukodystrophies. 3) Distinguish hypomyelinating from demyelinating leukodystrophies. 4) Identify most common neurometabolic disorders of the newborn.

**ABSTRACT**

RC813D  Presurgical Imaging of Pediatric Epilepsy

Participants
Sanjay P. Prabhu, MBBS, Boston, MA, (sanjay.prabhu@childrens.harvard.edu) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) How to design an optimal MRI protocol that can help maximize detection of epileptogenic foci. 2) Describe a systematic approach to reviewing MRI of children with drug resistant epilepsy. 3) Appreciate value of multimodality and interdisciplinary approaches to the management of this group of children. 4) Describe potential pitfalls whilst reviewing preoperative imaging studies in these patients 5) Optimize evaluation of imaging studies in patients with recurrent seizures after epilepsy surgery.

**ABSTRACT**
PURPOSE
To determine the most effective advanced virtual monochromatic imaging (VMI) energy level for maximizing the brain parenchymal image quality in dual-energy unenhanced brain computed tomography (CT) of children and to assess the improvement with this technique compared with conventional monochromatic reconstruction and polychromatic scanning.

METHOD AND MATERIALS
Institutional review board approval was obtained with no informed consent required for this retrospective analysis. 23 consecutive dual-energy unenhanced brain CT scans (7 boys and 16 girls; mean age 7.8 years; range, 9 months to 18 years) acquired in a dual-source dual-energy CT scanner were retrospectively reconstructed at 13 VMI energy levels from 40 to 100 keV in 5-keV increments using both conventional (Mono) and advanced monochromatic reconstruction (Monoplus) techniques. The following six quality indexes were analyzed: gray matter (GM) noise and signal-to-noise ratio (SNR), white matter (WM) noise and SNR, GM-WM contrast-to-noise ratio (CNR) and posterior fossa artifact index (PFAI). The VMI series with the best CNR were chosen from each monochromatic reconstruction technique and were compared with 28 consecutive scans obtained with the same scanner in 80 or 120-kVp single-energy mode.

RESULTS
The maximal GM SNR, WM SNR, and GM-WM CNR values were observed at 60 keV (Monoplus), and 65 keV (Mono). The CNR of Monoplus was significantly better than that of Mono and polychromatic CT (3.38, 3.18, and 2.69, respectively p<0.01), while GM and WM SNR from Monoplus showed no significant difference compared to those of Mono and was significantly better than those of the polychromatic CT (p<0.01). The minimal PFAI was obtained at 70 keV (Monoplus) and 75 keV (Mono). The PFAI of former was significantly lower than that of latter and conventional polychromatic CT (p<0.01). Quality index improvement ratios ranged from 8% to 34%.

CONCLUSION
The advanced virtual monochromatic reconstruction of dual-energy unenhanced brain CT scans at 60 keV (optimal energy levels) maximize image quality compared with scans obtained with conventional monoenergetic and polychromatic CT.

CLINICAL RELEVANCE/APPLICATION
Reconstruction of dual-energy unenhanced brain CT at 60 keV optimizes the brain image quality as well as reduces the radiation exposure in pediatric brain CT. Application of advanced virtual monochromatic imaging further improves the image quality compared with the conventional virtual monochromatic imaging.
examination. In the first part of this research, 18 ADHD and 15 healthy children were enrolled, these two groups were well-matched to each other with reference to age, gender, handness and intelligence quotient, respectively. 3D-T1 BRAVO scanning was performed and voxel-based morphometry analysis was used to assess the variation of whole-brain gray matter volume. In addition, 14 ADHD and 15 healthy children were enrolled as the second part of this study. Then 3D-ASL scanning was performed. The ASL data were transferred to an off-line workstation (General Electric, Advantage workstation, edition 4.5). CBF-map was constructed automatically from ASL data by the workstation’s functool software. ROIs were placed in bilateral caudate nucleus head, globus pallidus, putamen, thalamus and splenium of corpus callosum to detect the perfusion differences between these two groups. Furthermore, the relationships between ASL-CBF and age in the selected ROIs were analyzed using Pearson’s correlation analysis.

RESULTS

The gray matter volume of the right cerebellum, left superior temporal gyrus, left lingualis gyrus, right thalamus and left cuneus in ADHD group was significantly lower than that in the control group. The CBF of the bilateral caudate nucleus head, bilateral thalamus and left globus pallidus in ADHD group was significantly elevated compared to that in the control group. The CBF of bilateral caudate nucleus head and right thalamus in control group was positively correlated with age (R=0.4767, 0.4671, 0.299, respectively; p < 0.05), while there were no significant correlation between CBF and age in ADHD group.

CONCLUSION

The altered gray matter volume and perfusion in ADHD children suggest malfunction of advanced cognitive neural circuits. Furthermore, the correlation between CBF and age in several cerebral regions indicate the aberrant trajectory of ADHD children, which is helpful for further detecting the neural pathology of ADHD.

CLINICAL RELEVANCE/APPLICATION

These alterations about the gray matter volume and perfusion of ADHD children may help better account for the neural pathology and symptoms of attention deficit hyperactivity disorder.

SST09-05 Effect of ICA-based Denoising on Performance of Network-Based Intelligence Prediction in the Pediatric Epileptic Brain

Friday, Dec. 2 11:10AM - 11:20AM Room: E264

Participants

Zili David Chu, PhD, Houston, TX (Presenter) Nothing to Disclose
Wei Zhang, PhD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Farahnaz Golriz, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Lynn Chapielski, PhD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Michael J. Paldino, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose

PURPOSE

Resting functional MRI (r-fMRI) has become a major tool to evaluate the cerebral network toward understanding brain development and pathology. The inherent low signal to noise ratio in fMRI renders the network susceptible to noise contributed from multiple sources, including machine, non-neural physiology and motion. Recently independent component (IC) analysis (ICA) that separates a multivariate signal into additive subcomponents, found a role in the noise reduction of fMRI data. The noise components can be identified through their temporal and spatial features and removed from the 4D r-fMRI data. In this work, we sought to investigate the impact of such denoising on performance of brain network-based prediction of intelligence.

METHOD AND MATERIALS

28 epilepsy patients were identified for this IRB approved study. Full scale intelligence quotient (IQ) was measured by a pediatric neuropsychologist. Network nodes were defined based on subdivision of brain gray matter into approximately 350 volumes of interest. Edges were defined as the absolute value of the pairwise correlation of BOLD time series between nodes. A series of metrics were derived for each patient from the brain network and formed a feature vector for a machine learning algorithm to predict IQ. ICA was performed on the r-fMRI data using FSL Melodic software. Noise components were identified manually and removed. Those cases with few neuronal signal ICs were identified using threshold of signal-ICs/all-ICs < 7%. The percent variance explained was computed for three denoising levels: 1. without denoising (raw time series); 2. ICA denoising (denoised time series); 3. excluding cases with few neuronal signal ICs.

RESULTS

Network construction based on denoised time series did not outperform raw time series for the purposes of IQ prediction. However, datasets not previously identified as poor quality were successfully excluded based on ICA denoising. This method resulted in marked improvement in IQ prediction by the machine learning algorithm.

CONCLUSION

ICA-based denoising identified data too noisy to make any inference, resulting in better IQ prediction.

SST09-04 Effect of ICA-based Denoising on Performance of Network-Based Intelligence Prediction in the Pediatric Epileptic Brain

Friday, Dec. 2 11:00AM - 11:10AM Room: E264

Participants

Zili David Chu, PhD, Houston, TX (Presenter) Nothing to Disclose
Wei Zhang, PhD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Farahnaz Golriz, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Lynn Chapielski, PhD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Michael J. Paldino, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
PURPOSE
Architecture of the cerebral network has been shown to associate with IQ in children with epilepsy. However, subject-level prediction on this basis, a crucial step toward harnessing such analyses for the benefit of epilepsy patients, has yet to be achieved. We aimed to optimize network metric computation with regard to the capacity for patient-level IQ prediction.

METHOD AND MATERIALS
Patients were retrospectively identified: 1. Localization-related epilepsy; 2. Resting state fMRI; 3. Full scale IQ by a neuropsychologist. Brain network nodes were defined by anatomic parcellation, first in patient space (nodes defined for each patient) and again in template space (same nodes for all patients). Node parcellation in both spaces was performed at three different sizes, resulting in networks containing approximately 350, 750, or 1500 nodes. Whole-brain, weighted graphs were constructed according to pair-wise correlation of BOLD-signal time courses between nodes. A range of thresholds was applied to each graph (range: 0-0.9) on the basis of correlation coefficient. The following metrics were calculated: clustering coefficient, transitivity, modularity, path length, and global efficiency. Metrics computed on graphs in patient space were normalized to the same metric computed on a random network of identical size. A machine learning algorithm was trained on a subset of the cohort; we then assessed the ability of the algorithm to predict IQ of the remaining individuals based on their network metrics.

RESULTS
Twenty-six patients met criteria (age: 4-18 yrs). Percent variance explained for each condition is presented in Table 1. Accounting for differences in network size inherent to a pediatric cohort was a dominant factor in accurate IQ prediction. In this regard, network construction in patient space with normalization of metrics to a random network of identical size outperformed use of a standard template. Node size was also an important factor; larger networks had greater accuracy. There was an inverse relationship between accuracy and graph threshold.

CONCLUSION
Optimal patient-level prediction was achieved with: networks constructed in patient space; smallest nodes; no graph threshold.

CLINICAL RELEVANCE/APPLICATION
Our results provide preliminary guidelines for optimal construction of whole-brain networks based on resting state fMRI for the purpose of patient-level prediction of global brain function.

SST09-06 Altered Regional Brain Activities in Children with Non-syndromic Cleft and/or Lip Palate (CL/P): A Resting-State Functional MRI Study
Friday, Dec. 2 11:20AM - 11:30AM Room: E264

Participants
Hua Cheng, MD, Beijing, China (Presenter) Nothing to Disclose
Yingzi Gao, Beijing, China (Abstract Co-Author) Nothing to Disclose
Yang Fan, Beijing, China (Abstract Co-Author) Nothing to Disclose
Wenjing Zhang, Beijing, China (Abstract Co-Author) Nothing to Disclose
Yun Peng, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
Significant cortical structural alterations were found in patients with CL/P. These structural alterations may lead to brain functional abnormality. The purpose of this study was to detect the abnormal regional brain activity of children with CL/P using rs-fMRI

METHOD AND MATERIALS
Eight children (6-12yrs) with nonsyndromic CL/P and eight age- and gender-matched healthy controls (HCs) were involved in this study. rs-fMRI data were acquired for all subjects using a 3.0 T MR scanner. To detect differences of regional brain activity between two groups, Regional Homogeneity (ReHo), amplitude of low frequency fluctuations (ALFF) and fractional ALFF were computed. Then, statistical differences of those parameters between two groups were detected using two-sample t-test. Besides, assessments including IQ, auditory brainstem response (ABR) and Chinese language clear degree scale (CLCDS) were performed in CL/P group. The correlation between values of rs-fMRI indices and results of these assessments were analyzed

RESULTS
Only ReHo from those three indices revealed significant difference between two groups of children. Compared with HC, the CL/P group showed increased ReHo values in three cortical regions of the right temporal lobe (see Fig. 1), including the superior/middle temporal gyrus, the inferior temporal gyrus, and temporal pole. The superior/middle temporal gyrus was involved in auditory processing and language reception. The inferior temporal gyrus was a crucial area to analyze visual information. Temporal pole is related to brain network that governs personal and social behavior, emotion and decision making. Besides, there was one cortical area with reduced ReHo value in the left superior frontal gyrus. In addition, CLCDS was associated with increased ReHo in the right superior/middle temporal gyrus (r= -0.868, p=0.017). It indicates the relationship between increased ReHo and abnormal pronunciation

CONCLUSION
This study found abnormal spontaneous brain activities in multiple brain regions, especially in verbal and cognitive areas, in nonsyndromic CL/P children. It might contribute to understanding the abnormality of functional architecture of CL/P

CLINICAL RELEVANCE/APPLICATION
Altered regional brain activities were found in children with nonsyndromic CL/P using resting-state fMRI. It may offer great help in understanding the abnormality of functional architecture of CL/P

SST09-07 Image Quality Assessment of Synthetic Brain MRI in Children: Comparison with Conventional MR Imaging
Friday, Dec. 2 11:30AM - 11:40AM Room: E264
To evaluate the image quality and acquisition time of synthetic brain MR imaging in children and to compare with conventional brain MRI.

METHOD AND MATERIALS

Institutional review board approval and written informed consent were obtained for this prospective study. Synthetic MR imaging was implemented in addition to routine brain MR scanning in twenty-nine children (mean age, 5.7 years, age range, 0-16 years) on a 32-channel GE 3T scanner. Synthetic T2-, T1-weighted and FLAIR images matching conventional sequence settings were generated and compared with conventional images. Overall image quality was rated on a 5-point scale (1=nondiagnostic, 2=poor, 3=average, 4=good, 5=excellent). Image noise, gray-white matter differentiation, flow-related artifact and lesion conspicuity were evaluated on each sequence using a 5-point scoring system. The synthetic MR imaging acquisition time and total acquisition time for all 3 conventional MR sequences were compared.

RESULTS

Synthetic T2-, T1-weighted images were of average or good quality (mean score, 3.4 and 3.3, respectively). Synthetic FLAIR images were rated below average (mean score 2.8). Synthetic MR images were assessed to be of inferior image quality than conventional MR images. Image noise and flow-related artifact were more prominent on synthetic MR images. GM-WM differentiation was better on T2- and T1-weighted images, while synthetic FLAIR images showed significantly poor GM-WM differentiation than conventional FLAIR. Lesion conspicuity showed no significant difference between the two images. The acquisition time of synthetic MR imaging was significantly shorter than conventional MR imaging (6 minutes vs. 9 minutes 15 seconds).

CONCLUSION

Synthetic T2-, T1-weighted images were diagnostically acceptable, while synthetic FLAIR images were suboptimal. The acquisition time of synthetic MR imaging was about 30% shorter than conventional MR imaging.

CLINICAL RELEVANCE/APPLICATION

Synthetic brain MR images seem to be diagnostically acceptable, even though artifacts significantly degraded synthetic FLAIR images. Considering that synthetic MR imaging enables quantitative MR analysis and reduces the scanning time, synthetic MR imaging could be a useful alternative to conventional MR sequences.

SST09-08 Imaging Characteristics of Pediatric Diffuse Midline Gliomas Based on the Presence of a Poor Prognostic Marker Histone H3 K27M Mutation

Friday, Dec. 2 11:40AM - 11:50AM Room: E264

Awards

Student Travel Stipend Award

Participants

Mariam S. Aboian, MD, PhD, San Francisco, CA (Presenter) Nothing to Disclose
David Solomon, MD, PhD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Erin Felton, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Marc C. Mabray, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Sabine Mueller, MD, PhD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Soonmee Cha, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose

PURPOSE

The molecular basis underlying pediatric gliomas is distinct from adult gliomas. One unique molecular alteration that has been identified in pediatric gliomas is K27M missense mutation in histone H3 variants and presence of this mutation correlates with poor prognosis. The forthcoming 2016 WHO Classification will include "diffuse midline gliomas with histone H3 K27M mutation" as a new diagnostic entity. We identify imaging characteristics of these diffuse midline gliomas in pediatric patients based on the presence of histone H3 K27M mutation.

METHOD AND MATERIALS

We identified 42 pediatric patients (<20 yrs old) with diffuse gliomas with available MRI imaging. Histopathologic subtypes included diffuse astrocytoma, anaplastic astrocytoma, and glioblastoma. We evaluated the imaging patterns of these diffuse gliomas based on their location, enhancement pattern, and necrosis.

RESULTS

In these 42 patients, tumors were supratentorial in origin in 48.8% of cases, infratentorial in 46.5%, and cervical spine in 4.7%. 74.4% of the tumors were midline (thalamus, pons, or spinal cord) with 71.9% of these had K27M mutation. All tumors in cerebral hemispheres were histone H3 WT and were associated with high amount of necrosis (p < 0.003). All cervical spine tumors were K27M mutant and had distal subependymal metastases within the lateral ventricles on follow up at 5-13 months. Majority of the infratentorial tumors were K27M mutant (83%), while only 67% of the thalamus tumors had K27M mutation. When comparing histone H3 mutant to WT midline gliomas, there was no statistically significant correlation between enhancement or border characteristics, infiltrative appearance, or presence of edema.
CONCLUSION

Majority of diffuse midline gliomas originating in the thalamus, pons, or spinal cord were found to harbor histone H3 K27M mutation. Tumors arising in the cervical cord showed propensity for distal metastatic spread. In contrast, diffuse gliomas in the cerebral hemispheres were uniformly negative for K27M mutation and were more likely to demonstrate necrosis.

CLINICAL RELEVANCE/APPLICATION

We describe imaging features of a new 2016 World Health Organization (WHO) class of diffuse gliomas, Histone H3 K27M mutant gliomas.

SST09-09  Automatic Ventricular Volume Estimation (AVVE) from MRI/CT Data Using Statistical Learning

Friday, Dec. 2 11:50AM - 12:00PM Room: E264

Participants
Fernando Y. Calderon, Los Angeles, CA (Presenter) Nothing to Disclose
Edward Melamed, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Stefan Bluml, PhD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Marvin D. Nelson Jr, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
J G. McComb, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose

PURPOSE

To automatically quantify CSF ventricular volume from MRI/CT generated data.

METHOD AND MATERIALS

Using the currently available clinical imaging platform, Picture Administration and Communications System (PACS), data obtained from MRI/CT studies were analyzed using a newly developed algorithm -named AVVE- to automatically determine ventricular CSF volume. The calculated volumes were compared with those manually extracted in the same subjects. The similarity was quantified using the Jaccard index. The algorithm uses four parameters: 1) The normalized distances (ND) measured from every voxel to the Scanner Central Voxel (SCV). 2) The Histogram Classified Intensities (HCI) using intensity distribution to effect separation. 3) Neighboring (NAB) to determine the number of intensity based partners that a given voxel (V) has. Another voxel N is considered a neighbor of V if the difference between their intensities is lower than the one between the N and the second order neighbor NN in the direction of view. 4) Cardinality (CARD) which dissolves the ambiguity of the ND feature regarding its radial equality to a given distance in space and consists of dividing the 3D space into sub-units that are in turn labeled sequentially. See the companion figure for clarity.

RESULTS

The most exigent estimations corresponding to pathogenic cases are listed here following this format: Subject | Manual Ventricular Volume extraction | AVVE | Jaccard index. All volumes are given in milliliters.
Mild hydrocephalus | 28.2 | 26.8 | 0.94
Moderate hydrocephalus | 258.9 | 245.9 | 0.92
Severe hydrocephalus | 585.1 | 550.8 | 0.94

CONCLUSION

Using the method described above, it was possible to automatically segment the CSF in the ventricles from the surrounding brain and calculate the CSF volume which was 92% to 94% concordant to that determined manually. The solution is fully automatic so it can be incorporated into PACS networks. Additionally, by changing the masks the algorithm would learn to segment other structures.

CLINICAL RELEVANCE/APPLICATION

One of the most common clinical problems in pediatric neurosurgery is that of hydrocephalus. Being able to accurately determine ventricular CSF volume will be valuable for clinical decision-making.