Musculoskeletal Radiology

104th Scientific Assembly and Annual Meeting
November 25-30 | McCormick Place, Chicago
MK001-EB-X

Tibial Pilon Fractures: What Radiologists Need to Know

All Day Room: NA Hardcopy Backboard

Participants
Irfan Masood, MD, Galveston, TX (Presenter) Nothing to Disclose
Arsalan Saleem, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Stephen Herrmann, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Jax H. Pham, DO, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Maida Ribati, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Ndy C. Ikwuagwu, MD, Galveston, TX (Abstract Co-Author) Nothing to Disclose
Glenn M. Garcia, MD, San Antonio, TX (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
irmasood@utmb.edu

TEACHING POINTS
To review the patterns of tibial pilon fractures. To discuss the Ruedi - Allgower Classification System of the Pilon Fractures. To discuss type B & C distal tibial fractures of the Muller AO Classification System. To explain the commonly used nomenclature of fracture fragments of pilon fracture for accurate & relevant diagnostic information to the orthopedic surgeons. To discuss general surgical management considerations depending on the severity of the fractures.

TABLE OF CONTENTS/OUTLINE
Underestimated Ligament Injuries in MRI: How Maneuvers Can Help

All Day Room: NA Hardcopy Backboard

Participants
Paulette Mariette Dautt Medina, MD, Mexico City, Mexico (Presenter) Nothing to Disclose
Yeni Fernandez de Lara Barrera, MD, Mexico City, Mexico (Abstract Co-Author) Nothing to Disclose
Marco A. Teliz, MD, Puebla, Mexico (Abstract Co-Author) Nothing to Disclose
Rafael Choza Chenhalls, MD, Mexico City, Mexico (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
 drpaulettedautt@gmail.com

TEACHING POINTS
To know the different dynamic maneuvers in MRI. To identify the anatomy and how it varies depending on the maneuver applied. Demonstrate the greatest diagnostic certainty that MRI offers in dynamic images.

TABLE OF CONTENTS/OUTLINE
A Bump, So What? High-Resolution Ultrasound (HRUS) of Soft-Tissue Superficial Palpable Lesions (STSPL)

All Day Room: NA Hardcopy Backboard

Participants
Orlando Catalano, MD, Napoli, Italy (Abstract Co-Author) Nothing to Disclose
Antonio Nunziata, MD, Ercolano, Italy (Presenter) Nothing to Disclose
Carlo Varelli, MD, Naples, Italy (Abstract Co-Author) Nothing to Disclose
Ximena L. Wortsman, MD, Santiago, Chile (Abstract Co-Author) Nothing to Disclose
Vittoria Nunziata, Ercolano, Italy (Abstract Co-Author) Nothing to Disclose
Antonella Petrillo, MD, Naples, Italy (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
orlandcat@tin.it

TEACHING POINTS

STSPL represent a very common issue, with a wide spectrum of underlying abnormalities. HRUS is the first line imaging modality, frequently allowing a definitive diagnosis.

TABLE OF CONTENTS/OUTLINE

The role of US is to confirm the presence of a focal lesion, establish the precise location of the lesion, differentiate malignant from benign lesion (providing if possible a definitive diagnosis), guide the cytology/histology sampling when needed, help establishing the best treatment (by also identifying the involvement of critical structures), and follow-up the area after treatment if needed. Major queries to ask the patient include: when did you feel this swelling? Has it undergone any growth? Is it painful? Do you have any major systemic disease (cancer, diabetes, immunodepression, etc.)? The US examination should assess: Location (epidermis, dermis, superficial hypodermis, deep hypodermis, fascia, muscular layer, combined), Size (two orthogonal diameters, measured in millimeters), shape (round, oval, polilobulated, irregular), spatial orientation (parallel vs. antiparallel), echotexture (cystic, solid, mixed, pseudosolid, pseudocyst - hyperechoic, isoechoic, hypoechoic - homogeneous vs. heterogeneous), presence of calcifications, hair, tail, duct, or capsule, presence and distribution of flow signal at Doppler imaging, strain behavior at elastography.
Ultrasound and Color-Doppler Imaging of Non-Melanoma Skin Tumors

Participants
Orlando Catalano, MD, Napoli, Italy (Abstract Co-Author) Nothing to Disclose
Antonio Nunziata, MD, Ercolano, Italy (Presenter) Nothing to Disclose
Carlo Varelli, MD, Naples, Italy (Abstract Co-Author) Nothing to Disclose
Fernando Alfagene Roldan, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Ximena L. Wortsman, MD, Santiago, Chile (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact: orlandcat@tin.it

TEACHING POINTS
The current availability of high-resolution transducers (>15 MHz) allows appropriate assessment of skin tumors with US. US is going to complement the clinical and dermoscopic findings in the differential diagnosis and is helpful in the surgical planning as well as in locoregional staging and post-treatment follow-up. The purpose of this exhibit is to provide a comprehensive guide to the gray-scale and color-Doppler findings in skin malignancies other than melanoma.

TABLE OF CONTENTS/OUTLINE
We first provide guidelines for the appropriate assessment of skin cancers other than melanoma, with tips on scanner setting and exploration modality. Then we outline the most important aspects in surgical planning, with special reference on appropriate measurement of tumor thickness and on tumor spread within the deeper planes. In the central part of the exhibit we will provide a correlation between clinical photographs, gray-scale images, color-Doppler images, and histological findings in case of basal-cell carcinoma, squamous-cell carcinoma, primary lymphoma, Merkel-cell carcinoma, Kaposi sarcoma, dermatofibrosarcoma protuberans, and others. We finally show some paradigmatic cases, with intriguing differential diagnoses and pitfalls.
Rice Bodies: Leaving Routine 'RICE with BEAN'

All Day Room: NA Hardcopy Backboard

Participants
Luis Fernando S. Ferreira, MD, Rio de Janeiro, Brazil (Presenter) Nothing to Disclose
Leonardo K. Bittencourt, MD, PhD, Rio De Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Renato d. Milagres, MD, PhD, Rio de Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Flavia P. Lopes, MD, Rio de Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Clarissa Canella, MD, Rio de Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
**The term 'rice bodies' has been used to describe the histologic appearance of intra-articular detached hypertrophied synovial villi in patients with rheumatoid arthritis, mycobacterial infection, and other arthritides.** Describe the rice body formation as a rare condition due to chronic sinovial inflammation usually observed in Rheumatoid arthritis. **Although rare, atypical mycobacterial infection is an important disease to recognize, given the increasing incidence of the disease because of the spread of the AIDS epidemic and an increased virulence of the mycobacteria.** How to recognize the main differential diagnosis of “rice bodies” aspect in conventional MRI diagnosis. **To illustrate the differential diagnosis (synovial chondromatosis, Pigmented villonodular synovitis) with key findings to help you diagnose the cause of your aspect.**

TABLE OF CONTENTS/OUTLINE
Rice body formation: concept and etiology Main differential diagnosis: Rheumatoid arthritis and other chronic sinovitis Describes rice bodies found in patients with atypical mycobacterial tenosynovitis, emphasizing the MR imaging appearances. MRI protocols Main MRI findings
MK006-EB-X

Do You Know How Many Fat Pads Useful in the Diagnosis of MSK Disease? Anatomic and Case Review of Fat Pad Sign in the Whole Body

All Day Room: NA Hardcopy Backboard

Participants
Hyunji Kim, Bucheon, Korea, Republic Of (Presenter) Nothing to Disclose
Jang Gyu Cha, MD, Bucheon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jaegu Oh, MD, Bucheon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Seonghwan Byun, MD, Bucheon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Discuss the importance and reliability of fat pad signs
2. Review the normal anatomy of the fat pads of the paraspinal area, elbow, forearm, knee and foot.
3. Review the associated pathologies which change the normal fat pad finding on radiography

TABLE OF CONTENTS/OUTLINE
1. Introduction
2. Paraspinal fat pad
   A. Normal anatomy
   B. Associated pathology
3. Anterior and posterior fat pads of the elbow
   A. Normal anatomy
   B. Associated pathology
4. Pronator quadratus fat pad
   A. Normal anatomy
   B. Associated pathology
5. Supra and infrapatellar fat pad of the knee
   A. Normal anatomy
   B. Associated pathology
6. Kager fat pad
   A. Normal anatomy
   B. Associated pathology
Ultrasound elastography (strain imaging) is a recently developed technique that allows a noninvasive assessment of tissue mechanical properties. It is currently being used for the evaluation of breast lesions and hepatic pathology, and it has proven its utility for musculoskeletal imaging. The elastic properties of tissues are different from the acoustic impedance used to create B-mode imaging and the flow properties of Doppler imaging, hence elastography provides a different form of tissue assessment. The aim of this review is to compare the strain ratio values with sonoelastography of asymptomatic Achilles tendons between sedentary volunteers and professional athletes to identify patients with increased risk for tendinopathy.

TABLE OF CONTENTS/OUTLINE
Introduction to strain wave sonoelastography in musculoskeletal applications. Exploration technique. Sonoelastography appearance of the Achilles tendon and comparison with strain ratio values in asymptomatic sedentary population and professional athletes. Results. Discussion.
Resonating with Rockwood: MRI of Acromioclavicular Joint Injuries

All Day Room: NA Hardcopy Backboard

Participants
Hailey Allen, MD, Salt Lake City, UT (Presenter) Nothing to Disclose
Ryan P. Joyce, MD, Farmington, CT (Abstract Co-Author) Nothing to Disclose
Christopher J. Hanrahan, MD, PhD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Brian Y. Chan, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Patrick Kobes, DO, Manhasset, NY (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
hailey.allen@hsc.utah.edu

TEACHING POINTS
1. Review MRI anatomy of the acromioclavicular joint as well as important surrounding ligaments, muscles, and fascial structures. 2. Discuss the Rockwood classification of acromioclavicular injury using a case-based format with attention to key findings on radiographic and MRI exams. 3. Present the current clinical and surgical management strategies for acromioclavicular injuries.

TABLE OF CONTENTS/OUTLINE
TEACHING POINTS
To review the imaging tests performed prior to upper-limb transplantation. To learn what the surgeon needs to know for surgical planning. To be acquainted with the VAC postsurgical evaluation algorithm. The main objective is to learn how to assess a VCA, the immediate and long-term post-surgical multimodality findings.

TABLE OF CONTENTS/OUTLINE
• Introduction  • Presurgical work-up Conventional radiology CT and angioCT Gray-scale and Doppler ultrasound MRI  • Transoperatory imaging  • Postsurgical work-up Evaluation algorithm Conventional radiology CT and angioCT Gray-scale and Doppler ultrasound (vessels, tendons, nerves) Ultrasound biomicroscopy Musculoskeletal and brain functional MRI  • Summary
MK010-EB-X

Grow a Spine: Paravertebral Ligamentous Ossifications

All Day Room: NA Hardcopy Backboard

Participants
Maziar Sighary, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Jami Jadidi, MD, New York, NY (Presenter) Nothing to Disclose
Scott A. Lehto, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Srinivas Kolla, MD, Brooklyn, NY (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
maziar.sighary@downstate.edu

TEACHING POINTS
1) To review types of paravertebral ligamentous ossifications, specifically: i) Diffuse Idiopathic Skeletal Hyperostosis (DISH) ii) Ossification of the Posterior Longitudinal Ligament (OPLL) iii) Ossification of the Ligamentum Flavum (OLF). 2) To discuss the different pathophysiology and pathological correlations of the various paravertebral ligamentous ossifications. 3) To show imaging findings associated with Diffuse Idiopathic Skeletal Hyperostosis (DISH), Ossification of the Posterior Longitudinal Ligament (OPLL) and Ossification of the Ligamentum Flavum (OLF).

TABLE OF CONTENTS/OUTLINE
-Introduction to paravertebral ligamentous ossifications -Discuss pathophysiology and pathological correlations of 3 main types of paravertebral ligamentous ossifications i) Diffuse Idiopathic Skeletal Hyperostosis (DISH) ii) Ossification of the Posterior Longitudinal Ligament (OPLL) iii) Ossification of the Ligamentum Flavum (OLF) -Review imaging findings and how to differentiate of 3 main types of paravertebral ligamentous ossifications -Conclusion and summary
Time to Add DWI to Your MSK Tumor Protocol

All Day Room: NA Hardcopy Backboard

Participants
Oganes Ashikyan, MD, Dallas, TX (Presenter) Nothing to Disclose
Avneesh Chhabra, MD, Dallas, TX (Abstract Co-Author) Consultant, ICON plc; Author with royalties, Wolters Kluwer nv; Author with royalties, Jaypee Brothers Medical Publishers Ltd

For information about this presentation, contact:
oganes.ashikyan@utsouthwestern.edu

TEACHING POINTS
Learn how to apply DWI to imaging musculoskeletal neoplasms in practice. Attain knowledge on how DWI helps differentiate malignant and high grade neoplasms from benign and low grade neoplasms.

TABLE OF CONTENTS/OUTLINE
Brief overview of physics of diffusion imaging and ADC calculation. Brief review of current literature about use of ADC in the evaluation of musculoskeletal soft tissue neoplasms. Proposed cut off values to differentiate benign from malignant neoplasms, and high grade from low grade neoplasms. Examples of ADC measurements in benign, malignant, high grade and low grade tumors. Discussion of patient related, image acquisition related, and lesion related pitfalls through the use of imaging examples.
The High Cost of a Cheap Resort: Radiological Spectrum of the Injected Biopolymers Complications

All Day Room: NA Hardcopy Backboard

Participants
John L. Torres Castiblanco SR, MD, Bogota, Colombia (Presenter) Nothing to Disclose
Hernan D. Burbano Burbano, Mexico City, Mexico (Abstract Co-Author) Nothing to Disclose
Jorge A. Vargas, Bogota, Colombia (Abstract Co-Author) Nothing to Disclose
Ana B. Villamizar, MD, Bogota, Colombia (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
jltcastiblanco@gmail.com

TEACHING POINTS
1. Frequency in the performing of aesthetic procedures and plastic surgery procedures have increased in recent years mainly by women and transgender population. 2. Aesthetic procedures can vary according to the technique and materials used. One of the most widely component are silicone implants. 3. High costs can be a limitation for access to aesthetic procedure, leading people to resort to cheap interventions that can carry out different complications. 4. Other components that have been used to replace implants or procedures governed by the legal framework. 5. Complications can vary from encapsulation of the material injected, as well as, the formation of abscesses, fistulas and siliconomas. Some of them can be fatal (pulmonary embolism, pneumonitis or vascular thrombosis). 6. We intend to describe by our own cases, the typical radiological spectrum, local and systemic complications of the use of the biopolymers.

TABLE OF CONTENTS/OUTLINE
1. Define biopolymers and which are used the most. 2. Imaging Assessment 3. Normal imaging findings 4. Complications that include: muscle involvement, near spaces involvement, infection, granuloma formation and pulmonary embolism.
Arch Enemies: Elevate your Knowledge of Adult Flatfoot Deformity

All Day Room: NA Digital Education Exhibit

Awards
Magna Cum Laude
Identified for RadioGraphics

Participants
Catalina Mejia Gomez, MD, Medellin, Colombia (Abstract Co-Author) Nothing to Disclose
Moises Fernandez Hernando, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Dyan V. Flores, MD, Makati, Philippines (Presenter) Nothing to Disclose

For information about this presentation, contact:
dyanflores@yahoo.com

TEACHING POINTS
1. Review relevant anatomy and biomechanics of adult flatfoot deformity
2. Review common conditions contributing to flatfoot deformity
3. Briefly discuss goals of treatment and postoperative complications

TABLE OF CONTENTS/OUTLINE
1. Relevant anatomy and biomechanics
   * Dynamic and static stabilizers
2. Contributing conditions
   * PTT dysfunction
   * Ligament injury
   * Plantar fascia rupture
   * Malunited fractures
   * Coalitions
   * Osteoarthritis
   * Neuromuscular disease
3. Imaging
   * Radiograph
   * CT/MRI
4. Treatment
5. Post-operative assessment and complications
TEACHING POINTS

- Discuss common and uncommon conditions presenting with soft tissue calcification and ossification
- Review typical sites, distribution and imaging features of soft tissue calcification and ossification with emphasis on etiology

TABLE OF CONTENTS/OUTLINE

1. Vascular
   - Arterial calcification
   - Phleboliths
2. Congenital
   - Fibrodysplasia ossificans progressiva
   - Melorheostosis
3. Metabolic
   - Normal metabolism, devitalized tissues (dystrophic)
   - Abnormal metabolism, normal tissues
   - Normal metabolism, normal tissues
4. Autoimmune
   - Scleroderma
   - Dermatomyositis
5. Infection
   - Cysticercosis
   - Tuberculosis
6. Trauma
   - Myositis ossificans
   - Heterotopic ossification
7. Neoplastic
   - Synovial osteochondromatosis and chondrosarcoma
   - Primary or metastatic osteosarcoma
Time Wounds All Heels: The Musculoskeletal Sequelae of High-Heeled Shoes

All Day Room: NA Digital Education Exhibit

Participants
Dahlia Guerrero, MD, East Meadow, NY (Presenter) Nothing to Disclose
Harold Hunt, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Minakshi Ramchand, MD, East Meadow, NY (Abstract Co-Author) Nothing to Disclose
Mohammed F. Loya, MD, East Meadow, NY (Abstract Co-Author) Nothing to Disclose
Christos Kosmas, MD, Cleveland, OH (Abstract Co-Author) Consultant, BioClinica, Inc
Marnix T. van Holsbeeck, MD, Detroit, MI (Abstract Co-Author) Minor stockholder, Koninklijke Philips NV; Minor stockholder, General Electric Company; Stockholder, MedEd3D; Grant, Siemens AG; Grant, General Electric Company;
Mehool Shukla, MD, East Meadow, NY (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
dguerrer@numc.edu

TEACHING POINTS
To review the musculoskeletal pathologies associated with wearing high-heeled shoes through multiple imaging modalities. Each pathology will be discussed from a clinical, biomechanical, and imaging perspective- along with a review of pertinent normal anatomy.

TABLE OF CONTENTS/OUTLINE
The high-heeled shoe is a commonly worn fashion accessory with the average woman owning nine pairs, as per a 2014 national survey by The American Podiatric Medical Association. Many women have an "Achilles heel" for this beloved shoe, even if that means trading comfort for pain. Among high-fashion footwear, the high heel is the number one culprit for foot pain, contributing greater than three-billion-dollars in health care costs annually to the United States. The pathologic sequelae of high-heeled shoes arise from a combination of altered biomechanics/repetitive microtrauma. High heels result in forefoot weight redistribution and additional compressive forces on the heel. These biomechanical forces may cause multiple musculoskeletal ramifications including Haglund syndrome, retrocalcaneal bursitis, Achilles tendinosis, stress fractures, Morton's neuroma, plantar plate injury, hallux valgus deformity, and plantar fasciitis.
Synovial Sarcomas: An Institutional Review of the Imaging Characteristics in Pathologically Proven Cases

All Day Room: NA Digital Education Exhibit

Participants
David Wang, MD, London, ON (Presenter) Nothing to Disclose
Leena H. Alwafi, MBBS, Makkah, Saudi Arabia (Abstract Co-Author) Nothing to Disclose
Stephany L. Pritchett, MD, London, ON (Abstract Co-Author) Nothing to Disclose
Bret Wehrli, London, ON (Abstract Co-Author) Nothing to Disclose
Alison R. Spouge, MD, London, ON (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
david.wang@hsc.on.ca

TEACHING POINTS
The purpose of this educational exhibit is to: 1. Review the clinical profile of synovial sarcomas 2. Review the imaging findings of synovial sarcomas with a focus on MRI

TABLE OF CONTENTS/OUTLINE
Clinical review Epidemiology Pathophysiology Clinical presentation Diagnosis Prognosis Treatment Imaging characteristics Plain radiography Ultrasonography Computed tomography Magnetic resonance imaging Triple sign Bowl of grapes Primary tumours Recurrent/metastatic disease Possible mimickers
TB or Not TB: Imaging Features of Musculoskeletal Tuberculosis

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Dyan V. Flores, MD, Makati, Philippines (Presenter) Nothing to Disclose

For information about this presentation, contact: dyanflores@yahoo.com

TEACHING POINTS

* Review common and uncommon sites and imaging features of spinal and extraspinal musculoskeletal tuberculosis * Define the diagnostic value of different imaging techniques * Outline differential diagnosis * Treatment and management options

TABLE OF CONTENTS/OUTLINE

Anterior Glenohumeral Instability: A Systematic and Structured Approach with Arthroscopic Correlation

Participants
Ana M. Crespo, MD, PhD, Madrid, Spain (Presenter) Nothing to Disclose
Javier Jimenez-Cristobal, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Miguel Mendez, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Antonio Ruiz-Ollero, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Fernando Marco, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Juan Arrazola, Madrid, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Shoulder vulnerability to injury and the development of instability are due to the large range of motion of the glenohumeral joint. Anterior glenohumeral instability encompasses a broad spectrum of clinical presentations. Image interpretation and reporting may need to emphasize diagnosis and the identification of lesions that are associated with instability or the characterization of lesions for treatment planning. Radiologists must establish a systematic approach to imaging findings in order to provide a high quality, useful and structurated radiological report. Learning objectives: •Identify and evaluate the different types of osseous and soft-tissue lesions in anterior glenohumeral instability through Magnetic Resonance (MR) Imaging or MR Arthrography (MRA) with Arthroscopy correlation. •Offer a guide for a systematic approach and a structured radiologic report.

TABLE OF CONTENTS/OUTLINE
Anatomy and biomechanics of glenohumeral dislocation Clinical Scenarios: acute first-time shoulder dislocation, chronic instability with repeated dislocation and chronic instability without repeated dislocation. Imaging modalities for the assessment of anterior glenohumeral instability. Systematic approach to interpreting imaging findings. Treatment implications of several key imaging findings of anterior glenohumeral instability.
Imaging of Rotator Cuff Reconstructions for Massive Rotator Cuff Tears: What the Radiologist Needs to Know

All Day Room: NA Digital Education Exhibit

Participants
Maryam Soltanolkotabi, MD, Salt Lake City, UT (Presenter) Nothing to Disclose
Barry G. Hansford, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Christopher J. Hanrahan, MD, PhD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Sarah E. Stilwill, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Gregory S. Stacy, MD, Chicago, IL (Abstract Co-Author) Researcher, Zimmer Biomet Holdings, Inc
Patrick Kobes, DO, Manhasset, NY (Abstract Co-Author) Nothing to Disclose
Hailey Allen, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Megan K. Mills, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Understand the indications and contraindications for rotator cuff reconstruction (RCR)
Describe the various surgical techniques for RCR
Communicate important pre-operative shoulder MRI findings for RCR
Identify normal post-operative appearances of RCR on MRI
Recognize RCR complications on MRI

TABLE OF CONTENTS/OUTLINE
1. Introduction/background
   Definition of massive, irreparable RCT
   Pathophysiology of massive rotator cuff tears
   Restoration of biomechanics with RCR
   Review of the current RCR surgical literature including outcome measures
2. Indications/patient selection for RCR
3. Contraindications for RCR
4. Review of surgical techniques including:
   Latissimus dorsi tendon transfer for massive posterosuperior RCT,
   Pectoralis major tendon transfer for massive anterosuperior RCT,
   Rotator cuff reconstruction with fascia lata allograft, etc.
5. Pre-operative RCR MRI
   Relevant anatomy specific to each surgical technique
   Important pre-operative MRI findings to communicate to the orthopedist
6. Post-operative RCR MRI
   Techniques to identify normal post-operative anatomy
   Normal RCR with arthroscopic correlation
   RCR complications with arthroscopic correlation
   Reviewing MRI in close concert with orthopedic notes
7. Summary
Awards
Certificate of Merit

Participants
Alexeys Perez, MD, Barcelona, Spain (Presenter) Nothing to Disclose
Luis Cerezal, MD, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Javier Mota, MD, PhD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Antonio Cruz, MD, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Fernando Idoate, MD, Pamplona, Spain (Abstract Co-Author) Nothing to Disclose
Inigo Iriarte, Bilbao, Spain (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
alexeyes11@gmail.com

TEACHING POINTS

1. MRI and ultrasound can be used to diagnose a ligament injury of the ankle, but offer no advantages over clinical diagnosis and stress Rx. 2. MRI it is not dynamic and does not correlate with the clinic 3. Sometimes tear can not be differentiated from edema. 4. MRI: Underestimate injuries?, Change the prognosis?

TABLE OF CONTENTS/OUTLINE

Detailed anatomical and functional review of ligament complexes of the ankle; review acute and chronic injury patterns with surgical correlation; utility of the different image methods; associated injuries; useful points for the radiological report; therapeutic algorithm; controversies.
Carpal Scaphoid Fractures Radiologist Role and Surgical Perspectives

All Day Room: NA Digital Education Exhibit

Awards
Identified for RadioGraphics

Participants
Alexeys Perez, MD, Barcelona, Spain (Presenter) Nothing to Disclose
Luis Cerezal, MD, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Francisco Pinal, MD, PhD, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Ricardo H. Trueba, MD, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
 alexeys11@gmail.com

TEACHING POINTS
1. Is important to precise if fracture is unstable because can change the treatment and is a risk factor for nonunion.
2. CT allow us to asses tridimensional morphology of scaphoid and also the consolidation follow up and also the orientation and localization of screws.
3. Development of osteonecrosis is directly related to the position of the fracture line. Fractures of the middle third are associated with a 30% incidence of osteonecrosis and proximal third nearly 100%.
4. Conventional MRI has no value for determinate the vascularization grade.
5. Define the enhancement of distal pole is crucial to define surgical procedure. Viable Pole: Treatment must be bone graft and internal fixation AVN: bone vascularized graft and screw or proximal carpectomy if fails

TABLE OF CONTENTS/OUTLINE
1. Study the scaphoid fractures classification by Hebert.
2. Review the fracture instability criteria.
3. Utility of the different imaging methods in the evaluation of the fractures.
4. Describe fracture complications: AVN, pseudo arthrosis, carpal collapse (SNAC).
5. Treatment of acute fractures and its complications.
A Review of Epidural Spinal Injections: What the Radiologist Needs to Know

All Day Room: NA Digital Education Exhibit

Participants
Zachary R. Ashwell, MD, Aurora, CO (Presenter) Nothing to Disclose
Colin D. Strickland, MD, Denver, CO (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
zachary.ashwell@ucdenver.edu

TEACHING POINTS
After reviewing this presentation, the learner should understand the general anatomy of the spine including the pathophysiology of pain generation, approaches to management and expected outcomes. Additionally, the learner will be instructed on the role that radiologists may play in pain management including the various techniques available surrounding epidural spinal injections as well as their corresponding risks. Based on a systematic review of the literature, we will present an informed approach to the best practices surrounding spinal injections with data supported by our own institutions experience such that readers will take away the tools necessary to minimize risk in their own practice.

TABLE OF CONTENTS/OUTLINE
A. Review of Relevant Anatomy (foramen, exiting nerve roots etc).
B. Etiology of Pain.
C. Clinical Presentation (and its utility in guiding management and selecting patients)
D. Review of Imaging
E. Approach to Epidural Spinal Injections
   1. Transforaminal
   2. Interlaminar
   3. Cervical vs. Thoracic vs. Lumbar
F. Review of Expected Outcomes
G. Important Complications and Likely Etiologies
H. Review of Best Practices
A Case-based Imaging Review of Mazabraud Syndrome

All Day Room: NA Digital Education Exhibit

Participants
Ban Sharif, MBBS, FRCR, London, United Kingdom (Presenter) Nothing to Disclose
Eva Markert, MD, Stanmore, United Kingdom (Abstract Co-Author) Nothing to Disclose
Michele Calleja, MD, Banbury, United Kingdom (Abstract Co-Author) Nothing to Disclose
Michael Khoo, MBBS, FRCR, Stanmore, United Kingdom (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
ban.sharif@nhs.net

TEACHING POINTS
Mazabraud syndrome is a rare disease characterised by the co-existence of fibrous dysplasia and intramuscular myxoma. The purpose of this educational exhibit is to present a multimodality imaging review of our 10-year experience of patients referred to our tertiary centre with this condition, consisting of a cohort of 19 patients aged between 27 and 75 years.

TABLE OF CONTENTS/OUTLINE
1. Outline the epidemiology, aetiology and pathophysiology of Mazabraud syndrome
2. Present the typical multimodality imaging features of Mazabraud's syndrome
3. Highlight patterns and extent of skeletal and muscular involvement within our cohort.
4. Provide histopathology correlation of fibrous dysplasia and myxoma.
Preserving the Six-Pack: Multimodality Imaging Assessment of Abdominal Wall Injuries from Initial Injury Through Recovery

Awards
Magna Cum Laude

Participants
Eric B. England, MD, Cincinnati, OH (Presenter) Nothing to Disclose
Casey Reed, MD, Cincinnati, OH (Abstract Co-Author) Nothing to Disclose
Gregory Stark, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Aaron Kuehn-Himmler, Cincinnati, OH (Abstract Co-Author) Nothing to Disclose
Susan E. Braley, MD, Cincinnati, OH (Abstract Co-Author) Nothing to Disclose
Kaushal Mehta, MD, Cincinnati, OH (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:

eric.england@uc.edu

TEACHING POINTS

The purpose of this exhibit is to: 1) Review the anatomy of the abdominal wall musculature including origins, insertions, and locations of injury. 2) Discuss several examples of abdominal wall injuries with focus on MRI and Ultrasound appearance of varying muscle injuries. 3) Discuss different treatment options for muscle injuries with particular attention to collegiate athletes and how return to activity can be assessed and monitored utilizing ultrasound.

TABLE OF CONTENTS/OUTLINE

1) Anatomy of the Abdominal Wall Musculature
2) Rectus Abdominus Muscle Injuries a) Insertional/Avulsion b) Midsubstance muscle belly tears
3) Internal/External Oblique Muscle Injuries a) Insertional/Avulsion b) Midsubstance muscle belly tears and Intramuscular hematoma
4) Treatment options and Monitoring Progression/Recovery of Muscle Injuries Utilizing Ultrasound in Collegiate Athletes a) Utility of Dynamic Ultrasound and Color Doppler monitoring of the recovery from abdominal wall muscle injury. b) Brief overview of treatment options; Non-surgical: Platelet Rich Plasma (PRP), stem cell (Ammiofix) and Surgical
Anterior Cruciate Ligament Graft Tears Mimicking Cyclops Lesions on Magnetic Resonance Imaging: Pseudocyclops

All Day Room: NA Digital Education Exhibit

Participants
Augusto Napoli, MD, Buenos Aires, Argentina (Presenter) Nothing to Disclose
Ramiro Chobadindegui SR, Lomas de Zamora, Argentina (Abstract Co-Author) Nothing to Disclose
Eduardo Martin, Lomas de Zamora, Argentina (Abstract Co-Author) Nothing to Disclose
Claudio H. Bruno, MD, Lomas de Zamora, Argentina (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To show partial and complete anterior cruciate ligament (ACL) graft tears with torn anterior graft fibers displaced into the intercondylar notch mimicking focal arthrofibrosis on magnetic resonance image (MRI). 2. To explain that not every intercondylar nodular focal image with intermediate signal intensity on MRI in cases of ACL reconstruction corresponds to a true cyclops lesion.

TABLE OF CONTENTS/OUTLINE
1. Normal appearance of an ACL graft on MRI. 2. Cyclops lesion. Definition. Characteristics of a true cyclops image. 3. Pseudocyclops. Sample cases of partial tears of the ACL graft simulating a cyclops lesion. Pseudocyclops in a complete tear of the ACL graft fibers with a progression of stump entrapment from type 1 to type 2. 4. Conclusion. 5. References.
Behind the Scenes of Ballet: The Imaging Spectrum of Musculoskeletal Injuries in Elite Ballet Dancers

Participants
Natalia Gorelik, MD, Montreal, QC (Presenter) Nothing to Disclose
Judith Peterson, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Yudi Kerbel, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Philip G. Colucci, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
William B. Morrison, MD, Philadelphia, PA (Abstract Co-Author) Consultant, AprioMed AB; Patent agreement, AprioMed AB; Consultant, Zimmer Biomet Holdings, Inc; Consultant, Samsung Electronics Co, Ltd; Consultant, Medical Metrics, Inc
Adam C. Zoga, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
natalia.gorelik@mail.mcgill.ca

TEACHING POINTS
The aims of this exhibit are to: 1. review the prevalence of various musculoskeletal injuries in elite ballet dancers; 2. provide a pictorial review of their imaging findings; 3. illustrate the complementary use of different imaging modalities in their evaluation; 4. describe their mechanism of injury, depicting how the classical ballet positions and movements place unique supraphysiologic biomechanical stresses on the body; and 5. discuss their management, highlighting the role of ultrasound-guided interventions.

TABLE OF CONTENTS/OUTLINE
1. Prevalence of musculoskeletal injuries in ballet dancers: overall, by type (osseous, disc-related, tendinous, ligamentous, articular, juxta-articular or impingement), and by anatomical location 2. Pictorial review of ballet injuries with emphasis on the mechanism of injury specific to ballet dancing and management. Reviewed injuries will include, among others: hallux sesamoiditis, Morton's neuroma, metatarsal stress fracture, posterior ankle impingement, ankle tendon pathologies (e.g. flexor hallucis longus tenosynovitis), osteochondral injuries, tibial stress fractures, jumper's knee, ligamentum teres tear, acetabular labral tear, ischiofemoral impingement, delayed onset muscle soreness, core muscle injuries, disc disease, and spondylolysis
The Role of Imaging in Leukemia

All Day Room: NA Digital Education Exhibit

Participants
Se kyoung Park, Busan, Korea, Republic Of (Presenter) Nothing to Disclose
Seok Hahn, MD, Busan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jisook Yi, MD, Busan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To review the pathophysiology and the updated WHO classification of leukemia
To explain imaging findings of leukemia: initial presentation, complications, relapse and remission
To demonstrate the diagnostic dilemmas in imaging
To discuss the role of imaging in leukemia

TABLE OF CONTENTS/OUTLINE
Pathophysiology and updated WHO classification of leukemia
Imaging features
Initial presentation
Complications from therapy or from the disease process itself
Relapse and remission
Differential diagnosis and diagnostic dilemmas in imaging
Sample cases
Summary
New Approach to Osteoporosis: Bone Microstructure Revealed by Ultra-High Resolution CT

All Day Room: NA Digital Education Exhibit

Participants
Ryota Inai, MD, Okayama, Japan (Presenter) Research funded, Canon Medical Systems Corporation
Ryuichi Nakahara, Okayama, Japan (Abstract Co-Author) Nothing to Disclose
Yusuke Morimitsu, Okayama, Japan (Abstract Co-Author) Nothing to Disclose
Noriaki Akagi, RT, Okayama, Japan (Abstract Co-Author) Nothing to Disclose
Takashi Tanaka, MD, PhD, Okayama, Japan (Abstract Co-Author) Nothing to Disclose
Akhiro Tada, Okayama, Japan (Abstract Co-Author) Nothing to Disclose
Susumu Kanazawa, MD, Okayama, Japan (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
inat2016hamburger@yahoo.co.jp

TEACHING POINTS
The purpose of this exhibit is: To review the recent concept to evaluate osteoporosis based on bone microstructure. To introduce our experiments to measure bone microstructure by Ultra-High Resolution CT. To show visual differences of bone microstructure on each CT scanner (in-vivo Micro-CT, General-use clinical CT and Ultra-High Resolution CT). To reveal microstructural deterioration in human bone on Ultra-High Resolution CT.

TABLE OF CONTENTS/OUTLINE
1. Recent concept of evaluation for osteoporosis: -What is Bone quality recognized as new concept in osteoporosis?-Characteristics of DEXA, HR-pQCT, Ultra-High Resolution CT.
2. Explanation of bone microstructure -How to analyze bone microstructure. -The meaning of parameters in trabecular bone and cortical bone.
3. Introduce our experiments -Visual differences on each CT scanner (in-vivo Micro-CT, General-use clinical CT and Ultra-High Resolution CT) in bone microstructure of tiger vertebrae. -Visual differences by slice thickness and matrix in bone microstructure of human tibia. -Discrimination of microstructural bone deterioration in human tibia by Ultra-high resolution CT.
Dealing with a Pain in the Butt: Ultrasound-Guided Musculoskeletal Intervention of the Hip

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Jason I. Blaichman, MD, FRCPC, New Westminster, BC (Presenter) Nothing to Disclose
Brian Y. Chan, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Paul Michelin, MD, Rouen, France (Abstract Co-Author) Nothing to Disclose
Kenneth S. Lee, MD, Madison, WI (Abstract Co-Author) Grant, General Electric Company Research support, SuperSonic Imagine Research support, Johnson & Johnson Consultant, Echometrix, LLC Royalties, Reed Elsevier

For information about this presentation, contact:
KLee2@uwhealth.org

TEACHING POINTS
To recognize the clinical presentation and diagnostic imaging of musculoskeletal conditions of the anterior, lateral and posterior hip that may warrant ultrasound-guided intervention. To review the indications, contraindications, interventional methods, potential complications and expected outcomes of ultrasound-guided interventions of the hip. To discuss the technical approaches to various ultrasound-guided musculoskeletal interventions of the hip.

TABLE OF CONTENTS/OUTLINE
Anterior Hip
Anatomy
Pathophysiology
Clinical findings
Differential diagnosis
Diagnostic imaging
Technique and expected outcomes:
Hip joint
Iliopsoas bursa
Ilioinguinal nerve
Lateral femoral cutaneous nerve
Lateral Hip
Anatomy
Pathophysiology
Clinical findings
Differential diagnosis
Diagnostic imaging
Technique and expected outcomes:
Greater trochanteric bursa
Iliotibial Band
Posterior Hip
Anatomy
Pathophysiology
Clinical findings
Differential diagnosis
Diagnostic imaging
Technique and expected outcomes:
Ischial bursa
Piriformis
Ischiofemoral space
Hamstring origin
MK117-ED-X

Treating Pain with a Little In-‘Genu’-ity: Ultrasound-Guided Musculoskeletal Intervention of the Knee and Ankle

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Jason I. Blaichman, MD, FRCPC, New Westminster, BC (Presenter) Nothing to Disclose
Brian Y. Chan, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Paul Michelin, MD, Rouen, France (Abstract Co-Author) Nothing to Disclose
Kenneth S. Lee, MD, Madison, WI (Abstract Co-Author) Grant, General Electric Company Research support, SuperSonic Imagine Research support, Johnson & Johnson Consultant, Echometrix, LLC Royalties, Reed Elsevier

For information about this presentation, contact:
KLee2@uwhealth.org

TEACHING POINTS
To recognize the clinical presentation, pathophysiology and diagnostic imaging of musculoskeletal conditions of the knee and ankle that may warrant ultrasound-guided intervention. To review the indications, contraindications, interventional methods, potential complications and expected outcomes of ultrasound-guided interventions of the knee and ankle. To discuss the technical approaches to various ultrasound-guided musculoskeletal interventions of the knee and ankle.

TABLE OF CONTENTS/OUTLINE
Knee Anatomy Clinical Findings/Indications Pathophysiology Diagnostic Imaging Technique(s), patient positioning and outcomes (including complications) Knee joint Baker cyst Patellar tendon Medial collateral ligament Pes anserine bursa Ankle Anatomy Clinical Findings/Indications Pathophysiology Diagnostic Imaging Technique(s), patient positioning and outcomes (including complications) Tibiotalar joint Peroneal tendon sheath Retrocalcaneal bursa Achilles tendon Plantar fascia
TEACHING POINTS
To review the pathophysiology and staging classification of posterior tibial tendon dysfunction (PTTD). To discuss the benefits in early detection including prevention in further disease progression. To illustrate posterior tibial tendon sonographic guided evaluation. To review sonographic findings of posterior tibial tendon dysfunction (PTTD) and expected corrective post-surgical related changes. To overview sonographic guided treatment options.

TABLE OF CONTENTS/OUTLINE
Introduction Anatomy Pathophysiology Epidemiology Staging and Classification Diagnosis Sonographic Imaging Findings PTT Tendinosis PTT Tenosynovitis PTT Partial Thickness and Full-thickness Tears PTT Subluxation/Dislocation with or without Flexor Retinaculum Involvement Subfibular Impingement Sinus Tarsi Syndrome Spring Ligament Insufficiency PTTD Corrective Post-Surgical Related Changes Sonographic Guided Treatment Options Conclusion
MK119-ED-X

A Radiologist’s Guide to Posterior Tibial Tendon Dysfunction with Surgical Implementations

All Day Room: NA Digital Education Exhibit

Participants
Jeffrey D. Stevens, MD, Temple, TX (Abstract Co-Author) Nothing to Disclose
Jared B. Com, MD, Temple, TX (Presenter) Nothing to Disclose
Ricardo D. Garza-Gongora, MD, Temple, TX (Abstract Co-Author) Nothing to Disclose
Brandon R. Callahan, MD, Temple, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Detail anatomy and biomechanical properties of the posterior tibial tendon and regional hindfoot stabilizers. Discuss radiographic features and measurements indicative of posterior tibial tendon dysfunction (PTTD) and resultant medial longitudinal arch collapse. Highlight clinical and radiographic classification schemes for PTTD. Emphasize useful imaging parameters for surgical management stratification, treatment options and surgical techniques.

TABLE OF CONTENTS/OUTLINE
The PTT is the principal dynamic stabilizer of the medial longitudinal arch. Failure of the PTT commonly cascades to insufficiency of the contributing static hindfoot stabilizers to include the spring, deltoid and sinus tarsi ligaments. Simultaneous loss of hindfoot support and acquired pes planovalgus leads to secondary osteoarthritis. Many radiographic parameters are known which are predictive of pes planovalgus. These radiographic parameters together with cross-sectional findings, with or without the development of osteoarthritis, are useful for determining the appropriate management course for patients afflicted with PTTD. Surgical management ranging from PTT tenosynovectomy in early disease to calcaneal osteotomy with or without arthrodesis in more advanced disease hinges on the imaging findings.
**Hip Impingement Syndromes: What the Surgeon Wants to Know**

All Day Room: NA Digital Education Exhibit

**Participants**
William W. Kesler, MD, Hershey, PA (*Abstract Co-Author*) Nothing to Disclose
Jonelle M. Petscavage-Thomas, MD, MPH, Hummelstown, PA (*Presenter*) Nothing to Disclose
Eric A. Walker, MD, MHA, Hummelstown, PA (*Abstract Co-Author*) Nothing to Disclose

**TEACHING POINTS**

- Hip impingement syndromes are a common cause of osteoarthritis in young active patients
- CAM, Pincer, and combined forms of Femoroacetabular impingement (FAI) exist
- Early radiographic findings of hip impingement are important to recognize to prevent development of osteoarthritis
- Magnetic resonance imaging (MRI) is important in defining labral and cartilage abnormalities associated with FAI
- The radiologist is critical to optimizing MR protocols, providing measurements, and creating a comprehensive report of FAI findings
- Radiologist should also understand common surgical procedures performed to treat FAI

**TABLE OF CONTENTS/OUTLINE**

- Review clinical populations affected by hip impingement syndromes
- Discuss radiographic imaging techniques to evaluate for FAI
- Highlight radiographic findings of CAM, pincer, and mixed FAI
- Discuss MR optimization for FAI evaluation
- Illustrate MR findings of FAI, including retroversion, overcoverage, alpha angle, chondral and osseous changes, and labral abnormalities
- Review surgical management for FAI and complications to assess on postoperative imaging
MK121-ED-X

MRI in Neuromuscular Disorders

All Day Room: NA Digital Education Exhibit

Participants
Ying Zhu, MD, Beijing, China (Presenter) Nothing to Disclose
Jiang X. Xiao, MEd, Beijing, China (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
iamzhu@126.com

TEACHING POINTS

to introduce the application of MRI in different neuromuscular disorders to review MR findings in different neuromuscular disorders

TABLE OF CONTENTS/OUTLINE

to discuss the application of MRI in neuromuscular disorders MR anatomy of muscles of the thigh and the calf how to evaluate the changes of the morphology and signals in muscles of NMD patients. to review MR findings in different neuromuscular disorders, including the muscular dystrophies, congenital myopathies, inflammatory myopathies, and metabolic myopathies et. al.
Psoriatic arthritis (PsA) is a chronic inflammatory arthritis that develops after or concurrently with the dermatological alterations of psoriasis, although 15% of the patients have joint involvement preceding the cutaneous in up to 2 years, especially children. Our learning objectives are:

To discuss the role of the imaging modalities that are available for the assessment of patients with PsA with emphasis on active inflammatory lesions.

To review the characteristic imaging findings of the five clinical patterns of PsA: asymmetric oligoarthritis, symmetric polyarthritis, distal interphalangeal (DIP) arthropathy, arthritis mutilans, and spondylitis with or without sacroiliitis. To highlight the clinical importance of enthesitis in patients with psoriasis as the initial osteoarticular inflammatory site in patients with early PsA.

TABLE OF CONTENTS/OUTLINE

Concept Clinical manifestations of PsA: peripheral arthritis, axial disease, enthesitis, dactylitis and skin and nail disease. Imaging findings: Radiographic changes. Ultrasound assessment in PsA. MR Imaging of PsA: Current use of MRI Technical aspects of MR imaging of the PsA. MR features of PsA: Active lesions Chronic lesions Clinical usefulness of MRI in PsA. Classification criteria upon the international Classification of Psoriatic Arthritis (CASPAR) study
MK123-ED-X

Multiple Hereditary Exostoses: Genetics, Classic Multimodality Imaging Features, and Review of Complications - Differential Diagnosis, and Treatment Options

All Day Room: NA Digital Education Exhibit

Participants
George R. Matcuk JR, MD, Los Angeles, CA (Presenter) Nothing to Disclose
Sean R. Bowman, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Tijani Hassan, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Eric A. White, MD, Santa Monica, CA (Abstract Co-Author) Nothing to Disclose
Dakshesh B. Patel, MD, Porter Ranch, CA (Abstract Co-Author) Nothing to Disclose
Anderanik Tomasian, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Jordan S. Gross, MD, Nashville, TN (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
matcuk@usc.edu

TEACHING POINTS

Multiple Hereditary Exostoses (MHE or HME, multiple osteochondromatosis, or diaphyseal aclasis) is an uncommon autosomal dominant disorder caused by mutations of the EXT genes that encode glycosyltransferase enzymes involved in heparan sulfate proteoglycan synthesis, affecting 1 in 50,000 people. MHE is characterized by the development of numerous osteochondromas. The purpose of this exhibit is to educate the radiologist about the clinical presentation, the different forms, the classic radiographic, CT, MR, and nuclear medicine imaging findings, the differential diagnosis, and the common and serious complications of multiple hereditary exostoses.

TABLE OF CONTENTS/OUTLINE

General overview including demographics, genetics, and pathophysiology
Classic clinical features and presentation
Review of sessile versus pedunculated osteochondromas with multimodality depiction of classic imaging findings involving a myriad of locations throughout the skeleton
Discussion of common complications including growth disturbance and deformities, limitations to range of motion, osteoarthritis, neurovascular or musculotendinous impingement, fracture, adventitial bursitis with imaging examples
Imaging features for malignant degeneration into chondrosarcoma
Differential considerations
Prognosis and treatment options
References

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/ George R. Matcuk Jr, MD - 2018 Honored Educator
Dakshesh B. Patel, MD - 2018 Honored Educator
Soft-Tissue Tumors in the Wrist and Hand: A Systematic Imaging Approach

All Day Room: NA Digital Education Exhibit

Participants
Maria D. Lopez Parra, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Jose Acosta Batlle, Madrid, Spain (Presenter) Nothing to Disclose
Rosa Monica Rodrigo Del Solar, Bilbao, Spain (Abstract Co-Author) Nothing to Disclose
Begona Gutierrez San Jose, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Beatriz Alba Perez, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Javier Blazquez Sanchez, Madrid, Spain (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
jacostabatlle@yahoo.es

TEACHING POINTS
The purpose of this exhibit is: 1. To review the most common soft tissue lesions of the hand, focusing on those lesions, that based, on their behaviour and location, the radiologist can suggest a specific type of tumor. 2. To describe the role of imaging in the diagnostic approach.

TABLE OF CONTENTS/OUTLINE
1. Introduction. 2. WHO classification of soft tissue tumours. 3. The masses are categorized broadly as: - Non-neoplastic. - Benign neoplastic. - Malignant neoplastic. - If a lesion cannot be characterized as benign, the tumour should be reported as indeterminate, and is absolutely necessary to perform a biopsy to exclude malignancy. 4. Clinical approach. 5. Imaging approach: - Radiographs. - Ultrasound. - MRI: + Conventional MRI. + Diffusion weighted imaging. - Future directions. 5. Sample cases and mimics. 4. Summary.
Positive MRI of the Sacroiliac Joint in the ASAS Criteria for Diagnosing Axial Spondyloarthritis: Not Everything That Glitters is Gold

All Day Room: NA Digital Education Exhibit

Participants
Jose A. Narvaez, MD, Hospitalet, Spain (Presenter) Nothing to Disclose
Javier Narvaez, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Javier Hernandez Ganan, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Juan Carlos Sardinas, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Xavier Juanola, PhD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
jnarvaez@bellvitgehospital.cat

TEACHING POINTS
Magnetic resonance imaging (MRI) is essential in the process of diagnosis of axial spondyloarthritis (axSpA) in clinical practice. ASAS (Assessment of Spondyloarthritis international Society) classification criteria for axSpA are commonly used for diagnostic purposes, mainly in pre-radiographic stages. Bone edema is the only MRI finding considered in the definition of positive MRI of the sacroiliac joint. Radiologist should consider other potential causes of subchondral/periarticular bone edema in the sacroiliac joints, as well some MRI artifacts, which may cause a false positive MRI diagnosis of sacroilitis. Accurate MRI technique, follow-up MR imaging and correlation with other imaging modalities can help to minimize these false diagnoses, which may have important repercussion in the patient management.

TABLE OF CONTENTS/OUTLINE
Imaging Features of Peripheral Arthritis: A Systematic Imaging Approach

All Day Room: NA Digital Education Exhibit

Participants
Jose Acosta Batlle, Madrid, Spain (Presenter) Nothing to Disclose
Maria D. Lopez Parra, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Nicolas A. Almeida SR, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Beatriz Alba Perez, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Blanca Lumbreras, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Javier Blazquez Sanchez, Madrid, Spain (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
jacostabatlle@yahoo.es

TEACHING POINTS

The purpose of this exhibit is: 1. To provide an educational and pictorial review of the peripheral arthritis based on radiological imaging features (plain radiography / CT/ MRI/ US), emphasizing its anatomical distribution. 2. To classify peripheral arthritis using clinical and radiological criteria.

TABLE OF CONTENTS/OUTLINE


The correct diagnosis of peripheral arthritis is based on clinical features, presence or absence of associated diseases, laboratory values and imaging features. Radiographs represent the mainstay for diagnosis and MRI and US are useful in the early stages of disease.
Hanging by a Thread: Pictorial Review of Surgical Options and Complications in Biceps Tenodesis

All Day Room: NA Digital Education Exhibit

Participants
Mohammed T. Nawas, MD, Philadelphia, PA (Presenter) Nothing to Disclose
Nogah Shabshin, MD, MBA, Afula, Israel (Abstract Co-Author) Consultant, Active Implants Corporation
Netanel S. Berko, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
mohammed.nawas@uphs.upenn.edu

TEACHING POINTS
1. Review the common indications of biceps tenodesis. 2. Discuss the appropriate imaging modalities and protocols. 3. Identify the spectrum of normal findings following biceps tenodesis Suprapectoral versus subpectoral fixation Suture anchor, interference screw, and cortical button fixation 4. Review the postoperative complications.

TABLE OF CONTENTS/OUTLINE
Work Related Musculoskeletal Disorders in Radiologists and Reading Room Ergonomics

All Day Room: NA Digital Education Exhibit

Participants
Padmaja A. Jonnalagadda, MD, Wynnewood, PA (Presenter) Nothing to Disclose
Sana Hava, DO, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Alyssa R. Goldbach, DO, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Omer A. Awan, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Stephen E. Ling, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Sayed Ali, MD, Aston, PA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
padmaja.jonnalagadda@tuhs.temple.edu

TEACHING POINTS
1. Review work related Musculoskeletal Disorders
2. Demonstrate examples of poor ergonomic posture and provide recommendations to develop good reading room ergonomic practice

TABLE OF CONTENTS/OUTLINE
Work related musculoskeletal injuries are well documented in frequent computer users. With the advent of fully digitized radiology departments centered around PACs and digital imaging, diagnostic radiologists spend the majority of their working day at workstations. We discuss the impact of this environment on the occurrence of various musculoskeletal disorders, which include nerve entrapment syndromes such as carpal tunnel and cubital tunnel syndromes, tendon related disorders including tendinopathy, tenosynovitis and epicondylitis, neck and back related disorders such as cervicalgia and lumbago and finally miscellaneous disorders such as ganglion cysts. We will present a pictorial review of these disorders, symptoms and management. We will also discuss various examples of poor ergonomic practice and provide recommendations to develop good ergonomic practice. This will aid in avoiding injury and fatigue thereby increasing efficiency, productivity and job satisfaction.
Shining a Light on Shin Tumors: Tumors of the Tibia

All Day Room: NA Digital Education Exhibit

Participants
Willy Tjong, MD, Rochester, NY (Presenter) Nothing to Disclose
Scott R. Schiffman, MD, Rochester, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
• Provide an overview of common and uncommon tumors that occur in the tibia • Identify imaging features on various modalities that characterize specific tumors • Establish a framework for organizing a differential diagnosis for tibial tumors

TABLE OF CONTENTS/OUTLINE
The purpose of this exhibit is to provide an overview of tumors that occur in the tibia. While the tibia can serve as the location for relatively common benign and malignant tumors, there are a number of more uncommon entities that occur almost exclusively in the tibia. For example, rare lesions such as adamantinoma, osteofibrous dysplasia and chondromyxoid fibroma are seen predominantly in the tibia with infrequent involvement of other bones in the appendicular skeleton. Through an image-rich, case-based format, this exhibit will present imaging features and associated teaching points for both common and uncommon tibial tumors. An emphasis will be placed on techniques to help narrow the differential diagnosis. Case examples will include: aneurysmal bone cyst, chondroblastoma, chondromyxoid fibroma, chondrosarcoma, enchondroma, eosinophilic granuloma, Ewing sarcoma, fibrous dysplasia, giant cell tumor, lymphoma, metastases, multiple myeloma, non-ossifying fibroma, osteoblastoma, osteoid osteoma and osteosarcoma.
Clinical, Radiographic, MRI and US Evaluation of the Acquired Adult Flatfoot Deformity

All Day Room: NA Digital Education Exhibit

Participants
Chelsea C. Caruso, DO, Tucson, AZ (Abstract Co-Author) Nothing to Disclose
Daniel Latt, MD, PhD, Tucson, AZ (Abstract Co-Author) Nothing to Disclose
Andrea Klauser, MD, Reith bei Seefeld, Austria (Abstract Co-Author) Nothing to Disclose
Tyson S. Chadaz, MD, Tucson, AZ (Abstract Co-Author) Nothing to Disclose
Ansab Khwaja, MD, Tucson, AZ (Abstract Co-Author) Nothing to Disclose
Mihra S. Taljanovic, MD, Tucson, AZ (Presenter) Nothing to Disclose

TEACHING POINTS
Adult acquired flatfoot deformity (AAFD) comprises development of a new symptomatic flatfoot or progression of a preexisting deformity. The posterior tibial tendon (PTT) is a main dynamic stabilizer of the medial longitudinal arch while the spring ligament is a static stabilizer. PTT dysfunction (PTTD) includes a spectrum of tendon pathologies, frequently associated with spring ligament injuries. AAFD ranges from painful tenosynovitis with a maintained medial longitudinal arch to arch collapse with flexible or fixed flatfoot deformities, subtalar arthritis, and talonavicular tilt. Treatment options for AAFD are non-operative and operative.

TABLE OF CONTENTS/OUTLINE
Pathophysiology, clinical findings, and classification of the AAFD. Radiographic findings of AAFD. Normal anatomy and pathologic MRI and US findings associated with PTTD. Normal anatomy and pathologic MRI and US findings of the spring ligament injuries associated with PTTD. MRI measurements of hindfoot valgus and findings of subfibular impingement syndrome. Treatment options for AAFD with intraoperative and postoperative imaging findings.

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/ Mihra S. Taljanovic, MD - 2016 Honored Educator
MK131-ED-X

MRI and Arthroscopic Correlation: A Review of Common Hip Pathology

All Day Room: NA Digital Education Exhibit

Participants
John Nemer, New York, NY (Presenter) Nothing to Disclose
Thomas S. Lynch, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Tony T. Wong, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Review hip arthroscopy and indications
2. Correlate arthroscopic surface anatomy with MR imaging
3. Describe common hip pathologies and correlate MR imaging with arthroscopic findings

TABLE OF CONTENTS/OUTLINE
1. Pre-test questions
2. General review of hip arthroscopy and indications
3. Basic portal access at the hip and what the surgeon sees
4. Correlation of arthroscopic surface anatomy with MR imaging
   a. Normal anatomy
   b. Normal variants
5. Common hip pathologies with MRI and arthroscopic review
   a. Femoro-acetabular impingement
      i. Cam
      ii. Pincer
      iii. Subspine
   b. Labral tears
   c. Chondral lesions
   d. Ligamentum teres injuries
   e. Loose bodies
   f. Synovial disease
   g. Avascular necrosis
   h. Postoperative revision cases
6. Answers and review to pre-test questions
**Arachnoiditis Ossificans: A Rare but Potentially Disabling Disease**

All Day Room: NA Digital Education Exhibit

**Participants**

Ivan Masselli, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose  
Fernando M. Lima, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose  
Maria Alice F. Costa, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose  
Luciana F. Gavino, MD, Jacarei, Brazil (*Abstract Co-Author*) Nothing to Disclose  
Alexandre C. Valim, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose  
Andre Y. Aihara, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is:  
- To be familiar with this rare entity  
- To understand the difference between arachnoiditis ossificans and dural membrane ossification  
- To memorize the preceding events which predisposes patients from developing inflammation or arachnoid cells  
- To learn how to classify arachnoiditis ossificans based on morphology or size of the ossification  
- To highlight imaging findings on CT and MRI.  
- To understand treatment strategy and surgical procedures in this area disease.

**TABLE OF CONTENTS/OUTLINE**

- Differently from asymptomatic ossified dural plaques of the spine, frequently found at autopsy, arachnoiditis ossificans is associated with progressive neurologic deficits.  
- The risk factors of the arachnoiditis ossificans is easy to remember with this mnemonic: ‘SPIDER’.  
- Arachnoiditis ossificans has been classified into three different types based on its morphology. It’s simple to remember with another mnemonic: ‘BONE’.  
- Review CT and MRI imaging findings.  
- There is no consensus regarding treatment of patients with arachnoiditis ossificans. In general, any attempt to remove calcified plaques from the spinal cord or nerve roots should be avoided. On the other hand, surgical treatment via laminectomy and dural plasty may be indicated in patients with severe or deteriorating symptoms.
Quantitative Magnetic Resonance Imaging (Q-MRI) for the Assessment of Soft-Tissue Sarcoma Necrosis, Viable Tumor Volume, and Treatment Response

All Day Room: NA Digital Education Exhibit

FDA Discussions may include off-label uses.

Participants
Brandon K. Fields, BA, Los Angeles, CA (Presenter) Nothing to Disclose
George R. Matcuk Jr, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Mittul Gulati, MD, La Canada Flintridge, CA (Abstract Co-Author) Nothing to Disclose
Vinay A. Duddalwar, MD, FRCR, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Darryl Hwang, PhD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Bino A. Varghese, PhD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Steven Cen, PhD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Bhushan Desai, MBBS, MS, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
James Hu, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
bkfields@usc.edu

TEACHING POINTS

Soft tissue sarcomas (STS) exhibit a biologic response to chemotherapy, including necrosis and hemorrhage, that may prevent the tumor from shrinking or may even cause it to enlarge, despite an adequate treatment response. Criteria that rely on factors of tumor size, such as RECIST, are often misleading when assessing responses to chemotherapy for STS. For STS, decreased attenuation or contrast enhancement (Choi criteria) may more accurately predict tumor response. Quantitative magnetic resonance imaging (q-MRI) of the whole tumor volume can be used to estimate percent necrosis and viable tumor volume and may provide a more objective assessment of early response to treatment in STS.

TABLE OF CONTENTS/OUTLINE

Review soft tissue sarcoma imaging of neoadjuvant treatment response, including Response Evaluation Criteria in Solid Tumors (RECIST) and Choi criteria. Discuss q-MRI principles and technique. Detail step-by-step process of tumor registration, pre- from post-contrast digital subtraction, whole tumor volume segmentation and quantification and normalization of signal intensities. Demonstrate q-MRI histogram analysis for estimation of enhancing tumor volume and percent necrosis. Provide illustrative case examples of how q-MRI can aid evaluation of tumor treatment response better than RECIST or Choi criteria alone.

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/ George R. Matcuk Jr, MD - 2018 Honored Educator
MK135-ED-X

Musculoskeletal Manifestations of Recreational Drug Abuse

All Day Room: NA Digital Education Exhibit

Participants
Sana Hava, DO, Philadelphia, PA (Presenter) Nothing to Disclose
Alyssa R. Goldbach, DO, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Nicole E. Levy, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Stephen E. Ling, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Omer A. Awan, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Padmaja A. Jonnalagadda, MD, Wynnewood, PA (Abstract Co-Author) Nothing to Disclose
Sayed Ali, MD, Aston, PA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
sana.hava@gmail.com

TEACHING POINTS
Recognize imaging findings pertaining to recreational drug abuse and impact on prognosis/management. Multi-system involvement and atypical locations are common and musculoskeletal manifestations are protean.

TABLE OF CONTENTS/OUTLINE
Soft tissue and osseous pathology are frequently encountered in recreational drug abuse and are most often related to infection/inflammatory responses to foreign bodies, and less frequently sequel of ischemia and immobility. We will present common and uncommon musculoskeletal sequelae of injection (eg heroin, metamphetamine) and inhalation (eg cocaine, metamphetamine) drug overuse. Injection-related complications include cellulitis/fasciitis/myositis, soft tissue abscess/hematoma from ‘skin popping’, septic arthritis/osteomyelitis, discitis/osteomyelitis, superficial/deep thrombophlebitis, tendon laceration/septic tenosynovitis from direct needle injury, mycotic aneurysms and retained foreign bodies. Atypical locations are common in injection drug abuse eg. sternoclavicular/sacro-iliac joint septic arthritis. Inhalation-related complications include nasal mucosal atrophy/septal perforation from cocaine inhalation induced ischemia. Rhabdomyolysis from drug-induced coma in which the patient is motionless resulting in muscle necrosis from being ‘trapped’ in the prone/supine positions occurs in both routes.
Overview of Postoperative Findings of Spine: Techniques, Hardwares, Imaging Appearances, and Postoperative Complications

All Day Room: NA Digital Education Exhibit

FDA Discussions may include off-label uses.

Participants
Ji-Eun Kim, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Jihae Lee, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
dieun22@nate.com

TEACHING POINTS
1. To review and classify various techniques and hardwares using in spinal surgery 2. To review imaging findings (X-ray, CT, MRI) of normal postoperative spine, according to the procedural type 3. To learn postoperative complications of spinal surgery and and their imaging findings

TABLE OF CONTENTS/OUTLINE
1. General classification of spinal surgery Discectomy Disc replacement Decompression : Laminectomy, Laminotomy, Laminoplasty, Corpectomy, Foraminotomy Fusion Internal fixation 2. Instrumentations using various surgical hardwares, according to the procedural type Plates Screws (cortical, cancellous) Rods Cage Hook Wire & Cable Interbody devices 3. Examples of postoperative complications and their imaging findings Delayed union or nonunion Postoperative fluid collection (seroma, hematoma) Hardware fracture Implant migration Pseudoarthrosis Infection
Things Are Heating Up—Friction Related Knee Pain: An MRI Review

All Day Room: NA Digital Education Exhibit

Participants
Grayson J. Hall, MD, Vancouver, BC (Presenter) Nothing to Disclose
Blake Jamieson, MD, Vancouver, BC (Abstract Co-Author) Nothing to Disclose
Bruce B. Forster, MD, Vancouver, BC (Abstract Co-Author) Stockholder, Canada Diagnostic Centres
Gordon T. Andrews, MD, Vancouver, BC (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

TABLE OF CONTENTS/OUTLINE
Review of relevant anatomy, causes, MRI findings and treatment for the following conditions causing friction related knee pain: Iliotibial Band Friction Syndrome Patellar Tendon Lateral Femoral Condyle Friction Syndrome Bursitis (suprapatellar, prepatellar, superficial infrapatellar, deep infrapatellar, semimembranosus and pes anserine) Synovial Plicae Posteromedial Knee Friction Syndrome
Paget’s Disease of Bone: Typical and Atypical Imaging Findings

Participants
Luciana F. Gavino, MD, Jacarei, Brazil (Abstract Co-Author) Nothing to Disclose
Maria Alice F. Costa, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Ivan Masselli, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Alexandre A. Caland, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Fabiano N. Cardoso, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Andre Y. Aihara, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
lucianafg@icloud.com

TEACHING POINTS
The purpose of this exhibit is to: - Review Paget’s disease of bone. - Describe normal findings and common complications of Paget’s disease with practical examples in CT and MRI. - Give examples of atypical findings and its differential diagnosis

TABLE OF CONTENTS/OUTLINE
- Introduction: Paget’s bone disease is a common chronic disorder, characterized by excessive abnormal bone remodeling, affecting mostly the population over 40 years, being divided into three major phases (lytic, mixed and blastic phases). - Clinical manifestations: pain, deformity, fractures, arthritis, spinal stenosis, sarcomatous degeneration. - Typical imaging findings: coarsening of the primary trabeculae, generalized bone enlargement, ‘ivory vertebra’, lytic lesion (samples cases of CT and MRI). - Atypical imaging findings: unusual distribution, unusual radiological features. - Differential diagnosis - Conclusion
TEACHING POINTS

The purpose of this exhibit is: 1. To provide a comprehensive review of the normal anatomy and the biomechanical aspects of the elbow. 2. To highlight important technical aspects that optimise visualisation of anatomic structures. 3. To describe the spectrum of MRI findings of common elbow pathologies.

TABLE OF CONTENTS/OUTLINE

Tibial Tubercle Fractures: Understanding the Ogden Classification System

All Day Room: NA Digital Education Exhibit

Participants
Ahsan Khan, DO, Morristown, NJ (Presenter) Nothing to Disclose
Osmani Deochand, MD, Morristown, NJ (Abstract Co-Author) Nothing to Disclose
Neil Anand, MD, Morristown, NJ (Abstract Co-Author) Nothing to Disclose
Mariam Viqar, DO, Miami, FL (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
akhanrad@gmail.com

TEACHING POINTS
Describing normal tibial anatomy in concordance with tibial tubercle fractures in pediatric patients utilizing the Ogden Classification system. Review typical imaging characteristics to classify the type of tibial tubercle fracture with a variety of modalities which include plain radiograph, CT and MRI. Demonstrating importance of classification system on treatment and post treatment outcomes.

TABLE OF CONTENTS/OUTLINE
Tibial tubercle fractures in the adolescent population present in a multitude of ways and can range in severity. The Ogden Classification plays a vital role in categorizing various radiological findings of fractures involving the tibial tuberosity through differing imaging modalities to assess severity of the injury as well as aid in possible therapeutic intervention. Upon review of our presentation, the reader will be able to confidently identify normal anatomy and differentiate a variety of tibial tubercle fractures through various imaging modalities and determine the severity as well as possible intervention and post treatment outcomes in patients approaching skeletal maturity. Normal radiological features of tibial anatomy. Demonstrate tibial tubercle fractures utilizing the Ogden Classification. Discuss impact of classification system on assessing severity of injury, possible intervention, and post treatment outcomes.
Don't Paralyze! A Pocket Guide for Musculoskeletal Surveillance in Patients with Cerebral Palsy

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Thiago A. Murakami, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Luana B. Ferreira, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Andre Y. Aihara, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Andre Rosenfeld, MD, Recife, Brazil (Abstract Co-Author) Nothing to Disclose
Carlos H. Longo, PhD,MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Paulo R. Kanaji, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
thiagoamurakami@yahoo.com.br

TEACHING POINTS

At the final of this activity, the participant will be able to: - Understand what is cerebral palsy, including etiology and predisposing factors. - Identify the most common sites and patterns of musculoskeletal involvement, and it's imaging findings. - Be able to provide a systematic, accurate and reproducible report of the findings.

TABLE OF CONTENTS/OUTLINE

CP describes a group of disorders of the development, movement and posture, which are caused by lesion, dysfunction or malformation during the development of the infant brain, closely associated with premature delivery, low birth weight and intrauterine asphyxia. It is the most common cause of physical disability affecting children in developed countries, with incidence of approximately 2 per 1000 live births. Spastic diplegia is the most common form of CP and predominantly affects muscle groups of the spine and lower limbs, resulting in several skeletal deformities, such as scoliosis, hip dysplasia, femoral anteversion, coxa valga, knee flexion deformity and foot alterations, like equinus, planovalgus, equinovarus or equinocavovarus deformities, irreversible when not detected and treated early. In this context, it is fundamental to know the basics of CP, including the most commons patterns and sites of musculoskeletal involvement.
Everything You Want to Know About Chondromyxoid Fibromas! From Typical to Atypical and Its Differentials

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Lucas A. Mendes, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Igor R. Oliveira, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Adriene Paz, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Edson J. Ishida, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Claudia K. Yamaguchi, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Geanete Pozzan, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Eduardo Yonamine Sr, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Guinel Hernandez Filho, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcelo A. Nico, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Rafael B. Jorge, Paraiso, Brazil (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
lucasmendes.sc@gmail.com

TEACHING POINTS

The purpose of this exhibit is:
1. Review the characteristics of the chondromyxoid fibroma in the different imaging techniques, including typical and atypical cases.
2. Discuss the main differential diagnosis and the characteristics that differentiate them.
3. What radiologists should pay attention in order to raise their suspicion to chondromyxoid fibroma.

TABLE OF CONTENTS/OUTLINE

Epidemiology
Characteristics of the chondromyxoid fibroma in imaging examinations - Radiography (XR) and Computed tomography (CT) - Eccentric intramedullary lytic lesion in the metaphyseal region of long bones, determining local expansive effect, with well defined borders and sclerotic halo, and may present endosteal scalloping. - Magnetic Resonance Imaging (MRI) - Expansive lesion showing hypointensity on T1WI, hyperintensity on T2WI and enhancement on T1C+.

Differential Diagnosis - Enchondroma - Aneurysmal bone cyst - Giant cell tumor - Non-ossifying fibroma

Treatment

Conclusions
Pulse Sequences Used in Musculoskeletal MRI Exams: A Review for Residents and Fellows

All Day Room: NA Digital Education Exhibit

Awards
Identified for RadioGraphics

Participants
Stephanie Y. Jo, MD, PhD, Chicago, IL (Presenter) Nothing to Disclose
Steffen Sammet, MD, PhD, Chicago, IL (Abstract Co-Author) Research Grant, Koninklijke Philips NV
Stephen Thomas, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Gregory S. Stacy, MD, Chicago, IL (Abstract Co-Author) Researcher, Zimmer Biomet Holdings, Inc

For information about this presentation, contact:
stephanie.jo@uphs.upenn.edu

TEACHING POINTS
MRI is pervasively used for evaluation of musculoskeletal system, and a basic understanding of MRI physics and pulse sequences is important for assessing image quality and interpretation. This exhibit presents basics of MRI physics, commonly performed MRI sequences and their uses, and common MRI artifacts in musculoskeletal radiology. We expect readers to improve their understanding of MRI physics, identify characteristics and uses of MRI pulse sequences, and be aware of artifacts when interpreting studies. Table of contents/outline:

TABLE OF CONTENTS/OUTLINE
1. Introduction 2. Review of basic MRI physics - Physics of magnetic fields in an MRI suite and coil selection - MRI pulse sequences and sequence parameters 3. Review common MRI pulse sequences used in MSK radiology - Selection of appropriate pulse sequences to show anatomy and pathology - Influence of pulse sequence parameters on signal to noise ratio and image quality 4. Review common MRI artifacts in MSK radiology - Artifacts related to patient anatomy - Artifacts related to pulse sequences - Metal artifacts and image quality improvement
MK144-ED-X

MR Imaging of Growth Arrest in Bones and Disuse Osteopenia

All Day Room: NA Digital Education Exhibit

Participants
Ustun Aydingoz, MD, Ankara, Turkey (Presenter) Nothing to Disclose
Nurdan Cay, MD, Ankara, Turkey (Abstract Co-Author) Nothing to Disclose
Adalet E. Yildiz, MD, Ankara, Turkey (Abstract Co-Author) Nothing to Disclose
Fatma Bilge Ergen, Ankara, Turkey (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
ustunaydingoz@yahoo.com

TEACHING POINTS
To review MR imaging findings of growth arrest in bones and disuse osteopenia, which radiologists may encounter in the absence of plain radiographs and relevant medical history. To recognize how low intensity metaphyseal lines/stripes and/or epiphyseal silhouette(s) can represent growth arrest on MR imaging. To become familiar with hyperintense cortical foci of demineralization, which is an early yet persistent finding in disuse osteopenia on MR imaging.

TABLE OF CONTENTS/OUTLINE
Pathophysiology of growth arrest in bones and disuse osteopenia Review of MR imaging findings Sample cases and mimics
Update on Ultrasound Study of Subcutaneous Foreign Bodies: Pitfalls, Complications, and Differences Depending on Composition

All Day Room: NA Digital Education Exhibit

Participants
Elena Marin-Diez, MD, Santander, Spain (Presenter) Nothing to Disclose
Yasmina Lamprecht, MBBS, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Enrique Montes, MD, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Marta Pelaz Esteban, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Ana Belen Barba Arce, MD, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Victor Fernandez-Lobo, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Enrique Montes, MD, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Ana Belen Barba Arce, MD, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Elena A. Gallardo, MD, PhD, Santander, Spain (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
elena.marin@scsalud.es

TEACHING POINTS
The main objectives were: 1. To describe US foreign body (FB) imaging findings and features depending on its composition. 2. To quickly and systematically identify the FB associated complications. 3. To recognize the main pitfalls.

TABLE OF CONTENTS/OUTLINE
1- Background. a) General evaluation of punctured wounds and soft tissue lacerations. b) When is mandatory an US investigation. c) Transducers. 2- Ultrasound FB evaluation: metal, glass, vegetal and others. Sample cases. a) Detection with radiography. b) Ultrasound characteristics and artefacts: posterior shadowing, reverberation and surrounding hypoechogenic rim. 3- Associated complications: cellulitis, abscess formation, tenosynovitis, septic arthritis, tendon rupture, bone erosion and migration. Sample cases. 4- FB pitfalls. Sample cases. 5- Take-home summary chart.
Awards
Certificate of Merit

Participants
Paola C. Kuenzer Goes, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Andre Y. Aihara, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Fabiano N. Cardoso, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
paulakuenzer@gmail.com

TEACHING POINTS
The purpose of this pictorial essay is to review and exemplify the radiologic appearance of pitfalls, anatomical variations and artifacts in shoulder MRI that can lead to a false diagnosis or raise concern over findings that do not have clinical significance.

TABLE OF CONTENTS/OUTLINE
This pictorial essay includes cases of pitfalls, anatomical variations and artifacts in shoulder MRI that simulate pathology of bone, cartilage, glenoid labrum, muscles, tendons and ligaments. We didactically divide it into 5 categories:

1. Bones: ex. normal hypersignal in red bone marrow, acromial morphology and tubercle of Assaki.
2. Rotator Cuff: ex. magic angle artifact, interdigitation of muscle fibers, subscapular belly anatomy, pseudocalcifications and rotator cuff cable.
3. Long head of biceps tendon: ex. magic angle artifact, bicipital vincula and aponeurotic expansion of the supraspinatus tendon.
5. Miscellanea: ex. synovial fringes, capsular hyperdistention and extracapsular leakage of contrast and positional variations.

The knowledge of pseudolesions in shoulder MRI is important to all radiologists since it can improve reports, avoiding mistakes that could lead to inappropriate diagnosis and treatment.
320-Detector Row Dual-Energy CT Detects Bone Bruise: Development and Performance of Bone Bruise Imaging Without MRI

All Day Room: NA Digital Education Exhibit

Participants
Toshiyuki Nomizu, RT, Uozu, Japan (Presenter) Nothing to Disclose
Nobumitsu Takahashi, Oshu, Japan (Abstract Co-Author) Nothing to Disclose
Kyouko Itou, Nagoya, Japan (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
nomizu830@ybb.ne.jp

TEACHING POINTS
Bone bruise is a traumatic injury to a bone and associated with the inapparent occult fracture. Because of the difficulty to detect bone bruise with CT, MRI has been extensively utilized as the gold standard for evaluation of disease activity. Therefore, we develop bone bruise image (BBI) using dual-energy scan of the two rotations method. BBI is obtained by 320-detector row CT without table movement. As a result, BBI shows extremely similar findings as MR images for depiction of the bone bruise.

TABLE OF CONTENTS/OUTLINE
• BBI is calculated using three-material decomposition analysis. • For eighty-one cases who underwent DE-CT due to the suspicious bone fracture of limbs and the judgment of fracture type, we compare BBI with the last diagnosis. • BBI depicts the findings of bone bruise which closely resemble fat-saturated T2 weighted MRI. • BBI shows sensitivity and specificity of above 95%, positive-predictive value of 98.3%, and negative-predictive value of 87.0%. • BBI is effective for prevention of oversight of occult fracture and micro fracture. • BBI can omit MRI for the diagnosis of bone bruise.
A Radiologist’s Guide to Normal and Abnormal Accessory Ossicles and Unfused Secondary Ossification Centers

Participants
Cillian D. McNamara, BMBCh,MSc, London, United Kingdom (Presenter) Nothing to Disclose
Muhammad T. Dawood, MBBS,MRCP, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Maira Hameed, MA,BMBCh, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Mary E. Roddie, MD, London, United Kingdom (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
cillian.mcnamara@nhs.net

TEACHING POINTS
1. To understand the difference between an accessory ossicle (a normal anatomical variant) and a secondary ossification center (part of normal skeletal development). 2. To understand the anatomical difference between an accessory ossicle within a tendon (sesamoid bone) and other accessory ossicles. 3. To understand how unfused secondary ossification centers and certain accessory ossicles may be mistaken for pathology. 4. To understand common pathological processes related to accessory ossicles and unfused secondary ossification centers that may cause symptoms, and the associated radiological signs.

TABLE OF CONTENTS/OUTLINE
• Definition of term 'accessory ossicle'. • How accessory ossicles differ from unfused secondary ossification centers. • Pictorial review of pathology due to, or which may be mimicked by, common accessory ossicles and unfused secondary ossification centers: - Os odontoideum and persistent ossiculum terminale versus C2 fracture - Os acromiale and rotator cuff impingement - Os radiostyloideum versus os styloideum (latter may cause pain) - Bipartite patella versus patellar fracture - Os trigonum and posterior ankle pain - Os peroneum fracture and peroneus longus tendinopathy - Bipartite hallux sesamoid versus hallux sesamoid fracture
Watch Your Step! Metatarsalgia`s Differential Diagnosis on MRI

All Day Room: NA Digital Education Exhibit

Participants
Eduardo O. Pacheco, MD, Niteroi, Brazil (Presenter) Nothing to Disclose
Felipe M. von Ranke, MD, Cidade Universitaria, Brazil (Abstract Co-Author) Nothing to Disclose
Clarissa Canella, MD, Rio de Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Leonardo K. Bittencourt, MD, PhD, Rio De Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Vanessa A. Dino, MD, Niteroi, Brazil (Abstract Co-Author) Nothing to Disclose
Alessandro S. Melo, MD, PhD, Niteroi, Brazil (Abstract Co-Author) Nothing to Disclose
Diogo C. Oliveira, MD, Niteroi, Brazil (Abstract Co-Author) Nothing to Disclose
Ananda Altoe, MD, Niteroi, Brazil (Abstract Co-Author) Nothing to Disclose
Paulo d. Antunes, MD, Niteroi, Brazil (Abstract Co-Author) Nothing to Disclose
Bernardo O. Pacheco, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Gustavo O. Pacheco, Vila Velha, Brazil (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
pachecoeduardodr@gmail.com

TEACHING POINTS
• 1. To review the basic anatomy of the forefoot. • 2. To discuss about the epidemiology, difficult clinical diagnoses and the role of magnetic resonance imaging in differential diagnosis of lesser metatarsal pain. • 3. To learn the MRI necessary techniques for diagnosis. • 4. To learn the most common diseases aspects on magnetic resonance imaging by simple drawing schemes. • 5. To gain awareness of causes of forefoot pain besides the most common - Plantar vein thrombosis, Ganglion, Arthritis.

TABLE OF CONTENTS/OUTLINE
An Introduction to Regenerative Peripheral Nerve Interface

All Day Room: NA Digital Education Exhibit

Participants
Yoav Morag, MD, Ann Arbor, MI (Presenter) Nothing to Disclose
Theodore Kung, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
James Leonard, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
David Brown, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Jon A. Jacobson, MD, Ann Arbor, MI (Abstract Co-Author) Research Consultant, BioClinica, Inc; Advisory Board, General Electric Company; Advisory Board, Koninklijke Philips NV; Royalties, Reed Elsevier
Corrie M. Yablon, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Paul Cederna, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
yoavm@umich.edu

TEACHING POINTS
Learn the clinical indications for regenerative peripheral nerve interface (RPNI) surgery Understand the surgical technique of RPNI Understand the unique function of RPNI surgery Recognize the role of imaging following RPNI surgery Recognize the appearance of RPNI on diagnostic imaging

TABLE OF CONTENTS/OUTLINE
Background The epidemiology of limb amputations Potential complications and their implications following limb amputations The clinical indications for RPNI surgery Prosthetic control Prevention and treatment of post-amputation phantom pain and neuroma pain Surgical technique Diagnostic imaging of RPNI The imaging appearance of RPNI The role of imaging following RPNI surgery

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/ Yoav Morag, MD - 2017 Honored Educator Corrie M. Yablon, MD - 2017 Honored Educator Jon A. Jacobson, MD - 2012 Honored Educator
Muscle Anomalies of the Thorax and Abdomen

Participants
Sarah Raza, DO, Manhasset, NY (Presenter) Nothing to Disclose
Eric M. Goodman, MD, Mineola, NY (Abstract Co-Author) Nothing to Disclose
Timur Kotlyar, MD, New Hyde Park, NY (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
SRaza5@northwell.edu

TEACHING POINTS
1. Describe the gross anatomy of commonly occurring muscle variations of the thorax and abdomen. 2. Identify the imaging features of various accessory and anomalous muscles. 3. Review potential clinical symptoms which can be produced by these accessory muscles.

TABLE OF CONTENTS/OUTLINE
Quadriceps Femoris Muscle Complex Imaging Anatomy: It Keeps Going, Going, and Going...

All Day Room: NA Digital Education Exhibit

FDA Discussions may include off-label uses.

Awards
Certificate of Merit

Participants
Reda Britel, Palma de Mallorca, Spain (Presenter) Nothing to Disclose
Lorenzo Muntaner-Gimbernat, MD, PhD, Palma de Mallorca, Spain (Abstract Co-Author) Nothing to Disclose
Alfonso Rodriguez-Baeza, Cerdanyola del Valles, Spain (Abstract Co-Author) Nothing to Disclose
Ara Kassarjian, MD, Pozuelo, Spain (Abstract Co-Author) Research Consultant, Arthrosurface, Inc
Ivan Monge-Castresana, Palma de Mallorca, Spain (Abstract Co-Author) Nothing to Disclose
Carme Risssech-Badallo, Palma De Mallorca, Spain (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
muntaner.anatomia@gmail.com

TEACHING POINTS
1. Review classic and new anatomic variants discoveries of the quadriceps muscle complex with cadaveric correlatio
2. Improve our understanding of Imaging anatomy that is pertinent to perform biopsy and limb salvage surgery.
3. Describe the natural pathways of the anterior thigh extracompartimental dissemination of malignant and inflammatory diseases.
4. Describe the anatomical variants of perforator branches of the lateral circumflex femoral artery and recognize the role of imaging in the planning of anterolateral thigh flap planning.

TABLE OF CONTENTS/OUTLINE
Introduction 1-Imaging of anatomical variants in quadriceps femoris muscle complex Relevant anatomy Imaging findings 2-Sports and related injuries Relevant anatomy Imaging findings 3.Anterior Compartment & Limb salvage surgery imaging Relevant anatomy Imaging tumor staging tips & tricks Imaging follow-up after quadriceps femoris resections, soft tissue reconstruction and muscle transfer procedures 4.Anterolateral (ALT) Flap planning imaging Anatomical variants of perforator branches of the lateral circumflex femoral artery Imaging findings
Multimodality Imaging Review of Tarsal Coalition: A Commonly Overlooked Cause for Foot Pain

All Day Room: NA Digital Education Exhibit

Participants
Jasleen Saini, DO, Jersey City, NJ (Presenter) Nothing to Disclose
Osmani Deochand, MD, Morristown, NJ (Abstract Co-Autho) Nothing to Disclose

For information about this presentation, contact:
jasleen1126@gmail.com

TEACHING POINTS
The purpose of this exhibit is to: 1. Review the different subtypes of tarsal coalitions as well as their clinical presentation and pathology 2. Discuss the radiographic, computed tomography and magnetic resonance imaging findings of various tarsal coalitions 3. Learn the appropriate management for each subtype

TABLE OF CONTENTS/OUTLINE
A pictorial essay of the different types of tarsal coalitions will be presented. 1. Review of normal ankle anatomy 2. Introductory discussion on tarsal coalition and most common tarsal coalition subtypes 3. Discussion on the clinical presentation, pathology, imaging findings and management of each subtype listed below: - Calcaneonavicular coalition subtypes: osseous fibrous cartilaginous - Talocalcaneal coalition subtypes: osseous fibrous cartilaginous 4. Brief discussion on less common tarsal coalition subtypes 5. Conclusion: discussion on the importance of diagnosing tarsal coalition
MK155-ED-X

Gout in the Tropics: DECT Differences from Colder Climates

All Day Room: NA Digital Education Exhibit

Participants
Parang S. Sanghavi SR, DMRD, Mumbai, India (Presenter) Nothing to Disclose
Bhavin G. Jankharia, MD, Mumbai, India (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
sanghaviparang@gmail.com

TEACHING POINTS
1. To review the pathophysiology of gout and the diagnostic tools available
2. To understand the difference in pattern of involvement in tropical countries - Tophaceous vs Non-tophaceous Gout
3. To explain the importance of DECT in the diagnosis of Gout because of atypical presentation
4. To explain the role of DECT in quantification of tophus burden and in follow up cases
5. To be familiar with common artefacts to avoid false positive results

TABLE OF CONTENTS/OUTLINE
1. Pathophysiology of gout
2. Radiological findings
3. DECT Protocol for scanning
4. Role of DECT in diagnosis of Gout in Tropics - Typical and Atypical cases
5. Artefacts
6. Summary
Sonographic Evaluation of Peripheral Nerve Pathology: A Review of the Pathophysiology, Imaging Features, and Differential Diagnoses of Commonly Encountered Traumatic, Entrapment and Neoplastic Mononeuropathies

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Shane Mallon, MD, Detroit, MI (Presenter) Nothing to Disclose
Vladimir Starcevic, MD, Detroit, MI (Abstract Co-Author) Nothing to Disclose
Matthew C. Rheinboldt, MD, Detroit, MI (Abstract Co-Author) Nothing to Disclose
Andrew M. Petraszko, MD, Detroit, MI (Abstract Co-Author) Nothing to Disclose
Zachary S. Delproposto, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
shanem@rad.hfh.edu

TEACHING POINTS

The objectives of this presentation are: 1. to discuss pearls and pitfalls related to sonographic imaging of peripheral nerves by using a case-based approach to illustrate the spectrum of traumatic and atraumatic peripheral nerve injury 2. To familiarize the viewer with normal neural sonohistology and to enable the sonographic identification of major peripheral nerves using a landmark-based approach 3. To illustrate common sonographic applications in the real-time assessment of dynamic neural impingement and entrapment 4. To present imaging features and discuss differential considerations of primary benign and malignant peripheral nerve sheath tumors

TABLE OF CONTENTS/OUTLINE

Introduction Normal sonohistology Imaging technique Anatomic review of major peripheral nerves and associated landmark features for sonographic identification Traumatic peripheral nerve injury - Sedon classification, illustrations Peripheral nerve sheath tumors, neurofibromas, schwannomas, metastatic disease, malignant degeneration, perineural ganglion cysts Entrapment neuropathies: carpal, cubital, Guyon and tarsal tunnels, radial spiral groove, meralgia paresthetica, metrics of sonographic diagnostic performance Summary and future directions
Sonographic Evaluation of Acute Injuries to the Hand and Wrist: An Illustrative Review of the Pathophysiology, Imaging Features, and Differential Diagnostic Considerations

All Day Room: NA Digital Education Exhibit

Participants
Daniel Hillman, MD, Detroit, MI (Presenter) Nothing to Disclose
Vladimir Starcevic, MD, Detroit, MI (Abstract Co-Author) Nothing to Disclose
Matthew C. Rheinboldt, MD, Detroit, MI (Abstract Co-Author) Nothing to Disclose
Andrew M. Petraszko, MD, Detroit, MI (Abstract Co-Author) Nothing to Disclose
Zachary S. Delproposto, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
danielh@rad.hfh.edu

TEACHING POINTS
The purpose of this presentation is to: 1. review the normal sonographic appearance of the relevant soft tissue and osseous anatomy of the hand and wrist present illustrative examples and discuss the classification systems pertaining to the flexor and extensor tendon injuries 2. highlight the utility and prognostic implications of high resolution ultrasound in the evaluation of capsular, annular pulley, sagittal band and ligamentous traumatic injuries 3. review illustrative examples of sonographic features of nondisplaced fractures and foreign bodies

TABLE OF CONTENTS/OUTLINE
Introduction Anatomic review of carpal and digital extensor and flexor tendons, annular pulleys and capsulo-ligamentous complexes Sonographic technique, pitfalls Tendon injuries: normal anatomy, full and partial thickness tears and lacerations, jersey finger/Leddy packer classification, Boutonniere deformity, mallet finger, sagittal band injury, extensor carpi ulnaris subluxation, pulley injuries Ligamentous injuries: gamekeeper/Stener lesion, secondary collateral ligament injuries, volar plate avulsion, carpal intrinsic and extrinsic ligaments Foreign bodies Fractures Summary and future direction
Traumatic Shoulder Instability: A Comprehensive Review

All Day Room: NA Digital Education Exhibit

Participants
Nicholas M. Beckmann, MD, Houston, TX (Presenter) Nothing to Disclose

For information about this presentation, contact:
Nicholas.M.Beckmann@uth.tmc.edu

TEACHING POINTS
1. Recognize imaging appearance of shoulder dislocations
2. Describe injury patterns of shoulder dislocations
3. Describe role of imaging in pre-operative planning for traumatic shoulder instability
4. Recognize normal appearance and common complications of surgical treatments for traumatic shoulder instability

TABLE OF CONTENTS/OUTLINE
1. Review incidence & imaging of anterior, posterior, and inferior shoulder dislocations on radiographs with emphasis on how to avoid missing shoulder dislocation
2. Discuss anteroinferior labroligament complex: Labral injuries: Bony/Soft tissue Bankart, Perthes, ALPSA, GLAD, IGHL injuries: HAGL/GAGL
3. Post-operative appearance/complications of labroligament repairs
4. Discuss role of glenoid bone loss in recurrent dislocation: CT vs. MRI for assessing bone loss
5. Methods for measuring glenoid bone grafting for bone loss
6. Discuss concept of the 'glenoid track'
7. Compare/contrast injury patterns & treatment of posterior dislocations with anterior dislocations
Fracture Healing Assessment: Techniques, Definitions, Challenges, and Future Directions

All Day Room: NA Digital Education Exhibit

Participants
Paul H. Yi, MD, Baltimore, MD (Presenter) Nothing to Disclose
David Sing, Boston, MA (Abstract Co-Author) Nothing to Disclose
Paul Tornetta, Boston, MA (Abstract Co-Author) Editorial Advisory Board, Journal of Orthopaedic Trauma; Royalties, Smith & Nephew plc; Royalties, Wolters Kluwer nv
Jan Fritz, MD, Baltimore, MD (Abstract Co-Author) Research Grant, Siemens AG; Scientific Advisor, Siemens AG; Scientific Advisor, Alexion Pharmaceuticals, Inc; Speaker, Siemens AG

For information about this presentation, contact:
pyi10@jhmi.edu

TEACHING POINTS
1. A "healed" fracture is defined clinically as bone strong enough to support function; imaging is used to suggest "healed" status and augment clinical evaluation. 2. Although clear radiographic findings of fracture healing exist (e.g., bridging callus), no formal definition of radiographic bony union exists, making fracture healing assessment difficult. 3. Radiologists and orthopaedic surgeons have poor inter- and intra-observer agreement on radiographic fracture healing. 4. Standardized scoring systems have attempted to standardize and quantify radiographic evaluation of fracture healing with high inter- & intra-rater agreement. 5. Clinical correlation of fracture imaging with the patient's functional status is critical, as radiographic signs of healing do not always correlate with clinical status.

TABLE OF CONTENTS/OUTLINE
• Definitions of fracture "healing" from clinical, biomechanical, & imaging standpoints. • Review of fracture healing biology and timeline. • Imaging features of fracture healing/union. • Overview of standardized fracture healing scoring systems (e.g., RUST). • Case-based review of how to grade fracture healing based on standardized scoring systems. • Pearls for the radiologist reporting fracture healing imaging studies.
TEACHING POINTS

1. Review the major lesions affecting the vertebral body, emphasizing the focal lesions.
2. How clinical and epidemiological data and radiological features may narrow the differential diagnoses.
3. Help in differentiation lesions, principally from signs of MRI and CT, illustrated through cases of our department that were confirmed with biopsy.
4. Emphasize the importance of the radiologist in the decision to perform the biopsy and contribute with the pathologist for the correct final diagnosis.

TABLE OF CONTENTS/OUTLINE

1. Brief explanation separating focal lesions from multiple.
2. Review the key epidemiological and location points that may help with differentials.
3. Teaching how to narrow the differentials from typical characteristics of the lesions and the type of matrix.
4. Show the main focal lesions of the spine, highlighting the points that can not be missing in the report, pitfalls and differential diagnoses.
5. Reinforce the radiologist's role in tumor management (biopsy and treatment).
6. Conclusion.
What Can the Radiologist Tell About Multiple Vertebral Lesions Beyond Metastasis from Thorax CT?

All Day Room: NA Digital Education Exhibit

Participants
Gamze Durhan, MD, Ankara, Turkey (Abstract Co-Author) Nothing to Disclose
Omer Onder, Ankara, Turkey (Presenter) Nothing to Disclose
Meltem G. Akpınar, Ankara, Turkey (Abstract Co-Author) Nothing to Disclose
Figen B. Demirkazık, MD, Ankara, Turkey (Abstract Co-Author) Nothing to Disclose
Macit Ariyurek, MD, Ankara, Turkey (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
gamzedurhan@gmail.com

TEACHING POINTS
1. The advantages of learning of the imaging features of non-metastatic vertebral lesions for radiologists are twofold. First, radiological evaluation of non-neoplastic diseases affecting spine helps to do accurate differential diagnosis in systemic disease or hematological and renal disorders. Second, it prevents misdiagnosis of lesions as metastasis. 2. Various bone diseases result in multifocal or diffuse vertebral changes. Degenerative diseases and spondyloarthopathies present with consecutive endplate lesions, osteopoikilosis, tuberosclerosis, uncommon histiocytic disorders are seen multifocal lesions with a predilection to the body and posterior elements of the thoracic spine. On the other hand, osteoporosis and osteopetrosis, renal osteodystrophy and hematological disorders show diffuse changes in spine. 3. While Schmorl nodes and hemangiomas are lucent mimicking lytic metastases, tuberosclerosis, osteopoikilosis and Romanus lesions are sclerotic mimicking sclerotic bone metastases. Assessment of the density, location, margins of the lesion usually permits correct diagnosis with the help of clinical history.

TABLE OF CONTENTS/OUTLINE
Overview of the benign diseases affecting thoracic spine. Radiologic evaluation of the multiple vertebral lesions according to density, margins and location. Tips and tricks for differential diagnosis. Conclusion.
An Overview of the ABER Sequence in MR Shoulder Arthrography

All Day Room: NA Digital Education Exhibit

Participants
Mitchell Daun, MD, Orange, CA (Presenter) Nothing to Disclose
Adam A. Rudd, MD, Garden Grove, CA (Abstract Co-Author) Nothing to Disclose
Karen Cheng, MD, Orange, CA (Abstract Co-Author) Nothing to Disclose
David Gedeon, MD, Orange, CA (Abstract Co-Author) Nothing to Disclose
Farzad Rezai, MD, Long Beach, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The ABER (ABduction and External Rotation) view is a highly useful and potentially underutilized sequence in MR shoulder arthrography, with specific advantages in evaluating the joint capsule, anteroinferior labroligamentous complex, and rotator cuff. Pathology involving these structures may go undetected on conventional sequences, and ABER view can be essential for diagnosis in these cases. Understanding the correct patient positioning and technical aspects of the ABER acquisition is necessary for optimizing the quality and thus diagnostic yield of the resulting images. Familiarity with normal anatomy and pathology in the ABER view is essential to improve accuracy in interpretation and optimize patient care. The purpose of this exhibit is to: 1) Discuss proper technique and patient positioning to achieve ABER view. 2) Provide an overview of normal anatomy. 3) Become familiar with pathology that can be detected on ABER view.

TABLE OF CONTENTS/OUTLINE
A. Principals and biomechanics of the ABER position
B. Patient positioning and comfort
C. Technique and alignment for imaging acquisition and multiplanar reconstruction
D. Normal anatomy and landmarks in the ABER view
E. Case-based review of high yield pathology on ABER sequence
MK163-ED-X

Where to Draw the Line: Anatomical Measurements Used to Evaluate Patellofemoral Instability

All Day Room: NA Digital Education Exhibit

Participants
Murray J. Grissom, MD, San Jose, CA (Presenter) Nothing to Disclose
Bao H. Do, MD, Stanford, CA (Abstract Co-Author) Nothing to Disclose
Kathryn J. Stevens, MD, Stanford, CA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
murray.grissom@hhs.sccgov.org

TEACHING POINTS
- Review anatomical factors contributing to patellofemoral instability and their surgical relevance - Review 10 anatomical measurement methods and their normal threshold values, comparing normal with pathologic imaging examples

TABLE OF CONTENTS/OUTLINE
A. Clinical considerations regarding patellofemoral instability - Presentation: chronic instability vs. acute traumatic dislocation - Risk factors: anatomical features and translational forces - Highlight relevance of imaging for determination of underlying etiology and surgical planning, introducing 10 relevant imaging measurements (listed below) B. Anatomical factors: - Determination of patellar height (Insall-Salvati ratio, Caton-Deschamps index) - Radiographic (Laurin method) and CT (Dejour method) determination of patellar tilt and displacement - Measurement of the patellar congruence angle (Merchant method) - Evaluation of trochlear dysplasia (trochlear inclination, facet asymmetry, and depth) C. Determination of translational forces: - Drawing the Q angle - Calculating the tibial tubercle-trochlear groove distance D. Conclusion - Checklist for patellofemoral instability
MK164-ED-X

Imaging Review of Tumors and Tumor-Like Lesions of the Wrist

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Maria Margarita M. Santos, MD, MBA, Bonifacio Global City, Philippines (Abstract Co-Author) Nothing to Disclose
Eva Llopis, MD, Valencia, Spain (Abstract Co-Author) Nothing to Disclose
Catalina Mejia Gomez, MD, Medellin, Colombia (Abstract Co-Author) Nothing to Disclose
Dyan V. Flores, MD, Makati, Philippines (Presenter) Nothing to Disclose

For information about this presentation, contact:
dyanflores@yahoo.com

TEACHING POINTS

* Work-up and evaluation (clinical context, location, number of lesions) * Pertinent anatomy * Optimal imaging protocol * Imaging features of wrist masses with emphasis on tissue origin * Pitfalls (pseudotumors/normal variant) (Focus on wrist masses although some finger masses will be discussed)

TABLE OF CONTENTS/OUTLINE

Cinematic Rendering of Musculoskeletal Trauma: Possibilities and Opportunities

All Day Room: NA Digital Education Exhibit

Participants
Karen Clark, MD, Baltimore, MD (Presenter) Nothing to Disclose
Paul H. Yi, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Nevil N. Ghodasara, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Steven P. Rowe, MD, PhD , Baltimore, MD (Abstract Co-Author) Research funded, Progenics Pharmaceuticals, Inc
Elliott K. Fishman, MD, Baltimore, MD (Abstract Co-Author) Institutional Grant support, Siemens AG; Institutional Grant support, General Electric Company; Co-founder, HipGraphics, Inc
Jan Fritz, MD, Baltimore, MD (Abstract Co-Author) Research Grant, Siemens AG; Scientific Advisor, Siemens AG; Scientific Advisor, Alexion Pharmaceuticals, Inc; Speaker, Siemens AG

For information about this presentation, contact:
pyi10@jhmi.edu

TEACHING POINTS

Cinematic rendering (CR) is a new method of displaying 3D-reconstructed volumetric CT data which uses complex lighting models to create photorealistic images. After review of this exhibit, the user will understand:

1. What CR is, how it works, and how it differs from traditional volumetric rendering (VR).
2. Potential clinical applications of CR in visualization of musculoskeletal (MSK) trauma, including complex fractures; the relationship between fractures and adjacent soft tissue/vasculature; and soft tissue injuries. Case examples from our institution will be provided to demonstrate added benefit of CR for these purposes over traditional VR.

TABLE OF CONTENTS/OUTLINE

• What is CR and how does it work? • How does CR differ from traditional VR? • CR for characterization of complex fractures. • CR for visualization of injuries to soft tissue and vasculature adjacent to fractures. • CR for visualization of soft tissue injuries (e.g., tendon, ligaments, muscles). • Current limitations and pitfalls of CR for evaluation of MSK trauma. • Challenges and future opportunities for CR in the evaluation of MSK trauma.

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/ Elliot K. Fishman, MD - 2012 Honored Educator Elliot K. Fishman, MD - 2014 Honored Educator Elliot K. Fishman, MD - 2016 Honored Educator Elliot K. Fishman, MD - 2018 Honored Educator
Incidental or Life-threatening? A Case-based Review of Osteochondroma Related Pathology from Mechanical Complications to Malignant Degeneration

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit
Participants
Candice A. Henry, MD, Portland, OR (Presenter) Nothing to Disclose
Barry G. Hansford, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Brooke R. Beckett, MD, Portland, OR (Abstract Co-Author) Nothing to Disclose
Bryan M. Wolf, MD, Aurora, CO (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
henryca@ohsu.edu

TEACHING POINTS
After reviewing this educational case-based review, the learner will be able to: Identify solitary versus syndromic multifocal osteochondroma formation. Describe key imaging findings to differentiate osteochondroma from chondrosarcomatous degeneration. List mechanical complications of osteochondromas. Describe expected postoperative appearance of resected solitary osteochondromas. Discuss postoperative imaging of chondrosarcoma including recurrence and metastases.

TABLE OF CONTENTS/OUTLINE
Lymphedema of the Upper and Lower Extremities: What the Radiologist Needs to Know

All Day Room: NA Digital Education Exhibit

FDA Discussions may include off-label uses.

Participants
Geunwon Kim, MD, PhD, Boston, MA (Presenter) Nothing to Disclose
Martin P. Smith, MD, Newton, MA (Abstract Co-Author) Research Grant, Bracco Group Research Grant, Bayer AG Consultant, Bayer AG Research Consultant, General Electric Company
Dhruv Singhal, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Kevin J. Donohoe, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Muneeb Ahmed, MD, Boston, MA (Abstract Co-Author) Research Grant, General Electric Company; Stockholder, Agile Devices, Inc; Scientific Advisory Board, Agile Devices, Inc
Leo L. Tsai, MD, PhD, Boston, MA (Abstract Co-Author) Co-founder, Agile Devices Inc Stockholder, Agile Devices Inc Research Consultant, Agile Devices Inc

For information about this presentation, contact:
gkim6@bidmc.harvard.edu

TEACHING POINTS
1. Lymphedema is swelling of soft tissues due to disrupted or impaired lymphatic drainage leading to accumulation of protein rich fluid. It is associated with significant morbidity such as infection and decreased mobility. 2. Primary (hereditary) type is rare and the three types are classified according to the age of onset. Secondary (acquired) type is over 90% of cases of lymphedema. 3. Breast cancer is the leading cause of secondary upper extremity lymphedema. Lower extremity edema has variety of causes including oncologic treatments, venous insufficiency and trauma. Obesity is an independent risk factor. 4. Nuclear lymphoscitigraphy is the current gold standard for diagnosis. 5. MR imaging of the limbs provide anatomic detail and composition of the affected limb, such as distribution of fluid and fatty hypertrophy which can co-exist in a patient with lymphedema.

TABLE OF CONTENTS/OUTLINE
The Conundrum of Soft Tissue Infections: Pearls and Pitfalls of MR Imaging

All Day Room: NA Digital Education Exhibit

Participants
Manickam Subramanian, MBBS, FRCR, Singapore, Singapore (Presenter) Nothing to Disclose
Ashutosh Prakash, FRCR, MMEd, Singapore, Singapore (Abstract Co-Author) Nothing to Disclose
Kabilan Chokkappan, Singapore, Singapore (Abstract Co-Author) Nothing to Disclose
Rupak Dutta, FRCR, Singapore, Singapore (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
spmanickam@yahoo.com

TEACHING POINTS
To briefly review various soft tissue infections. To illustrate the magnetic resonance (MR) imaging features of soft tissue infections. To highlight the importance of diffusion imaging in detecting the abscess. To briefly discuss pearls and pitfalls of MR imaging in soft tissue infections.

TABLE OF CONTENTS/OOUTLINE
MK169-ED-X

No Frozen? You Can Chill: Core Macroscopic Features to Help Determining Adequate Sampling in Soft Tissue Biopsies

All Day Room: NA Digital Education Exhibit

Participants
Joao Rafael T. Vicentini, MD, Boston, MA (Presenter) Nothing to Disclose
Connie Y. Chang, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
jvicentini@mgh.harvard.edu

TEACHING POINTS
- Performing frozen pathology for biopsies of soft tissue lesions is helpful to ensure proper sampling and avoid a repeat biopsy, particularly when the lesion is small or necrotic. However, this practice can be time consuming and not readily available in some centers;
- Macroscopic on-site core evaluation may offer valuable information on sample adequacy and likelihood of a diagnostic result;
- Features to be evaluated in the obtained core include: size, color, consistency, fragmentation during handling and if the core floats or sinks when placed in saline;
- Solid lesion cores are usually whitish, firm and sink when placed in saline;
- Samples with muscle tissue may have characteristic red streaks;
- Fat containing samples may be tan or show yellow streaks, with soft consistency and usually float on saline;
- Necrotic or myxoid content lead to translucent, easily fragmented cores

TABLE OF CONTENTS/OUTLINE
- Literature review on core sample analysis performed on-site and features related to higher diagnostic yield;
- Discussion covering macroscopic appearances of different types of soft tissue core samples obtained at our hospital and correlation with imaging and pathology;
- Grouping in main categories based on tissue type (including solid tumors, muscle, fat, myxoid material and necrosis) and features that can be used to recognize each case.
Conventional and Advanced MRI for Sarcopenia Assessment

All Day Room: NA Digital Education Exhibit

Awards
Cum Laude

Participants
Mercedes Vallejo, MD, Seville, Spain (Presenter) Nothing to Disclose
Teodoro M. Noguerol, MD, Jaen, Spain (Abstract Co-Author) Nothing to Disclose
Ana Cano Gomez, Queensland, Australia (Abstract Co-Author) Nothing to Disclose
Marta Gomez Cabrera, MD, Cadiz, Spain (Abstract Co-Author) Nothing to Disclose
Maria Tienda Flores, Cordoba, Spain (Abstract Co-Author) Nothing to Disclose
Antonio Luna, MD,PhD, Jaen, Spain (Abstract Co-Author) Consultant, Bracco Group; Speaker, General Electric Company; Speaker, Canon Medical Systems Corporation; Royalties, Springer Nature

For information about this presentation, contact:
mervallejo@gmail.com

TEACHING POINTS
1. Review the diagnostic criteria of sarcopenia and other muscular atrophy syndromes.
2. Highlight the current role of imaging in the assessment of sarcopenia.
3. Identify the current role of clinical MRI in the diagnosis of sarcopenia.
4. To discuss the potential role of advanced MRI for the quantitative monitoring of sarcopenia.

TABLE OF CONTENTS/OUTLINE
1. Pathophysiology of muscle aging
2. Diagnostic criteria of sarcopenia
2.a Non-imaging diagnostic techniques
2.b Imaging techniques: - X-ray absorptiometry (DXA). - Ultrasound - Cross-sectional CT image
3. MRI
3.a Morphological sequences of MRI - 3D T1-weighted image - Fluid sensitive image
4. Future directions and summary.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Antonio Luna, MD - 2018 Honored Educator
Morell-Lavallee Lesions: When to be Suspicious and the Radiologists Role in Treatment

TEACHING POINTS
Understand the mechanism and pathology of Morel-Lavallee lesions and how this correlates with the classic imaging findings. Discuss the specific utility of radiology in suggesting the diagnosis. Expound on the role of radiology in management of patients, including intervention and follow-up imaging.

TABLE OF CONTENTS/OUTLINE
Clearing the Fog from Fog Machines: Breaking Down Lucent Bone Lesions on Plain Film with Cross-Sectional Correlates

All Day Room: NA Digital Education Exhibit

Participants
Michael N. Pakdaman, MD, Los Angeles, CA (Presenter) Nothing to Disclose
Peyman Kangavari, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Catherine Evans, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
michael.pakdaman@cshs.org

TEACHING POINTS

1) Obtain general understanding of the characteristics of common lucent bone lesions on plain film, CT, MRI, and Nuclear Studies.
2) Enhanced ability to differentiate lucent bone lesions on plain film, generate a narrow differential diagnosis, as well as order and interpret appropriate follow-up studies.

TABLE OF CONTENTS/OUTLINE

1) Review of the various common lucent bone lesions with respect to the following features 1a) Benign vs. malignant 1b) Patient characteristics (age/gender) 1c) Disease mechanism 1d) Clinical presentation 1e) Affect on surrounding bone 1f) Location (Bones involved, Location on bone, Central/eccentric, Subchondral involvement, Multiplicity) 1g) XR 1h) CT/MR 1i) Nuc Med 2) A summary table will be progressively compiled after each lesion. 3) Lesions to be reviewed 3a) Nonossifying Fibroma 3b) Osteoid Osteoma 3c) Osteoblastoma 3d) Unicameral Bone Cyst 3e) Aneurysmal Bone Cyst 3f) Giant Cell Tumor 3g) Eosinophilic Granuloma 3h) Malignant Fibrous Histiocytoma 3i) Brown Tumor 3j) Chondroblastoma 3k) Chondromyxoid Fibroma 3l) Chondroma 3m) Chondrosarcoma 3n) Telangiectatic osteosarcoma 3o) Multiple Myeloma 3p) Osteomyelitis
Why Can't I Extend My Knee? Imaging of Anterior Knee Pain

All Day Room: NA Digital Education Exhibit

Participants
Bhavana Nagabhushana Reddy, MBBS, MD, Bangalore, India (Presenter) Nothing to Disclose
Bharath B. Das, MD, MBBS, Bangalore, India (Abstract Co-Author) Nothing to Disclose
Prashanth Reddy, MBBS, MD, Bangalore, India (Abstract Co-Author) Nothing to Disclose
Sankar Neelakantan, MD, Bangalore, India (Abstract Co-Author) Nothing to Disclose
Sanjaya Viswanatra, MD, Bengaluru, India (Abstract Co-Author) Nothing to Disclose
Sumit T. Prabhakar, MBBS, MD, Bangalore, India (Abstract Co-Author) Nothing to Disclose
Sanjaya Viswamitra, MD, Bengaluru, India (Abstract Co-Author) Nothing to Disclose
Anju Das Thulasi Das, DMRD, Bangalore, India (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
bhavana.anu@gmail.com

TEACHING POINTS
To describe the anatomy of anterior knee (extensor mechanism). To discuss the spectrum of pathologies causing anterior knee pain in a case based approach. To emphasise the key imaging findings to arrive at the right diagnosis.

TABLE OF CONTENTS/OUTLINE
300 radiographs and MRI knee studies evaluated for anterior knee pain from 2016 to 2018, revealed 25 cases which are as follows:
Traumatic causes: Fracture of patella, iliotibial band friction syndrome, articular cartilage injury, osteochondritis dessicans, patellar tendonitis, patellar tendon tear, Osgood Schlatter disease, Patellar sleeve avulsion, patellar tendinopathy, Quadriceps tendonitis, Quadriceps tendon tear.
Degenerative: Patellofemoral osteoarthritis.
Inflammatory: Rheumatoid arthritis, tubercular arthritis, pigmented villonodular synovitis, prepatellar and pre and infrapaetellar bursits, hoff's disease.
Neoplastic: Giant cell tumour, melorheostosis.
Miscellaneous: Patellofemoral maltracking, chondromalacia patellae, bipartite patella, loose body. We illustrate the key imaging findings to arrive at the right diagnosis.
The Unfolded Rib View: Promises and Challenges

Awards
Certificate of Merit

Participants
Nidhi M. Doshi, MBBS, MD, Mumbai, India (Presenter) Nothing to Disclose
Parang S. Sanghavi SR, DMRD, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Bhavin G. Jankharia, MD, Mumbai, India (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
doshi.nidhi18@gmail.com

TEACHING POINTS
1) To familiarize oneself with the artificial intelligence based application - 'CT Bone Reading' which aims to simplify rib cage evaluation.
2) To understand reading and interpretation of the Curved Planar Reformatted image (unfolded view) generated by this application.
3) A pictorial review of common rib cage pathologies (traumatic, infective, neoplastic), to demonstrate their appearance on standard multiplanar and unfolded rib views.
4) To recognize potential pitfalls encountered with this application in order to avoid errors in reporting.
5) Overall an intuitive and user friendly tool which also helps in clear demonstration of pathology for clinical reference.

TABLE OF CONTENTS/OUTLINE
1) Introduction: Importance of prompt interpretation of thoracic CT scans with special emphasis on rib cage evaluation.
2) Artificial intelligence in radiology - how the 'CT bone reading' application works.
3) Cases to illustrate the appearance of common rib pathologies viz. traumatic (acute and old), infective (unifocal and multifocal) and neoplastic (benign and malignant) on the unfolded rib view.
4) Perquisites and potential pitfalls of this application.
5) Conclusion.
MK175-ED-X

Frozen Hip: Don’t ‘Let It Go’

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Camila L. Albino, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Andre Y. Aihara, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Carlos H. Longo, PhD, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Rogerio N. Filho, MBBS, Sao Roque, Brazil (Abstract Co-Author) Nothing to Disclose
Marcio M. Moreira, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Bruno S. Carleial, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
camis.albino@gmail.com

TEACHING POINTS

Review of the anatomy of the hip capsule. Pathophysiology, staging and clinical findings of adhesive capsulitis of the hip (ACH) and the similarity with adhesive capsulitis of the shoulder. Discuss and describe imaging findings of adhesive capsulitis of the hip. Illustrate with eight cases of adhesive capsulitis of the hip from our institution.

TABLE OF CONTENTS/OUTLINE

Adhesive capsulitis of the hip, also known as frozen hip, is a supposedly rare but probably underdiagnosed entity. Similar to adhesive capsulitis of the shoulder, it is characterized by a progressive painful decrease in active and passive range of motion, which may also be nocturnal or exacerbated by weight bearing. From a physiopathology standpoint, begins with synovial inflammation in the acute stages and progress to capsular fibrosis, and can be divided into four stages. In MRI, there is thickening and edema of the joint capsule with pericapsular enhancement. With that in mind, the purpose of this exhibit is to review and illustrate adhesive capsulitis of the hip, emphasizing what the radiologist must know to not miss this diagnosis. Conclusions. Bibliographical references.
MR Evaluation of Bone Marrow

All Day Room: NA Digital Education Exhibit

Participants
Brett T. Deatherage, MD, Temple, TX (Presenter) Nothing to Disclose
Ricardo D. Garza-Gongora, MD, Temple, TX (Abstract Co-Author) Nothing to Disclose
Linda M. Parman, MD, Temple, TX (Abstract Co-Author) Nothing to Disclose
Connie C. So, MD, Temple, TX (Abstract Co-Author) Nothing to Disclose
Jeffrey D. Stevens, MD, Temple, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. To describe and give a pictorial depiction of normal bone marrow and its physiologic conversion from birth to adulthood.
2. To discuss various pathologies and infiltrative processes involving the bone marrow and give a pictorial depiction of each.

TABLE OF CONTENTS/OUTLINE

(1) Function & Development: Red Marrow Conversion, Epiphyses and Apophyses, T1 MRI Characteristics, & Age-Related Degeneration. (2) Marrow Proliferative Disorders: Benign (Benign, Pathologic, Focal Red Marrow Conversion, Myelofibrosis, Polycythemia Vera, Mastocytosis, & Myelodysplastic Syndrome) & Malignant processes (Leukemia, Multiple Myeloma, Amyloidosis, Waldenstrom's Macroglobulinemia. (3) Marrow Replacement Disorders: Benign (Primary Bone Tumors & Osteomyelitis) & Malignant processes (Metastases, Lymphoma, & Primary Bone Tumors). (4) Marrow Depletion: Aplastic Anemia, Radiation, Chemotherapy, Marrow Toxins. (5) Vascular Abnormalities: Bone Marrow Edema & Ischemia. (6) Miscellaneous: Gaucher Disease, Paget's Disease, Hemosiderin Deposition, Serous Atrophy, Osteopetrosis, AIDS, SAPHO Syndrome, & Diffuse "Black" Marrow.
TEACHING POINTS

1. Patients with vascular malformations can present with classic, but also with atypical imaging features and clinical symptoms. 2. Classification of vascular anomalies has traditionally emphasized clinical and imaging features. 3. Differential diagnoses can be developed through specific findings allowing for optimal evaluation.

TABLE OF CONTENTS/OUTLINE

1. Appearance of soft tissue vascular malformations. Radiographsb. Ultrasoundc. MRId. CT. E. Intervention

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Jon A. Jacobson, MD - 2012 Honored Educator Jon A. Jacobson, MD - 2017 Honored Educator
Biopsy Challenge in Dedifferentiated Chondrosarcomas

All Day Room: NA Digital Education Exhibit

Participants
Miguel Bello Erias, MD, Madrid, Spain (Presenter) Nothing to Disclose
Daniel Bernabeu Taboada, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Eduardo Ortiz-Cruz, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Juan Jose Pozo Kreilinger, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Mar Tapia Vine, Madrid, Spain (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
miguel.bello@salud.madrid.org

TEACHING POINTS
1. Review the typical radiological characteristics of dedifferentiated chondrosarcomas. 2. Learn how to improve the rate of successful diagnostic biopsies by choosing the most appropriate locations for sampling, based on radiological findings. 3. Emphasize the importance of multidisciplinary diagnostic and therapeutic management of this complex tumor pathology.

TABLE OF CONTENTS/OUTLINE
1. Introduction 2. Epidemiologic and anatomopathologic characteristic of dedifferentiated chondrosarcoma. 3. Radiological findings in CT and MRI, focusing on the bimorphic pattern description typical of this tumor. 4. Biopsy procedure under CT guidance is described to optimize pathological diagnosis before surgery. Tips and suggestion for tumor sampling based on MRI findings are provided. 5. Conclusions
Viscosupplementation: A Slippery Slope to Treatment

All Day Room: NA Digital Education Exhibit

Participants
Raees Bhatti, Liverpool, United Kingdom (Abstract Co-Author) Nothing to Disclose
Gulraiz S. Ahmad, MBChB, Manchester, United Kingdom (Abstract Co-Author) Nothing to Disclose
Waqar A. Bhatti, MBBCh, Manchester, United Kingdom (Presenter) Nothing to Disclose

TEACHING POINTS
This education exhibit will look at the use of viscosupplementation in degenerative joint disorders, particularly focusing on the indication of its use, and its risks and benefits. After viewing this exhibit the learner will understand what viscosupplementation contains, why it is used, and the beneficial effects it has on the joint disease. This exhibit will also demonstrate the specific use of viscosupplementation in the shoulder, in professional athletes, and for tendinopathy. All of the principles learned will be applied to real life cases throughout the exhibit.

TABLE OF CONTENTS/OUTLINE
1. What does viscosupplement contain, with particular emphasis on hyaluronic acid. 2. What is the role of hyaluronic acid in managing degenerative joint disorders, including its analgesic and chondroprotective effect. 3. What is the mechanism of action of hyaluronic acid, specific to its anti-inflammatory effect and restoration of joint homeostasis. 4. What are the indications for viscosupplementation, including the benefits and risks. 5. What is the evidence that viscosupplementation works, with reference to previous trials. 6. Case examples of the use of viscosupplementation.
Anatomical Considerations for Safe Biopsy of Extremity Osseous and Soft Tissue Lesions

Awards
Cum Laude

Participants
Austin M. Fischer, DO, Jacksonville, FL (Presenter) Nothing to Disclose
Paul L. Wasserman, DO, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose
Kristin J. Taylor, MD, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose
Mario Agrait-Bertran, MD, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
austin.fischer@jax.ufl.edu

TEACHING POINTS
When managing patients with extremity bone or soft tissue tumors, an integrative team approach between the musculoskeletal radiologist and the orthopedic oncologic surgeon is key for proper biopsy planning. Educational goals of this exhibit include: Discuss the importance of choosing appropriate biopsy route as it relates to limb sparing surgery. Review anatomy of upper extremity and lower extremity vital structures and compartments. Identify safe zones for potential biopsy routes.

TABLE OF CONTENTS/OUTLINE
Introduction and Key Points on Extremity biopsies Review anatomy of upper arm, forearm, upper leg, and lower leg- Vital Structures, Compartments, and Other structures Review patient positioning, biopsy routes, key structures to avoid, and surgical resection plane at the following levels: Upper arm Proximal Humerus Proximal Mid Humerus Mid Humerus Distal Mid Humerus Distal Humerus Forearm Proximal Forearm Proximal Mid Forearm Mid Forearm Distal Mid Forearm Distal Forearm Upper Leg Proximal Femur Proximal Mid Femur Mid Femur Distal Femur Distal Leg Femur Lower Leg Proximal Lower Leg Proximal Mid Lower Leg Mid Lower Leg Distal Mid Lower Leg Distal Lower Leg Companion Cases
The Dark Side of Soft Tissue Tumors: A Review of 'Determinant' MRI Hypointense Soft Tissue Lesions

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Hunter Sellers, BS, Temple, TX (Presenter) Nothing to Disclose
Ricardo D. Garza-Gongora, MD, Temple, TX (Abstract Co-Author) Nothing to Disclose
Derek S. Young JR, BS, Temple, TX (Abstract Co-Author) Nothing to Disclose
Jeffrey D. Stevens, MD, Temple, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Briefly discuss the current techniques used to assess soft tissue lesions. 2. Review the physiopathology components leading to low signal intensity among lesions. 3. Highlight MR features leading to the diagnosis of 'determinate' T1 and T2 hypointense soft tissues lesions. 4. Develop a systematic approach to hypointense soft tissue lesions leading to improved diagnosis

TABLE OF CONTENTS/OUTLINE
MK182-ED-X

Stuck in the Middle: Imaging Overview of the Midtarsal Chopart Joint

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Zoe Doyle, Stanford, CA (Presenter) Nothing to Disclose
Michelle Nguyen, MD, La Jolla, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Familiarize the radiologist with Chopart joint complex sprain, an often overlooked entity which can lead to prolonged disability 2. Review the anatomy of Chopart joint 3. Discuss mechanisms of Chopart injuries 4. Review multimodality imaging findings of Chopart injury 5. Discuss treatment options

TABLE OF CONTENTS/OUTLINE
Normal anatomy and alignment • Bones: Talus, navicular, cuboid, calcaneus - Normal radiographic Cyma lines of the talonavicular and calcaneocuboid joints • Ligaments: Bifurcate, dorsal calcaneocuboid (CC), talonavicular (TN), long and short plantar, spring
Mechanisms of injury • Classification - Main and Jowett - Zwipp: Trans -ligamentous, -talar, -calcaneal, -navicular, -cuboidal, combined Imaging findings (X-ray, CT, MRI): • Plantar talar head edema with spring, bifurcate, and CC ligament tears
(transligamentous) • Dorsal talar head fracture with TN ligament tear (transtalar) • Lateral distal calcaneus fracture with CC ligament tear and anterior calcaneal process fracture with bifurcate ligament tear (transcalcaneal) • Cuboid fracture with plantar ligament tear (transcuboidal) • Fracture-dislocation involving calcaneus, navicular, cuneiforms (combined) • Concurrent lateral ankle ligament injuries and extensor digitorum brevis edema Treatment: Operative vs nonoperative
**TEACHING POINTS**

There are various intra- and peri-articular synovial diseases and many of these diseases have specific imaging findings. The purpose of this exhibit is to review their typical imaging findings and consider noteworthy points of images to aid in accurately diagnosing.

**TABLE OF CONTENTS/OUTLINE**

Case presentations will comprise examples of intra- and peri-articular non-neoplastic masses. Using multiple modalities, we will present the points for accurately diagnosing each case. The list of cases includes: 1) Noninfectious synovial proliferative processes 2) Infectious granulomatous diseases 3) Deposition diseases 4) Inflammatory conditions 5) Degenerative lesions 6) Vascular malformations 7) Miscellaneous conditions.
Delayed Onset Muscle Soreness (DOMS): Pathogenesis, Diagnostics, Treatment, and Prevention

All Day Room: NA Digital Education Exhibit

Participants
Rafael Heiss, Erlangen, Germany (Presenter) Speakers Bureau, Siemens AG
Frank W. Roemer, MD, Erlangen, Germany (Abstract Co-Author) Officer, Boston Imaging Core Lab, LLC; Research Director, Boston Imaging Core Lab, LLC; Shareholder, Boston Imaging Core Lab, LLC
Wolfgang Wust, MD, Erlangen, Germany (Abstract Co-Author) Speakers Bureau, Siemens AG
Matthias S. May, MD, Erlangen, Germany (Abstract Co-Author) Speakers Bureau, Siemens AG
Christoph Lutter, Bamberg, Germany (Abstract Co-Author) Nothing to Disclose
Thomas Bayer, Erlangen, Germany (Abstract Co-Author) Nothing to Disclose
Rolf Janka, MD, PhD, Erlangen, Germany (Abstract Co-Author) Nothing to Disclose
Michael Uder, MD, Erlangen, Germany (Abstract Co-Author) Speakers Bureau, Bracco Group Speakers Bureau, Siemens AG Speakers Bureau, Bayer AG Research Grant, Siemens AG
Thilo Hotfiel, Erlangen, Germany (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To clarify the clinical significance of Delayed Onset Muscle Soreness (DOMS) as a minor muscle lesion. 2. To review the underlying histopathological changes. 3. To learn the appearance of DOMS in different imaging modalities and to explain strength and weakness of different modalities including B-mode ultrasound, contrast enhanced ultrasound (CEUS), acoustic radiation force impulse elastography (ARFI) and MRI. 4. To review different strategies in prevention and treatment (i.e. heat/cold therapy, compression, massage) and to work out the role of imaging in follow-up examinations.

TABLE OF CONTENTS/OUTLINE
1. Epidemiology; 2. Injury mechanisms and pathogenesis; 3. Clinical presentation and clinical diagnostics; 4. Imaging: Appearances of DOMS in B-mode ultrasound, contrast enhanced ultrasound (CEUS), acoustic radiation force impulse elastography (ARFI) and MRI (T1, T2 fs, T2 mapping); 5. Treatment and prevention.
**MRI Myositis Screening: Value for Money and Time**

All Day Room: NA Digital Education Exhibit

**Participants**
Amit K. Sahu, MBBS, MD, New Delhi, India *(Presenter)* Nothing to Disclose  
Sachin Bajaj, MBBS, New Delhi, India *(Abstract Co-Author)* Nothing to Disclose  
Prasandeep Rath, MBBS, MD, New Delhi, India *(Abstract Co-Author)* Nothing to Disclose  
Bharat Aggarwal, MBBS, MD, New Delhi, India *(Abstract Co-Author)* Nothing to Disclose

**TEACHING POINTS**
1. To discuss the MRI spectrum of soft tissue and musculature findings in idiopathic inflammatory myopathies (IIMs). 2. Highlight the role of MRI in diagnosis, extent of disease progression and follow-up of these patients. 3. To discuss standardized protocol for screening MRI of IIMs.

**TABLE OF CONTENTS/OUTLINE**
1. Idiopathic inflammatory myopathies are a group of disorder which includes polymyositis, dermatomyositis and inclusion body myositis. There is varied presentation and prognosis of these individual entities. 2. Proximal muscle weakness is a common presentation and to some extend there is involvement of different muscle group in different entity. 3. MRI findings include muscle & subcutaneous edema, muscle calcification and fatty atrophy of muscles. 4. Screening MRI of these patients can be limited and optimized to T1 & T2 (STIR) sequences of whole limbs in a large field of view. 5. MRI can also guide for muscle to be biopsied and is very helpful in follow-up and assess treatment response.
USG Evaluation of Hand: A Guide to Arthritis

All Day Room: NA Digital Education Exhibit

Participants
Amit K. Sahu, MBBS, MD, New Delhi, India (Presenter) Nothing to Disclose
Nidhi Gouthi, MBBS, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Prasandeep Rath, MBBS, MD, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Rishabh Aggarwal, DMRD, MBBS, Delhi, India (Abstract Co-Author) Nothing to Disclose
Bharat Aggarwal, MBBS, MD, New Delhi, India (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
drsahuamit@gmail.com

TEACHING POINTS
1. To discuss the spectrum of USG findings in various arthritis involving hands.
2. Differentiating features of inflammatory, infective and degenerative arthritis.
3. Highlighting the findings which can differentiate seropositive from seronegative spondyloarthritis.
4. Grading the disease activity according to the soft tissue and bone findings.

TABLE OF CONTENTS/OUTLINE
1. USG findings involving the hand include synovial thickening, synovial effusion, tendon sheath thickening and bone erosion. Power Doppler shows vascularity in the synovial thickening which can be graded. 2. Proximal joint involvement of hand favors rheumatoid arthritis while distal joint involvement with tenosynovitis and enthesophytes indicate seronegative arthritis. 3. Degenerative osteoarthritis of hand involves the 1st carpometacarpal joint and also the distal joints with periarticular osteophytes. 4. Infective arthritis is usually monoarticular with diffuse synovial thickening and soft tissue components with or without bone involvement. 5. At few occasions USG is the first modality to detect the findings supporting arthritis of hand. 6. Thus USG of hands is an easily accessible, cost effective and very informative modality in patients with arthritis both for diagnosis and treatment response.
**Bottoms Really Hurt: A Relook Into the Acetabular Injuries**

**All Day Room: NA Digital Education Exhibit**

**Participants**
Amit K. Sahu, MBBS, MD, New Delhi, India (Presenter) Nothing to Disclose  
Nikhil Gupta, MBBS, Delhi, India (Abstract Co-Author) Nothing to Disclose  
Mantu Jain, Bhubaneswar, India (Abstract Co-Author) Nothing to Disclose  
Gyaneesh Aggarwal, MBBS, FRCR, New Delhi, India (Abstract Co-Author) Nothing to Disclose  
Bharat Aggarwal, MBBS, MD, New Delhi, India (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:  
drsahuamit@gmail.com

**TEACHING POINTS**

1. To review the acetabular anatomy with biomechanics and imaging appearance of various types of acetabular fractures.  
2. Discuss complications associated with acetabular injury.  
3. Highlight the importance of CT emphasising on 3D imaging in complex anatomy involved in acetabulum fractures.  
4. Importance of mentioning the relevant findings which can guide the orthopedic surgeon in planning management.

**TABLE OF CONTENTS/OUTLINE**

1. Acetabular fractures are classified into five elementary and five associated types (Judet and Letournel) which is important to identify for surgical planning.  
2. Anterior & posterior wall, anterior & posterior column and transverse are the five elementary fracture types. Both column fracture is a unique type and needs to be dealt differently. Treatment options vary from conservative to surgery depending upon fracture type.  
3. Radiographs are good to identify the acetabular fractures, but 3D CT is the modality of choice for classification and identifying associated complications.  
4. Due to the complex anatomy of acetabulum, identification and characterization of its fractures are important for efficient patient treatment.  
5. Radiologists should be aware of operative techniques to identify complications and raise alert.
Multimodality Imaging Review of Osseous Stress Injuries throughout the Skeleton

All Day Room: NA Digital Education Exhibit

Participants
Katherine N. Epstein, MD, Albuquerque, NM (Abstract Co-Author) Nothing to Disclose
Steven R. Tandberg, MD, Albuquerque, NM (Abstract Co-Author) Nothing to Disclose
Jamie M. Elifritz, MD, Albuquerque, NM (Abstract Co-Author) Nothing to Disclose
Jennifer S. Weaver, MD, Albuquerque, NM (Presenter) Nothing to Disclose

For information about this presentation, contact:
jsweaver@salud.unm.edu

TEACHING POINTS
Osseous stress injuries can have a significant impact on patients' activity and well being. Recognition of these injuries by the radiologist can improve patients' recovery and function. We will utilize case material to illustrate a variety of osseous stress injuries throughout the skeleton. Teaching points: 1. Pathophysiology of osseous stress injuries 2. Imaging findings of a variety of osseous stress injuries throughout the body 3. Role of imaging in the clinical management of osseous stress injuries

TABLE OF CONTENTS/OUTLINE
Introduction Pathophysiology Imaging of stress related injuries Upper extremity Adults Children Axial Skeleton Lower extremity Adults Children Mimics Pearls and Pitfalls Conclusions
Artifacts in Musculoskeletal Ultrasound: Boon or Bane!

All Day Room: NA Digital Education Exhibit

Participants
Susila S. Krishnan, DMRD, FRCR, Chennai, India (Presenter) Nothing to Disclose

For information about this presentation, contact:
susi.krishnan@gmail.com

TEACHING POINTS
- Artifacts in MSK ultrasound include those that mimic pathology while examining normal structures and those artifacts that occur along with pathologic conditions at grey-scale or Doppler imaging. • This exhibit aims to describe the origin and illustrate with examples, the frequent and infrequent artifacts occurring in MSK ultrasound. • Physical properties causing the artifacts are described and their importance in image interpretation explained. • Teaching points are highlighted to recognise (1) artifacts that can be corrected by proper scanning technique, and (2) artifacts that are the result of ultrasound beam properties and inherent tissue characteristics and how they assist in decision making by providing important diagnostic information.

TABLE OF CONTENTS/OUTLINE
Grey scale and Doppler artifacts encountered in a total of 4682 patients referred for MSK ultrasound and interventions between January 2015 and February 2018 were included in the study. Categorised and discussed as follows: Associated with beam characteristics-Anisotropy, Beam width and Side lobe artifacts Velocity errors-Refraction and Speed displacement artifacts Attenuation errors-Posterior shadowing and enhancement Due to multiple echoes-Reverberation, comet tail, ring-down and mirror image artifacts Doppler artifacts-aliasing, twinkle, flash and pseudoflow artifacts
MR Imaging of Chondrogenic Tumors: Update on Selected Imaging Challenges

All Day Room: NA Digital Education Exhibit

Participants
Shivani Ahlawat, MD, Baltimore, MD (Presenter) Research Consultant, Pfizer Inc
Laura M. Fayad, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
sahlawa1@jhmi.edu

TEACHING POINTS

Conventional MR sequences can be helpful in the distinction of tumor-like lesions from chondrogenic tumors and the evaluation of anatomic extent associated with a chondrosarcoma (CS). Benign, atypical and malignant chondrogenic lesions can have overlapping features on diffusion weighted imaging (DWI) with apparent diffusion coefficient (ADC) mapping but dynamic contrast enhanced (DCE) sequences can be helpful. Patients with multiple chondrogenic tumors are predisposed to develop CS and extra-skeletal malignancies and may benefit from imaging surveillance. Majority of the chondrogenic skeletal lesions can be characterized confidently on imaging; however, in the small subset of lesions with overlapping imaging and pathological features, a multidisciplinary approach should be used.

TABLE OF CONTENTS/OUTLINE

Magnetic Resonance Imaging Findings of Superior Capsular Reconstruction in the Shoulder

Participants

Eliot S. Ku, MD , Albuquerque, NM (Abstract Co-Author) Nothing to Disclose
Jory Wasserburger, MD, Albuquerque, NM (Abstract Co-Author) Nothing to Disclose
Jamie M. Elifritz, MD, Albuquerque, NM (Abstract Co-Author) Nothing to Disclose
Steven R. Tandberg, MD, Albuquerque, NM (Abstract Co-Author) Nothing to Disclose
Eric Benson, MD, Albuquerque, NM (Abstract Co-Author) Nothing to Disclose
Jennifer S. Weaver, MD, Albuquerque, NM (Presenter) Nothing to Disclose

For information about this presentation, contact:
jsweaver@salud.unm.edu

TEACHING POINTS

Reconstruction of the superior capsule of the shoulder is a relatively new orthopedic intervention available to a subset of patients with massive, irreparable rotator cuff tears. Patients must meet certain inclusion criteria to be eligible for the intervention. We will describe the intervention, and present the inclusion criteria, as well as describe the MR imaging findings post reconstruction. Teaching points: 1. Describe the general technique of superior capsular reconstruction. 2. Describe the inclusion criteria for this intervention and the MR imaging findings important to the orthopedic surgeon. 3. Review the pertinent post-operative MR imaging findings following superior capsular reconstruction.

TABLE OF CONTENTS/OUTLINE

Introduction Description of Surgical Procedure Patient Inclusion Criteria Imaging findings pre reconstruction: what your surgeon needs to know Imaging findings post reconstruction Conclusion
TEACHING POINTS

Focal osseous lesions are common incidental findings on x-ray, CT, and MRI. Most of these lesions are not primary bone tumors, but rather represent normal anatomic variants or non-neoplastic processes. The purpose of this exhibit is to provide a review of the characteristic imaging findings of the many bone tumor mimics. Special emphasis is placed on the key imaging and clinical features that allow a definitive diagnosis to be made, thus avoiding unnecessary further work up and patient anxiety.

TABLE OF CONTENTS/OUTLINE

4. Iatrogenic a. Small Particle Disease b. Bone Graft Donor Site c. Biceps Tenodesis
5. Infection a. Osteomyelitis/Brodie’s Abscess
7. Other a. Melorheostosis b. Osteonecrosis
Pediatric Knee: Normal Variants and Benign Entities That May Mimic Abnormalities

All Day Room: NA Digital Education Exhibit

Participants
Gustavo R. Pinto I, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Leandro P. Lizarelli, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Fernando M. Lima, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Artur D. Da Rocha Correa Fernandes, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Andre Y. Aihara, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Fabiano N. Cardoso, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose

For information about this presentation, contact:
gusavo.rossanese@gmail.com

TEACHING POINTS
1. Identify image aspect of most common normal variants of the pediatric knee 2. Correctly distinguish those abnormalities from pathological findings

TABLE OF CONTENTS/OUTLINE
REVIEW THE NORMAL VARIANTS OF PEDIATRIC KNEE INCLUDING: DEVELOPMENTAL IRREGULAR OSSIFICATION; OSTEOCHONDRITIS DISSECANS DIFFERENTIAL DIAGNOSIS; DISTAL FEMORAL AVULSIVE IRREGULARITY; NONOSSIFYING FIBROMA; FOCAL PERIPHERAL EDEMA - 'FOPE'; BIPARTITE PATELLA.
**Imaging Findings in Musculoskeletal Invasive Pneumococcal Disease: How to Recognize**

All Day Room: NA Digital Education Exhibit

**Participants**

Renata F. Batista Pereira, MD, Sao Paulo, Brazil *(Presenter)* Nothing to Disclose  
Stephano R. Rocha, MD, Sao Paulo, Brazil *(Abstract Co-Author)* Nothing to Disclose  
Werner W. Kleina SR, MD, SAO PAULO, Brazil *(Abstract Co-Author)* Nothing to Disclose  
Renata V. Leao, Sao Paulo, Brazil *(Abstract Co-Author)* Nothing to Disclose  
Raul O. Martins, MD, Sao Paulo, Brazil *(Abstract Co-Author)* Nothing to Disclose  
Denise T. Amaral, Sao Paulo, Brazil *(Abstract Co-Author)* Nothing to Disclose  
Rodrigo Y. Fernandes, MD, Sao Paulo, Brazil *(Abstract Co-Author)* Nothing to Disclose  
Marcelo Bordalo-Rodrigues, MD,PhD, Sao Paulo, Brazil *(Abstract Co-Author)* Nothing to Disclose  
Claudia D. Leite, MD, PhD, Sao Paulo, Brazil *(Abstract Co-Author)* Nothing to Disclose  
Giovanni G. Cerri, MD,PhD, Sao Paulo, Brazil *(Abstract Co-Author)* Nothing to Disclose

For information about this presentation, contact: renatafernandesbp@gmail.com

**TEACHING POINTS**

Despite the introduction of conjugate vaccines, invasive pneumococcal disease continues to represent an important cause of mortality, especially when associated with infrequent manifestations, such as musculoskeletal complications. **Teaching points:** To contextualize the clinical and epidemiological aspects of pneumococcal infection. To define the concept of invasive pneumococcal infection. To describe the musculoskeletal image findings of invasive pneumococcal infection.

**TABLE OF CONTENTS/OUTLINE**

Introduction  
Objectives: illustrate cases of musculoskeletal invasive pneumococcal infection (MIPI) and the imaging findings that may contribute for its diagnosis illustrate the clinical set and the main image patterns that should make the radiologist think of invasive pneumococcal infection illustrate the main affected sites of this pathology Emphasize the differential diagnosis Case-based review of invasive musculoskeletal invasive pneumococcal infection: Acromioclavicular joint Hip joint Atlanto-axial joint Case-based differential diagnosis Conclusions References
Applications of Dual-Energy Computed Tomography in Musculoskeletal Imaging

Awards
Cum Laude

Participants
Renata F. Batista Pereira, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Stephano R. Rocha, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Raul O. Martins, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcos Felipe P. Correa, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Paulo Victor P. Helito, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcelo Bordalo-Rodrigues, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Hugo P. Costa, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Ceci Obara Kurimori, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Claudia D. Leite, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Giovanni G. Cerri, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
renatafernandesbp@gmail.com

TEACHING POINTS
Dual energy computed tomography (DECT) is a complementary diagnostic tool that offers the potential to analyze material composition through image acquisition at two different energy levels. This property may contribute to the differential diagnosis of some musculoskeletal (MSK) pathologies, complementing the evaluation by conventional computed tomography and magnetic resonance imaging. Teaching points: Describe the physical principles of Dual Energy Computed Tomography (DECT). Discuss when DECT may be superior to conventional CT (single energy). Emphasize and discuss the clinical applications of DECT.

TABLE OF CONTENTS/OUTLINE
Introduction Objectives Physical principles of DECT Postprocessing particularities Clinical applications: Bone Marrow Edema Detection Gout diagnosis - Urate Detection Metal Artifact Reductionon Perfusion analysis Conclusions References
Nervous About Nerve Tumors: A Comprehensive Review of Peripheral Nerve Tumors

All Day Room: NA Digital Education Exhibit

Participants
Willy Tjong, MD, Rochester, NY (Presenter) Nothing to Disclose
Steven P. Meyers, MD, PhD, Rochester, NY (Abstract Co-Author) Nothing to Disclose
Scott R. Schiffman, MD, Rochester, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
• Review the anatomy and structure of peripheral nerves
• Provide an overview of peripheral nerve sheath tumors
• Identify characteristic MR imaging features of peripheral nerve sheath tumors
• Discuss common locations, clinical presentations and management for various tumor types

TABLE OF CONTENTS/OUTLINE
The purpose of this exhibit is to provide an overview of peripheral nerve sheath tumors. Given their neurogenic etiology, these lesions have distinctive imaging features that help to make an appropriate diagnosis. MRI is the primary imaging modality used to characterize these lesions, and it is imperative for the practicing radiologist to be familiar with the typical features (such as location, association with adjacent structures and signal characteristics) that define these entities. Through a case-based format, this exhibit will provide a thorough overview of peripheral nerve sheath tumors and their characteristic appearance. Cases to be discussed include: schwannoma, neurofibroma (including localized cutaneous, intraneural and plexiform types), malignant peripheral nerve sheath tumor, fibrolipomatous hamartoma and traumatic / stump neuroma.
**Participants**

Alyssa R. Goldbach, DO, Philadelphia, PA (Presenter) Nothing to Disclose  
Sana Hava, DO, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose  
Stephen E. Ling, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose  
Padmaja A. Jonnalagadda, MD, Wynnewood, PA (Abstract Co-Author) Nothing to Disclose  
Omer A. Awan, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose  
Sayed Ali, MD, Aston, PA (Abstract Co-Author) Nothing to Disclose  

For information about this presentation, contact:  
alisayan@tuhs.temple.edu

**TEACHING POINTS**

1. The periphery of the ankle demonstrates complex anatomy making the area an overlooked source of ankle pain.  
2. Failure to recognize imaging findings and pathologic processes affects prognosis and alters management.

**TABLE OF CONTENTS/OUTLINE**

The ankle is a complex anatomical structure. The corners of the ankle can be overlooked, however there is diverse pathology in the periphery. We will review tendinous pathology including peroneal and posterior tibial tendon tendinosis, tenosynovitis, tear and subluxation; ligamentous pathology including those resulting in impingement eg. posteromedial impingement syndrome (POMI) and anterolateral impingement; accessory ossicular pathology including os naviculare, os trigonum and Painful Os Peroneum Syndrome (POPS); osseous pathology including fracture malunion resulting in secondary tendinous pathology and intersection syndromes such as occurs at the Chiasma Crurale and the Master Knot of Henry. We will demonstrate the normal anatomy of the periphery of the ankle and identify anatomic predisposition to certain conditions using illustrations, radiographs and representative MRI images. We will also elucidate the typical clinical and imaging characteristics of common pathologies, thereby allowing the radiologist to develop a comprehensive checklist approach to diagnosis of a clinically challenging entity.
High-Resolution MR Imaging of the First Metatarsophalangeal Joint: Gross Anatomy, Histology, and Injury Characterization

All Day Room: NA Digital Education Exhibit

Awards
Cum Laude
Identified for Radiographics

Participants
James Hallinan, MBChB, Singapore, Singapore (Presenter) Nothing to Disclose
Sheronda Statum, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Graeme M. Bydder, MBChB, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Christine B. Chung, MD, La Jolla, CA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
jim.hallinan@gmail.com

TEACHING POINTS
The purpose of this exhibit is: 1. To review the anatomy of the first metatarsophalangeal joint in cadaveric forefeet using high-resolution 3T and 11.7T MRI with anatomic-pathologic correlation. 2. To discuss the concept of the plantar plate complex. We will explain that the plantar plate is not a single structure, but rather a complex comprised of the sesamoids, capsuloligamentous structures and musculotendinous attachments. 3. To describe a systematic approach for reporting first metatarsophalangeal joint injuries using clinical cases involving the plantar plate complex, collateral ligaments and extensor mechanism.

TABLE OF CONTENTS/OUTLINE
Overview of first metatarsophalangeal joint anatomy and function. High-resolution 3T and 11.7T MRI imaging techniques. Review of high-resolution MRI imaging findings at the first metatarsophalangeal joint in cadaveric forefeet with anatomic-pathologic correlation. Systematic approach for reporting first metatarsophalangeal joint injuries. Clinical cases of first metatarsophalangeal joint injuries involving the extensor mechanism, collateral ligaments and plantar plate complex. Summary and references
Total Knee Arthroplasty Periprosthetic Fractures: What the Radiologist Needs to Know

All Day Room: NA Digital Education Exhibit

Participants
Paul H. Yi, MD, Baltimore, MD (Presenter) Nothing to Disclose
Nevil N. Ghodasara, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Karen Clark, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Craig J. Della Valle, Chicago, IL (Abstract Co-Author) Consultant, Johnson & Johnson; Editorial Advisory Board, Orthopedics Today; Stock options, Parvizi Surgical Innovations; Editorial Advisory Board, The Wyanoke Group; Royalties, The Wyanoke Group; Consultant, Smith & Nephew plc; Research support, Smith & Nephew plc; Research support, Stryker Corporation; Royalties, Wolters Kluwer nv; Royalties, Zimmer Biomet Holdings, Inc; Consultant, Zimmer Biomet Holdings, Inc; Research support, Zimmer Biomet Holdings, Inc
Laura M. Fayad, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Jan Fritz, MD, Baltimore, MD (Abstract Co-Author) Research Grant, Siemens AG; Scientific Advisor, Alexion Pharmaceuticals, Inc; Speaker, Siemens AG

For information about this presentation, contact:
pyi10@jhmi.edu

TEACHING POINTS
Periprosthetic (PP) fractures are a rare but devastating complication after total knee arthroplasty (TKA) whose treatment is guided by imaging, making accurate description an important task for radiologists. After review of this exhibit, the user will be able to apply: 1. The 3 categories of TKA PP fractures (distal femur, proximal tibia, and patellar) and risk factors. 2. The most-commonly used classification systems for each type of TKA PP fracture. 3. Radiographic, CT, and MRI findings to diagnose TKA PP fractures, including features most pertinent to guiding treatment and surgical planning. 4. Assign options and indications for nonsurgical vs. surgical treatment to imaging findings. 5. Imaging findings to diagnose postoperative complications after surgery for TKA PP feature.

TABLE OF CONTENTS/OUTLINE
• Epidemiology and risk factors for TKA PP fractures. • Lewis & Rorabeck Classification System and imaging features of distal femur PP fractures. • Felix and Associates’ Classification System and imaging features of proximal tibial PP fractures. • Goldberg Classification System and imaging features of patellar PP fractures. • Clinical and Surgical management options and indications. • Sample cases illustrating PP fractures from diagnosis to treatment to postoperative complications.
Pain in the Butt: Imaging Coccygeal Trauma and Coccydynia

Anatomy Coccyx anatomy Distal sacral anatomy Sacroccocygeal joint anatomy Ligamentous attachments Muscular/tendinous attachments Variant and pathoanatomy Coccydynia Causes Imaging features Treatment options Fracture and Dislocation Mechanisms Imaging features Treatment options Other pathologies that may cause coccydynia Neoplasm Infection Depositional diseases Conclusion

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/ George R. Matcuk Jr, MD - 2018 Honored Educator Dakshesh B. Patel, MD - 2018 Honored Educator
Pubalgia and Pubic Dysfunction: Anatomy, Multidisciplinary Approach, and Therapeutic Management

All Day Room: NA Digital Education Exhibit

Awards

Certificate of Merit

Participants
Esther Montes, Santander, Spain (Presenter) Nothing to Disclose
Moises Fernandez Hernando, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Luis Cerezal, MD, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Faustino Abascal Abascal, Santander, Spain (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
esmonpe13@hotmail.com

TEACHING POINTS

The purpose of this exhibit is: 1. To understand the anatomy, biomechanics and physiopathology of the pubis. 2. To know the imaging techniques for the study of the pubis and its indications. 3. To update the resonance protocol used for an optimal evaluation of the pubis. 4. To review the most common pathology of the pubis.

TABLE OF CONTENTS/OUTLINE

Postmortem Imaging of the Cervical Spine Injuries

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Yohsuke Makino, MD, Tokyo, Japan (Presenter) Nothing to Disclose
Hajime Yokota, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Hiroki Mukai, Chiba, Japan (Abstract Co-Author) Nothing to Disclose
Shinya Hattori, Chiba, Japan (Abstract Co-Author) Nothing to Disclose
Takuro Horikoshi, MD, Chiba, Japan (Abstract Co-Author) Nothing to Disclose
Hajime Yokota, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Yohsuke Makino, MD, Tokyo, Japan (Presenter) Nothing to Disclose
Hiroki Mukai, Chiba, Japan (Abstract Co-Author) Nothing to Disclose
Shinya Hattori, Chiba, Japan (Abstract Co-Author) Nothing to Disclose
Takuro Horikoshi, MD, Chiba, Japan (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
ymakino-aky@umin.ac.jp

TEACHING POINTS

The purpose of this exhibit is: 1. To review the utility of postmortem imaging of the cervical spine injuries for both autopsy support and death investigations. 2. To gain an awareness of the limitation of postmortem CT (PMCT) to detect cervical spine injuries. 3. To learn the feasibility of the CT with posterior-flexion position and postmortem MRI to overcome the shortcomings of PMCT.

TABLE OF CONTENTS/OUTLINE

Introduction: Why cervical spine injuries (CSIs) are important for forensic medicine? Objectives and warning
Utility of postmortem CT (PMCT) for detecting CSIs in autopsy room
Utility of PMCT for CSIs in death investigation
Pitfalls of PMCT for CSIs in death investigation
PMCT with posterior-flexion position
Postmortem MRI utility for detecting CSIs
Post-Operative Imaging of Soft Tissue Sarcomas

All Day Room: NA Digital Education Exhibit

Participants
Aniket N. Tavare, MA, MBBCh, London, United Kingdom (Presenter) Nothing to Disclose
Philip Robinson, MBChB, Leeds, United Kingdom (Abstract Co-Author) Director, The LivingCare Group

For information about this presentation, contact:
aniket.tavare@gmail.com

TEACHING POINTS
Recognise the normal post surgical appearances after resection of soft tissue sarcoma including the sequelae of adjuvant/neoadjuvant radiotherapy on ultrasound and MRI
Recognise the appearance of early and late post surgical complication on ultrasound and MRI
Recognise the appearances of recurrent disease on ultrasound and MRI and how to distinguish from other post-operative complications
Learn the utility of ultrasound as a tool in the post-operative setting for detection of complications and for guiding interventions such as biopsy of suspicious areas

TABLE OF CONTENTS/OUTLINE
Principles of soft tissue sarcoma (STS) surgery
US and MRI appearances of normal post operative findings after STS surgery including adjuvant/neoadjuvant radiotherapy
US and MRI appearances of post operative complications such as haematoma and seroma and how to distinguish these from recurrence
US and MRI appearances of recurrence after STS resection
Principles of US guided intervention after STS surgery especially biopsy of areas concerning for recurrence
MK204-ED-X

A "Pseudo" Review of Musculoskeletal Radiology

All Day Room: NA Digital Education Exhibit

Participants
Karthik M. Sundaram, MD, PhD, Nashville, TN (Presenter) Nothing to Disclose
Cara C. Connolly, MD, Nashville, TN (Abstract Co-Author) Nothing to Disclose
Shelby Payne, Nashville, TN (Abstract Co-Author) Nothing to Disclose
Martin I. Jordanov, MD, Nashville, TN (Abstract Co-Author) Nothing to Disclose
Yu Luo, MD, PhD, Nashville, TN (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
k.sundaram@vanderbilt.edu

TEACHING POINTS
In medicine, the prefix "pseudo" is used to indicate an entity that superficially appears like a specific entity but represents something else. Since "pseudo" can connote coincidence, imitation, or deception, "pseudo" musculoskeletal radiological entities as described by radiologists can often be confusing to referring providers and patients. We review entities with "pseudo" as a prefix and further subdivide them into clinical, pathological, and/or radiological entities. We then compare & contrast "pseudo" radiological entities (including diseases & descriptors) with their non-pseudo correlates, provide imaging pearls, & review relevant literature. Our exhibit will serve as a reference for radiologists and providers in regard to this often-confusing terminology.

TABLE OF CONTENTS/OUTLINE
A. Review of medical nomenclature & use of "pseudo" as a prefix. B. Classification of "pseudo" entities, as the term pertains to clinical, pathological, & imaging characteristics (slide 2). Example of cases to be reviewed include pseudogout, pseudoarthrosis, pseudocapsule, and pseudo-acetabulum. C. Compare & contrast a radiological "pseudo" entity with the corresponding "non-pseudo" correlates. Imaging pearls & pitfalls and pathology will be included when pertinent. D. Review of the pertinent literature, discussion, & clinical implications will be included.
Utility of Virtual Non-Calcium Dual Energy CT for Detecting Hip Fractures

All Day Room: NA Digital Education Exhibit

Participants
Francis Baffour, MD, Rochester, MN (Presenter) Nothing to Disclose
Joel G. Fletcher, MD, Rochester, MN (Abstract Co-Author) Grant, Siemens AG; Consultant, Medtronic plc
Cynthia H. McCollough, PhD, Rochester, MN (Abstract Co-Author) Research Grant, Siemens AG
Shuai Leng, PhD, Rochester, MN (Abstract Co-Author) License agreement, Bayer AG
Katrina N. Glazebrook, MBChB, Rochester, MN (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
baffour.francis@mayo.edu

TEACHING POINTS
To understand the concept of virtual non-calcium (VNCa) dual energy CT (DECT) Review several cases involving DECT Discuss the benefits and limitations of VNCa

TABLE OF CONTENTS/OUTLINE
Background: MRI is the gold standard for detecting osseous pathology related to bone marrow edema; however, it is time intensive and not available at all times. Radiographs, while ubiquitous, are often inconclusive in the setting of nondisplaced fractures. CT, although readily available in the ED setting, is limited by osteopenia.
Dual Energy CT: Acquires attenuation data using two different x-ray spectra. Allows for decomposition to different materials. Same radiation dose as single energy CT.
VNCa: Removes calcium signal from cancellous bone to visualize the marrow space. Edema in the marrow space can be identified, an indicator of pathology. Can demonstrate occult fractures, avascular necrosis and metastatic disease. Cases Benefits and Limitations of VNCa: Edema can be helpful in differentiating acute and chronic processes. Edema parallels that seen on T2 weighted MRI sequences. Compared to MRI, VNCa has a sensitivity of 90% and PPV of 86% in detecting hip fractures. VNCa technique is limited by large body habitus and the presence of metal hardware.
**Awards**
Cum Laude

**Participants**
David Gedeon, MD, Orange, CA (Presenter) Nothing to Disclose
Karen Cheng, MD, Orange, CA (Abstract Co-Author) Nothing to Disclose
Adam A. Rudd, MD, Garden Grove, CA (Abstract Co-Author) Nothing to Disclose
Mitchell Daun, MD, Orange, CA (Abstract Co-Author) Nothing to Disclose
Farzad Rezai, MD, Long Beach, CA (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**
The primary goals of this exhibit are: 1) to present a case-based review of fixation hardware for the common types of bony hip injuries, and 2) to provide images illustrating common hip hardware complications.

**TABLE OF CONTENTS/OUTLINE**
A. Brief review of normal hip anatomy  
B. Case-based review of common bony hip injuries and fixation hardware  
   a. Femoral head fractures  
      i. Open reduction internal fixation with lag screws  
      ii. Greater trochanteric osteotomy for visualization  
   b. Femoral neck fractures 
      i. Closed reduction percutaneous pinning  
      ii. Hemiarthroplasty  
      iii. Total hip arthroplasty  
      iv. Sliding (Dynamic) hip screw  
   c. Intertrochanteric femur fractures 
      i. Sliding (Dynamic) hip screw  
      ii. Cephalomedullary nail (long)  
      iii. Helical blade fixation  
      iv. Intertan nail  
      v. Cephalomedullary nail (short)  
   d. Subtrochanteric femur fractures 
      i. Intramedullary nailing  
C. Complications of hip hardware  
   a. Screw cut out  
      i. Convex versus concave surfaces and determining cut out  
   b. Z-effect  
   c. Avascular necrosis  
   d. Rotational malalignment  
D. Post-quiz
The Nuts and Bolts of Orthopaedic Screws and Plates

All Day Room: NA Digital Education Exhibit

Participants
Karen Cheng, MD, Orange, CA (Presenter) Nothing to Disclose
Adam A. Rudd, MD, Garden Grove, CA (Abstract Co-Author) Nothing to Disclose
Mitchell Daun, MD, Orange, CA (Abstract Co-Author) Nothing to Disclose
David Gedeon, MD, Orange, CA (Abstract Co-Author) Nothing to Disclose
Farzad Rezai, MD, Long Beach, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The primary goals of this exhibit are: 1. to review basic principles of fracture fixation and their implications for the musculoskeletal radiologist, and 2. to present a case-based review of types of plates and screws used in fracture fixation and how to distinguish them on plain films.

TABLE OF CONTENTS/OUTLINE
A. Review of the types of bone healing and their radiographic appearance a. Primary bone healing b. Secondary bone healing
TEACHING POINTS

1. Effective arthrography at the foot and ankle requires an understanding of the three-dimensional surface orientation of joints and capsule capacities. 2. When performing arthrography for pain management or confirming the site of pain generation, normal and variant communications between articulations must be considered. 3. Ultrasound-guided interventions at the foot and ankle may be performed utilizing in-plane or out-of-plane approaches. 4. When injecting the foot, a dorsal or lateral approach is preferable due to increased patient discomfort when a needle traverses the plantar surface.

TABLE OF CONTENTS/OUTLINE

Benign and Malignant Lesions in the Maxillofacial Region and Mandible

All Day Room: NA Digital Education Exhibit

Participants
Carrie K. Gomez, DO, Rochester, NY (Presenter) Nothing to Disclose

For information about this presentation, contact:
ckgomez1@gmail.com

TEACHING POINTS
- A wide spectrum of benign and malignant tumors can be seen in the maxillofacial region. They may arise from osteogenic, chondrogenic, fibrogenic, vascular, hematopoietic and other elements of bone. - Mandibular lesions develop from both odontogenic and nonodontogenic origins and have varying degrees of destructive potential. They can be cystic or solid, benign or malignant. - Osteoma is the most common tumor of the maxillofacial region. - Osteosarcoma usually involves the mandible and alveolar ridge or the antral area of the maxilla. - Ameloblastoma is a locally aggressive benign tumor that most commonly occur in the posterior mandible but can arise from the maxilla.

TABLE OF CONTENTS/OUTLINE
- Illustrate benign maxillofacial tumors including osteoma, fibrous dysplasia, Paget disease, chondromyxoid fibroma, aneurysmal bone cyst, among others. - Depict malignant maxillofacial neoplasms such as osteosarcoma, plasmacytoma and metastasis. - Portray benign odontogenic cystic lesions such as radicular cysts, follicular cysts and odontogenic keratocysts. - Present benign odontogenic solid tumors such as ameloblastoma, odontoma, cementoblastoma, odontogenic myxoma as well as nonodontogenic solid benign lesions such as cemento-ossifying fibroma. - Display malignant tumors of the mandible including ameloblastic carcinoma and metastasis.
MK210-ED-X

Pelvic Ring Sports Injuries: A Review of Anatomy, Mechanisms of Injury, and Injury Patterns

All Day Room: NA Digital Education Exhibit

Awards
Cum Laude

Participants
Matthew D. Li, MD, Boston, MA (Presenter) Nothing to Disclose
William E. Palmer, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Connie Y. Chang, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
mdli@mgh.harvard.edu

TEACHING POINTS

The pelvis is at the center of trunk rotation, which plays a critical role in both torso stabilization and transmission of power from the lower to the upper extremities in a wide variety of sports like baseball, hockey, and golf. Athletes frequently experience injuries at the intersections between the rigid pelvic bones and the mobile, and often twisting muscles that insert into it. MRI of the pelvis is growing in popularity for the evaluation of patients who present with such injuries. After completion of this educational exhibit, the participant should be able to: (1) recognize the musculotendinous anatomy of the pelvic ring, (2) describe the various mechanisms of injury that correlate with diverse pelvic ring sports injuries, and (3) identify characteristic injury patterns on pelvis MRI, and approach pelvis MRI with a systematic and rational approach.

TABLE OF CONTENTS/OUTLINE

1. Review of Pelvic Ring Musculotendinous Anatomy
2. Case-based Review of Common Pelvic Ring Sports Injuries (each with a review of characteristic mechanisms of injury and their correlating MR imaging patterns): (A) Athletic pubalgia (pre-pubic aponeurosis complex) (B) Core muscles (obliques, paraspinal muscles) (C) Thigh muscles and fascia (rectus femoris, sartorius, iliotibial band)
3. Systematic Approach to Pelvis MRI for Evaluating Pelvic Ring Sports Injuries
**Imaging the "Footprints of Microbes" - Atypical Infections of Spine**

All Day Room: NA Digital Education Exhibit

**Participants**
Sadineni Raghu Teja, MBBS, MD, Coimbatore, India (Presenter) Nothing to Disclose
Pushpa Bhari Thippeswamy, MD, MBBS, Coimbatore, India (Abstract Co-Author) Nothing to Disclose
Kavya Mikkineni, MD, Coimbatore, India (Abstract Co-Author) Nothing to Disclose
Anupama N. V., MBBS, FRCR, Coimbatore, India (Abstract Co-Author) Nothing to Disclose
Muhil Kannan, MD, Coimbatore, India (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
sadineniraghu@gmail.com

**TEACHING POINTS**
To describe the role of imaging in spinal infections. To discuss the imaging findings that help to distinguish typical from atypical features. To provide salient points of imaging footprints that the microbes provide to help in narrowing the differentials and point to a specific micro-organism.

**TABLE OF CONTENTS/OUTLINE**
Classical pyogenic spondylodiscitis involves two contiguous vertebrae with subchondral bone, disc and associated abscess. Spine is prone to infection by many other organisms which have varied presentations and differing imaging patterns. Various imaging findings in spinal infections are quite specific and give clue to the causative micro-organisms. This review highlights the multimodality imaging findings in microbiologically & histopathologically proven cases of atypical spinal infections and displays the imaging points which favor the specific micro-organism. Atypical infections of spine which would be discussed include Emphysematous osteomyelitis, Fungal spondylitis, Polymicrobial spondylodiscitis, Brucellar spondylitis, Spinal hydatid disease, Atypical tubercular lesions. Summary: This pictorial review presents the various imaging findings giving clue to the specific micro-organisms causing spinal infections.
The Journey to Diagnosis of Mutilating Benign Culprit: Tumor Induced Osteomalacia

All Day Room: NA Digital Education Exhibit

FDA Discussions may include off-label uses.

Participants
Meenakshi H. Thakur, MD, Mumbai, India (Presenter) Nothing to Disclose
Abhishek Mahajan, MBBS,MD, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Peter P. Pittappilli Jr, MBBS, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Nilesh Sable, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Tanvi Vaidya, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Vatsal Kania, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Ankur Chand, MD, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Anurag Gupta, MD, Alwar, India (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
drabhishek.mahajan@yahoo.in

TEACHING POINTS
To illustrate the clinico-radio-pathological findings in tumor induced osteomalacia Present a systematic review of all the cases of TIO from the literature. To provide a diagnostic work-flow for a suspected TIO

TABLE OF CONTENTS/OUTLINE
Paraneoplastic syndrome with non-specific presenting features often poses a diagnostic dilemma to the radiologist especially when the primary neoplasm is not detected on the routine imaging. Tumour induced osteomalacia (TIO) or oncogenic osteomalacia is one such rare culprit which is often undiagnosed on clinical, biochemical and routine imaging. Due to lack of awareness and relative rarity, this condition often remains undiagnosed for a long period of time causing aggravation of symptoms. The main biochemical manifestations include low serum phosphorus and Vitamin D levels, increased serum ALP levels, and elevated serum FGF-23 levels (normal < 150). The diagnosis is based on the tumor marker levels i.e. FGF-23 levels and localization of the source of FGF-23 using gallium DOTATATE PET imaging. These exhibit will feature the journey to diagnosis of TIO in patients without any previous diagnosis of malignancy.
Indications of Second Look Musculoskeletal Ultrasound Following Magnetic Resonance Imaging

All Day Room: NA Digital Education Exhibit

Participants
Mohamed Jarraya, MD, Darby, PA (Presenter) Nothing to Disclose
Jeffrey D. Poot, DO, Hamburg, PA (Abstract Co-Author) Nothing to Disclose
Amir R. Honarmand, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Cristina I. Olivas Chacon, MD, Darby, PA (Abstract Co-Author) Nothing to Disclose
Lulu He, DO, Cleveland, OH (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
mohamedjarraya@gmail.com

TEACHING POINTS

The purpose of this exhibit is to: 1- Review relevant indications of second look musculoskeletal ultrasound after initial MRI. 2- Illustrate examples of dynamic ultrasound images that further characterizes findings on MRI. 3- Demonstrate musculoskeletal ultrasound and MRI correlations emphasizing the complementary role of of both modalities.

TABLE OF CONTENTS/OUTLINE

1- Advantages and disadvantages of MRI and musculoskeletal ultrasound. 2- Indications of Second Look Musculoskeletal Ultrasound * Peripheral Neuropathies * Impingement syndromes * Transient abnormalities seen on dynamic evaluation * Potential treatments amenable to musculoskeletal ultrasound guidance * Small mass lesions (Morton's neuroma) * Foreign bodies. * Partial tendon tears. * Calcific tendinitis. 3- Summary
Percutaneous Treatment of Post-Operative CSF Leak at the Orthopedic Hospital: A Tutorial and Pictorial Review of Our 10-Year Experience

All Day Room: NA Digital Education Exhibit

Participants
Manisha S. Raythatha, MD, Boston, MA (Presenter) Nothing to Disclose
Lucien Rizzo, MS, Boston, MA (Abstract Co-Author) Nothing to Disclose
Owen D. Maddox, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Mihran A. Artinian, MD, Belmont, MA (Abstract Co-Author) Nothing to Disclose
Damon J. Spitz, MD, Waban, MA (Abstract Co-Author) Nothing to Disclose
Tal Rencus, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
manisha.raythatha@gmail.com

TEACHING POINTS
1. Epidural blood patch can be used as an effective treatment modality for CSF leak after lumbar spine surgery.[1] 2. MRI is the preferred modality by which to identify the site of CSF leakage. 3. Treatment should be considered only in patients who exhibit orthostatic (aka 'spinal') headache. 4. First line percutaneous therapy is conventional Epidural Blood Patch (EBP) performed one level above the duratomy utilizing 15-20mL of autologous blood. 5. Patients should lay prone for a minimum of one hour after the procedure. 6. Resolution of headache indicates successful procedure. Post procedure imaging is not required.

TABLE OF CONTENTS/OUTLINE
A: Anatomic Review B: The Incidental Durotomy: Clinical Presentation and Imaging Findings C: Screening for the Appropriate Patient D: Procedural Techniques E: Post-Procedure Clinical Follow-up
**MK215-ED-X**

**The Fault of Being Laid Back? Intraspinal Fat Containing Lesions**

All Day Room: NA Digital Education Exhibit

**Participants**
- Wai-Kan K. Tsang, FRCR, MBChB, Hong Kong, Hong Kong *(Presenter)* Nothing to Disclose
- Kwok-chung Lai, MBChB, FRCR, Hong Kong, Hong Kong *(Abstract Co-Author)* Nothing to Disclose
- Man Kwong Chan, Kowloon, Hong Kong *(Abstract Co-Author)* Nothing to Disclose
- Kwok Wing Tang, MBBS, Hong Kong, Hong Kong *(Abstract Co-Author)* Nothing to Disclose

For information about this presentation, contact: tsang_k@yahoo.com.hk

**TEACHING POINTS**

1. Illustrate the imaging features of various types of intraspinal fat containing lesions and conditions
2. Discuss the importance, associations and complications of these lesions and conditions
3. List mimics and differentiators of these lesions and conditions

**TABLE OF CONTENTS/OUTLINE**

1. Osseous - Hemangioma - Lipoma
2. Extradural - Epidural lipomatosis - Others
3. Intradural - Dermoid - Lipoma of the filum terminale - Intradural lipoma - Lipoblastoma - Dermoid - Others
4. Intramedullary - Intramedullary lipoma - Dermoid - Others
5. Mimics
Musculoskeletal Lipomatous Lesions: The Good, Bad, and Ugly

All Day Room: NA Digital Education Exhibit

Participants
Wai-Kan K. Tsang, FRCR, MBChB, Hong Kong, Hong Kong (Presenter) Nothing to Disclose
Kwok-chung Lai, MBChB, FRCR, Hong Kong, Hong Kong (Abstract Co-Author) Nothing to Disclose
Man Kwong Chan, Kowloon, Hong Kong (Abstract Co-Author) Nothing to Disclose
Kwok Wing Tang, MBBS, Hong Kong, Hong Kong (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
tsang_k@yahoo.com.hk

TEACHING POINTS
1. To illustrate the imaging features of various lipomatous tumors
2. To correlate the histopathology with radiological appearance of some of the lipomatous tumors
3. To discuss the epidemiology, clinical course and imaging characteristics
Quantitative Dynamic Contrast-Enhanced Ultrasound and Magnetic Resonance Imaging for the Evaluation of Synovitis and Treatment Response in Inflammatory Arthritis

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
George R. Matcuk JR, MD, Los Angeles, CA (Presenter) Nothing to Disclose
Jordan S. Gross, MD, Nashville, TN (Abstract Co-Author) Nothing to Disclose
Purva R. Chhobar, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Beatrice Kenol, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Mario Franco, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Bhushan Desai, MBBS, MS, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Stratos Christianakis, MD, Los Angeles, CA (Abstract Co-Author) Spouse, Employee, Allergan, Inc

For information about this presentation, contact:
matcuk@usc.edu

TEACHING POINTS

With disease-modifying antirheumatic drugs (DMARDs), the goal is to identify and treat inflammatory arthritis before the onset of radiographic findings. Contrast-enhanced magnetic resonance imaging (CEMR) can demonstrate synovitis and early bone erosions and marrow edema. Ultrasound can also evaluate synovitis, with color and power Doppler techniques demonstrating hyperemia associated with synovial inflammation. Contrast-enhanced ultrasound (CEUS) with lipid microspheres is even more sensitive for the evaluation of synovitis. Both dynamic CEMR and CEUS provide perfusion information that allows for quantitative assessment of time-intensity curves and calculation of other kinetic parameters. This information may potentially be used to assess treatment response to DMARD therapy and help the rheumatologist better tailor the patient's medication regimen.

TABLE OF CONTENTS/OUTLINE

Brief review of clinical scoring systems and imaging evaluation of inflammatory arthritis Dynamic CEUS and CEMR principles and techniques will be discussed Illustrative imaging examples of a variety of different inflammatory arthritides and target joints Description of quantitative assessment of perfusion time-intensity curves and kinetic parameters from dynamic CEUS and CEMR and their use for evaluation of treatment response

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/ George R. Matcuk Jr, MD - 2018 Honored Educator
Compressed Sensing Magnetic Resonance Imaging (CS-MRI) for Accelerated Knee MR Imaging

All Day Room: NA Digital Education Exhibit

Participants
George R. Matcuk JR, MD, Los Angeles, CA (Presenter) Nothing to Disclose
Hung P. Do, PhD, Irvine, CA (Abstract Co-Author) Employee, Canon Medical Systems Corporation
Jordan S. Gross, MD, Nashville, TN (Abstract Co-Author) Nothing to Disclose
Brandon K. Fields, BA, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Mario Franco, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Bhushan Desai, MBBS, MS, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
matcuk@usc.edu

TEACHING POINTS
Compressed sensing (CS) is a mathematical framework that allows rapid reconstruction of data from highly undersampled measurements. This technique has been applied to MRI to accelerate acquisition times or to allow for thinner slice thickness or higher resolution examinations in the same imaging time. CS-MRI has three fundamental requirements: 1) transform sparsity (which takes advantage of the compressibility of images and their wavelet transform); 2) incoherent (pseudo-random) undersampling of k-space (which results in noise-like artifact that can be denoised to obtain the original image); and 3) non-linear iterative reconstruction (which enforces data consistency and promotes sparsity via denoising). CS-MRI can be used to create an accelerate knee MR imaging protocol without significant decrease in image quality compared to the standard examination.

TABLE OF CONTENTS/OUTLINE
Review of MR Physics of traditional spin echo and fast spin echo sequences
Discussion of compressed sensing MRI techniques
Provide imaging examples of knee CS-MRI and acquisition time savings
Highlight potential applications of CS-MRI for advanced MRI techniques
References

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/ George R. Matcuk Jr, MD - 2018 Honored Educator
MK219-ED-X

Hard yet Not Too Hard to Understand- Musculoskeletal Fibromatoses

All Day Room: NA Digital Education Exhibit

Participants
Wai-Kan K. Tsang, FRCR, MBChB, Hong Kong, Hong Kong (Presenter) Nothing to Disclose
Kwok-chung Lai, MBChB, FRCR, Hong Kong, Hong Kong (Abstract Co-Author) Nothing to Disclose
Man Kwong Chan, Kowloon, Hong Kong (Abstract Co-Author) Nothing to Disclose
Kwok Wing Tang, MBBS, Hong Kong, Hong Kong (Abstract Co-Author) Nothing to Disclose
Koel Ko, Hong Kong, Hong Kong (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
tsang_k@yahoo.com.hk

TEACHING POINTS
1. Illustrate the imaging features of different type of musculoskeletal fibromatoses
2. Describe the patient's demographics, clinical presentations, association and treatment options of different type of musculoskeletal fibromatoses
3. Pathological correlation of some of the musculoskeletal fibromatoses

TABLE OF CONTENTS/OUTLINE
Superficial fibromatoses - Palmar fibromatosis - Plantar fibromatoses
Deep fibromatoses - Desmoid type fibromatosis - Abdominal wall fibromatosis
Childhood fibromatoses - Fibromatosis coli - Lipofibromatosis
Calcifying aponeurotic fibroma - Inclusion body fibromatosis - Myofibroma and myofibromatosis
Musculoskeletal Lymphoma - Uncommon Primary Presentation of a Common Disease

All Day Room: NA Digital Education Exhibit

Participants
Wai-Kan K. Tsang, FRCR, MBChB, Hong Kong, Hong Kong (Presenter) Nothing to Disclose
Kwok-chung Lai, MBChB, FRCR, Hong Kong, Hong Kong (Abstract Co-Author) Nothing to Disclose
Man Kwong Chan, Kowloon, Hong Kong (Abstract Co-Author) Nothing to Disclose
Kwok Wing Tang, MBBS, Hong Kong, Hong Kong (Abstract Co-Author) Nothing to Disclose
Lena Xu, Hong Kong, Hong Kong (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
tsang_k@yahoo.com.hk

TEACHING POINTS
1. Explain the criteria of primary musculoskeletal lymphoma
2. Illustrate the patient’s demographics, clinical and imaging features of musculoskeletal lymphoma as the initial presentation of lymphoma, especially those that are characteristic
3. Illustrate imaging features of post treatment change of musculoskeletal lymphoma

TABLE OF CONTENTS/OUTLINE
1. Bone lymphoma - Lytic, sclerotic, mixed lytic and sclerotic - Large soft tissue component
2. Soft tissue lymphoma - Deep - Intramuscular - Intermuscular - Transcompartmental - Superficial - Subcutaneous - Skin
3. A combination of the above
4. Post treatment appearance
MRI of Peripheral Nerve Injuries: Radiologic-Anatomic Correlation and Role of Imaging in Detection and Characterization of Injury Grade

All Day Room: NA Digital Education Exhibit

Participants
Blake C. Jones, MD, Baltimore, MD (Presenter) Nothing to Disclose
Shivani Ahlawat, MD, Baltimore, MD (Abstract Co-Author) Research Consultant, Pfizer Inc
Laura M. Fayad, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
bjones72@jhmi.edu

TEACHING POINTS
1) Peripheral Nerve Injuries may be serious; early diagnosis is important to initiate proper treatment. 2) Imaging is an increasingly integral part of clinical care and treatment algorithm. 3) Radiologists should be aware of the classification of peripheral nerve injury, and its effect on surgical options.

TABLE OF CONTENTS/OUTLINE
Normal nerve anatomy: Histologic and MRI Correlation - Nerve anatomy- MRI appearance of peripheral nerves - Classification of nerve injury- Seddon's rules- Sunderland classification - MRI of peripheral nerve injury - Features of Primary Nerve Abnormalities - Secondary Abnormalities (Muscle Denervation) - Acute/subacute/chronic appearance- Correlation of MRI features with severity grade- Treatment algorithm- Role of Imaging in Diagnosis- Conclusions
**Sticks and Stones May Break My Bones**

All Day Room: NA Digital Education Exhibit

**Participants**

Carlos Casian Ruiz Velasco, MD, Distrito Federal, Mexico (*Presenter*) Nothing to Disclose  
Oralia C. Rico Rodriguez, MD, PhD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose  
Lourdes M. Avila, MD, Mexico, Mexico (*Abstract Co-Author*) Nothing to Disclose  
Ericka M. Leon, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose  
Maria Augusta Serrano Cueva, MD, Distrito Federal, Mexico (*Abstract Co-Author*) Nothing to Disclose  
Ricardo Martinez Martinez, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose  
Jose Antonio Cienfuegos, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

[carlos_casian@hotmail.com](mailto:carlos_casian@hotmail.com)

**TEACHING POINTS**

Metabolic bone disease can be challenging to distinguish based solely on physical examination and clinical history, its is therefore of the utmost importance to properly identify and describe classic signs and bone structure. The purpose of this exhibit is to present cases that will illustrate in a comprehensive manner, common appearances of metabolic bone diseases.

**TABLE OF CONTENTS/OUTLINE**

Cases are presented in a quiz format, with four differential diagnosis. Key imaging findings with a brief disussion of the most common causes and pathogenesis for each metabolic bone disease will be presented in the discussion of each case. The list includes cases of Osteoporosis, Acromegaly, Rickets, Renal Osteodystrophy, Hyperoxaluria, Osteopetrosis, Hypophosphatasia, Paget’s Disease, Osteitis Fibrosa Cystica.
Pearls and Pitfalls for Soft Tissue and Bone Biopsies from Quaternary Orthopedic Oncology Referral Centers: A Cross-Institutional Review

All Day Room: NA Digital Education Exhibit

Awards
Cum Laude
Identified for RadioGraphics

Participants
Ryan D. Meek, MD, Portland, OR (Presenter) Nothing to Disclose
Brooke R. Beckett, MD, Portland, OR (Abstract Co-Author) Nothing to Disclose
Megan K. Mills, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Christopher J. Hanrahan, MD, PhD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Bryan M. Wolf, MD, Aurora, CO (Abstract Co-Author) Nothing to Disclose
Sandra Schmahmann, MD, Portland, OR (Abstract Co-Author) Nothing to Disclose
Barry G. Hansford, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
meekr@ohsu.edu

TEACHING POINTS
After viewing this exhibit, the learner will be able to: 1. Understand biopsies must be planned in concert with the referring orthopedic oncologist 2. List pre-biopsy site specific anatomic considerations and approaches 3. Identify critical "do not touch" lesions that may have deleterious consequences if sampled 4. Accurately identify and target the most high yield/aggressive component of a lesion 5. Describe methods to optimize biopsy yield and how to properly handle tissue samples 6. Triage non-diagnostic biopsies and repeat biopsy when warranted

TABLE OF CONTENTS/OUTLINE
Introduction/background - Importance of closely working with referring orthopedic oncologists - Review of "do not touch" lesions and biopsy implications - Pre-biopsy site-specific anatomic considerations (structures to avoid for reconstruction, primary tumor versus metastases, planning safest route) - Targeting appropriate portion of a lesion (maximize histologic grade and subsequent therapy) - Brief review of pre-biopsy anticoagulant protocols, INR cut-offs and moderate sedation - Factors which maximize diagnostic yield (Number and length of cores, needle gauge, etc.) - Handling of specimens including histology and microbiology ordering - Non-diagnostic biopsies and their influence upon management - Identification and targeting of recurrent tumor Summary
Hip Impingement: Multimodality Imaging Review of Femoroacetabular and Atypical Hip Impingement Syndromes

Participants
Marit Asadoorian, MD, Glendale, CA (Presenter) Nothing to Disclose
George R. Matcuk JR, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Matthew R. Skalski, DO, San Jose, CA (Abstract Co-Author) Nothing to Disclose
Eric A. White, MD, Santa Monica, CA (Abstract Co-Author) Nothing to Disclose
Dakshesh B. Patel, MD, Porter Ranch, CA (Abstract Co-Author) Nothing to Disclose
Anderanik Tomasian, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Jordan S. Gross, MD, Nashville, TN (Abstract Co-Author) Nothing to Disclose
Alexander Weber, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
masadoor2012@gmail.com

TEACHING POINTS
Hip impingement is postulated to be a cause of early osteoarthritis in young and active patients. Imaging can be very helpful to evaluate the underlying abnormal bony morphology, as well as diagnose resultant complications, such as labral tearing or chondral injury. The most well-known type of hip impingement is femoroacetabular impingement. However, other types of extra-articular hip impingement such as iliopectineal impingement, ischiofemoral impingement, and subspinous impingement can also be causes of hip pain, and the management of these entities is different. The aim of this exhibit is to review these various entities, their imaging characteristics, diagnosis, complications, and management.

TABLE OF CONTENTS/OUTLINE
Discuss femoroacetabular impingement imaging signs and measurements associated with cam- and pincer-types with arthroscopic correlation Review extra-articular hip impingement syndromes including anterior (subspine, iliopectineal), posterior (ischiofemoral, deep gluteal), and lateral (coxa saltans externa, trochanteric-pelvic) with imaging examples Highlight clinical characteristics, presentation diagnosis, and complications Provide an overview of management and treatment options and imaging features

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/ Dakshesh B. Patel, MD - 2018 Honored Educator George R. Matcuk Jr, MD - 2018 Honored Educator
MK225-ED-X

MR-Guided MR Arthrography of the Shoulder, Hip, Knee, Wrist, and Elbow: How We Do It

All Day Room: NA Digital Education Exhibit

Participants
Ethan Dyer, McDonough, GA (Presenter) Nothing to Disclose
Moustafa Abou Areda, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Bao Chau Ly, BS, MS, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Janice A. Wang, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Iman Khodarahmi, MD, PhD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Jan Fritz, MD, Baltimore, MD (Abstract Co-Author) Research Grant, Siemens AG; Scientific Advisor, Siemens AG; Scientific Advisor, Alexion Pharmaceuticals, Inc; Speaker, Siemens AG

For information about this presentation, contact:
jfritz9@jhmi.edu

TEACHING POINTS

At the conclusion of this educational exhibit, participants will be able to: • Compare the advantages and disadvantages of MR-guided MR arthrography as a one-stage, single-session technique with other techniques. • Implement MRI protocols for effective image guidance, identify a variety of workflow considerations, apply pulse sequence optimization, and utilize different MRI systems to perform MR-guided arthrograms. • Identify and troubleshoot the potential complications and pitfalls of MR-guided MR arthrography.

TABLE OF CONTENTS/OUTLINE

• Overview of and Indications for Various MR Arthrography Techniques • Advantages and Disadvantages of MR-Guided MR Arthrography • MRI System and Equipment Considerations • Fast Interventional MRI pulse sequence for puncture and monitoring of injections • MR-Guided MR Arthrography Workflow and Joint-Specific Considerations o Shoulder o Hip o Elbow o Wrist o Knee • Practical Tips, Pearls, and Pitfalls • Complications and Management • Cost-Benefit Considerations • Future Directions, Including Augmented/Virtual/Mixed Reality Navigation
Awards
Certificate of Merit

Participants
Luisa L. Faria, MD, Juiz de Fora, Brazil (Presenter) Nothing to Disclose
Felipe Lorenzo D. Marsolla, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Gabriela A. Bandeira, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Thais L. Matuki, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Deborah Y. Otto, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Dalton L. Ferreira, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
luisaleitao@icloud.com

TEACHING POINTS
Although certain skeletal dysplasias are individually rare, they are, together, not uncommon entities. The proper diagnosis depends on clinical and family history, physical examination, molecular and biochemical tests and a complete radiologic evaluation. The Nosology and Classification of Genetic Skeletal Disorders' is a classification system of dysplasias and, on its 9th edition, the disorders remain grouped either by genetics, or by phenotypic feature, or by radiological findings. This classification, although complete and important for the nomenclature standardization, may seem less intuitive during image evaluation, since it includes clinical and molecular aspects. The purpose of this exhibit is: (1) To review the skeletal embryology; (2) To discuss the main suspicious radiological findings for skeletal dysplasias; (3) To systematize the diagnostic reasoning narrowing the differential diagnoses and making the evaluation of these entities more intuitive.

TABLE OF CONTENTS/OUTLINE
A brief review of skeletal embryology; Epidemiology and a brief review of 'The Nosology and Classification of Genetic Skeletal Disorders' (2015) and the last changes; Radiological skeletal survey; Suspicious radiological findings for skeletal dysplasias; Systematization of the diagnostic reasoning of skeletal dysplasias.
Paget’s Disease: A Primer for Residents

All Day Room: NA Digital Education Exhibit

Participants
Andrew Ong, MD, Baltimore, MD (Presenter) Nothing to Disclose
Laura M. Fayad, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
aong8@jhmi.edu

TEACHING POINTS
Paget’s disease of the bone is a condition involving dysregulated, excessive bone remodeling with unclear etiology. It is the second most common bone disease after osteoporosis and has a plethora of imaging findings with variable appearances related to the pathologic stage of the disease. Localized pain is the most common complaint when symptomatic; however, many patients are asymptomatic at the time of diagnosis. As such, the diagnosis of Paget’s disease can be difficult and is primarily done radiologically. Classic imaging findings include coarsened trabeculae, cortical thickening, and bony enlargement. However, given the variable imaging features at different disease phases, it can be easy to mistake Paget’s disease for other entities. Also, occasionally, Paget’s disease presents with atypical appearances that can be confused with malignancy. This exhibit will discuss the role of different imaging modalities to diagnose and differentiate the varying appearances of Paget’s disease from other entities.

TABLE OF CONTENTS/OUTLINE
1) Introduction a) Paget’s Disease of the Bone b) Epidemiology and distribution c) Clinical presentation 2) Classic Imaging Findings a) Radiographs b) CT c) MRI d) Nuclear Medicine 3) Complications 4) Case examples a) Atypical Appearances b) Differential Diagnosis 5) Take home points
Use of Ultrasound in the Definition of Lesional Mapping of Peripheral Nerves in Severe Lesions of the Upper Limb

All Day Room: NA Digital Education Exhibit

Participants
Rafael Barousse, MD, Buenos Aires, Argentina (Presenter) Nothing to Disclose
Franklin A. Balboa Tarqui, Capital Federal, Argentina (Abstract Co-Author) Nothing to Disclose
Guzman I. Lopardo Villarino, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
Ana C. Loveglio, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
Gilda Di Massi, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
Ignacio Rossi, MD, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
drbarousse@gmail.com

TEACHING POINTS
Understand the usefulness of ultrasound in the detection of peripheral nerve lesions
Understand the simplicity and versatility of the method in the examination of complex nervous pathology of the upper limb.
Learning to recognize peripheral nerve injuries are acute, chronic, fibrous or scarring.
Learn to identify and define the important points that must be provided to the surgeon to obtain an optimal surgical behavior.

TABLE OF CONTENTS/OUTLINE
Diagnostic methods
Clinical examination
Electromyogram
Ultrasound
Ultrasound
Makes an injury mapping of peripheral nerves
Locates and identifies the nerve using internal anatomical and cutaneous repairs
Identify neuromas and their size
Identify the distal end of injured nerve (zone of Wallerian degeneration)
Accurately measure the gap
Evaluates viability of the nerve adjacent to the lesion
Evaluates fibrotic processes and perineural scarring
Information provided to plan surgery
Neuroma resection
Neurolysis
Neurorrhaphy with or without graft
Neurotization
Rotational Malalignment of the Lower Limb: An Update for the Radiologist

All Day Room: NA Digital Education Exhibit

Participants
Cristina Vilanova, Girona, Spain (Abstract Co-Author) Nothing to Disclose
Alberto Solano Lopez, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Ivan C. Garcia, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Anna Agusti Claramunt, MD, PhD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Jesus Ares Vidal, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Joan C. Vilanova, MD, PhD, Girona, Spain (Presenter) Nothing to Disclose

For information about this presentation, contact:
kvilanova@comg.cat

TEACHING POINTS
• To understand the clinical problem of rotational malalignment • To review how to perform and obtain the measurements for the different radiological techniques and to establish the most accepted one/s • To learn the advantages and disadvantages of each technique

TABLE OF CONTENTS/OUTLINE
a) Introduction - Definition of femoral anteversion angle b) Clinical determination and significance of femoral neck anteversion c) The contribution of different femur segments to the overall femoral torsion d) Definition of femoral neck and knee axes in radiological femoral anteversion measurements e) Imaging techniques measurements of femoral neck anteversion. - Plain radiography, biplane radiography, CT (multiple methods described, showing the 6 most common used) and MRI f) Clinical relevance of the femoral anteversion and its impact on radiology related to the different causes from spine, hip and knee pathology
Osteoid Osteoma - Typical and Atypical Presentations

All Day Room: NA Digital Education Exhibit

Discussions may include off-label uses.

Participants
Daniel P. Rodrigues, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Rodrigo Rodrigues da Cunha SR, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Alexandre Grimberg, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcelo d. Petrilli, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Andre Y. Aihara, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Artur D. Da Rocha Correa Fernandes, MD,PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Fabiano N. Cardoso, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose

For information about this presentation, contact:
danielpadilha@gmail.com

TEACHING POINTS
Identify the main clinical and imaging features of a typical osteoid osteoma. Recognize uncommon sites of presentation. Provide differential diagnosis and recognize imaging pitfalls

TABLE OF CONTENTS/OUTLINE
Review the typical clinical presentation and imaging aspects of an osteoid osteoma. Review atypical locations, unusual presentations, differential diagnosis and imaging pitfalls.

All Day Room: NA Digital Education Exhibit

Awards
Identified for RadioGraphics

Participants
Michael D. Weintraub, MD, Salt Lake City, UT (Presenter) Nothing to Disclose
Barry G. Hansford, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Sarah E. Stawill, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Christopher J. Hanrahan, MD, PhD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Richard L. Leake, MD, North Salt Lake, UT (Abstract Co-Author) Nothing to Disclose
Megan K. Mills, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
After reviewing this exhibit, the learner will be able to: 1. Understand relevant hand and wrist osseous and soft tissue anatomy 2. Appreciate injury specific mechanism and associated underlying pathology 3. Discuss appropriate imaging algorithms based on clinical suspicion/question 4. Recite fracture specific imaging 'pearls' and associated injuries 5. Recognize mimics of hand and wrist injuries on multimodality imaging

TABLE OF CONTENTS/OUTLINE
Introduction/background - Appropriate imaging algorithmic work-up for hand and wrist injuries Case-based review of common and rare avulsion injuries and tendon ruptures of the hand and wrist including: - Scapholunate ligament, ulnar collateral ligament (non-displaced and Stener), radial styloid process, extensor carpi radialis brevis, extensor carpi ulnaris, base thumb metacarpal (simple and comminuted), dorsal triquetrum, non-displaced distal radial fracture/delayed extensor pollicis longus rupture, severe DRUJ arthrosis/extensor digit minimi rupture, etc. Case Highlights: - Relevant anatomy - Injury mechanisms - Key imaging findings - Treatment Mimics Including: Deposition- Calcium pyrophosphate, hydroxyapatite and gout Tumors- Fibroma, PVNS tendon sheath, etc Sequela of remote trauma- BPOP, turret exostosis, etc Summary
Retinaculum of the Foot and Ankle What Every Radiologist Should Know About Normal and Pathological Conditions

Participants
Rodrigo Rodrigues da Cunha SR, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Daniel P. Rodrigues, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Andre Y. Aihara, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Artur D. Da Rocha Correa Fernandes, MD,PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Lais U. Aivazoglou, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Fabiano N. Cardoso, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose

For information about this presentation, contact:
rodrigo.rcunha@hotmail.com

TEACHING POINTS
After reading this presentation, the reader will be able to: • Describe and identify on MR images the peculiar anatomy of the retinaculum - flexor, extensor and peroneal retinaculum and the structures surrounded by them • List the most common retinaculum and related tendon injuries at ankle and foot. • Evaluate the spectrum of imaging findings of acute and chronic traumatic conditions affecting the retinaculum • Recognize the importance of imaging in clinical management decisions
I Is for Infection: A Primer on Commonly Encountered MSK Infections and Their Mimics for the Non-MSK Radiologist

All Day Room: NA Digital Education Exhibit

Participants
Michael Nellamattathil, DO, Washington, DC (Presenter) Nothing to Disclose
Arash R. Zandieh, MD, Washington, DC (Abstract Co-Author) Nothing to Disclose
Ian Amber, MD, Washington, DC (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
michael.nellamattathil@gunet.georgetown.edu

TEACHING POINTS
1. Recognize the difference between normal synovial enhancement and septic arthritis on both MRI and CT. 2. Understand the mechanism for osteomyelitis in the diabetic foot along with the similarities, differences, and overlap with Charcot arthropathy. 3. Identify the most common location and appearance of pediatric septic arthritis and osteomyelitis. 4. Recognize the overlap in appearance with pediatric osteomyelitis, Ewings sarcoma, and eosinophilic granulomatosis to construct patient centered differential diagnoses.

TABLE OF CONTENTS/OUTLINE
1. Present normal synovial morphology and contrast this with the appearance of septic arthritis on both CT and MRI along with pertinent osseous and soft tissue findings. 2. Review the pathophysiology of diabetic skin changes which lead to wound formation and osteomyelitis. Demonstrate the characteristic appearance and classification of Charcot type arthropathy. Use a case based approach to illustrate the differences and enhance the recognition of each entity. 3. Present the epidemiology of pediatric septic arthritis and osteomyelitis, along with classical findings on radiographs and cross sectional imaging for each entity. 4. Review the similarities of pediatric osteomyelitis with Ewings sarcoma and eosinophilic granulomatosis, with verbiage recommendations in the setting of a patient health care portal.
Calcaneal Trauma: What the Orthopedist Wants to Know

All Day Room: NA Digital Education Exhibit

Participants
Josephina A. Vossen, MD, PhD, Richmond, VA (Presenter) Nothing to Disclose
William C. Goodman, DO, Richmond, VA (Abstract Co-Author) Nothing to Disclose
Peter J. Haar, MD, PhD, Richmond, VA (Abstract Co-Author) Nothing to Disclose
Kevin B. Hoover, MD, PhD, Richmond, VA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
josephina.vossen@vcuhealth.org

TEACHING POINTS

This exhibit will review calcaneal anatomy, improve detection of traumatic calcaneal injuries, instruct on how to utilize mechanism of injury to predict the type of calcaneal fracture, and educate regarding treatment of calcaneal fractures. Improved detection of traumatic calcaneal injuries can prevent delays in treatment that could result in long-term disability.

TABLE OF CONTENTS/OUTLINE

- Review of the anatomy and biomechanics of the osseous, myotendinous and ligamentous structures associated with the calcaneus.
- Describe and illustrate the major patterns of injury including intra- and extraarticular fractures. The Sanders classification system for intraarticular fractures will be demonstrated. A multimodality review will include radiographs, multiplanar reformatted CT, CT angiography and MRI.
- Discuss an approach to reporting calcaneal trauma findings and emphasize pitfalls when reviewing these cases.
- Describe treatment options and their imaging appearance.
Awards
Certificate of Merit

Participants
Gitanjali Bajaj, MD, Little Rock, AR (Presenter) Nothing to Disclose
Michelle K. Whisman, MD, Little Rock, AR (Abstract Co-Author) Nothing to Disclose
Akshaya V. Jagadale, MD, Little Rock, AR (Abstract Co-Author) Nothing to Disclose
Roopa Ram, MD, Little Rock, AR (Abstract Co-Author) Nothing to Disclose
Kedar Jambhekar, MD, Little Rock, AR (Abstract Co-Author) Nothing to Disclose
Jerad M. Gardner, MD, Little Rock, AR (Abstract Co-Author) Nothing to Disclose
Tarun Pandey, MD, FRCR, Little Rock, AR (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
gbajaj@uams.edu

TEACHING POINTS
1. Majority of soft tissue sarcomas lack specific diagnostic imaging features and often a biopsy is mandatory for a definitive diagnosis. 2. Conventional pathology may show overlapping cellular architecture leading to confusion regarding exact diagnosis and differentiation of the tumor. 3. New immunostains and genetic markers help in refining the differential diagnosis and in many cases provide a specific diagnosis that helps in patient management. 4. However, the jargon on immunostains and genetic markers is often confusing for the radiologists. 5. This exhibit will serve as a unified education resource on soft tissue tumors for radiologists and pathologists using the framework of the WHO classification

TABLE OF CONTENTS/OUTLINE
Post-Operative MRI Findings of Superior Capsular Reconstruction

All Day Room: NA Digital Education Exhibit

Awards
Identified for RadioGraphics

Participants
Jose Perez, Miami, FL (Abstract Co-Author) Nothing to Disclose
Harry G. Greditzer IV, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Carlos Barrera, Miami, FL (Presenter) Nothing to Disclose
Ane Ugarte Nuno, MD, San Sebastian, Spain (Abstract Co-Author) Nothing to Disclose
Kush Shah, MD, Miami, FL (Abstract Co-Author) Nothing to Disclose
Julianne Munoz, MD, Miami, FL (Abstract Co-Author) Nothing to Disclose
Michael Baraga, Miami, FL (Abstract Co-Author) Nothing to Disclose
Jean Jose, MS, DO, Miami Beach, FL (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
c.barrera@med.miami.edu

TEACHING POINTS
- To describe superior capsular reconstruction technique for irreparable rotator cuff tears, including the indications and contraindications. - To review normal MRI imaging findings in SCR. - To present the spectrum of radiologic findings suggestive of graft failure, including infraspinatus tear, mid-substance graft tear, glenoid failure, and greater tuberosity failures.

TABLE OF CONTENTS/OUTLINE
SCR is an anatomic reconstruction technique of the superior capsule meant to restore the superior stability of the glenohumeral joint reducing superior translation of the humeral head which occurs with a deficient rotator cuff. Therefore, SCR provides surgeons an alternative treatment option for irreparable rotator cuff tears, especially in younger patients in which a reserve total shoulder arthroplasty wants to be avoided or delayed. The purpose of our presentation is to familiarize radiologist and orthopedic surgeons with the normal post-operative appearance of SCRs on MRI, and subsequently the appearance of SCR graft failures on MRI. Studying cases of failure can help elucidate optimization of surgical technique as well as the patients who are at high risk of SCR failure. Post-Operative Presentations of SCR: • Normal Intact Graft • Glenoid Failures • Infraspinatus Failures • Greater tuberosity Failures • Mid-Substance Graft Ruptures
Midfoot Pain: An 'Overarching' Case-Based MR Imaging Review

All Day Room: NA Digital Education Exhibit

Participants
Richard L. Leake, MD, North Salt Lake, UT (Presenter) Nothing to Disclose
Samuel Braden, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Megan K. Mills, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Hailey Allen, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Patrick Kobes, DO, Manhasset, NY (Abstract Co-Author) Nothing to Disclose
Christopher J. Hanrahan, MD, PhD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
richard.leake@hsc.utah.edu

TEACHING POINTS

Foot pain is a common reason for primary care and emergency department visits with foot and toe injuries accounting for approximately 3.5% of emergency department visits according to the 2013 National Hospital Ambulatory Medical Care Survey. MR imaging can be a useful adjunct to radiographs in the diagnosis of midfoot pain. The purpose of this exhibit is to aid the practicing radiologist in:

- Recognizing conventional midfoot anatomy.
- Interpreting common pathology seen on midfoot MRI.

TABLE OF CONTENTS/OUTLINE

- Overview of midfoot pain epidemiology.
- MR imaging review of conventional midfoot anatomy.
- Case based imaging review organized into three broad categories: non-traumatic, traumatic/overuse, and neoplastic.
- Summary.
Imaging of Musculoskeletal Infection: From Presentation to Treatment

All Day Room: NA Digital Education Exhibit

Participants
Ryan Stephens, MD, Baltimore, MD (Presenter) Nothing to Disclose
Jan Fritz, MD, Baltimore, MD (Abstract Co-Author) Research Grant, Siemens AG; Scientific Advisor, Siemens AG; Scientific Advisor, Alexion Pharmaceuticals, Inc; Speaker, Siemens AG
Shivani Ahlawat, MD, Baltimore, MD (Abstract Co-Author) Research Consultant, Pfizer Inc
Laura M. Fayad, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Imaging of musculoskeletal infections is a complex topic with a wide range of appearances and clinical presentations. Understanding the role of multimodality imaging and the clinical management of musculoskeletal infections is critical to provide accurate characterization and prompt diagnosis. At the conclusion of this educational exhibit, participants will be able to:

- Indicate the appropriate imaging modalities for the diagnosis of musculoskeletal infection in different clinical scenarios.
- Detect imaging findings of various musculoskeletal infections for compartment-based diagnoses.
- Apply current guidelines for evidence-based recommendations on patient management.

TABLE OF CONTENTS/OUTLINE
Multimodality Imaging of Musculoskeletal Infection
Radiographs
CT
Ultrasound
MRI
Nuclear Medicine
Clinical Scenarios
Emergency Room
Role of Imaging Modalities utilized
Treatment algorithm
Outpatient with a bone lesion: Infection or tumor?
Role of Imaging Modalities utilized
Treatment algorithm
Chronic Osteomyelitis in a Diabetic
Role of Imaging Modalities utilized
Treatment algorithm
Clinical Management of Musculoskeletal Infection
MK239-ED-X

Temporomandibular Joint: An Imaging Primer

All Day Room: NA Digital Education Exhibit

Participants
Josephina A. Vossen, MD, PhD, Richmond, VA (Presenter) Nothing to Disclose
Leah Ahn, MD,MS, Richmond, VA (Abstract Co-Author) Nothing to Disclose
Peter J. Haar, MD, PhD, Richmond, VA (Abstract Co-Author) Nothing to Disclose
Kevin B. Hoover, MD, PhD, Richmond, VA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
josephina.vossen@vcuhealth.org

TEACHING POINTS

This exhibit will review temporomandibular joint anatomy and describe imaging techniques and pitfalls. Subsequently, imaging features of temporomandibular joint pathology will be discussed. Improved detection of temporomandibular joint can prevent delay in treatment that could result in long-term orofacial pain symptoms.

TABLE OF CONTENTS/OUTLINE

This exhibit will:
- Review the anatomy and biomechanics of the temporomandibular joint.
- Discuss an approach to imaging of the temporomandibular joint.
- Review strategies for reporting temporomandibular joint findings and emphasize pitfalls when reviewing these cases.
- Describe and illustrate the classification of common pathology involving the temporomandibular joint, including internal derangement, degenerative joint disease, trauma, inflammatory arthritis, tumors, infection, and osteonecrosis.
- Review current treatment options and their imaging appearance.
Tears of the rotator cuff of the shoulder are frequently described with imperfect anatomical correlation although the fibrous frame of the rotator cuff is accurately visible with MR imaging. Three main fibrous structures are involved in the superior part of the rotator cuff of the shoulder, including the articular capsule, and the tendinous bands from the supraspinatus and infraspinatus muscles. The tendinous band of the supraspinatus consists of a strong cord-like anterior reinforcement and of a weak posterior flat bundle. The tendinous band of the infraspinatus is a strong and wide strap-like structure. The tendinous band of the supraspinatus muscle is closely adherent to the capsule while the tendinous band of the infraspinatus is more superficial. The tendinous band of the infraspinatus distally overlaps the posterior part of the band of the supraspinatus.

TABLE OF CONTENTS/OUTLINE

Normal Anatomy of the superior part of the rotator cuff of the shoulder: Gross anatomy (dissections) correlation with normal images
Anatomy based interpretations of abnormal images: partial thickness tears of the rotator cuff full thickness tears of the rotator cuff cleavages between tendinous bands Discussion Conclusion with plea for anatomically based description of the lesions of the rotator cuff of the shoulder
Sclerosing Bone Dysplasias: What the Radiologist Should Know

All Day Room: NA Digital Education Exhibit

Participants
Joao Marco B. Teixeira, BDS, Tres Coracoes, Brazil (Presenter) Nothing to Disclose
Andre Y. Aihara, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Alecio F. Lombardi, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
joaomarcobt@hotmail.com

TEACHING POINTS
At the conclusion of this live activity, the participant will be able to: • Have sufficient knowledge regarding sclerosing bone dysplasias • Establish differential diagnoses according to the main radiologic findings of each entity

TABLE OF CONTENTS/OUTLINE
Sclerosing bone disorders are a diagnostic challenge. However, many of them have characteristic radiological features that allow diagnosis. Sclerosing bone disorders correspond to a large and rare group of diseases, that can be classified as hereditary and non-hereditary diseases. This panel will demonstrate the main radiological features of each type of sclerosing bone dysplasia, exemplified by case studies of our service. Significant features that may lead us to the differential diagnosis between sclerosing bone dysplasias will be demonstrated. Examples: Osteopetrosis (bone within a bone), Pyknody sostosis (Wormian bones), Vooerhoeve disease (celery stalk metaphysis), Engemann-Camurati disease (fusiform bony enlargement with sclerosis in long bone), Ribbing's disease (intramedullary sclerosis), osteopoikilosis (bone islands of osteopoikilosis clustered around joints), intramedullary osteosclerosis (just intramedullary sclerosis), Melorheostosis (flowing candle wax appearance) and overlap disease (multiple Sclerosing bone dysplasias mixed together).
Awards
Certificate of Merit

Participants
Kari R. Wilson, MD, Lexington, KY (Presenter) Nothing to Disclose
Aaron D. Fain, MD, Lexington, KY (Abstract Co-Author) Nothing to Disclose
Justin R. Montgomery, MD, Lexington, KY (Abstract Co-Author) Nothing to Disclose
Paul J. Spicer, MD, Lexington, KY (Abstract Co-Author) Nothing to Disclose
Francesca D. Beaman, MD, Lexington, KY (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
a.fain@uky.edu

TEACHING POINTS
Discuss imaging findings of pediatric musculoskeletal infections. Review important reportable key findings that affect management. Present imaging mimics of pediatric musculoskeletal infections and differential diagnoses.

TABLE OF CONTENTS/OUTLINE
Unique pathophysiology of pediatric musculoskeletal infections
Review of imaging findings of pediatric musculoskeletal infections
Radiographs Ultrasound Conventional MRI Sample cases and mimics Clinical importance and summary
TEACHING POINTS

A wide variety of buttock masses can occur, ranging from non-neoplastic, benign or malignant entities. Malignant entities in the buttock region include sarcomas, lymphoma, and metastases.

TABLE OF CONTENTS/OUTLINE

**Tale of the Sacred Bone: The Sacrum**

**All Day Room: NA Digital Education Exhibit**

**Participants**

Muhammad Naeem, MBBS, Saint Louis, MO (Presenter) Nothing to Disclose
Travis J. Hillen, MD, Saint Louis, MO (Abstract Co-Author) Consultant, Biomedical Systems; Consultant, Medtronic plc
Jeremiah R. Long, MD, Ft Belvoir, VA (Abstract Co-Author) Nothing to Disclose
Jennifer L. Demertzis, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Michael V. Friedman, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Jonathan C. Baker, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Jack W. Jennings, MD, Saint Louis, MO (Abstract Co-Author) Speakers Bureau, Merit Medical Systems, Inc Consultant, Merit Medical Systems, Inc

For information about this presentation, contact:
mnaeem@wustl.edu

**TEACHING POINTS**

1. To review the anatomy of the sacrum and its anatomical relation to adjacent structures 2. To review the imaging findings related to congenital anomalies, transitional anatomy, systemic disease, infections, inflammation, benign and malignant tumors affecting sacrum.

**TABLE OF CONTENTS/OUTLINE**

Achilles Tendinopathy: From Biomechanics to the Imaging

All Day Room: NA Digital Education Exhibit

**Participants**
Tomas A. Pascual, MMEd, Vicente Lopez, Argentina (Presenter) Nothing to Disclose
Leandro A. Mazza, MD, Capital Federal, Argentina (Abstract Co-Author) Nothing to Disclose
Damian A. Couto, MD, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
Agustin M. Marrero Sr, MD, Capital Federal, Argentina (Abstract Co-Author) Nothing to Disclose
Alejandro U. Rolon, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
Martin L. Palmas, MD, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
Tatiana Piedra Velasco, MD, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
Federico Magdaleno, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
tomatepascu@hotmail.com

**TEACHING POINTS**
To analyze the functional and biomechanical anatomy of the Achilles tendon and its expression in diagnostic images. Classify and define Achilles tendinopathy and to describe its imaging findings. To review the different stages of Achilles tendinopathy, integrating the image into the pathological process and clinical stage, in order to provide important information for an adequate treatment.

**TABLE OF CONTENTS/OUTLINE**
Achilles tendinopathy covers a wide spectrum of conditions (tendinosis, paratendinosis, enthesitis, bursitis, etc.) that can involve different segments of the tendon, caused by different biomechanical disorders that alter its visco-elastic properties and therefore the ability to respond to requirements. While in the non-insertional tendinopathies the main factor would imply a tensile overload, in the insertion tendinopathy, compression mechanisms take over, weakening the 'stress shielded fibers', and making them vulnerable. The US and MRI have a critical role in the diagnosis and staging of this pathology, having different tools that allow the structural and functional analysis of the tendon. Its adequate use, together with the knowledge of the biopathological mechanisms allows the choice of an adequate treatment and its evolutionary control.
MK246-ED-X

MRI of Postoperative Osteochondral Knee Injuries - Pictorial Essay

All Day Room: NA Digital Education Exhibit

Participants
Stephano R. Rocha, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Renata F. Batista Pereira, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Raul O. Martins, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Renata V. Leao, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Paulo Victor P. Heilto, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcelo Bordalo-Rodrigues, MD,PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Ceci Gbara Kurimori, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Denise T. Amaral, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Giovanni G. Cerri, MD,PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcos Felipe P. Correa, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
raydanrocha@gmail.com

TEACHING POINTS
To illustrate the normal postoperative appearance of the joints after cartilage repair that varies according to the surgical technique used and the stage of healing. To identify potential complications of the repair tissue at various postoperative intervals.

TABLE OF CONTENTS/OUTLINE
The procedures that have been developed for the repair of such lesions include microfracture, autologous osteochondral transplantation, allograft transplantation, autologous chondrocyte implantation and osteochondral fragment fixation. An imaging assessment of the repair tissue is necessary to evaluate the postoperative outcome, and we aim to discuss the main imaging aspects that radiologists need to know. The normal postoperative appearance of the joints after cartilage repair varies according to the surgical technique used and the stage of healing. To identify potential complications, it is important to be familiar with the various repair procedures and the characteristic MRI features of the repair tissue at various postoperative intervals. Imaging of repair cartilage is needed to determine the extent of defect filling, the degree of peripheral integration with the host tissue, signal intensity of the repair tissue and the integrity of the host cartilage. A pictorial essay showing cases with different surgical techniques, their normal patterns and their main complications.
Avascular Bone Necrosis Through the Whole Body

All Day Room: NA Digital Education Exhibit

Participants
Dair Enge JR, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Eduardo Kaiser Uruahy Nunes Fonseca, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Debora Tomazoni, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Jessyca Otoni, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Renata S. De Paula, MD, Sao Jose dos Campos, Brazil (Abstract Co-Author) Nothing to Disclose
Adham A. Castro, MD, Paranagua, Brazil (Abstract Co-Author) Nothing to Disclose
Andre Dubinco, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Eduardo Baptista, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Durval D. Santos, MD, Sorocaba, Brazil (Abstract Co-Author) Nothing to Disclose
Laercio A. Rosemberg, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
edukaiser_unf@hotmail.com

TEACHING POINTS
The purpose of this exhibit is: 1. To review pathophysiology and natural history avascular bone necrosis 2. To correlate their natural history with imaging findings in both radiographies and MRI 3. To discuss epidemiology and risk factors of the most important avascular bone necrosis through the whole body, correlating their findings in both radiographies and MRI

TABLE OF CONTENTS/OUTLINE
1- Pathophysiology and general risk factors of avascular bone necrosis 2- Radiographic findings 3- MRI findings 4- Legg-Calve-Perthes 5- Kienbock 6- Kummel 7- Freiberg 8- Kohler 9- Sesamoid bone of the hand 10- Accessory fibular bone 11- SONK 12- Humeral head 13- Talus 14- Iselin 15- Preiser
Finger MRI Tips: A Tutorial Case-Based Presentation for Residents

All Day Room: NA Digital Education Exhibit

Participants
Adham A. Castro, MD, Paranagua, Brazil (Abstract Co-Author) Nothing to Disclose
Luiz Guilherme Hartmann, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Eduardo Kaiser Uruahy Nunes Fonseca, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Leandro Guarento, San Paolo, Brazil (Abstract Co-Author) Nothing to Disclose
Eduardo Baptista, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Durval D. Santos, MD, Sorocaba, Brazil (Abstract Co-Author) Nothing to Disclose
Laercio A. Rosemberg, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
edukaiser.unf@gmail.com

TEACHING POINTS
Injuries to the fingers are very common in sports and work activities and may lead to severe disabling complications. Finger MRI plays an essential role in these lesions adequate characterization and proper management. In this context, familiarity with the challenging anatomy of the fingers becomes of paramount importance. Upon completing this exhibit, the learner will be able to: 1- Evaluate and recognize the normal MRI anatomy of tendons and ligaments of hand and fingers. 2- Understand and recognize the MRI findings of the main hand and fingers injuries.

TABLE OF CONTENTS/OUTLINE
A Physician, A Radiologist, A Surgeon, and the Tibial Plateau: Patterns of Injury and Surgical Management

All Day Room: NA Digital Education Exhibit

Participants
Shravan Sridhar, MD, MS, Albuquerque, NM (Presenter) Nothing to Disclose
Jennifer S. Weaver, MD, Albuquerque, NM (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
shsridhar@salud.unm.edu

TEACHING POINTS
Tibial plateau fractures are commonly encountered by radiologists at various practice settings. It is important to be able to identify the mechanism of injury, predict and seek associated trauma, and understand the appropriate management of these injuries. After reviewing this exhibit, the learner should be able to:

- Develop a method to assess tibial plateau fractures and extrapolate mechanism of injury.
- Develop a search pattern based on injury mechanism and regional anatomy.
- Understand principles of management based on the recently updated 2018 Arbeitsgemeinschaft für Osteosynthesefragen Foundation /Orthopedic Trauma Association (AO/OTA) classification of tibial plateau fractures.

TABLE OF CONTENTS/OUTLINE
Sacroiliac Joint Imaging Beyond Sacroiliitis: New Insights on Old Findings

All Day Room: NA Digital Education Exhibit

Awards
Cum Laude

Participants
Bruno C. Carneiro, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Alípio Ormond Filho, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Andre H. Rassi, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Caio Werner S. Santos, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Julio B. Guimarães, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Flavio D. Silva, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcelo A. Nico, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
bruno.carneiro@grupofleury.com.br

TEACHING POINTS
1. The sacroiliac joint is an amphiarthrosis composed of a posterior syndesmosis and an anterior flat diarthrosis. 2. The joint has limited mobility, a function of reducing torsional stress in the pelvis, transmission of load from the axial skeleton to the lower limbs and vice versa, being susceptible to early mechanical and degenerative changes. 3. The weight bearing area in the middle / upper third of the anterior segment of the synovial portion is susceptible to mechanical / degenerative changes. 4. Two small foci of subchondral edema in the sacroiliac joints without other associated findings, especially in the weight bearing area, are more often mechanical than inflammatory, even in young patients, and may lead to misdiagnosis of sacroiliitis, resulting in unnecessary side effects related to treatment and burdening the health system.

TABLE OF CONTENTS/OUTLINE
The Reformatted Sagittal Spine on Abdominal CT: Can a Single Image Make the Diagnosis?

Participants
Hannah S. Recht, MD, Baltimore, MD (Presenter) Nothing to Disclose
Elliot K. Fishman, MD, Baltimore, MD (Abstract Co-Author) Institutional Grant support, Siemens AG; Institutional Grant support, General Electric Company; Co-founder, HipGraphics, Inc

TEACHING POINTS
1. To establish the importance and accuracy of lumbar spine evaluation on abdominal CT
2. To propose a pattern based approach to evaluate a variety of non traumatic spinal pathology on CT
3. To present a number of cases in an interactive quiz format with a wide range of lumbar spine pathology highlighting the CT imaging appearance and show how characteristic imaging findings can help determine the underlying disease process

TABLE OF CONTENTS/OUTLINE
1. Accuracy of abdominal CT to evaluate the lumbar spine
2. Importance of utilizing the reformatted sagittal spine in diagnosis
3. Pattern based approach to assess for various spinal pathology
   a. Morphology/congenital abnormalities
   b. Bone density
   c. Number of lesions
   d. Contiguity or discontinuity of lesions
   e. Aggressive vs. benign appearing lesions
4. The following cases will be presented in an interactive quiz format with discussion of key CT imaging findings and differential diagnosis
   a. Renal osteodystrophy
   b. Discitis/osteomyelitis
   c. Sickle cell disease
   d. Ankylosing spondylitis
   e. Metastatic osteosarcoma
   f. Myelodysplastic syndrome
   g. Metastatic neuroendocrine cancer
   h. Plasmacytoma
   i. Multiple myeloma
   j. Metastatic urothelial cancer
   k. Paget’s Disease
   l. Marfan syndrome
   m. McCune Albright
   n. Tuberculosis
   o. Morquio syndrome
   p. Beta thalassemia
   q. Lymphoma
   r. Achondroplasia

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/
Elliot K. Fishman, MD - 2012 Honored Educator
Elliot K. Fishman, MD - 2014 Honored Educator
Elliot K. Fishman, MD - 2016 Honored Educator
Elliot K. Fishman, MD - 2018 Honored Educator
MK252-ED-X

Acuity and Etiology of Vertebral Compression Fractures on Plain Radiography

All Day Room: NA Digital Education Exhibit

Participants
Meghan Jardon, MD, Los Angeles, CA (Presenter) Nothing to Disclose
Kambiz Motamedi, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
mjardon@mednet.ucla.edu

TEACHING POINTS
1. Understand the importance of establishing the diagnosis of compression fracture.
2. Thoracic and lumbar plain radiography (XR) technique and interpretation for evaluating for compression fractures.
3. Learn to diagnose compression fractures as acute or chronic based on XR findings (using case examples), and understand the impact this has on management.
4. Learn the role of cross-sectional imaging modalities (Computed Tomography - CT, Magnetic Resonance Imaging - MRI) in diagnosis of compression fractures.
5. Learn to differentiate pathologic fractures related to metastatic disease vs. osteoporosis.

TABLE OF CONTENTS/OUTLINE
1. Imaging modalities to assess for vertebral fractures (XR--Technique for thoracic and lumbar spine, CT and MRI)
2. Diagnosis (Establishing a diagnosis on XR, Differential Diagnosis)
3. Classification of acuity based on XR findings (Signs: intravertebral vacuum cleft sign, cortical disruption, impaction of trabeculae, etc.)
4. Review of existing classifications systems for severity of compression fractures and impact on management/outcome
5. Distinguishing pathologic fractures from osteoporotic fractures
6. Management of acute vs. chronic compression fractures
7. Case Examples (XR examples with compression fractures + MRI correlations)
8. Test your knowledge - case-based assessment of knowledge
Teaching Points

The purpose of this exhibit is: 1) To gain an awareness of the imaging findings on conventional cervical spine MRI sequences for suspicion of brachial plexus injury 2) To describe in detail the advanced MRI techniques available in evaluation of the brachial plexus and their role in traumatic brachial plexopathy. 3) To understand the utility of advanced MRI sequences to determine the site, degree and extent of brachial plexus injury.

Table of Contents/Outline

- Radiological anatomy of brachial plexus and normal appearance on the various sequences
- Mechanism of brachial plexus injury
- Neurological classification of brachial plexus injury with MRI features: Pre and post ganglionic injury
- Conventional MRI sequences: signs to suspect brachial plexus injury
- Utility of advanced MRI sequences in evaluation of brachial plexus injury
- DWIBS (Diffusion weighted imaging with background suppression), DTI (Diffusion tensor imaging), MR myelography, 3D STIR, VISTA (Volume ISotropic Turbo spin echo Acquisition)
- Role of imaging in guiding management protocol
The Role of MR and 18F-FDG PET/CT in the Diagnosis of Plasmacytoma: A Pictorial Imaging Review with Pathological Correlation

All Day Room: NA Digital Education Exhibit

Participants
Xiomara A. Santos Salas, MD, Madrid, Spain (Presenter) Nothing to Disclose
Galan Itxaso, MBCh, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Ramiro Pedro Campos Rivas, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Carmen Idoate, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Freih Alwalid SR, Madrid, Spain (Abstract Co-Author) Nothing to Disclose
Nieves Gomez Leon, MD, Madrid, Spain (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
xiomyalt86@hotmail.com

TEACHING POINTS
To demonstrate the role of the different radiologic techniques that are available for the study of plasmacytoma, including magnetic resonance (MR) and 18FDG-PET/CT. To illustrate the spectrum of extramedullary plasmocytomas (EMPs) abnormalities with pathological correlation. To study the advantages and disadvantages of each diagnostic technique.

TABLE OF CONTENTS/OUTLINE
Pathophysiology of plasmacytoma, including demographics. Review of common imaging findings in bone plasmocytomas and EMPs with pathological correlation, as these findings are often unspecific. We evaluated all plasmocytomas collected in our center during the last 10 years, and included only those cases in which diagnoses were confirmed by histopathological studies (n=37). Conclusions: MR and FDG-PET/CT are complementary techniques to detect plasmacytomas of the bone and EMPs. In extramedullary plasmocytomas, the pathological study is crucial to reach a final diagnosis.
Operator-Related Errors and Pitfalls in Dual Energy X-Ray Absorptiometry: How to Recognize and Avoid Them

All Day Room: NA Digital Education Exhibit

Participants
Carmelo Messina, MD, Milan, Italy (Presenter) Nothing to Disclose
Domenico Albano, Palermo, Italy (Abstract Co-Author) Nothing to Disclose
Salvatore Gitto, MD, Milan, Italy (Abstract Co-Author) Nothing to Disclose
Vito Chianca, MD, Napoli, Italy (Abstract Co-Author) Nothing to Disclose
Fabio M. Ulivieri, Milan, Italy (Abstract Co-Author) Nothing to Disclose
Luca Maria Sconfienza, MD, PhD, Milano, Italy (Abstract Co-Author) Travel support, Bracco Group; Travel support, Esaote SpA; Travel support, ABIOTEN PHARMA SpA; Speakers Bureau, Fidia Pharma Group SpA

For information about this presentation, contact:
CARMELOMESSINA.MD@GMAIL.COM

TEACHING POINTS
Osteoporosis is commonly evaluated through a quantitative assessment of bone mineral density (BMD). In clinical practice, dual-energy X-ray absorptiometry (DXA) is the technique of choice for BMD measurements, being accurate, reproducible and low-cost. Nevertheless, DXA technology relies on a two-dimensional x-ray examination, a condition that can lead to precision errors. The purpose of this educational exhibit is: To show all common operator-related errors in DXA examinations that can reduce BMD accuracy. To understand the clinical impact of such errors

TABLE OF CONTENTS/OUTLINE
A. Patient positioning errors: wrong position of the patient on the DXA table. Correct criteria: Lumbar spine: centered in the image field, straight, field of view including last ribs and ischium. Femur: diaphysis straight, proper internal. B. Post-acquisition analysis errors. Lumbar spine: pitfall in vertebral counting, inaccuracies in vertebral inclusion/exclusion when structural changes are present (osteoarthritis, vertebral fractures, etc). Femur: inaccurate placement of femoral neck region of interest (ROI), overlapping of the femoral neck ROI with bony structures. C. Miscellaneous: Demographic errors which are crucial for T- and Z-score calculation. Follow-up scan errors. Inaccuracies related to the comparison of two subsequent scan.
Posterior Shoulder Instability: Radiologic and Orthopedic Evaluation

All Day Room: NA Digital Education Exhibit

Participants
Jenika Karcich, MD, New York, NY (Presenter) Nothing to Disclose
Charley Jobin, New York, NY (Abstract Co-Author) Nothing to Disclose
Jonathan K. Kazam, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Tony T. Wong, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
jek9125@nyp.org

TEACHING POINTS
1. Understand epidemiology and role of misdiagnosis. 2. Describe radiographic, CT, and MR imaging findings. 3. Understand role of imaging in determining treatment options.

TABLE OF CONTENTS/OUTLINE
Post Treatment Imaging of Soft Tissue Sarcomas

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Alexei U. Kudla, MD, Boston, MA (Presenter) Nothing to Disclose
Jennifer Nimhuircheartaigh, MBBC, Boston, MA (Abstract Co-Author) Nothing to Disclose
Jim S. Wu, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
akudla@bidmc.harvard.edu

TEACHING POINTS

1. Knowing the appearance of post treatment conditions is essential for interpreting soft tissue sarcoma follow up imaging. 2. Tumor recurrence is best assessed on MRI and it is important to review the pre-treatment study as recurrence often appears similar to the original tumor.

TABLE OF CONTENTS/OUTLINE

Background: Soft tissue sarcomas are rare malignancies with a 5-year survival rate of 50%. Local recurrence is common and earlier identification of recurrence improves prognosis. Therefore, close clinical and imaging surveillance is extremely important. Post Treatment Conditions: Familiarity with the appearance of post treatment conditions including: 1) local recurrence, 2) fluid collections, 3) muscle/soft tissue injury, 4) bone complications, and 5) distant metastases is essential for imaging interpretation. Knowing a patient’s treatment history helps avoid mimics and pitfalls. Imaging Evaluation: Contrast enhanced MRI is the best test for tumor recurrence. Recurrent tumor often appears as a new solid enhancing soft tissue mass. Review of pretreatment and multiple prior imaging studies is critical as recurrence often appears similar to the initial tumor and can be subtle over short time periods. Dynamic contrast enhancement, diffusion weighted imaging, and PET-CT have an increasing role.
Necrotizing Fasciitis: When Can Imaging Be Definitive?

All Day Room: NA Digital Education Exhibit

Participants
Alexei U. Kudla, MD, Boston, MA (Presenter) Nothing to Disclose
Andrew H. Haims, MD, Madison, CT (Abstract Co-Author) Nothing to Disclose
Jennifer Nimhuircheartaigh, MBBCh, Boston, MA (Abstract Co-Author) Nothing to Disclose
Jim S. Wu, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
akudla@bidmc.harvard.edu

TEACHING POINTS

1. Soft tissue gas in the fascia and deep muscles is highly specific for necrotizing fasciitis but its absence does not exclude the diagnosis when clinical suspicion is high.
2. Awareness of soft tissue disorders that can mimic necrotizing fasciitis is important to prevent overcalls.

TABLE OF CONTENTS/OUTLINE

Background: Necrotizing fasciitis is a rare, rapidly progressive, soft tissue infection with high mortality that requires swift clinical diagnosis. Emergent surgery should not be delayed to obtain imaging when clinical suspicion is high, but imaging can be extremely helpful. Imaging: Soft tissue gas tracking along fascia and deep muscles is highly specific for necrotizing fasciitis in an acutely septic patient. Unilateral multi-compartment and deep intermuscular fascial involvement or thickening (>3mm) raises concern. However, absence of typical imaging features does not exclude the diagnosis in the appropriate clinical setting. MRI is optimal but CT is more frequently employed due to speed. Both modalities are useful to define extent of disease, abscesses, and potential surgical approach. Mimics: Multiple soft tissue disorders can mimic necrotizing fasciitis clinically or on imaging including cellulitis, myositis, pyomyositis, myonecrosis, noninfectious fasciitis, and venous thrombosis.
When the Cure Mimics the Disease: Surgical Findings Misinterpreted as Pathology on Musculoskeletal Radiographs

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Justin C. Black, MD, Winston-Salem, NC (Presenter) Nothing to Disclose
Bahram Kiani, MD, Winston Salem, NC (Abstract Co-Author) Nothing to Disclose
Maha Torabi, MD, Winston Salem, NC (Abstract Co-Author) Nothing to Disclose
Jason Powell, MD, Winston Salem, NC (Abstract Co-Author) Nothing to Disclose
Leon Lenchik, MD, Winston-Salem, NC (Abstract Co-Author) Nothing to Disclose
Scott D. Wuertzer, MD, MS, Winston-Salem, NC (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
swuertze@wakehealth.edu

TEACHING POINTS
1. Review surgical techniques and their associated findings in the upper extremity, lower extremity, pelvis, and spine that may mimic pathology on radiographs. 2. Review a differential diagnosis for the surgical findings. 3. Present key features to differentiate the surgical findings from different types of pathology.

TABLE OF CONTENTS/OUTLINE
MRI of Postoperative Shoulder: What Should Radiologists Recognize?

All Day Room: NA Digital Education Exhibit

Participants
Sharon Rosemberg, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Arthur M. Correa, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Ana Flavia P. Ferreira, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Afonso C. Neto, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Rodolfo F. Nunes, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcelo Bordalo-Rodrigues, MD,PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Almir A. Urbanetz, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Laercio A. Rosemberg, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Paulo Victor P. Helito, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To review postoperative techniques for rotator cuff and labrum repair and demonstrate their MR imaging findings Demonstrate a recently described procedure for the treatment of irreparable supraspinatus tendon tears: the superior capsular reconstruction

TABLE OF CONTENTS/OUTLINE
In this poster we intend to keep radiologists familiarized with surgical techniques for rotator cuff and labrum repair by using original schematic drawings of: (a) Subacromial space decompression; (b) Rotator cuff reinsertion; (c) Labrum reinsertion; (d) Bristow-Latarjet; (e) Superior capsular reconstruction. MRI findings of normal and abnormal postoperative techniques will be demonstrated by presenting didactic cases of our department
MK263-ED-X

How Can MSK Ultrasound Help the Hand Surgeon?

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Maria L. Gregorio, MD, Shreveport, LA (Presenter) Nothing to Disclose
Hunter T. Christy, MD, Shreveport, LA (Abstract Co-Author) Nothing to Disclose
John Garrett, MD, Shreveport, LA (Abstract Co-Author) Nothing to Disclose
Abhishek T. Haritha, MD, Shreveport, LA (Abstract Co-Author) Nothing to Disclose
Guillermo P. Sangster, MD, Shreveport, LA (Abstract Co-Author) Nothing to Disclose
Alberto A. Simoncini, MD, Shreveport, LA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
gsangs@lsuhsc.edu

TEACHING POINTS
1. Discuss the role of MSK Ultrasound in the clinical practice of hand surgeons. 2. Discuss the role of MSK Ultrasound in pre- and postoperative evaluations. 3. Recognize capabilities and limitations. 4. Identify sonographic characteristics of commonly seen abnormalities.

TABLE OF CONTENTS/OUTLINE
Pathophysiology, clinical manifestations, and imaging patterns of hand injuries: • Tendon and nerve lacerations • Ligamentous injuries • Articular cavity evaluation • Wrist and hand mass evaluation • Bone surface evaluation In this educational exhibit, we explored MSK ultrasound imaging of the hand and wrist as an important element of diagnostic and therapeutic practice for a hand surgeon. Hand and wrist US can evaluate pathology in a fast, economic, and dynamic way. Most clinical decisions, especially surgical procedures, are often based on ultrasound findings. US simplifies the pre-surgical evaluation through direct localization of anatomic abnormalities and real-time planning of surgical approaches. US also has great utility in post-surgical evaluations, for example when differentiating tendon re-rupture vs adhesions or nerve re-rupture vs nerve discontinuity. This educational exhibit demonstrates the power of US in the clinical evaluation of hand and wrist pathology.
Knee Injuries in Pre-Adolescent Children: MRI - Arthroscopy Correlation

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Maha Torabi, MD, Winston Salem, NC (Presenter) Nothing to Disclose
Cristen Ferguson, Winston Salem, NC (Abstract Co-Author) Nothing to Disclose
Bahram Kiani, MD, Winston Salem, NC (Abstract Co-Author) Nothing to Disclose
Leon Lenchik, MD, Winston-Salem, NC (Abstract Co-Author) Nothing to Disclose
Justin C. Black, MD, Winston-Salem, NC (Abstract Co-Author) Nothing to Disclose
Scott D. Wuertz, MD, MS, Winston-Salem, NC (Abstract Co-Author) Nothing to Disclose
Joanna M. Costello, MD, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
matorabi@wakehealth.edu

TEACHING POINTS

Although MRI is commonly used for the evaluation of pediatric knee injuries, arthroscopic procedures in patients under the age of 16 years are not common, constituting less than 5% of all arthroscopic procedures. The goals of this educational exhibit are to: - Provide case-based correlation between magnetic resonance imaging and arthroscopic findings in pediatric patients with knee injuries with emphasis on current arthroscopic interventions. These include discoid meniscal tears, osteochondritis dissecans, anterior cruciate tears, medial patellofemoral ligament tears, and synovial pathologies. - Emphasize the differences in clinical management of these injuries in pre-adolescent children compared to adults.

TABLE OF CONTENTS/OUTLINE

Introduction Anatomic considerations Common knee pathologies in pre-adolescent children with MRI and arthroscopic correlation Surgical management and pearls Pathology mimics Conclusion
Ultrasonography Imaging and Guided Interventions in Upper Extremity Entrapment Neuropathy

All Day Room: NA Digital Education Exhibit

Participants
Nishith Kumar, MD, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Dharmendra K. Singh, MD,FRCR, New Delhi, India (Presenter) Nothing to Disclose
Bibhu K. Nayak, MD, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Saurabh Suman, MBBS, Delhi, India (Abstract Co-Author) Nothing to Disclose
Amit Katyan, MBBS, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Sagar Tomar, MD, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Nikhil Rathee, MD, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Shabnam B. Grover, MD,DMRD, New Delhi, India (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
dksinghrad@gmail.com

TEACHING POINTS
Entrapment neuropathy is defined as neural compression at anatomically defined predisposed locations with carpal tunnel syndrome being the commonest cause. Nerves are best identified on sonography by evaluation in short axis at key anatomical landmarks which is followed by tracing the nerve cranio-caudally. Cardinal imaging features of entrapment neuropathy includes imaging appearance within the nerve, etiology at the entrapment site and sequelae of denervation. Perineural injections are instilled while imaging nerves in short axis with in-plane needle insertion and trajectory visualization with success of intervention indicated by circumferential epineural injectant flow.

TABLE OF CONTENTS/OUTLINE
The Radiological Progressive Changes of Giant-Cell Tumours of the Bone in Treatment with Denosumab

All Day Room: NA Digital Education Exhibit

Participants
Santiago Bonilla Saborido, Barcelona, Spain (Presenter) Nothing to Disclose
Claudia Nunez Peralta, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Jaume Llauger Rosello, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Carme Lozano, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
santibonilla22@gmail.com

TEACHING POINTS
To describe the radiological progressive changes on Giant-cell tumor of bone (GCT) on treatment with denosumab. To describe the correlation between the radiological changes and the histopathology.

TABLE OF CONTENTS/OUTLINE
Background: GCTs are common being 4-9.5% of all primary bone neoplasms. They almost occur when the growth plate has closed and are typically seen in early adulthood. GCTs are believed to result from an over-expression in RANK/RANKL signalling pathway with over-proliferation of osteoclasts. Denosumab has been demonstrated to have a significant impact in its natural history because it’s antiosteoclastic activity. Results: We made a retrospective study with 34 patients with GCT confirmed histopathologically. We analyzed the radiological changes with plain film, CT and MRI. The radiological changes were diverse showing a matrix mineralization, sclerotic rim and reconstitution of cortical bone. On MRI showed a lower signal intensity on T2-weighted images and less enhancement after contrast admistration. We made an histopathological correlation. Conclusion: The treatment with Denosumab on GCT seems to be useful in the radiological response.
MK267-ED-X

MRI - Arthroscopy Correlation of Glenoid Labrum Lesions

All Day Room: NA Digital Education Exhibit

Participants
Brandon L. Roller, MD, PhD, Winston Salem, NC (Abstract Co-Author) Consultant, Bone Solutions, Inc
Kevin Coates, MD, Winston Salem, NC (Abstract Co-Author) Nothing to Disclose
Scott D. Wuerter, MD, MS, Winston-Salem, NC (Abstract Co-Author) Nothing to Disclose
Joanna M. Costello, MD, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
Jason Powell, MD, Winston Salem, NC (Abstract Co-Author) Nothing to Disclose
Maha Torabi, MD, Winston Salem, NC (Presenter) Nothing to Disclose

For information about this presentation, contact:
mtorabi@wakehealth.edu

TEACHING POINTS
The goals of this educational exhibit are: 1- Provide a case-based correlation between magnetic resonance imaging and arthroscopic findings in patients with glenoid labrum pathologies. 2- Emphasis surgical pearls and current management strategies.

TABLE OF CONTENTS/OUTLINE
Introduction Classification of labral tears using the Snyder, Maffet and Powell system Case example of different types of labral tears with arthroscopic correlation Surgical management and pearls Pathology mimics Conclusion
MK268-ED-X

Spinal Bone Tumors

All Day Room: NA Digital Education Exhibit

Participants
Christina Duffin, MD, Springfield, MA (Presenter) Nothing to Disclose
Shan Li, MD, Springfield, MA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Descriptions of imaging findings, pathophysiology and treatment of malignant focal and systemic disease entities will include but are not limited to osteosarcoma, chordoma, eosinophilic granuloma, histiocystosis, and metastatic disease. 2. Advantages and disadvantages of different imaging modalities and techniques with special attention given to cross-sectional CT and MR imaging. 3. Current therapeutic interventions and follow-up imaging.

TABLE OF CONTENTS/OUTLINE
1. Introduction to Spinal Bone Tumors
2. Objectives
3. Malignant Focal Diseases
   a. Osteosarcoma
      i. Epidemiology/pathophysiology
      ii. Imaging findings
   b. Chordoma
      i. Epidemiology/pathophysiology
      ii. Imaging findings
   c. Sacral Schwannoma
      i. Epidemiology/pathophysiology
      ii. Imaging findings
4. Malignant Systemic Diseases
   a. Histiocystosis
      i. Epidemiology/pathophysiology
      ii. Imaging findings
5. Metastatic Disease
   a. Epidemiology/pathophysiology
   ii. Imaging findings
6. Summary
7. References
The Expanding Role of Wrist Ultrasound in Rheumatoid Arthritis and Its Mimics

All Day Room: NA Digital Education Exhibit

Discussions may include off-label uses.

Participants
Neha Antil, MBBS,MD, New Delhi, India (Presenter) Nothing to Disclose
Shabnam B. Grover, MD,DMRD, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Dharmendra K. Singh, MD,FRCR, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Garvit D. Khatri, MBBS, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Mahesh K. Mittal, MBBS, MPH, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Hemal Grover, MBBS, New York, NY (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
drnehtil@gmail.com

TEACHING POINTS
1. Synovitis is the earliest sign of Rheumatoid Arthritis (RA) and ultrasound (US) is an unparalleled imaging modality for expeditious detection and grading of synovitis. Early diagnosis is of paramount importance as it facilitates early administration of disease modifying antirheumatoid drugs (DMARD’S) for preventing structural damage. 2. US also documents disease activity and treatment response by assessing degree of synovitis on grey scale and extent of vascularity on color Doppler. 3. US guided joint aspiration and Synovial biopsy play important role in differentiating RA from tuberculosis and other inflammatory arthritis. Beyond biopsy, it aids in guiding therapeutic injections.

TABLE OF CONTENTS/OUTLINE
1. Radiological anatomy and distribution of disease. 2. Illustration of US appearances: • Synovitis • Tenosynovitis • Bone erosions • Secondary carpal tunnel syndrome • Treatment response 3. Enumerate RA mimickers and emphasise key differentiating features. • Infection • Other inflammatory arthritis 4. Role of US guided intervention • Aspiration • Synovial biopsy • Steroid injection for symptomatic relief
When Your Shoulder Leaves the Party: Imaging Features of Shoulder Instability

All Day Room: NA Digital Education Exhibit

Participants
Ali Gholamrezanezhad, MD, Glendale, CA (Abstract Co-Author) Nothing to Disclose
Omid Khalilzadeh, MD, MPH, New York, NY (Abstract Co-Author) Nothing to Disclose
Sahra Emamzadehfard, MD, MPH, San Antonio, TX (Presenter) Nothing to Disclose
Farhad Mehrkhani, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Reza Hayeri, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Matthew R. Skalski, DO, San Jose, CA (Abstract Co-Author) Nothing to Disclose
George R. Matcuk JR, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
Sahra.e.fard@gmail.com

TEACHING POINTS
To review imaging anatomy of shoulder To summarize different types of shoulder instability, including TUBS versus AMBRI To illustrate on-track versus off-track concept (bipolar bone loss) To discuss the role of imaging in pre-op planning of shoulder instabilities

TABLE OF CONTENTS/OUTLINE
Classification of shoulder instabilities TUBS AMBRII AIOS Shoulder instability versus impingment Relevant imaging anatomy Anterior shoulder dislocations Hill-Sachs Bankart and its equivalents Engaging versus non-engaging Bipolar concept: ‘On-Track’ versus ‘Off-Track’ Coracoid transfer procedures and compensation of bone loss Important measurements and quantitative values Rotator cuff injuries in shoulder instability Posterior dislocation Inferior dislocation Multidirectional instability Microtraumatic glenohumeral instability What to include in the final report

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/ George R. Matcuk Jr, MD - 2018 Honored Educator
'SARed out...! What Now, Doc?' SAR, SED, B1+RMS, and CEM43°C - What the MSK Radiologist Needs to Know

All Day Room: NA Digital Education Exhibit

Participants
Iman Khodarahmi, MD, PhD, Baltimore, MD (Presenter) Nothing to Disclose
Rory Johnson, RT, Cary, NC (Abstract Co-Author) Employee, Siemens AG
John Kirsch, PhD, Charlestown, MA (Abstract Co-Author) Nothing to Disclose
Sunder S. Rajan, PhD, Silver Spring, MD (Abstract Co-Author) Nothing to Disclose
Jan Fritz, MD, Baltimore, MD (Abstract Co-Author) Research Grant, Siemens AG; Scientific Advisor, Siemens AG; Scientific Advisor, Alexion Pharmaceuticals, Inc; Speaker, Siemens AG

For information about this presentation, contact:
ikhodar1@jhmi.edu

TEACHING POINTS
Following completion of this presentation, the reader will be able to: Identify mechanisms of power deposition during MRI Define Specific Absorption Rate (SAR) and its estimation for individual MRI acquisitions Specify SAR limitations imposed by regulatory agencies Apply other metrics of power deposition including Specific Energy Dose (SED) and B1+ root mean square (B1+RMS) Optimize patient conditions and sequence parameters to keep SAR within allowable limits Explain the concept of CEM43°C thermal dose threshold

TABLE OF CONTENTS/OUTLINE
Power deposition during MRI Effects of radiofrequency pulses and gradient fields Definitions, limits, and practical implications: Specific Absorption Rate (SAR), Specific Energy Dose (SED), B1 effective component root-mean-square (B1+RMS) and CEM43°C thermal dose thresholds Considerations for pulse sequences and protocols typically used for musculoskeletal MRI Special consideration for patients with orthopedic implants Strategies to troubleshoot MRI protocols that reach SAR and SED limits and their effect on image quality: field strength, parallel imaging, coil selection, fan convection, patient positioning, flip angle, repetition time, RF pulses, echo-train length, rectangular versus quadratic FOV, fat suppression technique and two-part exams.
The Nuts and Bolts of Long Bone Fractures: Radiographic Review of Various Hardware Used to Repair Long Bone Fracture Based on Mechanism of Injury

All Day Room: NA Digital Education Exhibit

Participants
Chaitanya Shilagani, MD, Valhalla, NY (Presenter) Nothing to Disclose
Usama Hasan, DO, Valhalla, NY (Abstract Co-Author) Nothing to Disclose
David Sadowsky, MD, Larchmont, NY (Abstract Co-Author) Nothing to Disclose
Judah Goldschmiedt, MD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Himanshu B. Patel, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
chaitanya.shilagani@wmchealth.org

TEACHING POINTS
Describe the mechanism of injury in various long bone fracture List various fixation devices used in long bone fracture repair Review the pros and cons of using one fixation hardware over another Discuss long term complications related to various fixation techniques

TABLE OF CONTENTS/OUTLINE
Describe the mechanism of injury in femoral fracture and classification Femoral neck fracture Femoral shaft fracture Tibial shaft fracture Distal radial fracture List various types of hardware used for repair of long bone fracture Intramedullary nail: antegrade versus retrograde Total hip arthroplasty versus Dynamic hip screw versus cannulated screws Radial (volar or dorsal) plate vs percutaneous pinning Long term complication of various fixation hardware Risk of revision related to each type of fixation
Musculoskeletal Biopsy 101: From Pre-Procedural Planning to Post Procedure Care

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Harold Hunt, MD, Cleveland, OH (Presenter) Nothing to Disclose
Ali Gholamrezanezhad, MD, Glendale, CA (Abstract Co-Author) Nothing to Disclose
Jawad M. Nesheiwat, MD, Albany, NY (Abstract Co-Author) Nothing to Disclose
Reza Hayeri, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To review the current guidelines and best practice recommendations on biopsy procedures To discuss the importance of pre-procedure planning through case base studies and how it may affect patient care To illustrate step-by-step description of principals of MSK biopsy procedure from preprocedural planning to post biopsy complications To discuss pitfalls and provide useful tips for a successful biopsy result, avoid unnecessary biopsies To discuss strategies aimed to minimize the risk of biopsy related complications,

TABLE OF CONTENTS/OUTLINE
Introduction Indication and contraindication Pre biopsy planning Patient selection and consent Reviewing imaging studies and relevant labs Need for consulting the orthopedic surgeon and pathology consultation Need for additional imaging before biopsy? - Biopsy Step by step description of principals of biopsy utilizing common biopsy systems and their indications Prep and drapig Positioning the patient and choosing the optimal approach Biopsy (FNA, Core biopsy, etc) Minimize ‘unsatisfactory samples’ Optimal solution medium for the samples and special circumstances - Post-biopsy care and complication - Tips and Pitfalls
Essential Keys to Diagnosing Tarsal Coalitions

All Day Room: NA Digital Education Exhibit

Participants
Xenia Codo, BDS, Logrono, Spain (Presenter) Nothing to Disclose
Jaime Rivera, Logrono, Spain (Abstract Co-Author) Nothing to Disclose
Sara Ribagorda, Logrono, Spain (Abstract Co-Author) Nothing to Disclose
Jose Luis Abades, MD, Logrono, Spain (Abstract Co-Author) Nothing to Disclose
Leticia Salazar, Logrono, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this poster is: - To review the radiographic, CT, and MR imaging findings of tarsal coalitions. - To review the imaging appearance of the specific types of tarsal coalitions: calcaneonavicular, talocalcaneal and other less common like calcaneocuboid, talonavicular or cubonavicular coalitions.

TABLE OF CONTENTS/OUTLINE
Essential keys to diagnosing tarsal coalitions 1. Imaging findings of tarsal coalition a. Radiograph - Radiographic findings: Indirect findings Direct findings - Radiographic signs: Talar beak sign 'C' sign Drunken waiter sign Absent middle facet sign Anteater nose sign b. CT imaging - Osseous coalitions - Non-osseous coalitions c. MR imaging - Osseous coalitions - Non-osseous coalitions 2. Types of tarsal coalition a. calcaneonavicular b. talocalcaneal c. Others (calcaneocuboid, talonavicular, cubonavicular)
Non-Tumoral Musculoskeletal Pain in Oncologic Patients - It is Not All About the Tumor

All Day Room: NA Digital Education Exhibit

FDA Discussions may include off-label uses.

Participants
Raul O. Martins, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Stephano R. Rocha, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Renata F. Pereira, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Renata V. Leao, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Paulo Victor P. Helito, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcelo Bordalo-Rodrigues, MD,PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Giovanni G. Cerri, MD,PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
omenaraul@hotmail.com

TEACHING POINTS
Musculoskeletal pain in oncologic patients are separate in tumoral and non-tumoral causes. Since tumoral causes of pain are usually the clinicians main concern, radiologists should be aware of non tumoral causes to provide accurate diagnosis and avoid pitfalls. Non tumoral causes of pain may be related to treatment (surgery, chemotherapy and radiotherapy), paraneoplastic or not directly related to the disease or treatment (mechanic, vascular, inflammatory, infectious and degenerative). The objective of this study is to illustrate non tumoral causes of pain in the oncologic patient and demonstrate as the analysis beyond the tumor are important for the correct diagnosis and patient management.

TABLE OF CONTENTS/OUTLINE
Ultrasound Evaluation in Peripheral Neuropathies: A Review

All Day Room: NA Digital Education Exhibit

Participants
Luciana C. Zattar, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Davi d. Romao, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Roberto B. Taveira, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Renata B. Batista Pereira, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Stephano R. Rocha, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Renata V. Leao, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Antonio S. Marcelino, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Giovanni G. Cerri, MD,PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcos Felipe P. Correa, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Paulo Victor P. Helito, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
luzattar@gmail.com

TEACHING POINTS

The “Peripheral neuropathies” (PN) is traditionally diagnosed based on clinical history, physical examination and electrodiagnostic testings. To achieve accurate and timely diagnoses, the ultrasound (US) is among the most effective methods since it provides entire limb evaluations with spatial information regarding the nerve and the surrounding structures and allows dynamic maneuvers for confirmation and appropriate evaluation. This study aims to illustrate such conditions, as the knowledge of its characteristics and imaging findings is essential for correct diagnosis and management of patients. The purpose of this exhibit is:- Describe the normal peripheral nerve anatomy with images and videos.- To illustrate characteristic imaging findings at common sites of neural entrapment.- Identify the US features of normal peripheral nerves and each PN findings.- To show US techniques and dynamic maneuvers for correct characterization of the PN- To list and discuss the most common causes of PN

TABLE OF CONTENTS/OUTLINE

*UPPER LIMB NERVES:*- RADIAL- POSTERIOR INTEROSSEOUS (PIN)PIN Syndrome (Sd)Radial tunnel Sd- MEDIANCarpal tunnel Sd- ULNARCubital tunnel Sd**LOWER LIMB NERVES:*- LATERAL FEMORAL CUTANEOUS Meralgia paresthetica- FEMORAL- SCIATIC- COMMON PERONEALFibular tunnel Sd- POSTERIOR TIBIALTarsal tunnel Sd
Role of Imaging in Temporomandibular Joint Inflammation and Arthropathy in Children

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Reza Hayeri, MD, Cleveland, OH (Presenter) Nothing to Disclose
Ali Gholamrezanezhad, MD, Glendale, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Role of MRI in evaluation of Arthropathies with emphasis on Juvenile Rheumatoid Arthritis in children Spectrum of imaging findings with clinical correlation

TABLE OF CONTENTS/OUTLINE
Principles of MR imaging of the temporomandibular joint. Normal anatomy Multimodality approach in diagnosis of TMJ dysfunction with emphasis on MRI. Describe the role of MR imaging in the assessment of temporomandibular joint dysfunction and Arthropathy (i.e., Diagnosis, Response to treatment Followup). Spectrum of pathologies in TMJ arthropathy with emphasis on JRA imaging findings Differential diagnosis and imaging mimics
Musculoskeletal Findings in Achondroplasia: A Short Radiologist’s Pocket Guide

All Day Room: NA Digital Education Exhibit

Participants
Stephanie Y. Ogata, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Guilherme G. Miguel II, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Rachel F. Muffareg Do Amaral, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Alexandre Zuccon, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Andre Y. Aihara, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
steogata@gmail.com

TEACHING POINTS
- Classic radiographic changes in achondroplasia.
- Imaging of typical orthopedic complications in achondroplasia.

TABLE OF CONTENTS/OUTLINE

Achondroplasia is a congenital genetic disorder that results in rhizomelic dwarfism and is the most common skeletal dysplasia. Anatomic peculiarities of achondroplasia determine numerous distinctive radiographic features and frequently lead to orthopedic complications, like spinal canal stenosis, recurrent patellar dislocation, and early osteoarthritis. Our purpose is to review the classic radiographic changes and remind the imaging aspect of typical orthopedic complications associated with this disease, providing the radiologist with essential information for proper diagnosis and follow up of these patients.
Don’t Turf the Toe: What the Radiologist Needs to Know About Turf Toe and Other Painful Entities of the Hallux-Sesamoid Complex

All Day Room: NA Digital Education Exhibit

Participants
Juan Villa Camacho, MD, Boston, MA (Presenter) Nothing to Disclose
Connie Y. Chang, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Turf toe occurs when an axial force is applied to the raised heel while the hallux is planted on the ground. Forced metatarsophalangeal (MTP) joint hyperextension may disrupt the capsuloligamentous complex, commonly involving the medial collateral ligament and plantar plate. Plantar plate disruption can be associated with retraction of the sesamoids, which can be detected radiographically. Radiographs can also detect capsular avulsion fractures and fractures of the metatarsal head and sesamoids. Commonly, however, they are normal. MR imaging is a powerful tool for the assessment of MTP injuries as it can show variable patterns of signal intensity resulting from partial or complete tearing of the plantar plate. Numerous entities involving the hallux-sesamoid complex, such as sesamoiditis, sesamoid osteonecrosis and metatarsal fractures, can have significant overlap with regard to clinical presentation and physical findings. Imaging can play a pivotal role in accurately diagnosing the source of pain.

TABLE OF CONTENTS/OUTLINE
Introduction Anatomy Mechanism of injury Turf Toe Imaging Findings What the Clinician Needs to Know Differential Diagnosis Lesser toe plantar plate injuries Osteonecrosis Sesamoiditis & Sesamoid Trauma Metatarsal Fractures & Osteochondral Lesions Summary
Don’t Put Your Foot in It! - Tips and Trick for Tackling Diabetic Charcot Arthropathy on MRI

All Day Room: NA Digital Education Exhibit

Participants

Bhavna Batohi, MBBS, London, United Kingdom (Presenter) Nothing to Disclose
Lisa M. Meacock, MBBS, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Marcela De la Hoz Polo, MD, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Michael E. Edmonds, MBBS, London, United Kingdom (Abstract Co-Author) Advisory Board, Urgo Medical; Advisory Board, Edixomed; Advisory Board, Integra; Speaker, Bayer AG
Nina Petrova, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
David A. Elias, MBBS, London, United Kingdom (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
bhavnabatohi@doctors.org.uk

TEACHING POINTS

Describe the imaging features of acute and chronic stages of Charcot arthropathy. Differentiate between Charcot arthropathy and osteomyelitis on MRI. Recognise the value of other imaging modalities in work up of the warm, swollen diabetic foot.

TABLE OF CONTENTS/OUTLINE

- Anatomy of the foot with reference to the Sanders and Frykberg’s classification for Charcot arthropathy-Clinical presentation of Charcot arthropathy-Incidence of diabetic Charcot arthropathy (0.1-7.5% of patients with diabetes and may be bilateral)-Causes of Charcot arthropathy-Pathogenesis of Charcot arthropathy with reference to neurotraumatic and neurovascular theories-MRI findings in the acute and chronic stages of Charcot arthropathy-MRI features used to distinguish Charcot arthropathy from osteomyelitis in the diabetic foot including superimposed infection-Other soft tissue complications in the diabetic foot-MRI protocols and special considerations for imaging-Value of other imaging modalities in assessment of the diabetic foot and future advances
Diagnostic Imaging of the Chronic Exertional Compartment Syndrome in the Lower Extremities: Two Steps MRI Images for an Accurate Diagnosis

All Day Room: NA Digital Education Exhibit

Participants
Leandro A. Mazza, MD, Capital Federal, Argentina (Presenter) Nothing to Disclose
Agustin M. Marrero Sr, MD, Capital Federal, Argentina (Abstract Co-Author) Nothing to Disclose
Augusto Napoli, MD, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
Alejandro U. Rolo, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
Tatiana Piedra Velasco, MD, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
Tomas A. Pascual, MMEd, Vicente Lopez, Argentina (Abstract Co-Author) Nothing to Disclose
Martin L. Palmas, MD, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
Damian A. Couto, MD, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
drleandromazza@gmail.com

TEACHING POINTS
• To show magnetic resonance imaging (MRI) findings of chronic exertional compartment syndrome (CECS).
• To correlate the clinical features with the imaging findings.
• To propose a diagnostic algorithm with acquisition of MR images at rest and post effort.

TABLE OF CONTENTS/OUTLINE
• This exhibit shows the imaging findings in patients with clinical suspected CECS of the anterior leg compartment who underwent our MRI exercise protocol with prior normal conventional MRI exams.
• We will describe the possible causes of this entity and we will show the imaging findings.
• We will analyze the correlation between the radiologic findings and the clinical history.
• We suggest this imaging algorithm as a complimentary guideline to intramuscular pressure measurement in order to avoid unnecessary invasive procedures.
TEACHING POINTS

Graft versus host disease (GVHD) is a complication of allogeneic hematopoietic stem cell transplantation, and its musculoskeletal manifestations are uncommon, but represent a potential cause of functional impairment. Because of its sometimes insidious onset, the disease is often diagnosed late in its course, when disability has already begun. Since it is generally well controlled with a combination of corticosteroid and immunosuppressive drugs, an early recognition of these complications allows an appropriate treatment and avoidance of potentially life-threatening events. The objective of this study is to illustrate through a case based review, patterns of musculoskeletal findings in GVHD.

TABLE OF CONTENTS/OUTLINE

- Introduction
- Differential Diagnosis.
Public Symphysis: Beyond the Athletic Pubalgia

All Day Room: NA Digital Education Exhibit

FDA

Discussions may include off-label uses.

Participants
Raonne S. Menezes, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Renata V. Leao, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Paulo Victor P. Helito, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Renata F. Pereira, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Nicolau F. Guerreiro, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcelo Bordalo-Rodrigues, MD,PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Claudia D. Leite, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Giovanni G. Cerri, MD,PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
raonne.menezes@gmail.com

TEACHING POINTS

The pubic symphysis is the non-synovial joint of the pubic ramus and, due to constant traction over the aponeurosis formed by the rectus abdominis and the adductors, myotendineous diseases and degenerative changes are the most frequent causes of pubalgia. Trauma, pyoarthritis and seronegative arthropathies are not uncommon. The purpose of this exhibit is: - To recognize the anatomy of the normal pubic symphysis. - To discuss and illustrate the athletic pubalgia through anatomical review of the mechanisms of injury. - To list and illustrate imaging findings of others causes of pain in pubic symphysis. - To describe and keep in mind the major differential diagnosis of pubalgia.

TABLE OF CONTENTS/OUTLINE

A) INTRODUCTION ANATOMY * BONES * LIGAMENTS * FIBROCARTILAGINOUS DISC * MUSCLES * BIOMECHANICS OF PUBIC SYMPHYSIS MR IMAGING PROTOCOL B) PUBALGIA ATHLETIC PUBALGIA * MUSCLES LESIONS X PUBIC OSTEITIS DEGENERATIVE AFFECTIONS INFECTIOUS DISEASES * SEPTIC ARTHRITIS/OSTEOMYELITIS TRAUMA * TRAUMATIC DIASTASIS * POST-BIRTH DIASTASIS * STRESS FRACTURE CONGENITAL VARIATIONS INFLAMMATORY CHANGES * SERONEGATIVE SPONDYLOARTHROPATHY * RHEUMATOID ARTHRITIS METABOLIC DISEASES * CALCIUM PYROPHOSPHATE DIHYDRATE DISEASE * OSTEOPOROSIS * HYPERPARATHYROIDISM D) DIFFERENTIAL DIAGNOSIS E) CONCLUSIONS
Manubriosternal Joint Disorders: Imaging Findings and Differential Diagnosis

All Day Room: NA Digital Education Exhibit

Participants
Jucelio P. Moura Filho, BMedSc, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Daniela F. Vieira Vendramini, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Nicolau F. Guerreiro, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Renata V. Leao, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Karla Schoen, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcelo Bordalo-Rodrigues, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Paulo Victor P. Hello, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Renata F. Pereira, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Claudia D. Leite, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Giovanni G. Cerri, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Felipe L. Costa, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Manubriosternal joint (MSJ) diseases are an often undetected cause of chest pain and have a spectrum of differentials, ranging from traumatic lesions to inflammatory or infectious disorders. The objective of this study is to review the imaging findings and the main differential diagnoses of the pathologies involving a manubriosternal joint.

TABLE OF CONTENTS/OUTLINE
Several conditions may involve the manubriosternal joint, highlighting degenerative changes such as osteoarthritis and DISH (diffuse idiopathic skeletal hyperostosis), inflammatory arthritis such as rheumatoid arthritis, ankylosing spondylitis, psoriatic arthritis, SAPHO syndrome, microcrystalline arthropathies such as gout and deposit of calcium pyrophosphate, septic arthritis and the syndrome Titze. Recognizing the imaging features is indispensable to the radiologist to narrow the differential diagnosis and to assist in the therapeutic conduct.
Case-Based Approach to Image-Guided Musculoskeletal Biopsies: A Primer for Residents

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Muhammad Naeem, MBBS, Saint Louis, MO (Presenter) Nothing to Disclose
Jeremiah R. Long, MD, Ft Belvoir, VA (Abstract Co-Author) Nothing to Disclose
Jack W. Jennings, MD, Saint Louis, MO (Abstract Co-Author) Speakers Bureau, Merit Medical Systems, Inc Consultant, Merit Medical Systems, Inc
Travis J. Hillen, MD, Saint Louis, MO (Abstract Co-Author) Consultant, Biomedical Systems; Consultant, Medtronic plc
Jonathan C. Baker, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To gain knowledge regarding the apperance and use of commonly utilized needles in musculoskeletal biopsies. 2. To review the indications, diagnostic imaging, interventional methods, contraindications, and potential complications of bone, muscle and soft tissue biopsies in case based format

TABLE OF CONTENTS/OUTLINE
Overview. Appearance and uses of various biopsy needles and system utilized in bone, bone marrow, and soft tissue biopsies. Case based approach. For each case describe indications, diagnostic imaging, interventional methods, contraindications, and potential complications : Common case scenarios a. Vertebral body biopsy with core technique using a bone biopsy needle. b. Intervertebral disc biopsy using bone needle access and soft tissue core needle at disc. c. Biopsy of a lytic bone lesion using bone needle access and a soft tissue core needle d. Bone marrow biopsy and aspiration with OnControl needle. e. Soft tissue mass biopsy by using coaxial method and without it.
**Teaching Points**

1. Review the physical basis of Diffusion Tensor Imaging (DTI) and their technical adjustment for skeletal muscle evaluation.
2. Explain, from an educational point of view, the biological meaning of parameters derived from DTI studies in MSK system.
3. Show potential applications of DTI for skeletal muscle evaluation in different clinical scenarios.

**Table of Contents/Outline**

1. Introduction
2. Physical basis of DTI focused in skeletal muscle evaluation
3. Technical adjustments
   a. Sequence design
   b. Coils selection and patient positioning
   c. How to identify and avoid potential pitfalls
   d. 1.5T or 3T magnet?
4. Biological meaning of parameters derived
   a. Mean Diffusivity
   b. Fractional Anisotropy
   c. Axial Diffusivity
   d. Radial Diffusivity
5. General considerations and Potential applications
   a. When do I have to perform DTI for skeletal muscle evaluation?
   b. Is necessary to integrate DTI in routine protocols?
   c. How should I report DTI studies?
   d. Quantitative assessment or fiber tracking?
   e. Skeletal muscle trauma and sport injuries related lesions
   f. Primary and secondary myopathies
   g. Exercise and Treatment monitoring
6. Conclusions and take home messages

**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/ Antonio Luna, MD - 2018 Honored Educator
Blood or Calcium? Usefulness of Susceptibility Weighted Imaging (SWI) for Musculoskeletal System Lesions Evaluation

All Day Room: NA Digital Education Exhibit

Participants
Teodoro M. Noguerol, MD, Jaen, Spain (Presenter) Nothing to Disclose
Marta Gomez Cabrera, MD, Cadiz, Spain (Abstract Co-Author) Nothing to Disclose
Javier Royuela, Cordoba, Spain (Abstract Co-Author) Nothing to Disclose
Antonio Luna, MD, PhD, Jaen, Spain (Abstract Co-Author) Consultant, Bracco Group; Speaker, General Electric Company; Speaker, Canon Medical Systems Corporation; Royalties, Springer Nature

For information about this presentation, contact:
t.martin.f@htime.org

TEACHING POINTS
1. Review the physical basis of Susceptibility Weighted Imaging (SWI) and technical adjustments for its application in musculoskeletal (MSK) system. 2. Describe the advantages and disadvantages of SWI with regard to other imaging modalities and especially conventional MRI morphological sequences. 3. Review the potential role of SWI for detection of calcifications and for the differential between blood and calcium in MSK lesions

TABLE OF CONTENTS/OUTLINE

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Antonio Luna, MD - 2018 Honored Educator
MK289-ED-X

Hip Arthroplasty: Structured Reporting

All Day Room: NA Digital Education Exhibit

Participants
Maria Alice F. Costa, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Luciana F. Gavino, MD, Jacareí, Brazil (Abstract Co-Author) Nothing to Disclose
Ivan Masselli, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Andre Y. Aihara, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Hamilton Guidorizzi, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Fabiano N. Cardoso, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
marialicefc@gmail.com

TEACHING POINTS

The purpose of this exhibit is: 1. How to describe normal findings and the appearance of common complications of hip prostheses. 2. To provide a simple framework for a systematic approach to postoperative CT exams following hip arthroplasty and examples of structured reporting.

TABLE OF CONTENTS/OUTLINE

Schematization of the parameters to be analysed on a CT scan following an arthroplasty of the hip: leg length, vertical and horizontal centre of rotation, lateral acetabular inclination, femoral stem positioning, acetabular anteversion, and both metal-cement and cement-bone interfaces. To show the features related to the main complications or failure: periprosthetic lucencies, sclerosis or bone proliferation, and component failure or fracture. To show structured reporting topics: osteolysis, insinuation of acetabular fixation screws to the adjacent soft tissues, anterior acetabular prominence, lateral acetabular inclination and acetabular anteversion, position of the femoral stem in the center shaft, position of the femoral head within the acetabular component, and femoral offset measure. Didactic and illustrative cases to test and consolidate the acquired knowledge.

Conclusions Bibliographical references
Patellar Tumoral and Pseudotumoral Lesions

All Day Room: NA Digital Education Exhibit

Participants
Leandro P. Lizareli, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Gustavo R. Pinto I, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcelo d. Petrilli, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Artur D. Da Rocha Correa Fernandes, MD,PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Andre Y. Aihara, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Fabiano N. Cardoso, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose

For information about this presentation, contact:
leandroplp@gmail.com

TEACHING POINTS
After reading this presentation, the reader will be able to: Know some differential diagnoses for tumoral and pseudotumoral lesions of the patella. Recognize imaging characteristics of these lesions.

TABLE OF CONTENTS/OUTLINE
Review the tumoral and pseudotumoral lesions of the patella with presentation of common and not so common lesions including: Osteoid osteoma; Intraosseous gout; Langerhans cell histiocytosis; Anatomical variants, bipartite patella, dorsal defect of the patella; Giant Cell Tumor; Dissecans osteochondritis.
Radiological Aspects of Haemophilic Arthropathy (HA)

All Day Room: NA Digital Education Exhibit

Participants
Ananda Altoe, MD, Niteroi, Brazil (Presenter) Nothing to Disclose
Clarissa Canella, MD, Rio de Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Sylvia Thomas, Cuiaba, Brazil (Abstract Co-Author) Nothing to Disclose
Eduardo O. Pacheco, MD, Niteroi, Brazil (Abstract Co-Author) Nothing to Disclose
Diogo C. Oliveira, MD, Niteroi, Brazil (Abstract Co-Author) Nothing to Disclose
Paulo d. Antunes, MD, Niteroi, Brazil (Abstract Co-Author) Nothing to Disclose
Vinícius V. Alves, Niteroi, Brazil (Abstract Co-Author) Nothing to Disclose
Alair Augusto S. Santos, MD, Niteroi, Brazil (Abstract Co-Author) Nothing to Disclose
Alessandro S. Mello, MD, PhD, Niteroi, Brazil (Abstract Co-Author) Nothing to Disclose
Leonardo K. Bittencourt, MD, PhD, Rio De Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Emerson d. Casagrande, MD, Niteroi, Brazil (Abstract Co-Author) Nothing to Disclose
Flavia D. Botelho, MD, Niteroi, Brazil (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
ananda_altoe@hotmail.com

TEACHING POINTS
1 - Review of the pathophysiology of the disease. 2 - Importance of the available methods in the clinical practice in avoiding disease progression. 3 - Main Aspects in X-Ray, ultrasound and MRI (example figures). 4 - Which method should I choose?

TABLE OF CONTENTS/OUTLINE
1 - Recurrent joint bleeding, inflammation, synovial proliferation, destruction of cartilage and bone (schema). 2 - Main clinical manifestation and cause of comorbidity in hemophilia. 14% of asymptomatic patients present some degree of joint damage that must be treated to prevent irreversible damage. The available clinical scores (Gilbert Orthopedic Joint Score - GOJS and Hemophilia Joint Health Score - HJHS) have low sensitivity for bleeding and early joint damage. 3 - MRI and US: Identifies early and late findings (examples described below). 4 - X-Ray: Just late findings. Examples for early findings: joint effusion, synovial proliferation with hemosiderin deposits and initial chondral changes. Example for late findings: Epiphyses hypertrophy, ‘square Patella’, osteopenia, marginal erosions, cartilage destruction, joint space narrowing, subchondral cysts, fragmentation and joint deformity. 4 - MRI (golden standart) vs. ultrassound vs X-Ray: Advantages and disadvantages of each method.
Flex Your fingers

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Luis Cerezal, MD, Santander, Spain (Presenter) Nothing to Disclose
Esther Montes, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Ana Canga, MD, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Alexeys Perez, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Moises Fernandez Hernando, Santander, Spain (Abstract Co-Author) Nothing to Disclose
Francisco Del Pinal, MD, PhD, Santander, Spain (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
lcerezal@gmail.com

TEACHING POINTS

1. To provide a comprehensive review of the normal anatomy and biomechanical aspects of the flexor tendons and pulley system of the fingers.
2. To highlight important technical aspects that optimise visualisation of flexor tendon and pulley injuries.
3. To describe the spectrum of ultrasound (US) and MRI findings and treatment approach of common flexor tendon and pulley injuries.

TABLE OF CONTENTS/OUTLINE

From Pre-Op to Post-Op: The Radiologist's Role in the Evaluation of Femoroacetabular Impingement

All Day Room: NA Digital Education Exhibit

Participants
Jay P. Willhite, MD, Durham, NC (Abstract Co-Author) Nothing to Disclose
Leah Strickland, MD, Birmingham, AL (Abstract Co-Author) Nothing to Disclose
Erin McCrum, MD, Durham, NC (Presenter) Nothing to Disclose

For information about this presentation, contact:
erin.mccrum@duke.edu

TEACHING POINTS
At the end of this session, the participant should be able to: 1) Describe radiographic and MRI findings which support a diagnosis of femoroacetabular impingement. 2) Discuss the utility of MR Arthrography and intra-articular steroid injections in the evaluation of hip pain. 3) Describe the expected appearance of the hip after arthroscopic surgery for femoroacetabular impingement and identify post-operative complications.

TABLE OF CONTENTS/OUTLINE
I. Discussion of hip structural abnormalities thought to contribute femoroacetabular impingement II. Imaging evaluation of femoroacetabular impingement a) Radiographic techniques including routine views and proper patient positioning with corresponding radiographic measurements b) MRI findings of femoroacetabular impingement c) MR arthrography technique d) Brief review of literature with regards to intra-articular steroid injection III. Description of surgical techniques used to address femoroacetabular impingement IV. Imaging evaluation after arthroscopic surgery for femoroacetabular impingement in patients with persistent hip pain a) Normal appearance of the post surgical hip b) Findings which suggest post-operative complication
MK294-ED-X

MRI of Sport-Related Peripheral Nerve Injuries

All Day Room: NA Digital Education Exhibit

Participants
Blake C. Jones, MD, Baltimore, MD (Presenter) Nothing to Disclose
Shivani Ahlawat, MD, Baltimore, MD (Abstract Co-Author) Research Consultant, Pfizer Inc
Laura M. Fayad, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
bjones72@jhmi.edu

TEACHING POINTS

1) Radiologists should be aware that sports-specific neuropathies exist. 2) Acute nerve injuries are less common than chronic sports-related neuropathies. 3) Imaging is an increasingly integral part of the clinical care of patients with sports-related peripheral nerve injuries.

TABLE OF CONTENTS/OUTLINE

Chronic Recurrent Multifocal Osteomyelitis: A Pattern Approach

All Day Room: NA Digital Education Exhibit

Participants
Bruno S. Caileial, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Maria Alice F. Costa, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Andre Y. Aihara, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Melissa Fraga, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Maria T. Terrei, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Artur D. Da Rocha Correa Fernandes, MD,PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Luciana F. Gavino, MD, Jacarei, Brazil (Abstract Co-Author) Nothing to Disclose
Eduardo Baptista, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Fabiano N. Cardoso, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
marialicefc@gmail.com

TEACHING POINTS
The purpose of this exhibit is: 1. Discuss the epidemiologic and clinical features of chronic recurrent multifocal osteomyelitis. 2. Describe the common sites of disease in chronic recurrent multifocal osteomyelitis. 3. Illustrate the typical patterns of bone findings in chronic recurrent multifocal osteomyelitis.

TABLE OF CONTENTS/OUTLINE
Introduction presenting the epidemiology, typical clinical picture, etiology and pathogenesis. Schematization of the most common sites of chronic recurrent multifocal osteomyelitis. Present the typical MR imaging findings of chronic recurrent multifocal osteomyelitis (bone marrow edema, periostitis, soft tissue edema, extension across the physes, post-gadolinium enhancement). Illustrate the most common differential diagnosis. Provide didactic and illustrative cases in a challenging format to test and consolidate the acquired knowledge. Conclusions Bibliographical references
MK296-ED-X

Sacroilitis: What Else to Think Beyond Ankylosing Spondylitis: A Case-Based Guide to Access Differential Diagnosis of Axial Spondyloarthritis and Their Mimickers

All Day Room: NA Digital Education Exhibit

Participants
Maria Helena T. Rodrigues, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Mariana D. Silva, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Paulo Victor P. Helito, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcelo Bordalo-Rodrigues, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
mariahtr27@gmail.com

TEACHING POINTS

After reading this presentation, the reader will be able to: Discuss imaging features that enable reliable differential diagnosis of the sacroiliac joint involvement in axial spondyloarthritis group. List the conditions that must be included in the differential diagnosis of sacroilitis. Provide a practical approach on how to avoid overdiagnosis of spondyloarthritis and to improve the diagnostic value of images for their mimickers. Recognize the importance of radiologist’s role in the diagnosis of sacroiliac joint dysfunction and clinical management decisions.

TABLE OF CONTENTS/OUTLINE

Review and create didactic charts of functional anatomy and pathomechanics of the sacroiliac joint (SIJ). Describe SIJ anatomic variants and physiologic changes. Review the group of axial spondyloarthritis disease based in the current literature and focus on imaging findings and cases. Diagnostic imaging of sacroiliac joints in the course of a variety of other conditions (sacroilitis mimics) - metabolic diseases, benign and malignant conditions, infection, granulomatous diseases, for example. Sample cases (radiographs, CT and MRI scans) Create a Flow Chart for differential diagnosis in sacroiliac joint dysfunction.
**MK297-ED-X**

**Crystal Deposition Disease about the Knee: Is MRI Enough for the Diagnosis?**

All Day Room: NA Digital Education Exhibit

**Participants**
Andre Rosenfeld, MD, Recife, Brazil (Presenter) Nothing to Disclose
Maria Alice F. Costa, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Fabiano N. Cardoso, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Andre Y. Aihara, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Eduardo Felipe K. Kawakami, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Carlos H. Longo, PhD, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
marialicefc@gmail.com

**TEACHING POINTS**

Case-based diagnosis for Cristal Deposition Disease about the knee, including gout, CPPD and HADD. Main findings no MRI studies:

- Making diagnosis simple. Special methods can help? Dual source CT

**TABLE OF CONTENTS/OUTLINE**

Diagnosis of crystal deposition diseases in MRI can be challenging. In Gout, we have crystals of sodium monourate in the synovial fluid. Has predilection for middle-aged male patients. Synovitis and tophaceous deposits occurs in typical sites, such as the popliteal tendon, distal quadriceps and cruciate ligaments. Dual energy CT can be useful in distinguishing gouty tophi from other calcifications. HADD can occur in any joint, including the knee. It has a predilection for middle-aged women. Its pathophysiology is uncertain, but in reabsorption phase, migration of calcification occurs, promoting intense inflammatory process, with local edema, quite painful. CDDP arthritis is common in the elderly, as in osteoarthritis. It is characterized by deposits of calcium pyrophosphate crystals in ligaments, menisci and cartilage. About knee, there is atypical pattern of distribution, with preferential involvement by the patellofemoral compartment. The "gear aspect" in the patellofemoral compartment is pathognomonic. We will show knee involvement by crystal deposition diseases using MRI and epidemiological data on a case-based-study.
Participants
Natalia Y. Zuniga, MD, Cali, Colombia (Presenter) Nothing to Disclose
Martin E. Renjifo, MD, Bogota, Colombia (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
dranataliazl@gmail.com

TEACHING POINTS
Become familiar with the different types of surgery, the assessment of the components and the diagnosis of associated complications. Recognize the initial approach of the patient with joint replacement, done with conventional radiography and systematically enforced depending on whether it is a post-surgical evaluation or follow-up. To be able to make the post-surgical analysis of the radiography aimed to assess the proper position of the prosthetic components and the alignment of the prosthesis relative to the native bone. Interpret the follow-up radiography including the evaluation of the alignment and instability of the prosthesis. To recognize complications in both scenarios. Post-surgical radiography should evaluate complications such as dislocation, periprosthetic fractures, and other intra-surgical complications. In the follow-up analysis the complications that must be taken into account are: loosening that could be septic or aseptic, osteolysis, periprosthetic fractures and signs of instability.

TABLE OF CONTENTS/OUTLINE
Introduction Types of hip arthroplasty Radiographic analysis of the hip Types of knee arthroplasty Radiographic analysis of the knee Check list Conclusions
Spine Malformations: Not So Complex, If You Understand the Basics!

Participants
Luiz Felipe B. Assirati, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Rachel F. Muffareg Do Amaral, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Alexander J. Rossato, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Andre Y. Aihara, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
- Basic concepts of the spine development.
- Spine malformations classification.
- Recognize the image findings of the main spine malformations on Radiograph, CT and MRI

TABLE OF CONTENTS/OUTLINE
There are several types of spine malformations, like spinal dysraphisms and bone malformation, which knowledge is fundamental for professionals working with imaging exams. Accurate recognition and description of the malformations on imaging exams are necessary to guide neurosurgeons, clinician and other specialists, so they can have an optimal management, including surgery decision. Our purpose is to review the spine development and malformations, by presenting illustrative cases that appeared in our institute, like myelomeningocele, lipomyelocele, diastematomyelia, caudal agenesis, lipomas, dermal sinus, persistent terminal ventricle, hemivertebrae, etc. We consider that by understanding the basics findings, it is going to be easier to recognize the main spine malformations on routine exams.

All Day Room: NA Digital Education Exhibit

Awards
Identified for RadioGraphics

Participants
Nevil N. Ghodasara, MD, Baltimore, MD (Presenter) Nothing to Disclose
Paul H. Yi, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Karen Clark, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Elliot K. Fishman, MD, Baltimore, MD (Abstract Co-Author) Institutional Grant support, Siemens AG; Institutional Grant support, General Electric Company; Co-founder, HipGraphics, Inc
Jan Fritz, MD, Baltimore, MD (Abstract Co-Author) Research Grant, Siemens AG; Scientific Advisor, Siemens AG; Scientific Advisor, Alexion Pharmaceuticals, Inc; Speaker, Siemens AG

For information about this presentation, contact: pyi10@jhmi.edu

TEACHING POINTS
At the conclusion of this educational exhibit, participants will be able to: • Optimize CT protocols for maximizing image quality and minimizing metal-induced artifacts. • Categorize various types of spine surgeries, instrumentation, and implants. • Recognize a wide range of abnormal findings on postoperative CT studies of the spine and differentiate normal post-operative findings. • Systematically evaluate and report postoperative CT exams of the spine.

TABLE OF CONTENTS/OUTLINE
• Technical challenges and solutions for postoperative CT imaging of the spine • Main categories of spine surgeries and types of instrumentation/implants • Postoperative CT imaging of the spine checklist for the novice and experienced radiologist • Normal imaging findings of postoperative spine CT • Categorized CT findings of post-operative abnormalities and complications • Case-based review of normal and abnormal postoperative CT findings of the spine

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/ Elliot K. Fishman, MD - 2012 Honored Educator Elliot K. Fishman, MD - 2014 Honored Educator Elliot K. Fishman, MD - 2016 Honored Educator Elliot K. Fishman, MD - 2018 Honored Educator
MRI on Knee Cartilage Repair Surgery - A Step-By-Step for Beginners

Awards
Certificate of Merit

Participants
Anthony R. Souza, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Adham A. Castro, MD, Paranagua, Brazil (Abstract Co-Author) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Leticia M. Nunes, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Eduardo Baptista, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Luiz Guilherme Hartmann, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Durval D. Santos, MD, Sorocaba, Brazil (Abstract Co-Author) Nothing to Disclose
Laercio A. Rosenberg, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
anthonyreisms@gmail.com

TEACHING POINTS
Radiologists must familiarize with the main cartilage repair techniques and imaging evaluation methods to know what to report to orthopedic surgeons. The purpose of this exhibit is to:
- Illustrate the main cartilage repair techniques on knee.
- Identify what MRI sequences are useful for post operative assessment.
- Recognize essential findings in post-operative exams.
- Show complementary MR imaging techniques that can be applied (compositional MR imaging).

TABLE OF CONTENTS/OUTLINE
Introduction approaching evaluation of normal knee cartilage appearance on conventional MRI.
Instructions about how to evaluate chondromalacia and chondral fissures / erosions. Discussion concerning the main cartilage repair techniques on knee, including:
marrow stimulation, osteochondral grafting, cell-based repair and others.
Imaging findings and key points in pre and post-operative exams using didactic cases.
Future directions and summary.
Synthetic MRI for the Musculoskeletal Radiologist: A Primer

TEACHING POINTS

Participants will be able to: 1) Review the principles of synthetic MRI and methods of T1 and T2 quantification. 2) Identify the advantages of synthetic MRI relative to conventional MRI. 3) Interpret synthetic MRI of the knee for internal derangement.

TABLE OF CONTENTS/OUTLINE

Definitions Synthetic MRI: images derived from quantitative MRI Principles of Quantitative MRI Measure T1/T2 relaxation times, proton density (PD), diffusion coefficient and magnetization transfer Bloch-Torrey equation Continuous-wave solutions for magnetization transfer Multi-parametric Techniques Basic mixed-echo Turbo Spin Echo 2 inversion times and 2 effective echo times QRAPMASTER Additional data points: improved curve fitting Local B1 field correction of T1 and PD quantification T2 Quantification T2-preparation, 3D acquisitions, multi-exponential fitting Example: GRAPPATINI: Parallel imaging and model-based reconstruction T1 quantification Inversion recovery or variable flip angle approaches Example: MP2Rage: Ratio of 2 data sets at different inversion times Advantages Simultaneous morphological and quantitative evaluation Improved image contrast Acquisition time = conventional MRI Knee Applications T2 and PD Cartilage Mapping T1 mapping of bone marrow
Dual-Energy CT Imaging of Gout: Beyond the Diagnosis

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
William Wong, Vancouver, BC (Presenter) Nothing to Disclose
Luck J. Louis, MD, Vancouver, BC (Abstract Co-Author) Nothing to Disclose
Waleed Abdellatif, MD, Vancouver, BC (Abstract Co-Author) Nothing to Disclose
John P. Walsh, MBChB, Dublin, Ireland (Abstract Co-Author) Nothing to Disclose
Gavin M. Sugrue, MBChB, Dublin, Ireland (Abstract Co-Author) Nothing to Disclose
Savvas Nicolaou, MD, Vancouver, BC (Abstract Co-Author) Institutional research agreement, Siemens AG

TEACHING POINTS

Teaching Points: Dual-energy CT (DECT) has emerged as an accepted clinical tool for the detection of gout. DECT’s use, however, extends beyond the initial diagnosis of gout itself. This exhibit discusses the various applications of DECT in gout detection and management.

TABLE OF CONTENTS/OUTLINE

MK304-ED-X

From Hip to Toe: MRI of Musculoskeletal Overuse Injuries of Lower Limbs in Recreational Athletes

All Day Room: NA Digital Education Exhibit

Participants
Anindita Sinha, MD, Chandigarh, India (Presenter) Nothing to Disclose
Santosh Dhungana, MD, Chandigarh, India (Abstract Co-Author) Nothing to Disclose
Mahesh Prakash, MBBS, MD, Chandigarh, India (Abstract Co-Author) Nothing to Disclose
Niranjan Khandelwal, MD, Chandigarh, India (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
dranindita@gmail.com

TEACHING POINTS
1. Identify and describe acute or chronic muscular, ligamentous, osseous overuse injuries of lower limbs in recreational athletes.
2. Grade the severity of muscular and osseous injuries, wherever possible.
3. Recognise congenital variations, especially in the ankle which can cause chronic pain or impingement

TABLE OF CONTENTS/OUTLINE
We review MR findings of 32 athletes who presented with musculotendinous, ligamentous and osseous overuse injuries of the lower limb.
2. Around the Knee- Anterior pain- chondromalacia patellae, patellar tendinopathy, Osgood-Schlatter disease, osteochondritis dissecans. Lateral or anterolateral pain- iliotibial band friction, quadriceps fat pad impingement, discoid lateral meniscus tear. Posterior knee pain-gastrocnemius and soleus injuries. Medial-Bursitis
3. Leg and calf pain- Calf muscle tear and stress fracture.
4. Around the ankle and foot- Stress fractures of metatarsals, impingement and osteochondral injuries. Congenital variations like coalitions or accessory ossicles were often found in the ankle.

Summary: Imaging findings range from acute and florid to subtle findings due to chronic healed injuries.
**Soccer Injuries in the Foot and Ankle: Mechanisms and Radiographic Appearance**

All Day Room: NA Digital Education Exhibit

**Participants**
Andrew Z. Liu, MD, New York, NY (*Presenter* Nothing to Disclose)
Jonathan K. Kazam, MD, New York, NY (*Abstract Co-Author* Nothing to Disclose)
Tony T. Wong, MD, New York, NY (*Abstract Co-Author* Nothing to Disclose)

For information about this presentation, contact:
azl7001@nyp.org

**TEACHING POINTS**
- Review relevant ankle and foot anatomy
- Review the soccer kicking mechanism
- Describe the common injuries and their mechanisms
- Describe the radiographic characteristics of the common injuries

**TABLE OF CONTENTS/OUTLINE**

1. Pre-test questions
2. Basic ankle and foot anatomy
3. Mechanism behind kicking in soccer
5. Answers and review of pre-test questions
Central Sarcopenia: What the Oncologist, Oncologic Surgeon, Transplant Surgeon, and Trauma Surgeon Want to Know

Participants
Joseph E. Burns, MD, PhD, Orange, CA (Presenter) Nothing to Disclose
Jianhua Yao, PhD, Bethesda, MD (Abstract Co-Author) Royalties, iCAD, Inc
David Gedeon, MD, Orange, CA (Abstract Co-Author) Nothing to Disclose
Arash Anavim, MD, Orange, CA (Abstract Co-Author) Nothing to Disclose
Ronald M. Summers, MD, PhD, Bethesda, MD (Abstract Co-Author) Royalties, iCAD, Inc; Royalties, Koninklijke Philips NV; Royalties, ScanMed, LLC; Research support, Ping An Insurance Company of China, Ltd; Researcher, Carestream Health, Inc; Research support, NVIDIA Corporation; ; ; ;

For information about this presentation, contact:
jburns@uci.edu

TEACHING POINTS
Central sarcopenia is a risk factor for mortality in multiple cancers, liver transplantation, cirrhosis, and trauma patients. Relatively recently becoming a topic of interest in radiology, it has been and continues to be an area of research and topic of interest in multiple medical and surgical specialties to help guide patient management. it is assessed via quantification of the normalized cross section of the truncal musculature groups, typically at the level of the lumbar spine. It may guide patient management in pre-treatment risk assessment and surgical planning, and act as a platform to facilitate large scale clinical trials

TABLE OF CONTENTS/OUTLINE
Tumors of Hand: Benign to Malignant Spectrum with Imaging Characteristics and a Pictorial Review

Participants
Sweta Bothra JR, MD, Mumbai, India (Presenter) Nothing to Disclose
Amit Janu, MBBS, MD, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Sureshkumar G, MBBS, MD, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Somesh Singh, MBBS, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Ashita Rastogi, MBBS, MD, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Ajay Puri, MBBS, Mumbai, India (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
suri626@gmail.com

TEACHING POINTS

TABLE OF CONTENTS/OUTLINE
Fibroblastic and Myofibroblastic Tumors in Adults: A Pictorial Review

All Day Room: NA Digital Education Exhibit

Participants
Jose A. Narvaez, MD, Hospitalet, Spain (Presenter) Nothing to Disclose
Javier Hernandez Ganan, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Juan Carlos Sardinas, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Xavier Sanjuan, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Eugenia De Lama, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
jnarvaez@bellvitgehospital.cat

TEACHING POINTS

List the fibroblastic and myofibroblastic tumors seen in adults and classify them on the basis of their biological behavior (benign, intermediate-locally aggressive, intermediate-rarely metastasizing and malignant). Describe the distinguishing imaging findings of fibroblastic and myofibroblastic tumors common in adults. Correlate the findings in the different imaging modalities with pathologic features.

TABLE OF CONTENTS/OUTLINE

TEACHING POINTS

1. To review the normal MRI appearance of bone marrow and the pattern of maturation from birth to adulthood, highlighting the utility of advanced MRI techniques such as diffusion-weighted imaging.
2. To illustrate disease processes characterized by bone marrow depletion, bone marrow replacement, metabolic disease, osteonecrosis, trauma, infection and inflammatory disease, using cases from our institution to highlight useful pearls and common pitfalls.
3. Provide a framework for the resident and general radiologist to approach skeletal MRI.

TABLE OF CONTENTS/OUTLINE

- INTRODUCTION
  - The physiology of bone
  - The normal imaging appearances of bone
- BONE MARROW SIGNAL CHANGES IN MARROW REPLACEMENT DISORDERS
  - Multiple myeloma
  - Metastases
  - Renal bone metabolic disease
  - Haematological disease (LEUKEMIA, LYMPHOMA)
- BONE MARROW SIGNAL CHANGES IN MARROW DEPLETION DISORDERS
  - Chemotherapy
  - Radiotherapy
  - Aplastic anaemia
  - Myelodysplasia
- BONE MARROW SIGNAL CHANGES IN FOCAL DISEASE
  - Trauma in normal and abnormal bone
  - Infection
  - Inflammatory disease
  - Transient osteoporosis
- Self test review: Framework in practice
TEACHING POINTS

Chordomas of the mobile spine are rare, but represent the most common primary malignancy of the spine, after lymphoproliferative disorders, in adult population. Imaging characteristic that suggest the diagnosis of vertebral chordoma include: origin in the vertebral body, midline location, common extravertebral involvement and/or transdiscal extension, mixed lytic-blastic appearance on radiographs/CT, high-signal intensity on T2-weighted images, often with septal architecture, 'honeycomb pattern' of enhancement on CT/MRI, and restricted diffusion, with low ADC values. Differential diagnosis include mainly chondrosarcoma, benign tumors of the notochordal rest, giant cell tumor, lymphoproliferative disorders and metastases. Location within the vertebra, patterns of signal intensity and enhancement, and diffusion MRI help to narrow this differential diagnosis.

TABLE OF CONTENTS/OUTLINE

The Lumbar Lexicon: An Imaging Review for Proper Lumbar Disc Nomenclature

Awards

Certificate of Merit

Participants

Jose Hawayek, San Juan, PR (Presenter) Nothing to Disclose
Stephanie C. Torres Ayala, MD, Mayaguez, PR (Abstract Co-Author) Nothing to Disclose
Joaquin R. Ortiz-Cruz, MD, San Juan, PR (Abstract Co-Author) Nothing to Disclose
Laura C. Figueroa Diaz, MD, Mayaguez, PR (Abstract Co-Author) Nothing to Disclose
Jaime Atiles-Castro, MD, San Juan, PR (Abstract Co-Author) Nothing to Disclose
Luis F. Garcia-Paredes, MD, San Juan, PR (Abstract Co-Author) Nothing to Disclose
Jorge A. Vidal, MD, San Juan, PR (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:

jose.hawayek1@upr.edu

TEACHING POINTS

To review the nomenclature and classification of lumbar disc pathology as established in 2014 by consensus between the NASS, ASSR and ASNR
To promote the use of standard lumbar terminology between radiologists, clinicians and researchers
To review imaging findings in lumbar disc pathology

TABLE OF CONTENTS/OUTLINE

Common Lumbar Disc Pathology Diagram Review
Review of proper nomenclature for Lumbar Disc Pathology
Review of imaging findings for selected Lumbar Disc 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/ Jorge A. Vidal, MD - 2012 Honored Educator
**TEACHING POINTS**

1. To review the physical basis, technical adjustments, quantification methods and potential pitfalls of magnetic resonance (MR) based musculoskeletal (MSK) perfusion imaging.
2. To explore the current clinical applications (tissue characterization, staging and treatment monitoring) of perfusion imaging in MSK tumors.
3. To elaborate a practical diagnostic algorithm for the application of MR based perfusion in MSK lesions.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction
2. Vascularization of normal and abnormal tissues
3. Physical basis of MR perfusion imaging: pros and cons
4. Artifacts in MSK perfusion imaging and how to avoid them
5. Clinical applications
   5.1. Bone and cartilage tumors
   5.2. Adipous tumors
   5.3. Muscular sarcomas
   5.4. Peripheral nerve sheath neoplasms
   5.4. Fibroblastic, myofibroblastic and fibrohistiocytic lesions
   5.6. Cutaneous lesions
   5.7. Lymphoma
6. MR perfusion and treatment monitoring
7. MR perfusion and MSK tumors diagnostic algorithm
8. Conclusion

**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/ Antonio Luna, MD - 2018 Honored Educator
Extrinsic Ligaments of the Wrist Joint - Anatomy and MRI Imaging

Participants
Hyun Young Kim, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Yuusuh Kang, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Eugene Lee, Seongnam-Si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Joon Woo Lee, MD, PhD, Sungnamsi, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Joong Mo Ahn, MD, PhD, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
Heung Sik Kang, Gyeonggi-Do, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
4everjsm@hanmail.net

TEACHING POINTS
The wrist ligaments are divided into two major categories: intrinsic and extrinsic. The intrinsic ligaments arise entirely within the carpus onto the carpal bones, whereas the extrinsic ligaments extend beyond the carpal bones and insert onto metacarpal bones and have additional insertions on the retinaculum and tendon sheath. Radiologists need to understand the anatomy of the extrinsic ligaments to diagnose various pathologic conditions.

TABLE OF CONTENTS/OUTLINE
MK314-ED-X

MR Imaging of Non-Neoplastic Skeletal Muscle and Fascia Disorders

All Day Room: NA Digital Education Exhibit

Participants

Hwi Ryong Park, Seongnam, Korea, Republic Of (Presenter) Nothing to Disclose
Yusuhn Kang, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Eugene Lee, Seongnam-Si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Joon Woo Lee, MD, PhD, Sungnamsi, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Joong Mo Ahn, MD, PhD, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
Heung Sik Kang, Gyeonggi-Do, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
suniad@naver.com

TEACHING POINTS

Review the normal anatomy, patterns of pathologic findings, and the imaging characteristics of diseases involving the skeletal muscle and fascia. Classify disorders according to MR imaging findings and clinical manifestations to establish narrow differential diagnosis.

TABLE OF CONTENTS/OUTLINE

1. Normal anatomy
2. Patterns of involvement
   A. Edema
   B. Fatty atrophy
   C. Mass-like
3. Disorders
   A. Injury
      Strain
      Hematoma
      Compartment syndrome
      Myositis ossificans
   B. Inflammatory/infectious diseases
      Polymyositis
      Dermatomyositis
      Necrotizing fasciitis
   C. Mass-like lesions
      Proliferative myositis
      Nodular fasciitis
   D. Others
      Rhabdomyolysis
      Radiation therapy
      Diabetic muscle disorder
      Denervation
4. Summary
Knee Osteochondral Allografts and Autografts: What to Expect and Look For
All Day Room: NA Digital Education Exhibit

Participants
Ana Flavia P. Ferreira, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Virginia R. Netto, MD, Araraquara, Brazil (Abstract Co-Author) Nothing to Disclose
Luis Eduardo P. Tirico, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Sharon Rosenberg, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Arthur M. Correa, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Affonso C. Neto, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Almir A. Urbanetz, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Rodolfo F. Nunes, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Pedro U. Maia, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Paulo Victor P. Helito, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcelo Bordalo-Rodrigues, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
ana.flaviarad@gmail.com

TEACHING POINTS
The purpose of this exhibit is: To review the postoperative MRI imaging findings of osteochondral allografts and autografts, providing helpful and comprehensive evaluation of surgical outcome. To discuss the main indications and possible complications of osteochondral allografts and autografts. To review standard MR imaging techniques that may be used postoperatively to evaluate the success of implantation and the state of cartilage healing.

TABLE OF CONTENTS/OUTLINE
Table of Contents/Outline: Indications of each type of osteochondral graft. Normal MRI early and late postoperative findings of osteochondral allografts and autografts. Evaluation of the donor site of the graft. Signs of incomplete graft incorporation and potential instability. Complications that may be detected at MR imaging. MR imaging techniques for graft evaluation.
Teaching Points

Spine lesions may have a challenging diagnosis, especially the isolated ones. This exhibit emphasizes the clinical and imaging parameters to determine the correct diagnosis or narrow down the differential diagnosis of spine lesions. Upon completing this exhibit, the learner will be able to: 1- Properly evaluate the imaging features of vertebral lesions. 2- Narrow the differential according to vertebral location (cervical, thoracic or lumbar spine, vertebral body, posterior elements), clinical features (age, symptoms and previous diseases) and presentation (isolated vs diffuse lesions). 3- Determine the correct diagnosis or narrow down the differential diagnosis for the requesting physician according to all imaging and clinical features.

Table of Contents/Outline

1. General imaging features to be evaluated of vertebral lesions
2. General clinical features that helps narrowing the correct diagnosis
3. Vertebral haemangioma
4. Osteonecrosis
5. Cordoma
6. Spondylolisthesis
7. Aneurysmal bone cyst
8. Osteoblastoma
9. Metastasis
10. Plasmocytoma
11. Multiple myeloma
12. Paget Disease
13. Vertebral body osteomyelitis
14. Osteoid Osteoma
15. Chondrosarcoma
16. Hypoplastic pedicles
MR Imaging of Skeletal Muscle Diseases: Anatomical and Pathological Correlations

Participants
Masataka Kakiuchi, Kashihara, Japan (Presenter) Nothing to Disclose
Toshiteru Miyasaka, MD, Kashihara, Japan (Abstract Co-Author) Nothing to Disclose
Tomoko Ochi, Kashihara, Japan (Abstract Co-Author) Nothing to Disclose
Yumi Matsui, Kashihara, Japan (Abstract Co-Author) Nothing to Disclose
Kimihiko Kichikawa, MD, Kashihara, Japan (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
masa-kaki.ypa@naramed-u.ac

TEACHING POINTS
1) To classify imaging findings of skeletal muscle diseases according to locations and causes. 2) To know the correlations between imaging findings and etiology of skeletal muscle diseases.

TABLE OF CONTENTS/OUTLINE
Alterations in muscle signal intensity at MR imaging are produced by the multiple causes. We classify anatomical and pathological characteristics of skeletal muscle diseases and summarize their radiological findings. Anatomy: Muscle, fascia and nerves. Pathology: Muscle edema, Fatty infiltration and Mass lesion
2.1 Muscle edema: In most cases, that reflects increased intracellular or extracellular free water. For example, autoimmune diseases, injuries, myositis, radiation therapy. 2.2 Fatty infiltration: The end stages of pathologic conditions of skeletal muscle diseases, seen usually with muscle atrophy. 2.3 Mass lesion: A localized lesion. For example, neoplasms, myonecrosis, intramuscular abscess. Illustrative cases.
Enchondroma versus Low-Grade Chondrosarcoma in Appendicular Skeleton: A Diagnostic Challenge

All Day Room: NA Digital Education Exhibit

Participants
Anurima Patra, MD, Mumbai, India (Presenter) Nothing to Disclose
Garima Pathak, Mumbai, India (Abstract Co-Author) Nothing to Disclose
Amit Janu, MBBS, MD, Mumbai, India (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Elaborate the spectrum of chondroid neoplasms, their salient imaging findings and differentiating points.
2. To determine the radiological features of enchondroma and low grade chondrosarcoma on all imaging modalities.
3. To highlight the salient distinguishing features of enchondroma and low grade chondrosarcoma on imaging.

TABLE OF CONTENTS/OUTLINE
1. Introduction—Natural history and current concepts of diagnosing the chondroid neoplasms on imaging.
2. Illustrative pictorial review of chondroid neoplasms: highlighting the crucial differentiating points.
3. Key imaging findings of low grade enchondroma and chondrosarcoma on Radiograph, CT, MRI and bone scan.
4. Comparison between the clinical, radiological and histological features of enchondroma and low grade chondrosarcoma.
5. Role of imaging as first line in determining the appropriate management approach.
Looking on the Bright Side: A Review of 'determinant' Hyperintense Soft Tissue Lesions

All Day Room: NA Digital Education Exhibit

Participants
Derek S. Young Jr, BS, Temple, TX (Presenter) Nothing to Disclose
Ricardo D. Garza-Gongora, MD, Temple, TX (Abstract Co-Author) Nothing to Disclose
Hunter Sellers, BS, Temple, TX (Abstract Co-Author) Nothing to Disclose
Jeffrey D. Stevens, MD, Temple, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Briefly discuss the current techniques used to assess soft tissue lesions. 2. Review the physiopathology components leading to higher signal intensity among lesions. 3. Highlight MR features leading to the diagnosis of 'determinate' T1 and T2 hyperintense soft tissues lesions. 4. Develop a systematic approach to hyperintense soft tissue lesions leading to improved diagnosis

TABLE OF CONTENTS/OUTLINE
1) Introduction to soft tissue MR
   a) Techniques i) Field of view ii) Planes iii) Contrast Enhancement
   b) Pulse sequences used
2) Physiopathologic components of lesions contributing to hyperintensity
   a) T1 weighted hyperintense containing lesions
   b) T2 weighted hyperintense lesions
3) T1 hyperintense lesions
   a) Fat containing i) Hemangioma ii) Lipoma iii) Well differentiated liposarcoma iv) Myxoid liposarcoma
   b) Calcification containing i) Hemangioma ii) Myositis ossifications
   c) Methemoglobin containing i) Hæmatoma
   d) Proteinaceous material i) Abscess, Ganglion cyste) Melanin i) Melanoma
4) T2 hyperintense lesions
5) Systematic Approach to identifying 'determinant' MRI hyperintense lesions
MK320-ED-X

Brachial Plexopathy: Anatomy and Imaging Review

All Day Room: NA Digital Education Exhibit

Participants
Amanda Baker, MD, Providence, RI (Presenter) Nothing to Disclose
Gaurav Jindal, MD, Providence, RI (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Understand the anatomy of the brachial plexus Discuss the two main etiologies of brachial plexopathy Use this anatomic basis to understand patterns of traumatic versus non-traumatic injury Understand the different modalities used in evaluation of the brachial plexopathy

TABLE OF CONTENTS/OUTLINE
MDCT and MRI in the Evaluation of Pressure Ulcer-Related Pelvic Osteomyelitis - In Bedridden and Wheelchair Patient

All Day Room: NA Digital Education Exhibit

Participants
Cristina A. Fontes, MD, Niteroi, Brazil (Presenter) Nothing to Disclose
Alair Augusto S. Santos, MD, Niteroi, Brazil (Abstract Co-Author) Nothing to Disclose
Danilo A. Araujo Sr, MBBS, Niteroi, Brazil (Abstract Co-Author) Nothing to Disclose
Naomi Murakami Sr, MBBS, Niteroi, Brazil (Abstract Co-Author) Nothing to Disclose
Thallys L. Silva, MBBS, Niteroi, Brazil (Abstract Co-Author) Nothing to Disclose
Weydler H. Corbiceiro, MBBS, Niteroi, Brazil (Abstract Co-Author) Nothing to Disclose
Pedro T. Barros Sr, MBBS, Niteroi, Brazil (Abstract Co-Author) Nothing to Disclose
Diogo A. Rizzo, MBBS,MBBS, Niteroi, Brazil (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The objective of this study is to evaluate through MDCT and MRI patients unable to move spontaneously (either by spinal cord injuries or other diseases, neurological or not) that have developed changes in soft tissues and bone structures that varied from heterotropic calcifications, pressure ulcers with or without complications, such as soft tissue infections and osteomyelitis.

TABLE OF CONTENTS/OUTLINE
In the image evaluation of bedridden and wheelchair patients, computerized tomography and magnetic resonance imaging are of great value in the diagnosis and follow-up of pressure ulcers and osteomyelitis, being extremely important in pre and postoperative studies. On the other hand, MRI is capable to show earlier findings in acute osteomyelitis, characterized by bone marrow edema and contrast enhanced, as well as Nuclear Medicine exam, but with excellent anatomical detail and superior soft tissue resolution. Furthermore, gadolinium diffuses better in the tissues, being superior to the iodinated contrast of MDCT, for the identification of enhancement alterations, being indicated in stage IV ulcers.
MK322-ED-X

Sarcopenia, The Life Wasting Condition: What Radiologists Need to Know?

All Day Room: NA Digital Education Exhibit

Participants
Koeun Lee, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jimi Huh, MD, Suwon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Yongbin Shin, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Seong Ho Park, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Research Grant, DONGKOOK Pharmaceutical Co, Ltd; Research Grant, Central Medical Service Co, Ltd
Kwon-Ha Yoon, MD, PhD, Iksan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Kyung Won Kim, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose

TEACHING POINTS
1. To understand the concept of body composition imaging focusing on sarcopenia 2. To explain the updated knowledge about sarcopenia 3. To systematically review the researches for outcomes of sarcopenia and its effect on quality of life

TABLE OF CONTENTS/OUTLINE
Peripheral Nerve Tumors and Tumor-Like Lesions: Imaging Characteristics of Ultrasound

All Day Room: NA Digital Education Exhibit

Participants
Sun Joo Lee, MD, Busan, Korea, Republic Of (Presenter) Nothing to Disclose
Hye Jung Choo, MD, Busan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
sunjulee98@gmail.com

TEACHING POINTS
1. To demonstrate the characteristic findings of high-resolution ultrasonography in peripheral nerve tumors and tumor-like lesions 2. To correlate with other imaging modality and pathologic findings

TABLE OF CONTENTS/OUTLINE
Radicular Pain Syndrome: What Radiologist Should Know from Diagnosis to Interventional Management

All Day Room: NA Digital Education Exhibit

Participants
Ariel R. Pacheco Usmayo, Valencia, Spain (Presenter) Nothing to Disclose
Manuel Cifrian-Perez, MD, Castellon, Spain (Abstract Co-Author) Nothing to Disclose
Raul Garcia Marcos, Valencia, Spain (Abstract Co-Author) Nothing to Disclose
Jose A. Flores Mendez, MD, Valencia, Spain (Abstract Co-Author) Nothing to Disclose
Daniel Perez Enguix, Valencia, Spain (Abstract Co-Author) Nothing to Disclose
Jose J. Martinez-Rodrigo, MD, Valencia, Spain (Abstract Co-Author) Nothing to Disclose
Maximiliano R. Lloret, MD, Valencia, Spain (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
pachecoariel.med@gmail.com

TEACHING POINTS
• To describe anatomy, clinical presentation and radiological findings of radicular pain syndrome
• To describe in detail specific interventional management of radicular pain syndrome

TABLE OF CONTENTS/OUTLINE
'MRI Mirrors the Histopathology' - Role of MRI in Synovial Disorders of Knee

All Day Room: NA Digital Education Exhibit

Participants
Sadineni Raghu Teja, MBBS, MD, Coimbatore, India (Presenter) Nothing to Disclose
Pushpa Bhari Thippeswamy, MD, MBBS, Coimbatore, India (Abstract Co-Author) Nothing to Disclose
Kavya Mikkineni, MD, Coimbatore, India (Abstract Co-Author) Nothing to Disclose
Anupama N. V., MBBS, FRCR, Coimbatore, India (Abstract Co-Author) Nothing to Disclose
Muhil Kannan, MD, Coimbatore, India (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
sadineniraghu@gmail.com

TEACHING POINTS
To review imaging features in synovial disorders of knee. To identify patterns and imaging findings to differentiate various etiologies in confirmation with tissue sampling (arthrocentesis, synovial biopsy). Key features on MRI for accurate diagnosis comparable to histopathology.

TABLE OF CONTENTS/OUTLINE
The spectrum of MRI findings are due to proliferation of synovial thickening, presence of adipose tissue / osteo-cartilaginous metaplasia / vascular structures / hemosiderin and crystals deposits. The radiologist can suggest etiology for each synovial pathology in view of location of lesion inside knee, its appearance in different MRI sequences and other associated findings. MRI can decrease the requirement of an invasive diagnostic procedure. The imaging patterns of various mentioned causes would be discussed with teaching points for accurate diagnosis. Septic arthritis Noninfectious Synovial Proliferative Processes (Lipoma Arborescens, Synovial Osteochondromatosis, Pigmented Villonodular Synovitis, Rheumatoid Arthritis Psoriatic arthritis) Infectious Granulomatous Diseases (Tuberculous Arthritis) Deposition Diseases (Gout, CPPD) Vascular Malformations (Synovial Hemangioma) Malignancies (Synovial Sarcoma) Miscellaneous Lesions: Cyclops Lesion.
Dynamic Ultrasound and Guided Intervention in Cubital Tunnel Ulnar Nerve Subluxation - A Diagnosis Often Overlooked

All Day Room: NA Digital Education Exhibit

Participants
Dharmendra K. Singh, MD,FRCR, New Delhi, India (Presenter) Nothing to Disclose
Mahesh Fumar, MBBS, Faridabad, India (Abstract Co-Author) Nothing to Disclose
Palbha Khanna, MBBS, Faridabad, India (Abstract Co-Author) Nothing to Disclose
Anuradha Sharma, MD, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Hemal Grover, MBBS, New York, NY (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
maheshverma2708@gmail.com

TEACHING POINTS
• The key anatomical stabilizing structure of the ulnar nerve within the cubital tunnel is the Osborne ligament. • The biomechanics of ulnar nerve elongation with increased intracubital tunnel pressure during elbow flexion is a predisposing factor for ulnar nerve subluxation which is best evaluated on dynamic Ultrasound (US). • The main objective of guided intervention is to reduce perineural frictional inflammation within the cubital tunnel; which is achieved by real time needle trajectory visualization, precise placement of the needle tip in the epineurium followed by successful circumferential instillation of the injectant.

TABLE OF CONTENTS/OUTLINE
1. Key sonographic anatomical landmarks • Osborne ligament • Boundaries of cubital tunnel
2. Variants • Anconeus epitrochlearis • Hypertrophied medial head of triceps
3. Ulnar nerve morphology • Short axis circumference of the nerve. • Ulnar nerve echopattern • Thickness of the perineurium. 4. Dynamic examination for ulnar nerve subluxation. 5. US guided intervention. • Appropriateness criteria • In plane approach • Rationale of injectant
TEACHING POINTS

To show the radiologist how to identify, classify and report the most common lower limb malformations, and learn the role of X-ray, MRI and TC in their evaluation. To understand normal development of the child and infant limb, and how the "timing" of genetic or extrinsic interference leads to deformity.

TABLE OF CONTENTS/OUTLINE

Limb malformation are pathologic disorders that affects 7.9 in every 10,000 births. Clinical diagnosis is challenging and imaging plays a vital role in diagnosis, classification and treatment. Due to its rarity, radiologists usually have difficulty in reporting this disorders. The main objective of this presentation is to provide a practical guide to understand normal development and main malformations that can affect the lower limbs, facilitating the act of reporting. Lower limb defects can be classified as failure of development, differentiation, duplication or other. The main example of failure of development is proximal focal femoral deficiency. Sindactily and clinodactily are common forms of failure of differentiation. The main example of duplication is polydactily, which can be subclassified in pre, meso and post-axial polydactily. We will also include illustrations showing normal limb development, as it facilitates understanding of the malformations.
MR Imaging of Superior Capsular Reconstruction for Irreparable Cuff Tears - No Bridges Burned! What the Radiologist Needs to Know

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Diego F. Lemos, MD, Burlington, VT (Presenter) Nothing to Disclose
Manickam Kumaravel, MD, FRCR, Houston, TX (Abstract Co-Author) Nothing to Disclose
Mohammad M. Samim, MD, MRCS, New York, NY (Abstract Co-Author) Nothing to Disclose
Luis S. Beltran, MD, Chestnut Hill, MA (Abstract Co-Author) Nothing to Disclose
Soterios Gyftopoulos, MD, Scarsdale, NY (Abstract Co-Author) Nothing to Disclose
William P. Pennington, MD, Franklin, WI (Abstract Co-Author) Consultant, Arthrex, Inc; Speaker, Arthrex, Inc
Alan Hirahara, MD, Sacramento, CA (Abstract Co-Author) Consultant, Arthrex, Inc; Royalties, Arthrex, Inc; Research support, Arthrex, Inc; Consultant, LifeNet Health; Medical Advisor, Clarius Mobile Health Corp

For information about this presentation, contact:
Diego.Lemos@UVMHealth.org

TEACHING POINTS
1. To learn about a relatively recent developed procedure used in the setting of irreparable rotator cuff tears, the superior capsular reconstruction. 2. To review the pathophysiology, indications and surgical technique of the superior capsular reconstruction. 3. To become familiar with the normal MR imaging appearances of superior capsular reconstruction, with radiographs and ultrasound correlation in some cases. 4. To recognize the MR imaging appearance of postsurgical complications and patterns of failure seen with superior capsular reconstruction.

TABLE OF CONTENTS/OUTLINE
Multiple Osteolytic Lesions: Another Approach for a More Accurate Diagnosis

All Day Room: NA Digital Education Exhibit

FDA Discussions may include off-label uses.

Participants
David Romero, MD, Bogota, Colombia (Presenter) Nothing to Disclose
German E. Galvis, MD, Bogota, Colombia (Abstract Co-Author) Nothing to Disclose
Fernando Rodriguez, MD, Bogota, Colombia (Abstract Co-Author) Nothing to Disclose
Juan C. Arjona Llano Jr, MD, Bogota, Colombia (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
sebasromeroleal@gmail.com

TEACHING POINTS
- Propose a systematic radiological diagnostic approach that allows to make the diagnostic presumption closer in the study of multiple bone lytic lesions.
- Propose a diagnostic tool that allows an approach to both the pediatric population and the adult population in multiple lytic bone lesions.
- Give a diagnostic tool to the radiologist that allows to make the diagnostic presumption closer in the study of multiple bone lytic lesions.

TABLE OF CONTENTS/OUTLINE
- Background of multiple bone lesion: state of the art
- Main characteristics and imaging findings of the multiple bone lithic lesions
- Diagnostic algorithm for the approximation to the multiple lytic bone lesions
  - Case 1: brown tumor
  - Case 2: Maffucci syndrome
- Sample cases and mimics
- Conclusions and key points
Am I Out of Sight?: Quiz-based Approach to Detect Various Metabolic Diseases in Routine Spine MRI

Participants
Sadineni Raghu Teja, MBBS, MD, Coimbatore, India (Presenter) Nothing to Disclose
Pushpa Bhari Thippleswamy, MD, MBBS, Coimbatore, India (Abstract Co-Author) Nothing to Disclose
Kavya Mikkineni, MD, Coimbatore, India (Abstract Co-Author) Nothing to Disclose
Anupama N. V., MBBS, FRCC, Coimbatore, India (Abstract Co-Author) Nothing to Disclose
Muhil Kannan, MD, Coimbatore, India (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
sadineniraghu@gmail.com

TEACHING POINTS
To describe marrow and soft tissue abnormalities in various metabolic diseases detected in routine spine MRI. A step by step quiz based approach for residents to narrow the differential diagnosis.

TABLE OF CONTENTS/OUTLINE
Incidentally detected marrow abnormalities are not uncommon on routine spine MRI and also there is lack of availability of plain radiograph at the time of reporting. Hence the role of MRI as primary modality in detection of metabolic bone disease cannot be underemphasized. A thorough knowledge of expected age related marrow changes is crucial in distinguishing normal versus abnormal marrow signals. T1 & STIR images play important role in detecting even early marrow abnormalities. We describe the following metabolic diseases in a quiz based approach with plain radiograph correlation at the end of the discussion. Ochronosis. Osteomalacia Osteoporosis Hemochromatosis Hemosiderosis Renal osteodystrophy Fluorosis SUMMARY - When a marrow abnormality is detected in routine spine MRI, step by step evaluation of the pattern of marrow abnormality and soft tissue changes gives clue to the diagnosis.
Humble Yet Remarkable: Routine Hip Radiographic Evaluation as a Road Map for Total Hip Arthroplasty—What Orthopedist Wants

All Day Room: NA Digital Education Exhibit

FDA

Discussions may include off-label uses.

Participants
Kavya Mikkineni, MD, Coimbatore, India (Presenter) Nothing to Disclose
Pushpa Bhari Thippeswamy, MD, MBBS, Coimbatore, India (Abstract Co-Author) Nothing to Disclose
Sadineni Raghu Teja, MBBS, MD, Coimbatore, India (Abstract Co-Author) Nothing to Disclose
Anupama N. V., MBBS, FRCP, Coimbatore, India (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
kavya.mikkineni16@gmail.com

TEACHING POINTS
To familiarise reader about importance of Dorr's classification based on plain radiograph in preoperative planning of total hip arthroplasty. To describe various options of hip replacement based on above classification. To describe radiographic appearance of satisfactory implant fixation in immediate postoperative period.

TABLE OF CONTENTS/OUTLINE
Routine hip radiograph is used by orthopedic surgeons to support diagnosis, monitor progression and influence management involving hip disease. The conventional plain radiograph is versatile in that, it can not only visualize localized processes such as osteoarthritis, but can also reflect systemic changes such as osteoporosis. Dorr's classification is based on conventional anteroposterior and lateral radiographs of the hip which will help to delineate bone quality of the proximal femur crucial for determining the type of femoral component implant fixation. Detailed illustrations of Dorr's classification and corresponding findings in immediate post operative radiographs indicating type of implant used and it's satisfactory fixation are described.
Assessment of Soft Tissue Tumors with Advanced MRI Techniques: How It Can Help Narrow Down Your Differential Diagnosis?

All Day Room: NA Digital Education Exhibit

Participants
Flavia M. Costa, MD, Rio De Janeiro, Brazil (Presenter) Nothing to Disclose
Pedro H. Martins, MD, Rio de Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Clarissa Canella, MD, Rio de Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose
Flavia P. Lopes, MD, Rio de Janeiro, Brazil (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
flavia26rio@hotmail.com

TEACHING POINTS
Soft tissue tumors represent a heterogeneous group of lesions routinely found in clinical practice that often means significant diagnostic challenges to radiologists. The use of advanced techniques is already part of the routine clinical protocol in some fields, especially neuroradiology, but is still not widely used in musculoskeletal field. The purpose of this presentation is to discuss and illustrate the characteristics of each advanced MRI sequences, including dynamic contrast-enhanced MR imaging (DCE-MRI), diffusion-weighted imaging (DWI) including DWI with extended body segment (DWIBS) evaluation, susceptibility-weighted imaging (SWI) and 3D DIXON quantitative chemical shift imaging, and how they can help to improve diagnostic accuracy in the evaluation of soft tissue tumors.

TABLE OF CONTENTS/OUTLINE
- Brief explanation about the soft tissue tumors classification according with the World Health Organization - To discuss and illustrate the characteristics of each advanced MRI sequence and how it might be helpful for differential diagnosis of soft tissue tumors
Percutaneous Image Guided Musculoskeletal Tumor Treatment

All Day Room: NA Digital Education Exhibit

Awards
Identified for RadioGraphics

Participants
Nathan Cornish, DO, Brooklyn, NY (Presenter) Nothing to Disclose
Michael Hoy, Washington, DC, DC (Abstract Co-Author) Nothing to Disclose
Dmitri Igonkin, MD, Albany, NY (Abstract Co-Author) Nothing to Disclose
Steven Shankman, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Shaun M. Honig, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Sergei A. Sobolevsky, MD, Brooklyn, NY (Abstract Co-Author) Nothing to Disclose
Debkumar Sarkar, DO, Camden, NJ (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
nathanacornish@gmail.com

TEACHING POINTS

1. Review the indications for percutaneous image guided musculoskeletal treatment for tumors.
2. Discuss the available percutaneous treatment options and their efficacy.
3. Review the common tumors that are treated with ablation and review their typical imaging appearances.

TABLE OF CONTENTS/OUTLINE

I. Introduction-Increasing use of image-guided percutaneous radiologic therapies Palliative Curative
II. Painful skeletal metastases-Palliation Invasive Radiofrequency Ablation (RFA) Cryoablation
2. Noninvasive Magnetic resonance imaging (MRI) guided focused ultrasound (FUS)
III. Local control of oligometastatic disease Image guided ablation IV. Preventing tumor progression Ablation
Osteoid Osteomas Painful Skeletal Mets Chondroblastoma Chordoma Epitheliod Hemangio-Endotheliomas 2. Sterotactic body radiotherapy 3. Vertebroplasty V. Fracture risk reduction Cementoplasty Osteosynthesis VI. Improvements in ablation techniques and monitoring Preprocedural and intraprocedural imaging Peripheral motor nerve stimulation
Forefoot Anatomy and Pathology: MRI Findings

All Day Room: NA Digital Education Exhibit

Participants
Jennifer Padwal, La Jolla, CA (Presenter) Nothing to Disclose
Palanan Siriwanarangsun, MD, Bankok, Thailand (Abstract Co-Author) Nothing to Disclose
Sheronda Statum, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Christine B. Chung, MD, La Jolla, CA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
jpadwal@ucsd.edu

TEACHING POINTS
1. Review musculoskeletal, nervous, and vascular anatomy of the forefoot
2. To review MRI findings of common traumatic and idiopathic etiologies of forefoot pain
3. To differentiate between forefoot pathologies secondary to systemic medical conditions

TABLE OF CONTENTS/OUTLINE
1. Objectives of the exhibit
2. Anatomy review of the forefoot
3. Traumatic pathology - turf toe, plantar plate disruption, fracture, sesamoiditis, Freiberg infraction
4. Chronic conditions - hallux valgus, hallux rigidus, bunionette, hammertoes
5. Neoplasms of the forefoot - lipoma, schwannoma, neurofibroma, giant cell tumor, sarcoma
6. Manifestations of chronic, systemic medical conditions in the forefoot - gout, rheumatoid arthritis
7. Tendinopathies and soft-tissue masses - Morton neuroma, ganglia, bursitis, foreign body granuloma, hemangioma, plantar fibromatosis
8. Take home points
Stranger Views: Making Sense of Uncommonly Ordered Projections in Musculoskeletal Radiography

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Patrick Kobes, DO, Manhasset, NY (Presenter) Nothing to Disclose
Hailey Allen, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Christopher J. Hanrahan, MD, PhD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Richard L. Leake, MD, North Salt Lake, UT (Abstract Co-Author) Nothing to Disclose
Zachary Berg, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Review uncommonly ordered musculoskeletal radiographic views and indications. 2. Review patient positioning as it pertains to specific radiography with normal/abnormal examples. 3. Stress the specific strengths of unique radiographic views in order to avoid CT utilization.

TABLE OF CONTENTS/OUTLINE
1. Brief history of radiography, basic views and positioning
2. Examples of unique radiography
   a. Noorgaard view
   b. Hindfoot view
   c. Broden view
   d. False profile view
   e. Dunn view
   f. Ferguson view
   g. Spider view
   h. Sesamoid view
   i. Serendipity view
   j. Clements Nakayama view
   k. Valpeau view
   l. Clenched fist view
   m. Carpal boss view
   n. Bergquist view
   o. Flamingo view
   p. Pelvic inlet and outlet views
   q. Grashey view
   r. Merchants view
   s. Prayer view
   t. Talar neck view
   u. Zanca view
   v. Zimmer view
3. Specific radiographic views
   a. Indications
   b. Positioning
   c. Photographs illustrating normal positioning
   d. Radiographic view
   e. Example of normal radiograph
   f. Illustrate anatomy
   g. Discuss pertinent image interpretation
   h. Example of abnormal radiograph
   i. Possible alternative examinations and limitations
4. Conclusion
5. Summary
Why Friction? A Pictorial Review of Ankle Impingement Syndromes

All Day Room: NA Digital Education Exhibit

Participants
Muhil Kannan, MD, Coimbatore, India (Presenter) Nothing to Disclose
Pushpa Bhani Thippeswamy, MD, MBBS, Coimbatore, India (Abstract Co-Author) Nothing to Disclose
Sadineni Raghu Teja, MBBS, MD, Coimbatore, India (Abstract Co-Author) Nothing to Disclose
Anupama N. V., MBBS, FRCR, Coimbatore, India (Abstract Co-Author) Nothing to Disclose
Kavya Mikkineni, MD, Coimbatore, India (Abstract Co-Author) Nothing to Disclose
Rajasekaran Shanmuganathan, MS, Coimbatore, India (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
dr.muhil@gmail.com

TEACHING POINTS
To illustrate the anatomical and clinical causes of ankle impingement. To demonstrate the role of multimodality imaging in identification of ankle impingement. To discuss the clinical features and management of ankle impingement.

TABLE OF CONTENTS/OUTLINE
Ankle impingement syndromes are painful conditions caused by friction of joint tissues, due to the altered joint biomechanics. Purpose of this pictorial review is to describe clinical features, relevant anatomy of different compartments, mechanics of impingement, Multimodality imaging findings in ankle impingement syndromes. The following ankle impingement syndromes will be discussed in this pictorial review: - Anterior impingement syndrome - Anterolateral impingement syndrome - Anteromedial impingement syndrome - Posteromedial impingement syndrome - Posterior impingement syndrome - Extraarticular lateral hindfoot impingement syndrome.
Ultrasound Appearance of Common and Uncommon Lumps and Bumps of the Extremities

All Day Room: NA Digital Education Exhibit

Participants
Usa Cain, MD, Rochester, NY (Presenter) Nothing to Disclose
Deborah J. Rubens, MD, Rochester, NY (Abstract Co-Author) Nothing to Disclose
Vikram S. Dogra, MD, Rochester, NY (Abstract Co-Author) Editor, Wolters Kluwer nv;
Scott R. Schiffman, MD, Rochester, NY (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
usa_cain@urmc.rochester.edu

TEACHING POINTS
Patients presenting with a mass-like lump of the upper extremities often undergo ultrasound imaging during initial work-up. Ultrasound is less expensive when compared to MRI and often useful. Diagnostic accuracy of soft tissue tumors by ultrasound has been estimated to be as high as 79% for the common diagnoses. Inaccurate diagnosis on initial ultrasound imaging may delay accurate diagnosis if further appropriate imaging is not recommended. Ultrasound is helpful in differentiating benign and malignant superficial tumors. Musculoskeletal lesions can be difficult to diagnose, especially by ultrasound imaging, increasing radiologist awareness of the ultrasound appearance of less common soft tissue tumors may improve diagnostic accuracy.

TABLE OF CONTENTS/OUTLINE
1. Review the ultrasound appearance of common musculoskeletal soft tissue tumors including: lipoma, vascular malformation, epidermoid cyst, abscess, and nerve sheath tumor. 2. Case review of less common soft tissue tumors of the extremities including primary and metstatic malignancy, organizing thrombus with vascularity. Case review will include CT and MRI correlation if available. 3. Discuss ultrasound characteristics of benign and malignant tumors. 4. Describe ultrasound imaging pitfalls including absence of vascular flow with improper technique which can drastically affect accurate diagnosis.
Beyond Femoroacetabular Impingement: What the Radiologist Should Know

All Day Room: NA Digital Education Exhibit

Participants
Mariana D. Silva, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Maria Helena T. Rodrigues, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Paulo Victor P. Helito, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcelo Bordalo-Rodrigues, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
maria.anass@gmail.com

TEACHING POINTS
Extra-articular hip impingement syndromes encompass a group of conditions that have previously been an unrecognized source of pain in the hip. The importance of these conditions has been recognized recently as arthroscopic techniques evolve, and they form an important part of the differential of hip pain. The aim of this review is to provide the reader with an evidence-based and comprehensive update of these syndromes, by reviewing past literature, the anatomy, pathophysiology, clinical features and the management of the most common extra-articular hip impingement syndromes.

TABLE OF CONTENTS/OUTLINE
Review the anatomy, pathophysiology, clinical and imaging features of the most common extra-articular hip impingement syndromes, including: Ischiofemoral impingement; Subspine impingement; Iliopsoas impingement; Pectineofoveal impingement; Pelvic-trochanteric impingement;
Talalgia: The Wide Spectrum of Heel Pain—Diagnosis and Imaging Findings

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit

Participants
Fernanda Caillava, Buenos Aires, Argentina (Presenter) Nothing to Disclose
Ignacio J. Volpe, MD, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
Ariel F. Gonzales Noaga, MD, PhD, CABA, Argentina (Abstract Co-Author) Nothing to Disclose
Gabriel H. Aguilar, MD, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose
Ignacio Rossi, MD, Buenos Aires, Argentina (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
- to recognize normal anatomy of the hindfoot.
- to explain the multiple causes of talalgia.
- to analyze radiographic and MRI findings for diagnostic approach.

TABLE OF CONTENTS/OUTLINE
Anatomy
The ankle joint are supposed to work as a functional unit for the appropriate movement of the foot. It is very important having knowledge not only about bone structures, but also tendinous, vascular and nervous components, and their normal variants.

Pathophysiology
When heel pain occurs, osseous components such as calcaneus, talus, distal tibia and fibula are affected and also muscles and tendons. That is why, there is a wide spectrum of entities that manifest as heel pain. Imaging techniques
The diagnosis approach in each case is through X-ray, computed tomography and MRI, but these last two are the most specific and sensible methods. Review of imaging findings
We evaluate a varied group of cases and correlate the imaging findings with patients’ symptomatology.

Conclusion
Heel pain is a very frequent clinical manifestation in the adult. The wide spectrum of its possible causes is due to multiple abnormalities that can occur both at osseous and soft tissues components. Therefore, it is important to know the different entities that lead to this and its radiological manifestations, in order to make a correct diagnosis and appropriate treatment.
MUSCULOSKELETAL SUNDAY CASE OF THE DAY

Sunday, Nov. 25 7:00AM - 11:59PM Room: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants
Daniel E. Wessell, MD, PhD, Jacksonville, FL (Presenter) Nothing to Disclose
Jonathan A. Flug, MD, MBA, Phoenix, AZ (Abstract Co-Author) Nothing to Disclose
Jeremiah R. Long, MD, Ft Belvoir, VA (Abstract Co-Author) Nothing to Disclose
Joseph M. Bestic, MD, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose
Hillary W. Garner, MD, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose
Andrew Z. Chow, MD, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose
Sara Eckloff, MD, Eau Claire, WI (Abstract Co-Author) Nothing to Disclose
Matthew A. Frick, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Nicholas G. Rhodes, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Sujan C. Fernando, MD, Milwaukee, WI (Abstract Co-Author) Nothing to Disclose
John S. Symanski, MD, Milwaukee, WI (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) Participants will test their diagnostic skills and become familiar with the imaging findings of a variety of challenging and interesting musculoskeletal cases.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Daniel E. Wessell, MD, PhD - 2013 Honored Educator
SSA14

Musculoskeletal (Bone Marrow and Neoplasms)

Sunday, Nov. 25 10:45AM - 12:15PM Room: E353C

MR MK

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

FDA Discussions may include off-label uses.

Participants
Luca Maria Sconfienza, MD, PhD, Milano, Italy (Moderator) Travel support, Bracco Group; Travel support, Esaote SpA; Travel support, ABIOMED PHARMA SpA; Speakers Bureau, Fidia Pharma Group SpA
Reto Sutter, MD, Zurich, Switzerland (Moderator) Nothing to Disclose

Sub-Events
SSA14-01 MR-Based Assessment of Bone Marrow Fat in a Population-Based Cohort Study: Comparison of Different Methods and Association to Physical Activity

Sunday, Nov. 25 10:45AM - 10:55AM Room: E353C

Participants
Robert C. Bertheau, MD, Heidelberg, Germany (Presenter) Nothing to Disclose
Roberto Lorbeer, Greifswald, Germany (Abstract Co-Author) Nothing to Disclose
Johanna Nattennueller, MD, Heidelberg, Germany (Abstract Co-Author) Nothing to Disclose
Elke Wintemeyer, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Christopher Schuppert, Heidelberg, Germany (Abstract Co-Author) Nothing to Disclose
Birgit Linkohr, Neubergh, Germany (Abstract Co-Author) Nothing to Disclose
Juergen Machann, MD, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Hans-Ulrich Kauczor, MD, Heidelberg, Germany (Abstract Co-Author) Research Grant, Siemens AG Research Grant, Bayer AG Speakers Bureau, Boehringer Ingelheim GmbH Speakers Bureau, Siemens AG Speakers Bureau, Koninklijke Philips NV Speakers Bureau, Bracco Group Speakers Bureau, AstraZeneca PLC
Annette Peters, Neubergh, Germany (Abstract Co-Author) Nothing to Disclose
Fabian Bamberg, MD, Tuebingen, Germany (Abstract Co-Author) Speakers Bureau, Bayer AG; Speakers Bureau, Siemens AG; Research Grant, Siemens AG
Christopher L. Schlett, MD, MPH, Heidelberg, Germany (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
robert.bertheau@med.uni-heidelberg.de

PURPOSE

We aimed to compare different MRI-based assessments of bone marrow adipose tissue (MAT) at different anatomic locations and its correlation with physical activity.

METHOD AND MATERIALS

As part of the population-based KORA study, largely healthy subjects underwent whole-body MR imaging including a 2-point-T1-DIXON-VIBE (2pDIXON) sequence (entire body) and a multi-echo DIXON (ME) sequence (upper abdomen). MAT was quantified in the L1 and L2 vertebrae using both sequences, in the femoral necks using the 2pDIXON. In the 2pDIXON, MAT percentage was calculated as the mean value of the fat image divided by the sum of the mean values of the fat and water image. In the ME sequence, MAT percentage was directly derived from the output images, which accounted for R2*. Physical activity was calculated as the mean value of the fat image divided by the sum of the mean values of the fat and water image. In the ME sequence, MAT percentage was directly derived from the output images, which accounted for R2*. Physical activity was determined by standardized questionnaire.

RESULTS

A total of 385 subjects (96%) were included in the analysis (56±9.1yrs, 58% male); with an evenly distributed physical activity pattern (29% >2h/week; 31% 1h/week; 15% 1h/week (irregularly); 26% no physical activity). Based on the 2pDIXON, MAT was 52.6±10.2% in L1, 56.2±10.3% in L2, 87.4±5.9% in the right and 87.2±5.9% in the left femur neck, while in the ME sequence MAT was significantly lower (43.0±8.0% and 44.1±7.9%, for L1 and L2, all p<0.001; respectively). Both MAT measurements in the vertebrae were strongly correlated (r: 0.81 to 0.93), in contrast, correlation of MAT between vertebrae and femoral necks was weak (r: 0.36 to 0.46). All vertebral bone marrow fat measurements were inversely associated with high physical activity (>2h/w), but no correlation was found with the femoral necks (all p>=0.35). Strongest association was observed for L1, derived from the 2pDIXON (ß= 3.9, p=0.005). This association remained significant when adjusted for age, gender and waist circumference (p=0.005). Also, high reproducibility, assessed in a subset of 30 subjects, was observed in the 2pDIXON measurement at L1 (ICC for inter- and intra-reader: 0.92 and 0.90).

CONCLUSION

Physical activity was negatively correlated with MAT in the L1, L2 vertebrae but not with the femoral necks. 2pDIXON depicted that correlation better than the ME sequence.

CLINICAL RELEVANCE/APPLICATION
MAT is centrally involved in many metabolic processes and may serve as a proxy for bone health/disease, e.g. osteoporosis. Its different dependence on physical activity at different body locations may contribute to a better understanding of related pathophysiology.

**SSA14-02 Application of Texture Analysis in the Differential Diagnosis of Osteoblastic Metastases and Enostoses: Comparison with CT Attenuation Measurements**

Sunday, Nov. 25 10:55AM - 11:05AM Room: E353C

**Participants**
Seong Woo Jeon, MD, Suwon, Korea, Republic Of (Presenter) Nothing to Disclose
Kyu-Sung Kwack, MD, PhD, Suwon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sunghoon Park, MD, Suwon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
The purpose of this study was to investigate the role of CT texture in distinguishing between osteoblastic metastases from enostoses and to compare the results with CT attenuation values.

**METHOD AND MATERIALS**
The study group comprised 32 patients with 64 sclerotic bone lesions found at CT (41 enostoses in 24 patients and 23 metastases in 8 patients). For each lesion in spine, CT texture analysis was performed by drawing a region of interest on axial CT slices. The histogram parameters (mean, SD, kurtosis, entropy, and skewness) were acquired using a research software 'TexRAD'. The diagnostic performances of mean CT attenuation values and texture analysis for differentiating osteoblastic metastases from enostoses were evaluated.

**RESULTS**
Mean CT attenuation values had the best diagnostic performance with an ROC AUC (Az) of 0.953 among all parameters. Among CT texture analysis parameters to differentiate osteoblastic metastases and enostoses, the kurtosis had the highest ROC (Az = 0.787) than the entropy (Az = 0.763) and skewness (Az = 0.691). The combination of mean attenuation and CT texture analysis parameters had poorer performance than mean CT attenuation values alone.

**CONCLUSION**
Using texture analysis does not improve diagnostic performance in the differentiation of osteoblastic metastases and enostoses in the spine.

**CLINICAL RELEVANCE/APPLICATION**
CT texture analysis may have a spectrum of potential application in lesion characterization for some tumor types. However, based on our data, we cannot recommend adding CT texture analysis to differentiate osteoblastic metastases of the spine.

**SSA14-03 Differentiation of Osteomyelitis from Reactive Osteitis in the Patients with Diabetic Foot Using Multivariable Logistic Regression Analysis**

Sunday, Nov. 25 11:05AM - 11:15AM Room: E353C

**Participants**
Yong-ho Jang, MD, Suwon, Korea, Republic Of (Presenter) Nothing to Disclose
Kyu-Sung Kwack, MD, PhD, Suwon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sunghoon Park, MD, Suwon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To retrospectively investigate the differentiating magnetic resonance (MR) imaging findings between osteomyelitis and reactive osteitis in the patients with diabetic foot.

**METHOD AND MATERIALS**
From November 2015 to March 2018, 118 patients who underwent MRI of the foot for evaluation of suspected osteomyelitis were included in this study. Primary (signal intensity, distribution, and pattern on the T1-weighted images, signal intensity on the T2-weighted images, and concordance of marrow signal intensity) and secondary MR imaging signs (cortical interruption, cellulitis, ulcer, soft tissue abscess, and gangrene) were retrospectively reviewed. To identify the MR features differentiating osteomyelitis from reactive osteitis and to evaluate their differentiating accuracy, multivariate regression and receiver operating characteristic (ROC) curve analysis were performed.

**RESULTS**
On MRI findings, signal intensity, distribution, and pattern on the T1-weighted images, signal intensity on the T2-weighted images, concordance of marrow signal intensity, cortical interruption, ulcer, soft tissue abscess, and gangrene were significantly different between two groups (p < 0.05). Multivariate regression analysis showed that the bright T2 signal intensity (OR 17.7, p < 0.001) and deep ulcer (OR 5.6, p = 0.009) were major factors associated with osteomyelitis. The area under the ROC curve of predicted probabilities for the combination of these factors was 0.879.

**CONCLUSION**
In the patients with diabetic foot, osteomyelitis can be accurately distinguished from reactive osteitis by the bright T2 signal intensity and deep ulcer.

**CLINICAL RELEVANCE/APPLICATION**
Identification and application of these MR features are important to analyzing radiological imaging in the patients with the diabetic foot and can help the radiologist to differentiate osteomyelitis from reactive osteitis.

**SSA14-04 Predicting Osteomyelitis in Patients with Equivocal MRI Findings**
No significant differences in the baseline serological- and MRI-derived indices were observed between groups. At the second chemotherapy, the patients were categorized into a CR group (n=12) or a non-CR group (n=30).

METHOD AND MATERIALS

We analyzed MR exams of diabetic patients with pedal ulcers and suspected osteomyelitis who were indeterminate for OM based on discordant bone marrow signal (normal T1, abnormal T2fs/STIR) adjacent to the ulcer. Follow-up imaging and/or surgical results determined outcome (OM or non-OM). Ulcers were categorized based on surface area and depth (distance to bone). Patterns of marrow edema (subcortical vs medullary) were recorded. The ratio of marrow to joint fluid signal on T2fs/STIR sequences was measured. Statistical analysis was performed with a two-sample t-test and a Cox proportional hazard model.

RESULTS

60 MR exams were identified. 26 showed resolution of marrow findings (no osteomyelitis) and 34 progressed to osteomyelitis. Marrow ROI/joint fluid ratios averaged 65% (39-87%) in the OM group, and 45% (17-97%) in the non-OM group, p < .001. ROI ratios > 53% had a 6.5-fold increased risk of osteomyelitis, p < .001. Proximity to bone averaged 6mm in the OM group and 9mm in the non-OM group, p = .02. Ulcer size averaged 4 cm² in the OM group versus 2.4 cm² in the non-OM group, p = .07. Ulcers greater than 3cm² had a 2-fold increase in the risk of osteomyelitis, p = .04.

CONCLUSION

High bone marrow/joint fluid signal ratio on T2fs/STIR images was the strongest risk factor for development of osteomyelitis, with a ratio > 53% portending an 6.5-fold increased risk of osteomyelitis. Ulcer size and depth to bone are weaker predictors for the development of osteomyelitis.

CLINICAL RELEVANCE/APPLICATION

Diabetes affects 9.3% of US citizens, 25% of which develop a foot ulcer, the most significant risk factor for amputation. A test that could accurately predict early osteomyelitis in this population would significantly reduce morbidity.
examination, tTV, M protein, and β2-microglobulin were significantly decreased and 75th percentiles of ADC and FF were significantly increased in the CR group. The general linear model demonstrated that percentage changes in FF and M protein contributed significantly to the achievement of CR (P=0.01, P=0.03, respectively). AUCs of ROC curves were 0.876 for FF and 0.843 for M protein.

CONCLUSION
Early change in the FF of lumbar BM soon after induction of chemotherapy was a significant predictor of CR. Total TV obtained by wb-DWI did not prove to be a significant predictor of CR. The sensitivity of FF in the lumbar BM for identification of CR was higher than M protein.

CLINICAL RELEVANCE/APPLICATION
Early change in the FF of lumbar BM soon after induction of chemotherapy is a predictor of CR, suggesting that lumbar spinal MRI can be used to predict remission status.

SSA14-06 MRI Radiomics in the Longitudinal Analysis of Desmoid Fibromatosis Undergoing Systemic Therapy

Sunday, Nov. 25 11:35AM - 11:45AM Room: E353C

Participants
Ty K. Subhawong, MD, Miami, FL (Presenter) Research Consultant, Arog Pharmaceuticals, Inc
Katharina Feister, Miami, FL (Abstract Co-Author) Nothing to Disclose
Kevin M. Sweet, MD, Miami, FL (Abstract Co-Author) Nothing to Disclose
Jorge Monge Urea, Miami, FL (Abstract Co-Author) Nothing to Disclose
Peter Demaria, Miami, FL (Abstract Co-Author) Nothing to Disclose
Robert Hsu, Miami, FL (Abstract Co-Author) Nothing to Disclose
Heath Catoe, Miami, FL (Abstract Co-Author) Nothing to Disclose
Ahmet M. Bagci, Miami, FL (Abstract Co-Author) Nothing to Disclose
Noam Alperin, PhD, Miami, FL (Abstract Co-Author) Nothing to Disclose
Breelyn A. Wilky, MD, Miami, FL (Abstract Co-Author) Research support, Merck & Co, Inc; Consultant, Novartis AG; Consultant, Johnson & Johnson; Consultant, Eli Lilly and Company

For information about this presentation, contact:
tsubhawong@miami.edu

PURPOSE
Desmoid-type fibromatosis exhibits unique morphological changes on MRI in response to systemic therapy. We sought to quantify the longitudinal changes in appearance of treated tumors to better elucidate the relationship between morphological and textural imaging features.

METHOD AND MATERIALS
This IRB-approved retrospective study included 16 extra-abdominal lesions in 11 subjects (mean age 37 years), 6 females and 5 males. Therapeutic regimens included cytotoxic chemotherapy (n=7), tyrosine kinase inhibitor (n=2), tamoxifen (n=3), and NSAIDS (n=2). Tumors were segmented using 3D-Slicer, and features were extracted with the Radiomics extension; data included tumor shape, signal intensity (tumor: muscle enhancement ratio), and image texture. Response was classified at the lesional level by RECIST1.1 maximum diameter (Dmax) thresholds for progressive disease (>20% increase from nadir, PD), partial response (>30% decrease from baseline, PR), or otherwise stable disease (SD).

RESULTS
The 16 lesions were followed for mean of 5.1 years (range 9 months -14 yrs); this included a total of 100 distinct timepoints. Baseline mean Dmax=10 cm (range 4.2-173 cm), volume 176 cc (range 8-796 cc), and mean enhancement ratio 1.8 (range 0.9-4.0). By RECIST1.1 6 lesions remained stable, 6 lesions showed PD (median progression free survival 1.8 yrs). Only 4 lesions (25%) achieved PR (median time to PR 3.9 yrs), while 13/16 (81%) showed a drop in enhancement ratio (mean -46% from baseline). 12/16 (75%) tumors exhibited at least >20% drop from baseline (median 2.6 yrs). Dmax correlated poorly with enhancement ratio (r=0.09). A random effects GLS regression model containing shape-based, first-order, and textural features established skewness (p=0.008), minor axis length (p=0.04), and run entropy (p=0.05) as significant independent predictors of contrast enhancement ratio.

CONCLUSION
Most desmoid fibromatoses show substantial decreased enhancement after systemic treatment despite relative stability in size. Desmoid segmentation enables identification of radiomic biomarkers that reflect clinically relevant longitudinal changes in tumor phenotype.

CLINICAL RELEVANCE/APPLICATION
Consistent and durable decreases in tumor enhancement support augmenting or replacing size-based with signal-based imaging response criteria for desmoid tumors undergoing systemic therapy.

SSA14-07 Differentiating Lipomatous Masses with High-Resolution 1H MRS Metabolites: Do Benign Lipomas and Atypical Lipomatous Tumors Have a Distinct Metabolic Signature?

Sunday, Nov. 25 11:45AM - 11:55AM Room: E353C

Participants
Santosh M. Bharti, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Brett A. Shannon, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Carol Morris, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Adam Levin, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Zaver M. Bhujiwalla, PhD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Laura M. Fayad, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
PURPOSE
Adipocytic tumors represent a spectrum of neoplastic disease from benign lipomas and variants, to atypical lipomatous tumors (ALTs) and liposarcomas. Some liposarcomas are suspected to arise through dedifferentiation of ALTs. The distinction of liposarcomas and premalignant ALTs can be a diagnostic challenge, as can the distinction of ALTs and lipoma variants (lipomas without pure lipid composition), with implications for surgical and clinical management. The purpose of this study is to identify metabolic biomarkers for adipocytic tumors, for accurate tumor classification.

METHOD AND MATERIALS
In a prospective study, de-identified human surgical samples were collected from subjects who underwent surgical resection of indeterminate adipocytic tumors (those with imaging features atypical for simple lipomas). Tissue samples were snap frozen and stored at -80°C until 1H MRS analysis. Dual phase solvent extraction was performed on approximately 300 mg of tumor tissue. The water phase was separated, freeze-dried, and reconstituted in 600ul D2O PBS for MRS analysis. All MR spectra were acquired on an Avance III 750 MHz (17.6T) Bruker NMR spectrometer. Computational modeling of pattern recognition based cluster analysis was utilized to look for significant differences in metabolic signatures between the adipocytic tumor types.

RESULTS
Tissue specimens from lipoma variants (n=6), ALTs (n=5) and adjacent non-involved subcutaneous normal fat (n=7) were examined using 1H MRS. Quantitative metabolite information is shown in figures 1A-B. The metabolic heatmap (Figure 1A) identifies the metabolic patterns of ALTs compared to lipoma variants and normal fat. A significant increase in several metabolite levels, including lactate, was observed in ALTs compared to lipomas and normal fat. Cluster analysis (Figure 1B) showed significant differences between normal fat, lipoma variants and ALTs.

CONCLUSION
Our preliminary data support investigating the use of high resolution 1H MRS of adipocytic tumors for differentiating between tumor subtypes and for understanding malignant progression.

CLINICAL RELEVANCE/APPLICATION
These results provide new insights into the metabolic differences between benign and premalignant tissue that may be exploited for formulating treatment plans and ultimately, metabolism-based therapeutic strategies.

SSA14-08 Radiomic Analysis of Peripheral Nerve Sheath Tumors Accurately Predicts Benign versus Malignant Status

Sunday, Nov. 25 11:55AM - 12:05PM Room: E353C

Participants
Alexander T. Mazal, BS, Dallas, TX (Presenter) Nothing to Disclose
Liuyan Chen, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Feng Poh, MBBS,FRCR, Singapore, Singapore (Abstract Co-Author) Nothing to Disclose
Jing Wang, PhD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Parham Pezeshk, MD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Oganes Ashikyan, MD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Avneesh Chhabra, MD, Dallas, TX (Abstract Co-Author) Consultant, ICON plc; Author with royalties, Wolters Kluwer nv; Author with royalties, Jaypee Brothers Medical Publishers Ltd

For information about this presentation, contact:
avneesh.chhabra@utsouthwestern.edu

PURPOSE
To evaluate whether radiomic analysis can accurately differentiate benign (BPNST) versus malignant peripheral nerve sheath tumors (MPNSTs), and compare it to the expert radiologist interpretation.

METHOD AND MATERIALS
44 patients with histologically confirmed PNSTs were identified from the institutional electronic data base. Fat suppressed T2W (fsT2W) imaging in isolation and all imaging combined including contrast (mirroring a routine setting) were used for Radiomic analysis and by two experienced musculoskeletal radiologists. Regions of interest (ROIs) corresponding to the tumor boundaries were contoured by a different experienced musculoskeletal radiologist using VelocityTM software (Varian Medical Systems). For system training, volumetric ROIs extracted from fsT2W images of 25 tumors (16 benign, 9 malignant) were used for the proposed Convolutional Neural Network (CNN), which included 7 convolution, 3 max-pooling and 2 fully connected layers. Data augmentation by rotating 3D images and Synthetic Minority Over-sampling technique (SMOTE) were employed to balance and increase training samples. The CNN was tested using 15 unknown tumors and evaluated for accuracy. Following which, two blinded radiologists in two different settings- fsT2W images (set 1) and all imaging sequences together (set 2) evaluated the same testing cases into benign versus malignant tumors. The accuracy of the CNN models was compared with radiologists. Statistical tests included Area Under the Curve (AUC) and Fisher's Exact Test.

RESULTS
The CNN model using fsT2W predicted benign versus malignant among PNSTs with an accuracy and AUC of 87% and 0.89, compared to the accuracy and AUC of 73%, 0.83 and 93%, 0.83 for the radiologists 1 and 2, respectively (p>0.05). The accuracy and AUC of radiologists 1 and 2, and CNN using all sequences including contrast imaging (mirroring the routine setting) was 71%, 0.81 and 71%, 0.70, and 93%, 0.94, respectively.
CONCLUSION
Radiomic analysis accurately differentiates benign versus malignant PNSTs and may serve as a powerful adjunctive measure during diagnosis of these neoplasms.

CLINICAL RELEVANCE/APPLICATION
Given the morbidity and mortality associated with MPNSTs, the high accuracy of radiomics is likely to be extremely valuable in their diagnostic work-up. Further study with larger cohorts can determine whether radiomics may aid in classification among BPNST subtypes, such as neurofibroma, schwannoma, and perineurioma.

SSA14-09  Grading of Soft Tissue Sarcoma by Using 3T MR Imaging Texture Analysis
Sunday, Nov. 25 12:05PM - 12:15PM Room: E353C

Participants
Ji Hyun Hong, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Won-Hee Jee, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Research Grant, Bayer AG;
Chan-Kwon Jung, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Joon-Yong Jung, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Yohan Son, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Seung Han Shin, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Yang-Guk Chung, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
whjee12@gmail.com

PURPOSE
To determine the value of 3T magnetic resonance (MR) imaging texture analysis to differentiate high-grade from low-grade soft tissue sarcomas.

METHOD AND MATERIALS
The institutional review board approved this retrospective study and informed consent was waived. Forty-eight patients with soft tissue sarcomas who had undergone 3T MR imaging including contrast-enhanced (CE) imaging were included in this study. Texture analysis of whole tumor volume on T1- and T2-weighted images and fat-suppressed CE T1-weighted images were performed using Multiparametric toolbox. Histogram features (mean intensity, standard deviation (SD), skewness and kurtosis) and gray-level co-occurrence matrix features (Difference entropy, Difference variance, contrast, entropy) were compared between high-grade (grades 2 and 3) and low-grade (grade 1) soft tissue sarcomas using Mann-Whitney U test. The receiver operating characteristic curves with areas under the curve (AUC) for all parameters were obtained.

RESULTS
There were 11 patients with low-grade sarcomas and 37 patients with high-grade sarcomas: grade 2 (n = 10) and grade 3 (n = 27). T1 mean, T2 mean, T1 SD and CE T1 skewness were significantly lower in high-grade than low-grade sarcomas: 510.6 vs 761.3; 637.8 vs 850.0; 90.6 vs 142.9; 0.12 vs 0.63 (P< .05), respectively. CE T1 mean, T2 skewness and CE T1 Difference variance were significantly higher in high-grade than low-grade sarcomas: 619.0 vs 385.9; 0.404 vs -0.425; 0.232 vs 0.175 (P< .05), respectively. AUCs of above parameters except T1 mean were over 0.7: 0.725 (95% CI, 0.573-0.876) in T2 mean; 0.752 (95% CI, 0.568-0.936) in CE T1 mean; 0.737 (95% CI, 0.568-0.906) in T1 SD; 0.722 (95% CI, 0.557-0.887) in T2 skewness; 0.722 (95% CI, 0.560-0.885) in CE T1 skewness; 0.706 (95% CI, 0.526-0.887) in CE T1 Difference variance. AUC of T1 mean was 0.698 (95% CI, 0.489-0.907).

CONCLUSION
Texture analysis based on 3T MR imaging may be reliable to differentiate between high-grade and low-grade soft tissue sarcomas.

CLINICAL RELEVANCE/APPLICATION
MR imaging texture analysis may help predict grade of soft tissue sarcoma.
PURPOSE

Although femoroacetabular impingement (FAI) describes a dynamic osseous abutment of the femur against the acetabulum, current standard imaging assessment is static. Recently CT-based impingement analysis was introduced whereas MRI would offer a radiation-free alternative. Thus we asked (1) what is the mean distance between surface points of 3D pelvis models derived from CT/MRI; (2) whether impingement free range of motion correlates between CT and MRI; (3) and whether zones of impingement match for 3D models based on CT and MRI?

METHOD AND MATERIALS

IRB-approved comparative, retrospective study of 20 symptomatic hips with FAI. 3D CT scans (isovoxel: 1mm³) of the entire pelvis and the distal femoral condyles were obtained. Preoperative MR arthrograms of the hip were obtained including 0.8mm³ isovoxel T1 3D VIBE- and 1mm³ isovoxel 3D T1 VIBE DIXON sequences of the entire pelvis and the distal femoral condyles. Threshold-based manual segmentation was performed using commercial software (AMIRA). Both 3D models were compared with inhouse developed software which includes two specific algorithms for detection of the acetabular rim and for detection of the center of rotation. We calculated (1) percentage of the surface points with < 1mm difference between the CT-based and MRI-based 3D models; (2) assessed correlation of impingement-free range of motion (in: flexion; extension; internal rotation 90° of flexion; external rotation in 90° of flexion; abduction; adduction) between CT and MRI and (3) compared location of impingement zones between CT and MRI using the clock-face system which divides the femur and acetabulum into 12 'hour' positions.

RESULTS

(1) 83% and 79% of the surface points of the proximal femur respectively of the acetabulum differed <1mm between the CT-based and MRI-based 3D models. (2) Correlation for the range of motion values was excellent (spearman rho=0.993, p<0.05) between CT and MRI. (3) Location of impingement did not differ between CT-based and MRI-based range of motion analysis in 12/12 acetabular and 11/12 femoral clock-face positions.

CONCLUSION

MRI-based 3D models of the pelvis can replace CT-based 3D models for range of motion analysis in femoroacetabular impingement.

CLINICAL RELEVANCE/APPLICATION

3D-MRI based impingement analysis of the hip is a further step towards non-invasive, personalized surgical planning of FAI especially for complex deformities such as abnormal femoral torsion.
Kevin Yan, BA, Dallas, TX (Presenter) Nothing to Disclose
Yin Xi, PhD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Chayanit Sasiponganan, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Joseph S. Zerr, MD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Joel Wells, MD, MPH, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Avneesh Chhabra, MD, Dallas, TX (Abstract Co-Author) Consultant, ICON plc; Author with royalties, Wolters Kluwer nv; Author with royalties, Jaypee Brothers Medical Publishers Ltd

For information about this presentation, contact:
Kevin.Yan@UTSouthwestern.edu

PURPOSE
Femoroacetabular impingement (FAI) and hip dysplasia (HD) are frequently evaluated by isotropic CT (3DCT) for preoperative planning at the expense of radiation. The aim was to determine if isotropic MRI (3DMR) imaging can provide similar quantitative and qualitative morphological information as 3DCT.

METHOD AND MATERIALS
25 consecutive patients with a final diagnosis of FAI or HD were retrospectively selected from December 2016-December 2017. Two readers (R1, R2) performed quantitative angular measurements on 3DCT and 3DMR, blinded to the diagnosis and each other's measurements. 3DMR and 3DCT of the hips were qualitatively and independently evaluated by a radiologist (R3), surgeon (R4), and fellow (R5). Interobserver and intermodality comparisons were performed.

RESULTS
Quality was good to excellent on all 3DCT and 3DMR reconstructions. The ICC was good to excellent for all measurements between R1 and R2 (ICC: 0.60-0.98) and the majority of intermodality measurements for R1 and R2. Average inter-reader and inter-modality PABAK showed good to excellent agreement for qualitative reads. On CT, all alpha angles (AA) were significantly lower in dysplasia patients than in cam patients (p<0.05). Lateral center-edge angle (LCEA) at the anterior, center, and posterior acetabulum were significantly lower in dysplasia than in cam patients (p<0.05). On MR, AA at 12, 1, and 2 o'clock, and LCEA at center were significantly lower in dysplasia patients than in cam patients (p<0.05).

CONCLUSION
Strong interobserver and intermodality correlations of hip morphology suggest that 3DMR has good potential to replace 3DCT and serve as a one-stop modality for bone and soft tissue characterizations in the pre-operative evaluation of FAI and HD.

CLINICAL RELEVANCE/APPLICATION
In patients with symptomatic FAI and HD, 3DMR can replace 3DCT in the pre-operative evaluation, thereby reducing radiation, time, cost, and discomfort for the patients.

SSA15-03 MR Texture Analysis of Acetabular Subchondral Bone Can Discriminate Between Normal and Cam Positive Hips

Sunday, Nov. 25 11:05AM - 11:15AM Room: E353B

Participants
Taryn Hodgdon, MD, Ottawa, ON (Presenter) Nothing to Disclose
Rebecca Thornhill, PhD, Ottawa, ON (Abstract Co-Author) Nothing to Disclose
Gerd Melkus, PhD, Ottawa, ON (Abstract Co-Author) Nothing to Disclose
Nicholas James, Ottawa, ON (Abstract Co-Author) Nothing to Disclose
Paul E. Beaulé, MD, Ottawa, ON (Abstract Co-Author) Nothing to Disclose
Kawan S. Rakhra, MD, Ottawa, ON (Abstract Co-Author) Nothing to Disclose

PURPOSE
To assess whether texture analysis of acetabular subchondral bone on MRI can differentiate between normal and cam positive hips.

METHOD AND MATERIALS
IRB-approved, retrospective case-control study analyzing MR images in subjects with and without cam morphology of the proximal femur (n=68: 19 controls, 25 asymptomatic cam and 24 symptomatic cam-FAI). All subjects underwent unilateral 1.5T hip MRI. The acetabular subchondral bone was contoured manually as a volume of interest (VOI) on sagittal PD images. 3D histogram and second order texture features were evaluated for the global acetabular VOI for each subject using MaZda (v4.6). Differences between controls and asymptomatic or symptomatic cam hips were explored using Mann-Whitney U tests with post-hoc Bonferroni correction. Intra-acetabular variations in texture were assessed by subdividing each VOI into anterior and posterior segments in the sagittal plane and into medial, middle, and lateral segments in the coronal plane, generating 6 ROIs. Between groups and within-subjects differences in texture features were assessed using mixed model ANOVAs. Features were used to train a series of gradient boosted regression trees; for each, 500 hyperparameter configurations were selected at random. 10-fold, stratified cross-validation was then performed and the accuracy of the 10 forests for identifying cam positive hips was averaged.

RESULTS
Both asymptomatic and symptomatic cam-FAI hips demonstrated higher gray-level variance and lower kurtosis compared to controls (p<0.003 for each). Gray-level co-occurrence features f3, f4, and f7 were significantly higher in cam positive hips compared to controls (p<0.003 for each). Sub-region analysis revealed no significant interactions between subject group and ROI. The post-validation classification accuracy achieved by each gradient boosted tree model was 72% (control vs asymptomatic) and 79% (control vs symptomatic cam-FAI).

CONCLUSION
Texture features extracted from MRI can detect subtle differences in subchondral bone architecture between controls and cam positive hips, regardless of patient symptom status.
CLINICAL RELEVANCE/APPLICATION

The texture profile of acetabular subchondral bone in cam positive hips is significantly different from controls in all regions. This suggests there are extra-articular structural changes occurring globally within the acetabular subchondral bone of patients with cam morphology regardless of symptom status.

SSA15-04 Postoperative, Traction MR Arthrography in Patients with Persisting Pain After Hip Arthroscopy for FAI Reveals Unexpected High Prevalence of Osseous Deformities and Intra-Articular Lesions Due to Under- or Overcorrection

Sunday, Nov. 25 11:15AM - 11:25AM Room: E353B

Participants

Florian Schmaranzer, Bern, Switzerland (Presenter) Nothing to Disclose
Till Lerch, Bern, Switzerland (Abstract Co-Author) Nothing to Disclose
Markus Hanke, Bern, Switzerland (Abstract Co-Author) Nothing to Disclose
Klaus A. Siebenrock, MD, PhD, Bern, Switzerland (Abstract Co-Author) Nothing to Disclose
Moritz Tannast, MD, Bern, Switzerland (Abstract Co-Author) Nothing to Disclose
Petr Vavron, St. Johann in Tirol, Austria (Abstract Co-Author) Nothing to Disclose
Benjamin Henninger, MD, Innsbruck, Austria (Abstract Co-Author) Nothing to Disclose
Ehrenfried Schmaranzer, St. Johann in Tirol, Austria (Abstract Co-Author) Nothing to Disclose

PURPOSE

Numbers of hip arthroscopies for FAI correction have risen exponentially, leading to an increase of patients with persistent pain who undergo postoperative MR imaging. To assess prevalence of new/residual (1) osseous deformities, (2) intra-articular lesions and (3) progression of osteoarthritis in symptomatic patients undergoing pre- and postoperative MR imaging after hip arthroscopy.

METHOD AND MATERIALS

IRB-approved, retrospective study. Between 2010-17, 806 patients underwent arthroscopic FAI correction and/or labrum surgery. Database was reviewed for symptomatic patients with complete radiographs and traction MR arthrography (MRA) of the hip (1.5 T) obtained before and after hip arthroscopy according to the routine protocol. 49 patients were included: mean age 29 ± 10 years, 67% female. Traction was applied using a MR-compatible traction device with weight-adaption. One reader assessed pre- and postoperative images. (1) Acetabular coverage (LCE<25° = dysplasia, LCE>39° = pincer deformity) and Tönnis osteoarthritis (OA) grade were assessed on AP pelvic views. Cam deformity was defined (a>60°) on radial MR images. Femoral torsion measurements were only available for postoperative MRI (low/high torsion: <5°/>30°). (2) Presence of residual tears-, retears of the labrum, capsular adhesions/defects was assessed on traction MRA. (3) OA progression on traction MRA was defined as new acetabular/femoral cartilage lesions and osteophytes formation.

RESULTS

(1) Preoperatively 42 (86%) hips showed deformities: 2 (4%) dysplastic-, 11 (22%) pincer- and 39 (80%) cam deformities. Postoperatively 39 (80%) hips showed deformities; 9 (18%) dysplastic-, 8 (16%) pincer-, 20 (41%) cam deformity, 4 (8%) hips with torsion <5°, 10 (20%) hips with torsion >30°. (2) Postoperatively 14 (29%) cases with residual-, 12 (24%) cases with labrum retears were observed. 6 (12%) hips had capsular adhesions, 22 (45%) had capsular defects. (3) Radiographic OA progression was observed in 5 (10%) hips, in 14 (30%) hips on traction MRA.

CONCLUSION

Prevalence of osseous deformities due to over- or undercorrection and intra-articular lesions is high after failed hip arthroscopy. Traction MRA was useful for detection of OA progression.

SSA15-05 Comparison of Lateral Centre Edge Angle and Sourcil Angle Measurements on "Ghost" 3D Volume Rendered CTs and Plain Radiographs

Sunday, Nov. 25 11:25AM - 11:35AM Room: E353B

Awards

Student Travel Stipend Award

Participants

Madhvi Patel, BSc,MBBS, London, United Kingdom (Presenter) Nothing to Disclose
Martin Siebachmeyer, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Myriam Guesso, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Jonathan Hutt, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Nikolaos Papadakos, Tooting, United Kingdom (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
modhvi.patel@stgeorges.nhs.uk

PURPOSE

Comparison of lateral centre edge angle and sourcil angle measurements on "Ghost" 3D volume rendered CTs and plain radiographs.

METHOD AND MATERIALS

A retrospective single-centre observational study evaluating the degree of agreement between measurements of lateral centre edge angle on CT and plain radiographs in 50 hips. Measurements of LCEA and sourcil angle were made on AP radiographs and 'Ghost' CT. All patients who were under orthopaedic investigation for femoro-acetabular impingement, had both a pelvic radiograph
and CT of at least one hip were included. Patients with severe anatomic deformity or those who were post-operative were excluded from the study. A paired sample t-test was performed to determine if there was a significant difference between measurements on plain radiograph and 'Ghost' CT, with the null hypothesis stating no significant difference.

RESULTS
On plain film the mean of the LCEA was 31.60, standard deviation = 8.254; and on CT "Ghost" images the mean LCEA was 30.96, standard deviation = 8.315 (paired t-test: p < .002). The confidence interval is 0.25 to 1.03. On plain film the mean of the Sourcil angle was 6.20, standard deviation = 4.848; and on CT "Ghost" images the mean of LCEA was 6.76, standard deviation = 4.841 (paired t-test: p < .016). The confidence interval is -1.19 to -1.17. The results show that there is a statistical difference between measurements of LCE and Sourcil angles made on plain radiographs and CT, but the confidence interval is small. We can be 95% sure that the true mean angle lies within a range of 1.28 degrees for lateral centre edge angle and a range of 0.02 degrees for the sourcil angle.

CONCLUSION
Although there is a statistical difference between measurements of LCE and Sourcil angles made on plain radiographs and "Ghost" CT the narrow confidence interval infers that the difference is actually quite small and in clinical practice this would be clinically insignificant. This would preclude the need for plain radiographs and reduce the radiation dose in young patients who ultimately require CT imaging as part of their femoro-acetabular impingement workup.

CLINICAL RELEVANCE/APPLICATION
Measurements of LCEA and Sourcil angles on 'Ghost CT' are clinically indifferent and can be used to preclude the need for plain radiographs in the work up of FAI in young patients with hip pain.

SSA15-06 The Puck Stops Here: An Adaptive Response of the Hip Observed with MRI and Unique to Super External Rotators

Sunday, Nov. 25 11:35AM - 11:45AM Room: E353B

Participants
Matthew Bober, MD, Philadelphia, PA (Presenter) Nothing to Disclose
Adam C. Zoga, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
matthew.bober@jefferson.edu

PURPOSE
Overhead athletes rely on extreme ranges of motion to excel in their respective fields, leading to structural changes including capsular and osseous overgrowth, which in turn contribute to overuse lesions including SLAP and unique impingement syndromes. Super external hip rotators, in particular hockey goalies, similarly rely on tremendous ranges of motion to excel at their avocation. We sought to compare hip capsule thickness in hockey goalies with age and gender matched controls in order to describe MRI findings of adaptive response of the hip.

METHOD AND MATERIALS
Retrospective cohort study examining the hip capsule thickness of hockey goalies with other male athletes aged matched at 20-30 years. Capsule thickness was used as a marker for adaptive response at the hip as this was described previously with adaptive response in the shoulder. Power analysis was performed and determined that a sample size of 17 was selected for each group. Measurements were performed at the anterior, middle, and posterior capsule regions on coronal non-fat saturated T1 MRI images at the level of the femoral head and neck. A two tailed t-test was then conducted to analyze the two groups.

RESULTS
The hip capsule was statistically thicker in super external rotators at each region when compared with other age matches athletic males. The average capsule thickness at the femoral head in the control group ranged from 8 - 9 mm and in the goalies group from 10 - 12 mm (p values ranged from 0.001 and 0.007). At the femoral neck, the control group capsule thickness was between 11 - 13 mm compared to 16 - 18 mm for the super external rotators (p-values between 0.002 and 0.01).

CONCLUSION
Hip super external rotating hockey goalies have a thicker hip capsule than their age and gender matched controls at both the level of the femoral head and neck.

CLINICAL RELEVANCE/APPLICATION
Hip super external rotators adapt with capsular thickening, which may predispose to hip pathology known to be prevalent in such athletes such as femoroacetabular impingement, labral tears, and early osteoarthritis. This adaptive hip capsular thickening should be observed at MRI, and should be correlated with other pathologies on a larger scale with a goal of prevention and early intervention.

SSA15-07 Diagnostic Performance of Magnetic Resonance Imaging in Detecting Syndesmotic Injuries: A Meta-Analysis

Sunday, Nov. 25 11:45AM - 11:55AM Room: E353B

Participants
Delaram Shakoor, MD, Baltimore, MD (Presenter) Nothing to Disclose
Lew Schon, MD, Baltimore, MD (Abstract Co-Author) Royalties, DJD, LLC; Royalties, Arthrex, Inc; Royalties, DARCO International, Inc; Royalties, Gerston Lehman Group, Inc; Royalties, Zimmer Biomet Holdings, Inc; Royalties, Reed Elsevier; Speakers Bureau, Arthrex, Inc; Speakers Bureau, Zimmer Biomet Holdings, Inc; Speakers Bureau, BioMimetic Therapeutics, Inc; Consultant, BioMimetic Therapeutics, Inc; Consultant, Guidepoint Global, LLC; Consultant, Gerston Lehman Group, Inc; Consultant, Tornier, Inc; Consultant, Wright Medical Technology, Inc; Consultant, Royer Medical, Inc; Consultant,
We evaluated 40 magnetic resonance imaging examinations of patients with ankle sprains (16 with ruptures and 24 without) for the diagnostic performance of MRI examinations. With high diagnostic performance of conventional non-enhanced MRI, using intravenous or intraarticular gadolinium may not improve diagnostic performance of MR-imaging in detecting syndesmotic injuries, using open or arthroscopic surgery as the standard of reference.

**METHOD AND MATERIALS**

A comprehensive literature search (until March 2018) was performed and original research studies reporting diagnostic performance of MRI and MR arthrography (MRA) in detecting syndesmotic injuries were included. Pooled values of sensitivity and specificity were calculated using fixed or random effect models based on the level of heterogeneity.

**RESULTS**

Out of 421 identified records, seven studies (309 MRI examinations) were included. Two studies (65 ankles) also reported the results of indirect MRA (iMRA) while other two studies (53 ankles) reported the results of direct MRA. There was no publication bias according to Deeks funnel plot asymmetry test (P=0.2) and meta-funnel. Pooled values of sensitivity were 89% [95% confidence interval (CI): 84%-94%] for non-enhanced MRI, 91% (CI: 79%-98%) for iMRA and 92% (CI: 73%-99%) for MRA. Pooled values of specificity of MRI, iMRA and MRA were 88% (CI: 82%-93%), 91% (CI: 82%-96%) and 67% (CI: 35%-90%), respectively. High degree of heterogeneity was observed in all modalities (I² >50%). Comparing diagnostic odds ratios (DOR) of MRI with iMRA yielded no significant result (relative DOR (rDOR):0.41, P=0.5). No significant difference was observed between DORs of MRI and MRA (rDOR: 1.76, P=0.4). There was no significant difference between DORs of iMRA and MRA (rDOR: 7.69, P=0.2).

**CONCLUSION**

MRI, iMRA and MRA can accurately detect syndesmotic injuries. The specificity of MRA appeared to be lower when compared to MRI and iMRA.

**CLINICAL RELEVANCE/APPLICATION**

With high diagnostic performance of conventional non-enhanced MRI, using intravenous or intraarticular gadolinium may not improve the diagnostic performance of MRI examinations.
performance, three readers with different levels of experience independently read the scanned images once and the fused images twice. We analyzed sensitivity, specificity, negative and positive predictive values, accuracy and agreement.

RESULTS
The experienced reader misinterpreted one OFR as false negative, demonstrating a sensitivity of 0.97 and specificity of 1.00. The intermediate reader had perfect accuracy. The inexperienced reader diagnosed two false positive ruptures (specificity: 0.92) in his first, and missed three ruptures (sensitivity: 0.81) in his second read. No differences were significant. Intrareader agreement was 0.95, 1.00 and 0.74 and interreader agreement was 0.90.

CONCLUSION
The proposed OFR enables reliable detection of anterior inferior tibiofibular ligament rupture with excellent inter- and intrareader agreement, making conventional scanning of oblique images redundant.

CLINICAL RELEVANCE/APPLICATION
Presented method enables the creation of additional MRI sequences in a totally different orientation from routine 2D images. Thereby scanning of e.g. oblique images is redundant and MRI scanning time - in our case 28% can be saved.

SSA15-09  Tarsal Coalition and the Accessory Anterolateral Facet
Sunday, Nov. 25 12:05PM - 12:15PM Room: E353B

Participants
Mashya T. Abbassi, MD, Richmond, VA (Presenter) Nothing to Disclose
Josephina A. Vossen, MD, PhD, Richmond, VA (Abstract Co-Author) Nothing to Disclose
Peter J. Haar, MD, PhD, Richmond, VA (Abstract Co-Author) Nothing to Disclose
Kevin B. Hoover, MD, PhD, Richmond, VA (Abstract Co-Author) Nothing to Disclose

PURPOSE
The accessory anterolateral talar facet (AALTF) is an anatomic variant that can cause peroneal spastic flatfoot in adolescents and accessory talar facet impingement (ATFI) in adults. The purpose of this study was to assess the relationship between AALTF and tarsal coalitions.

METHOD AND MATERIALS
Retrospective analysis of consecutive patients undergoing MRI ankle over a 2-year period (01/2014 to 12/2015) at our institution was performed. This study received IRB approval and complied with HIPAA guidelines. We reviewed MRIs for presence of AALTF and tarsal coalition. The criteria for identifying AALTF on MRI was facet articulation spreading contiguously from the posterior facet of the talus anterior to the lateral process of the talus. Presence of a tarsal coalition was assessed using MRI, allowing differentiation between types of coalition (cartilaginous, fibrous and osseous). Exclusion criteria were prior surgery, recent trauma, or abnormalities preventing visualization of the talocalcaneal joint.

RESULTS
Of the 391 patients (137 men, 254 women; mean age 45 years) included in this study, 3.6% (14/391) had an AALTF. Of these patients, 29% (4/14) had a tarsal coalition, of which 3 were talocalcaneal (1 osseous, 1 fibrous and 1 cartilaginous) and 1 was calcaneonavicular (fibrous). Of the patients without an AALTF, 2% (9/377) had a tarsal coalition, of which 7 were calcaneonavicular (4 fibrous and 3 cartilaginous), 2 were talocalcaneal (1 osseous, 1 fibrous). One-tailed chi-square tests of independence with Yates correction and odds ratio (OR) calculations were performed to examine the relation between the AALTF and the presence of a tarsal coalition. For the relationship between AALTF and tarsal coalition, \( \chi^2 = 21.2 \) (df, 1; n = 391; \( p < 0.0001; \) OR 16.3; 95% CI, 4.3-62.1).

CONCLUSION
Our study showed a significant relationship between the presence of an AALTF and tarsal coalition. Our findings indicate that MRI is a valuable test for identifying comorbid findings of AALTF in patients.

CLINICAL RELEVANCE/APPLICATION
The accessory anterolateral talar facet (AALTF) is an anatomic variant that can cause peroneal spastic flatfoot and accessory talar facet impingement (ATFI). Our study showed a significant relationship between the presence of an AALTF and tarsal coalition. Patients undergoing resection for tarsal coalition should be evaluated for AALTF, in order to improve pre-operative planning and postsurgical outcome.
The Echogenic Appearance of the Diabetic Deltoid Muscle on Shoulder Ultrasound: Is This Simply from Adipose Tissue Infiltration, Can This Appearance Predict Type 2 Diabetes and be Used to Detect Pre-Diabetes?

Station #1

PURPOSE
To evaluate the association of an echogenic deltoid muscle seen in type 2 diabetics during shoulder ultrasound versus the deltoid muscle appearance in non-diabetic obese patients and for any corresponding associations.

METHOD AND MATERIALS
The study included 137 shoulder ultrasounds from type 2 diabetics, including 13 pre-diabetics, confirmed by hemoglobin A1c levels and medications. It also included 49 ultrasounds from non-diabetic obese patients based on body mass index (BMI). Images of the deltoid muscle were blindly reviewed by 3 musculoskeletal radiologists as to whether the appearance was normal, suspected diabetic or definite diabetic. These results along with the patient’s age, sex, race, hemoglobin A1c level, BMI, and the use of insulin were analyzed.

RESULTS
A consensus diagnosis of ‘definite diabetic’ by 3 musculoskeletal radiologists based on an echogenic appearing deltoid muscle on ultrasound was a powerful predictor of diabetic status. The positive predictive value for the accurate designation of ‘definite diabetic’ was 89% (70 of 79 diabetic patients). An echogenic deltoid muscle was also a powerful predictor of pre-diabetes. Of 13 pre-diabetic ultrasounds reviewed, 13 were assigned either ‘suspected diabetic’ (3 of 13, 23%) or ‘definite diabetic’ (10 of 13, 77%) (P= 0.062). Obesity alone cannot solely explain the appearance of an echogenic deltoid muscle in diabetics. Non-obese diabetics were diagnosed ‘definite diabetic’ with 30% sensitivity (11 of 37 non-obese diabetics). Diabetic patients with a higher BMI, were more often diagnosed ‘definite diabetic’. Of 137 diabetic ultrasounds reviewed, 31(22.6%) were designated 'normal' (BMI 30.9 ± 7.3), 36 (26.2%) designated 'suspected diabetic' (BMI 32.6 ± 6.9), and 70 (51.2%) designated 'definite diabetic' (BMI 37.5 ± 8).

CONCLUSION
The ultrasound appearance of an echogenic deltoid muscle is a strong predictor of type 2 diabetes and seems to be due to more than just adipose infiltration. It could be related to impaired insulin-stimulated intramuscular glycogen synthesis or issues with collagen synthesis. We also conclude that this appearance may be used to detect pre-diabetes.

CLINICAL RELEVANCE/APPLICATION
Ultrasound of the type 2 diabetic deltoid muscle demonstrates increased echogenicity which is likely secondary to insulin resistance and may be used as a noninvasive means to detect pre-diabetes.
This study demonstrated differences in bony measurements on MR between pathological and normal sides, suggesting a bony

**CONCLUSION**

but were otherwise similar. T2 values were smaller for pathological compared to normal M (36.7 vs 35.3 ms, p=0.283) trended toward significance. Muscle volume for M, MP, and LP were similar between left/right sides and were slightly larger for pterygoid (LP) muscle volumes obtained by segmentation of individual muscle. Using T2 map data, T2 values of bilateral M, LP, and MP muscles were measured. Measurements were compared between normal vs TMD, and left vs right sides (for asymmetry in TMD) using a 2-way repeated measures ANOVA.

**METHOD AND MATERIALS**

The institutional review board approved this single-institution prospective study, which was performed between November 1, 2017, and March 21, 2018. Shear-wave and strain SE were used to evaluate elasticity of the SST and IST in healthy individuals (12 men and six women, 52.6 ± 10.5 years) and those with clinical findings suggestive of ACS (six men and 14 women, 53.5 ± 7.9 years). SE was performed in the coronal oblique plane under sitting and neutral shoulder position. Velocity and stiffness of the SST and IST on shear wave SE, and strain ratio (subcutaneous fat/tendon) on strain SE were measured in random order using specific region-of-interest. Statistically, Mann Whitney U-test, receiver operating characteristic (ROC) curve, and DeLong's tests were used.

**RESULTS**

On shear wave SE, SST and IST in ACS patients showed significantly higher mean, minimum, and maximum velocities, and higher mean, minimum, and maximum stiffness than those in the healthy individuals (all p<0.001). On strain SE, SST and IST in ACS patients showed significantly higher strain ratio than those in the healthy individuals (all p<0.001). Among these significant parameters, IST-strain ratio had the highest diagnostic performance (area under the ROC curve [AUC], 0.990; sensitivity, 95.7%, specificity, 100%). Also, IST-mean velocity and stiffness (AUC, 0.985; sensitivity, 92.0%, specificity, 100%). SST-strain ratio (AUC, 0.983; sensitivity, 95.7%, specificity, 100%), SST-mean velocity (AUC, 0.979; sensitivity, 88.0%, specificity, 100%), and SST-mean stiffness (AUC, 0.977; sensitivity, 84.0%, specificity, 100%) had excellent diagnostic performance. There was no difference of the AUC (p=0.36-1.0), sensitivity (p=0.39-1.0), and specificity (p=1.0) between shear wave and strain SE examinations.

**CONCLUSION**

Real-time shear wave and strain SE showed the stiffer SST and IST in the ACS with excellent diagnostic performance.

**CLINICAL RELEVANCE/APPLICATION**

The use of SE may be helpful in patients with clinically suspected ACS in diagnosis and follow-up, especially with emphasis on quantitative evaluation.

**MKS348-SD-**

Bony and Muscular Differences in Temporomandibular Joint Disorders on MRI

**SUA3**

**METHOD AND MATERIALS**

The main aim of our study was to evaluate the elasticity of the supraspinatus tendon (SST) and infraspinatus tendon (IST) in healthy individuals and patients with clinical findings suggestive of adhesive capsulitis of shoulder (ACS). The second aim was to compared diagnostic performance between two sonoelastography (SE) methods (shear wave vs. strain).

**RESULTS**

On shear wave SE, SST and IST in ACS patients showed significantly higher mean, minimum, and maximum velocities, and higher mean, minimum, and maximum stiffness than those in the healthy individuals (all p<0.001). On strain SE, SST and IST in ACS patients showed significantly higher strain ratio than those in the healthy individuals (all p<0.001). Among these significant parameters, IST-strain ratio had the highest diagnostic performance (area under the ROC curve [AUC], 0.990; sensitivity, 95.7%, specificity, 100%). Also, IST-mean velocity and stiffness (AUC, 0.985; sensitivity, 92.0%, specificity, 100%). SST-strain ratio (AUC, 0.983; sensitivity, 95.7%, specificity, 100%), SST-mean velocity (AUC, 0.979; sensitivity, 88.0%, specificity, 100%), and SST-mean stiffness (AUC, 0.977; sensitivity, 84.0%, specificity, 100%) had excellent diagnostic performance. There was no difference of the AUC (p=0.36-1.0), sensitivity (p=0.39-1.0), and specificity (p=1.0) between shear wave and strain SE examinations.

**CONCLUSION**

Real-time shear wave and strain SE showed the stiffer SST and IST in the ACS with excellent diagnostic performance.

**CLINICAL RELEVANCE/APPLICATION**

The use of SE may be helpful in patients with clinically suspected ACS in diagnosis and follow-up, especially with emphasis on quantitative evaluation.

**MKS348-SD-**

Bony and Muscular Differences in Temporomandibular Joint Disorders on MRI

**SUA3**

**Participants**

Jennifer Padwal, La Jolla, CA (Presenter) Nothing to Disclose
Palanan Sirwanaranangsun, MD, Bankok, Thailand (Abstract Co-Author) Nothing to Disclose
Sheronda Statum, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Mitsue Miyazaki, PhD, La Jolla, CA (Abstract Co-Author) Nothing to Disclose
Shantanu Sinha, PhD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Won C. Bae, PhD, La Jolla, CA (Abstract Co-Author) Nothing to Disclose
Christine B. Chung, MD, La Jolla, CA (Abstract Co-Author) Nothing to Disclose

**METHOD AND MATERIALS**

The main aim of our study was to evaluate the elasticity of the supraspinatus tendon (SST) and infraspinatus tendon (IST) in healthy individuals and patients with clinical findings suggestive of adhesive capsulitis of shoulder (ACS). The second aim was to compared diagnostic performance between two sonoelastography (SE) methods (shear wave vs. strain).

**RESULTS**

On shear wave SE, SST and IST in ACS patients showed significantly higher mean, minimum, and maximum velocities, and higher mean, minimum, and maximum stiffness than those in the healthy individuals (all p<0.001). On strain SE, SST and IST in ACS patients showed significantly higher strain ratio than those in the healthy individuals (all p<0.001). Among these significant parameters, IST-strain ratio had the highest diagnostic performance (area under the ROC curve [AUC], 0.990; sensitivity, 95.7%, specificity, 100%). Also, IST-mean velocity and stiffness (AUC, 0.985; sensitivity, 92.0%, specificity, 100%). SST-strain ratio (AUC, 0.983; sensitivity, 95.7%, specificity, 100%), SST-mean velocity (AUC, 0.979; sensitivity, 88.0%, specificity, 100%), and SST-mean stiffness (AUC, 0.977; sensitivity, 84.0%, specificity, 100%) had excellent diagnostic performance. There was no difference of the AUC (p=0.36-1.0), sensitivity (p=0.39-1.0), and specificity (p=1.0) between shear wave and strain SE examinations.

**CONCLUSION**

Real-time shear wave and strain SE showed the stiffer SST and IST in the ACS with excellent diagnostic performance.

**CLINICAL RELEVANCE/APPLICATION**

The use of SE may be helpful in patients with clinically suspected ACS in diagnosis and follow-up, especially with emphasis on quantitative evaluation.

**MK348-SD-**

Bony and Muscular Differences in Temporomandibular Joint Disorders on MRI

**SUA3**

**Participants**

Jennifer Padwal, La Jolla, CA (Presenter) Nothing to Disclose
Palanan Sirwanaranangsun, MD, Bankok, Thailand (Abstract Co-Author) Nothing to Disclose
Sheronda Statum, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Mitsue Miyazaki, PhD, La Jolla, CA (Abstract Co-Author) Nothing to Disclose
Shantanu Sinha, PhD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Won C. Bae, PhD, La Jolla, CA (Abstract Co-Author) Nothing to Disclose
Christine B. Chung, MD, La Jolla, CA (Abstract Co-Author) Nothing to Disclose

**METHOD AND MATERIALS**

The main aim of our study was to evaluate the elasticity of the supraspinatus tendon (SST) and infraspinatus tendon (IST) in healthy individuals and patients with clinical findings suggestive of adhesive capsulitis of shoulder (ACS). The second aim was to compared diagnostic performance between two sonoelastography (SE) methods (shear wave vs. strain).

**RESULTS**

On shear wave SE, SST and IST in ACS patients showed significantly higher mean, minimum, and maximum velocities, and higher mean, minimum, and maximum stiffness than those in the healthy individuals (all p<0.001). On strain SE, SST and IST in ACS patients showed significantly higher strain ratio than those in the healthy individuals (all p<0.001). Among these significant parameters, IST-strain ratio had the highest diagnostic performance (area under the ROC curve [AUC], 0.990; sensitivity, 95.7%, specificity, 100%). Also, IST-mean velocity and stiffness (AUC, 0.985; sensitivity, 92.0%, specificity, 100%). SST-strain ratio (AUC, 0.983; sensitivity, 95.7%, specificity, 100%), SST-mean velocity (AUC, 0.979; sensitivity, 88.0%, specificity, 100%), and SST-mean stiffness (AUC, 0.977; sensitivity, 84.0%, specificity, 100%) had excellent diagnostic performance. There was no difference of the AUC (p=0.36-1.0), sensitivity (p=0.39-1.0), and specificity (p=1.0) between shear wave and strain SE examinations.

**CONCLUSION**

Real-time shear wave and strain SE showed the stiffer SST and IST in the ACS with excellent diagnostic performance.

**CLINICAL RELEVANCE/APPLICATION**

The use of SE may be helpful in patients with clinically suspected ACS in diagnosis and follow-up, especially with emphasis on quantitative evaluation.
adaption in TMD. The role of bony and muscular changes in TMD will be elucidated in future studies to evaluate whether such changes are caused by or a result of TMD pathology.

CLINICAL RELEVANCE/APPLICATION

This study demonstrated differences in bony measurements on MRI between pathological and normal sides, suggesting a bony adaption in TMD. The role of bony and muscular changes in TMD will be elucidated in future studies to evaluate whether such changes are caused by or a result of TMD pathology.

MK349-SD-SUA4

Imaging Can Finally Be Used to Decide on Therapy of Cartilaginous Tumors in Long Bones: Resection or Curettage

Station #4

Participants
David Hanff, MD, Amsterdam, Netherlands (Presenter) Nothing to Disclose
Veroniek M. Van Praag, Leiden, Netherlands (Abstract Co-Author) Nothing to Disclose
Kirsten Van Langevelde, MD, Leiden, Netherlands (Abstract Co-Author) Nothing to Disclose
Carla S. Van Rijswijk, MD, Leiden, Netherlands (Abstract Co-Author) Nothing to Disclose
Herman Kroon, Leiden, Netherlands (Abstract Co-Author) Nothing to Disclose
Michiel van de Sande, MD, Leiden, Netherlands (Abstract Co-Author) Nothing to Disclose
H J. Bloem, Leiden, Netherlands (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
d.hanff@erasmusmc.nl

PURPOSE

To determine which radiographic and magnetic resonance imaging (MRI) features differentiate CS2 from an ACT/CS1 in long bones.

METHOD AND MATERIALS

In this retrospective study we reviewed 82 patients treated at our institution for an ACT/CS1 (58 patients) or CS2 (24 patients) in the long bones. Four observers separately reviewed radiographs and MRI using a fixed set of 19 parameters, and a subjective radiologic diagnosis. Parameters were compared with a reference standard consisting of a, non-imaging dependent, histopathological diagnosis of resected specimens using univariate, multivariate logistic regression analysis. Inter-observer variability (IOV) was calculated (Fleiss kappa).

RESULTS

Diagnosis (ACT/CS1 or CS2) of the four reviewers matched ultimate histologic diagnosis in 93% (304/328 observations for 82 patients), with an interrater agreement of 91.1%. In multivariate analysis the radiographic <50% chondroid matrix (OR 0.227; p=0.054, 95%CI 0.050-1.025, IOV 81.9%) showed a positive trend for CS2. For MRI prognostic factors were soft tissue mass (OR 0.070; p=0.001, 95%CI 0.024-0.200; IOV 89.2%), reactive soft tissue edema (OR 0.183; p<0.001, 95%CI 0.061-0.551; IOV 90.7%), peri-tumoral intraosseous edema (OR 0.157; p=0.016, 95%CI 0.035-0.710; IOV 92.1%), dynamic enhancement (IOV 62.2%) for 3-6 sec. (OR 0.141; p=0.015, 95%CI 0.029-0.687) and <=3sec (OR 0.374, 95% CI 0.161-0.1987); expansion of the medullary canal (OR 0.187; p=0.001, 95%CI 0.069-0.504; IOV 78.9%), and cortical thickening (OR 0.142; p=0.005, 95%CI 0.033-0.616; IOV 94.3%)(see table 1). R2 was 0.777, indicating a good level of prediction.

CONCLUSION

With an accuracy of 93% and high inter-rater reliability we were able to differentiate CS grade 2 from ACT. Most useful parameters are chondroid matrix, soft tissue mass, reactive soft tissue edema, peri-tumoral intraosseous edema, dynamic enhancement, expansion of the medullary canal and cortical thickening.

CLINICAL RELEVANCE/APPLICATION

Pre-operative radiologic assessment can reliably differentiate between a CS2 and ACT/CS1 and is therefore essential in determining a multidisciplinary and optimal treatment for the patient.

MK350-SD-SUA5

MR Anatomical-Histological Correlation of the Adductor Longus-Rectus Abdominis-Pubic Ligament Complex

Station #5

Participants
Michel O. De Maeseneer, MD, PhD, Jette, Belgium (Presenter) Nothing to Disclose
Ramses Forsyth, MD,MBA, Jette, Belgium (Abstract Co-Author) Nothing to Disclose
Steven Provyn, Brussels, Belgium (Abstract Co-Author) Nothing to Disclose
John de Mey, MD,PhD, Jette, Belgium (Abstract Co-Author) Nothing to Disclose
Filip De Ridder, Jette, Belgium (Abstract Co-Author) Nothing to Disclose
Maryam Shahabpour, MD, Brussels, Belgium (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
Michel.demaeseneer@uzbrussel.be

PURPOSE

The anatomy of the AL, rectus abdominus, pyramidalis insertions is still not completely understood. Recent investigations in the pyramidalis and adductor insertions have shed new light on this anatomy. Our purpose was to correlate high resolution MR imaging with cadaveric and en bloc histologic slicing to elucidate the anatomy of the adductor insertions.

METHOD AND MATERIALS

3T high resolution MR images in the three planes were correlated with cryosections and 'en bloc' histological sections of the pubic symphysis. Histological slices after decalcification were stained with HE. Findings were interpreted by consensus of a senior MSK radiologist, pathologist and anatomist.
RESULTS

Findings  The AL is the main tendon inserting on the pubic rami. It inserts in a triangular fashion very strongly anchoring tendon into bone. Its tendon fibers gradually transform in ligament fibers and these ligament fibers form cross connections with the contralateral AL tendon, an additional element of reinforcement. The pubic ligament is made of true strong ligament fibers and no cartilage or fibrocartilage nodule is present. Cartilage does line the joint surface at the symphyseal joint. The posterior aponeurosis of the rectus abdominis forms a 2 cm wide and 2 mm thick band that inserts directly onto the superior aspect of the pubic ligament. Connections of the piramidalis or when absent rectus abdominus continue laterally over the adductor longus but are actually quite delicate and surprisingly less thick and strong than has been typically believed. The other adductor tendons show muscular insertions on the pubic rami. The gracilis inserts on the adductor brevis muscle.

CONCLUSION

The anatomy-histology at the pubic symphysis is complex. The AL strongly anchors into the bone as 'tendinoligamentous fibers' but also has cross connections with the contralateral side.

CLINICAL RELEVANCE/APPLICATION

Pubic tendon and ligament is extremely important in high level athletes and injuries can be career ending. The anatomy of the tendon insertions is not well understood. This is related to the historical fact that this area is difficult to analyse in embalmed cadavers. Our MR correlations with fresh specimens, and histology shed new light on this anatomy.

TEACHING POINTS

To summarize indications and contraindications of DXA To highlight image acquisition protocol and quality control To review current guidelines and proper image interpretation and terminology To discuss the pitfalls and artifacts of DXA in the evaluation of BMD

TABLE OF CONTENTS/OUTLINE

Introduction Bone structure and metabolism. Definitions and terminology based on recent guidelines. Data and image acquisition (proper patient positioning and placement of regions of interest). Quality control and Artifacts. Proper Interpretation through multiple examples and case studies. Whole-body composition techniques. Pitfalls. Take home points
Rapidly Progressive Osteoarthropathy of the Hip: A Study of 1471 Patients After Steroid Injection

**Participants**
Atul K. Taneja, MD,PhD, Sao Paulo, Brazil (Moderator) Nothing to Disclose

**Sub-Events**

**MK351-SD-** Rapidly Progressive Osteoarthropathy of the Hip: A Study of 1471 Patients After Steroid Injection

**Sub1**

**Purpose**
Rapidly progressive osteoarthropathy of the hip (RPOH) is defined by progressive joint space narrowing (JSN) of > 2 mm or > 50% within 1 year. Our aims were to assess the incidence of RPOH after steroid injection, and to investigate the association of RPOH with possible risk factors including: (1) more concentrated anesthetic/steroid mixtures, (2) low bone mineral density, and (3) greater pain reduction after injection.

**Method and Materials**
After institutional review board approval, a retrospective search of our imaging database was performed, identifying 1471 patients who underwent a fluoroscopically-guided hip injection with triamcinolone acetonide (Kenalog) over a 10-year period ending March 1, 2017. Patients were eligible if they had radiographs at baseline and at least 1 year after injection. Patient demographics, hip DXA results, intra-articular injection data, and patient reported pain scores were gathered from patient records. Pre-injection and follow-up radiographs were systematically assessed for: JSN, femoral head deformity, osteophytes, acetabular/femoral cystic changes, femoral head ascension, and subchondral sclerosis. These radiographic parameters were used to grade osteoarthritis of the hip according to Croft criteria. Statistical analysis included Pearson's chi-square, Mann Whitney and T-tests, with significance defined as p<0.05.

**Results**
106 of 1471 injected subjects (7.2%) met the criteria for RPOH. A control group of 229 subjects was randomly selected from injected subjects without RPOH. Compared to controls, patients with RPOH were significantly older (p=0.005), had narrower joint spaces at baseline (p<0.001), and higher Croft scores (p=0.007). Patients who developed RPOH did not differ from controls in sex, BMI, hip DXA T-score, injected steroid dose, injected anesthetic concentration, or post injection pain improvement.

**Conclusion**
In our experience approximately 7% of patients undergoing steroid hip injection developed RPOH. More severe osteoarthritis, greater joint space narrowing, and patient age may be risk factors for development of RPOH after intra-articular steroid injection.

**Clinical Relevance/Application**
RPOA is uncommon, but not rare after hip steroid injection. Obesity, osteoporosis, and a higher injected steroid dose do not appear to increase the risk for RPOH.

Whole Body MRI for Breast Cancer Staging: The Roles of the Static Field Strength and Gadolinium Contrast Agents in Focus

**Participants**
Anne- Kathrin Wagner, Nordhausen, Germany (Presenter) Nothing to Disclose
Anhild Kott, MD, Nordhausen, Germany (Abstract Co-Author) Nothing to Disclose
Claudia Kurkat, MD, Nordhausen, Germany (Abstract Co-Author) Nothing to Disclose
Joachim Feger, MD, Nordhausen, Germany (Abstract Co-Author) Nothing to Disclose
Ismini Papageorgiou, PhD,MD, Nordhausen, Germany (Abstract Co-Author) Nothing to Disclose
PURPOSE

Whole-body magnetic resonance imaging (WB-MRI) is a powerful diagnostic tool for breast cancer staging, especially for the detection of bone metastasis. However, there is a weak level of evidence concerning the role of higher static field strengths and contrast media application. In this study, we compare the diagnostic efficacy of WB-MRI in different static field strengths, 1.5T and 3T. Moreover, we investigate the necessity for gadolinium contrast agent application for the effective detection of breast cancer bone metastasis.

METHOD AND MATERIALS

The study was retrospective for 855 patients scanned between 05/2007 and 08/2017. 345 patients were imaged at 1.5T and 510 at 3T static field strength (Philips Achieva or Ingenia) with a T1-weighted FFE and a STIR or a Dixon at the coronal level. In 431 patients, we injected Gadoteridol (ProHance®) 0.1 mmol/kg. Clinical confirmation with skeletal scintigraphy or biopsy confirmation served as the ground truth.

RESULTS

The sensitivity (SE) and specificity (SPE) for 1.5T was 98.34%/91.24% and the positive predictive value (PPV)/negative predictive value (NPV) was 96.03%/99%. A static field strength of 3T showed a SE/SPE 100%/92.81% and a PPV/NPV of 83.22%/100%. Binary logistic regression with Fisher’s exact test revealed no significant difference between 1.5T and 3T WB-MRI (P = 0.663, odds ratio 0.839). The SE/SPE of WM-MRI (merged 1.5T and 3T) without enhancement was 98.66%/91.60%, with PPV/NPV 86.54%/99.20%. Upon administration of ProHance, the SE/SPE shifted to 100%/92.83% and the PPV/NPV to 82.70%/100%. Binary logistic regression with Fisher’s exact test returned no significant effect for ProHance (P = 0.836, odds ratio 0.9).

CONCLUSION

WB-MRI is a highly specific and sensitive diagnostic tool for bone metastasis in breast cancer with equal diagnostic efficacy in static field strengths of 1.5T or 3T. Gadolinium can be omitted without affecting the diagnostic accuracy and should be spared only for problem-solving.

CLINICAL RELEVANCE/APPLICATION

WB-MRI is a highly specific and sensitive diagnostic tool for bone metastasis in breast cancer. Gadolinium should be spared only for problem-solving.

Microflow Imaging Technology of Ultrasound Examination for Diagnosis of Adhesive Capsulitis of the Shoulder

PURPOSE

The purpose of this study was to investigate whether Superb microvascular imaging (SMI), a new Doppler technique of ultrasonography (USG), correlates with clinical features in patients with adhesive capsulitis.

METHOD AND MATERIALS

This retrospective study included 34 patients with adhesive capsulitis on only one side shoulder. In USG, we evaluated the blood flow in rotator interval, using SMI and conventional power Doppler imaging (PWI). For quantitative analysis of blood flow, we performed pixel count analysis of blood flow in SMI and PWI. We also evaluated echogenicity in rotator interval, and coracohumeral ligament thickness. These USG findings were correlated with pain intensity (resting, night, motion, worst), range of motion (forward flexion, abduction, external and internal rotation), and duration of symptoms in patients of adhesive capsulitis. These USG findings were also measured on the normal shoulder and compared with the affected side.

RESULTS

Blood flow in SMI and PWI were associated with range of motion on external rotation (p = 0.003) and forward flexion (p = 0.001), night (p = 0.09) and worst pain intensity (p = 0.007). Wilcoxon signed ranks test showed the significant higher blood flow in SMI than PWI of adhesive capsulitis (721 vs. 419 pixels, p = 0.001). Blood flow in SMI and PWI of affected shoulder were significantly higher from the normal contralateral shoulder (742 vs. 82, and 459 vs. 23 pixels respectively, p < 0.001). Clinical features were not significant correlated with echogenicity in rotator interval, coracohumeral ligament thickness (p > 0.05).

CONCLUSION

The blood flow measurement using SMI at rotator interval of adhesive capsulitis was more sensitive test compared to the conventional Doppler technique, and showed significant correlation with ROM and pain intensity. It could be a valuable ultrasonographic finding in the diagnosis of adhesive capsulitis.

CLINICAL RELEVANCE/APPLICATION

The blood flow measurement using SMI at rotator interval of adhesive capsulitis is superior to PWI, could be helpful in diagnosis, and might be used as biomarker for treatment planning or monitoring of adhesive capsulitis.
PTT tenosynovitis and tendinosis were present in 92% and 60% of cases, respectively. Age-matched control MRI incidence of type II navicular os was established by performing an age-matched control review of all foot/ankle MRIs performed over the past 5 years. Cases were reviewed by 2 MSK radiologists blinded to clinical history, in consensus, graded on an ordinal scale for extent of BME (1 = mild/patchy immediately adjacent to the endplates of each VB were removed to avoid volume effect, and the FF of each remaining slice was obtained by drawing a 20×20mm2 region of interest. A biomarker, Fat Fraction Variability Index(FFVI), newly elicited in this study, was computed according to the formula, FFcenter - FFmargin, where FFcenter referred to the FF of the vertebral center, and FFmargin referred to the average FF of two vertebral margins. The univariate analysis of variance was performed with FFVI set as the dependent variable, while the age groups (20-29, 30-39, 40-49, 50-59, and 60-69 years) and VB (L1 to L5) as the independent variables. P <0.05 was considered as statistical significance.

RESULTS
Both age and VB affected the dependent variables significantly (P<0.01), however, there was no interaction effect between VB and age. FFVI of L1-L5 VB commonly started with a positive value in 20s and gradually converted to negative values with aging, indicating the FF distribution pattern converted from ‘center higher’ to ‘margin higher’ with age growth(Figure.1). Such transformation initially started at L1 and L2, then L4 and L5, and eventually, L3. In addition, FF increasing L5>L1 in the same subjects and FF increasing with aging was also shown in this study.

CONCLUSION
In lumbar spine, L1 and L2 vertebrae demonstrated lower FF level but with more common ‘margin higher’ FF distribution pattern comparing to other vertebrae, which might be related to stress and activities of the vertebrae. Considering that compression fracture is also more commonly observed in L1, L2 vertebrae, we suggested that FFVI indicate certain skeletal remodeling that affects bone strength.

CLINICAL RELEVANCE/APPLICATION
FFVI may be a promising indicator in assessing prevalent fracture besides the increased average FF of the whole vertebral body.

PURPOSE
Marrow fat fraction(FF) is considered relevant with bone marrow health. In this study, we tried to figure out the distribution pattern of FF in separate vertebrae body(VB) and evaluate the possible influence factors.

METHOD AND MATERIALS
Ninety-seven healthy volunteers (51females and 46 males, age ranging from 22 to 69 years old) were recruited in this study with written informal consent obtained. All the subjects underwent IDEAL IQ acquisition for L1-L5 vertebrae on a 3.0T MR scanner (MR750, GE Healthcare, US). The vertebrae were scanned on the axial plane respectively with 3mm slice thickness. The two slices adjacent to the endplates of each VB were removed to avoid volume effect, and the FF of each remaining slice was obtained by drawing a 20×20mm2 region of interest. A biomarker, Fat Fraction Variability Index(FFVI), newly elicited in this study, was computed according to the formula, FFcenter - FFmargin, where FFcenter referred to the FF of the vertebral center, and FFmargin referred to the average FF of two vertebral margins. The univariate analysis of variance was performed with FFVI set as the dependent variable, while the age groups (20-29, 30-39, 40-49, 50-59, and 60-69 years) and VB (L1 to L5) as the independent variables. P <0.05 was considered as statistical significance.

RESULTS
Both age and VB affected the dependent variables significantly (P<0.01), however, there was no interaction effect between VB and age. FFVI of L1-L5 VB commonly started with a positive value in 20s and gradually converted to negative values with aging, indicating the FF distribution pattern converted from ‘center higher’ to ‘margin higher’ with age growth(Figure.1). Such transformation initially started at L1 and L2, then L4 and L5, and eventually, L3. In addition, FF increasing L5>L1 in the same subjects and FF increasing with aging was also shown in this study.

CONCLUSION
In lumbar spine, L1 and L2 vertebrae demonstrated lower FF level but with more common ‘margin higher’ FF distribution pattern comparing to other vertebrae, which might be related to stress and activities of the vertebrae. Considering that compression fracture is also more commonly observed in L1, L2 vertebrae, we suggested that FFVI indicate certain skeletal remodeling that affects bone strength.

CLINICAL RELEVANCE/APPLICATION
FFVI may be a promising indicator in assessing prevalent fracture besides the increased average FF of the whole vertebral body.
II navicular os was 3.1%.

**CONCLUSION**

BME spanning a type II navicular os on MRI highly correlates with medial foot pain, likely accounting for patient symptoms. We hypothesize that in such patients, a history of antecedent trauma or repetitive sports activity likely destabilizes the synchondrosis, causing the os to become symptomatic. Grading degree of BME may be useful to referrers for predicting patient outcomes and making treatment decisions.

**CLINICAL RELEVANCE/APPLICATION**

BME associated with a type II navicular os strongly correlates with medial foot pain. Accurately grading degree of BME on MRI may be useful to referring clinicians.

**Awards**

**Certificate of Merit**

**Participants**

Nikola Tomanovic, MBBS, Brighton, United Kingdom (*Presenter*) Nothing to Disclose

Thomas Puttick I, MBBS, Reading, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

James S. Kho, MBBSch, Brighton, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

Ahmed Daghir, MRCP, FRCR, Oxford, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

David Yu, MBBS, Nottingham, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

nikola.tomanovic@bsuh.nhs.uk

**TEACHING POINTS**

Soft tissue calcifications may be an unspecific local response or present as a symptom of a complex underlying disease. As such, they are commonly seen but often misinterpreted, leading to delayed diagnosis or unnecessary overinvestigation. We present a pictorial quiz composed of a wide range of well selected cases, of varying complexity, collected from a university teaching hospital and aim to:- Demonstrate important, interesting and unusual imaging appearances.- Discuss key learning points, further imaging and differential diagnostic considerations, including imaging pitfalls.- Help participants create a robust systematic approach to reporting similar cases, in order to optimise their diagnostic accuracy and streamline patient pathways.

**TABLE OF CONTENTS/OPTLINE**

Amongst many others our cases include: Peri-articular Calcifications including: Chondrocalcinosis (gout, pseudogout, CPPD & hyperparathyroidism) Tumoral calcinosis (primary & secondary) Synovial Osteochondromatosis Calcific Tendinopathy Systemic SclerosisSynovial SarcomaNon-articular Ossification including:Neurogenic Heterotopic Ossification after CVA Fibrodyplasia Ossificans ProgressivaSecondary to Renal Failure CalcinosiS Universalis Vascular Calcifications inc. Chronic Venous Insufficiency Trauma related calcification, inc. Myositis Ossificans
Interventional Oncology Series: Lung, Kidney and Bone

Sunday, Nov. 25 1:30PM - 6:00PM Room: S405AB

Participants
Christos S. Georgiades, MD, PhD, Baltimore, MD (Moderator) Consultant, Galil Medical Ltd
Sean M. Tutton, MD, Milwaukee, WI (Moderator) Medical Director, Benvenue Medical, Inc; Consultant, Benvenue Medical, Inc; Researcher, Siemens AG; Consultant, BTG International Ltd

For information about this presentation, contact:
g_christos@hotmail.com

LEARNING OBJECTIVES
1) To understand the physics and physiology relevant to the main ablation modalities as applied to different target organs. 2) To become updated on the current evidence for kidney, lung and MSK tumor ablation. 3) To learn how to anticipate and mitigate potential complications related to lung, kidney and MSK ablations. 4) To learn techniques (including tackling challenging cases) that maximize oncologic outcomes.

Sub-Events

Keynote and Series Opening: Interventional Oncology-The 4th Pillar of Cancer Care
Sunday, Nov. 25 1:30PM - 1:55PM Room: S405AB

Participants
William S. Rilling, MD, Milwaukee, WI (Presenter) Research support, B. Braun Melsungen AG; Research support, Sirtex Medical Ltd; Research support, Siemens AG; Consultant, B. Braun Melsungen AG; Consultant, Cook Group Incorporated; Consultant, Terumo Corporation; Advisory Board, Terumo Corporation

Physics of MW, RF and Cryoablation: Clinically Relevant Parameters
Sunday, Nov. 25 1:55PM - 2:15PM Room: S405AB

Participants
Christos S. Georgiades, MD, PhD, Baltimore, MD (Presenter) Consultant, Galil Medical Ltd

LEARNING OBJECTIVES
To understand the physical principles behind the common ablation modalities (RFA, Microwave, Cryoablation, HIFU, IRE etc) To understand how physiological parameters can affect the efficacy of the ablation modality To be able to select the appropriate ablation modality for each specific case and optimize outcomes

Leukemia Cytogenetics & Pathogenesis
Sunday, Nov. 25 2:15PM - 2:35PM Room: S405AB

Participants
William H. Moore, MD, Port Washington, NY (Presenter) Consultant, Merck & Co, Inc; Consultant, BTG International Ltd;

LEARNING OBJECTIVES
1) Comprehend clinically relevant physical parameters of microwave, radiofrequency, and cryoablation technologies. 2) Apply the most appropriate thermal ablative technique for a patient.

Lung Cancer Ablation: Techniques to Optimize Outcome and Current Evidence
Sunday, Nov. 25 2:15PM - 2:35PM Room: S405AB

Participants
William H. Moore, MD, Port Washington, NY (Presenter) Consultant, Merck & Co, Inc; Consultant, BTG International Ltd;

LEARNING OBJECTIVES
1) Discuss Ablative Mechanism Understand Patient/Lesion selection Comparison of RFA/MVA/Cryo. 2) Review and describe outcomes including adverse events, local control, and survival abscopal effect.

Complications of Lung Ablation and Mitigating Actions
Sunday, Nov. 25 2:45PM - 3:05PM Room: S405AB

Participants
Stephen B. Solomon, MD, New York, NY (Presenter) Research Grant, General Electric Company; Consultant, Johnson & Johnson; Consultant, BTG International Ltd;

LEARNING OBJECTIVES
1) To review the complications associated with lung ablation and offer suggestions and approaches that would mitigate them.

**VSIO11-06 XRT versus Ablation with Curative Intent: Patient Selection and Outcomes**

**Sunday, Nov. 25 3:05PM - 3:25PM Room: S405AB**

**Participants**
Kelvin K. Hong, MD, Baltimore, MD (Presenter) Scientific Advisory Board, Boston Scientific Corporation Scientific Advisory Board, BTG International Ltd Research support, Merit Medical Systems, Inc

**LEARNING OBJECTIVES**
1) The current available data will be reviewed and contextualized.

**ABSTRACT**
Patients with early stage, non operable lung cancers suffer from local progression as the primary cause of failure. SBRT and thermal ablation (such as RFA) are promising non operative therapeutic options. At present, there are no randomized comparisons between SBRT or RFA, nor direct clinical comparisons- and no prospective trial is underway. It is difficult for cancer specialists to decide between the two, and it is not definitive which provides superior undisputable outcomes.

**VSIO11-07 Renal Cancer Ablation: Patient, Tumor Selection, Techniques and Current Evidence**

**Sunday, Nov. 25 3:25PM - 3:45PM Room: S405AB**

**Participants**
Debra A. Gervais, MD, Boston, MA (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
1) To review selection criteria for renal tumor ablation cases. 2) To review reported effectiveness of the most common renal tumor ablation modalities and techniques.

**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/ Debra A. Gervais, MD - 2012 Honored Educator

**VSIO11-08 Percutaneous Microwave Ablation versus Laparoscopic Partial Nephrectomy for cT1a Renal Cell Carcinoma: A 12-Year Inception Cohort Study with 1955 Patients**

**Sunday, Nov. 25 3:45PM - 3:55PM Room: S405AB**

**Participants**
Jie Yu, Beijing, China (Presenter) Nothing to Disclose
Ping Liang, PhD, Beijing, China (Abstract Co-Author) Nothing to Disclose
Xiaoling Yu, MD, PhD, Beijing, China (Abstract Co-Author) Nothing to Disclose
Zhigang Cheng, Beijing, China (Abstract Co-Author) Nothing to Disclose
Zhiyu Han, Beijing, China (Abstract Co-Author) Nothing to Disclose
Fangyi Liu, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact: jiemi301@163.com

**PURPOSE**
While partial nephrectomy (PN) is considered the standard approach for cT1a renal cell carcinoma (RCC). Objective of the study is to compare outcomes between percutaneous MWA (PMWA) and laparoscopic PN (LPN) for cT1a RCC.

**METHOD AND MATERIALS**
We performed a prospective study of patients who underwent either PMWA or LPN for cT1a RCC (<=4cm) between April 2006 and November 2017. To reduce the inherent biases of the study, PMWA and LPN groups were matched on the basis of key variables: tumor size and number, Charlson comorbidity index (CCI), age, pathology, preoperative serum creatinine, preoperative estimated glomerular filtration rate (eGFR) and gender. The matching algorithm was 1:1 genetic matching with no replacement. The risk of having a post-treatment complication and percent drop in eGFR, as well as the risks of local tumor progress (LTP), distant metastasis, and cancer-specific mortality, were compared between groups using logistic, linear, and Fine-and-Gray competing risk regression models.

**RESULTS**
The cohort included 1955 patients (PMWA: 185; LPN: 1770) with a median follow-up of 40.6 mo (interquartile range 25.1, 63.4). After matching, there was no significant difference between the PMWA and LPN groups for tumor size (2.3 vs 2.3 cm; p = 0.86), age (63.2 vs 60.4 yr; p = 0.07), tumor location (p = 0.68) and pathology classification (p = 1.0). But PMWA group had higher CCI (4 vs 1; p<0.001), preoperative creatinine (84.4 vs 74.2 mg/dl; p=0.001) and preoperative eGFR (119.5 vs 106.8 ml/min/1.73m²; p = 0.002). There were significant differences between PMWA and LPN in percentage drop in eGFR at discharge (mean: 6% vs 17.9%; p = 0.002) and major complication (mean: 2.2% vs 4.9%; p = 0.16). Likewise, no significant differences were noted in LTP (3.2% vs 0.5%; p = 0.06), distant metastases (4.3% vs 4.3%; p = 1.0), or 5-year cancer-specific mortality (p = 0.68). But LPN group needed longer operative time (29.4 vs 108.1 min; p<0.001), more estimated blood loss (4.0 vs 50 ml; p<0.001).

**CONCLUSION**
Our study found no significant difference in complications, renal function outcomes, and oncologic outcomes between PMWA and LPN for patients with cT1a RCC. Validation in a larger multi-institutional analysis may be warranted.
**CLINICAL RELEVANCE/APPLICATION**

PMWA with less invasion should be reserved for patients with imperative indications for nephron-sparing surgery who cannot be subjected to the risks of more invasive LPN.

**VSIO11-09 Complications of Renal Ablation and Mitigating Actions**

**Participants**
Shane A. Wells, MD, Madison, WI (Presenter) Consultant, Johnson & Johnson

For information about this presentation, contact: swells@uwhealth.org

**LEARNING OBJECTIVES**

1) Differentiate expected imaging findings and complications on imaging performed immediately after renal mass ablation. 2) Differentiate expected imaging findings and complications on follow-up imaging. 3) Develop strategies to mitigate procedure-related complications.

**VSIO11-10 Usefulness of a Modified RENAL Nephrometry Score in Predicting Renal Function after Cryotherapy for Renal Mass**

**Participants**
Yoshiki Asayama, MD, Fukuoka, Japan (Presenter) Nothing to Disclose
Akihiro Nishie, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Yasuhiro Ushijima, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Koichiro Morita, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Seiichiro Takaao, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Hiroshi Honda, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Daikoku Nakahara, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Keisuke Ishimoto, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Nobuhiro Fujita, MD, PhD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

We investigated the application of the modified RENAL nephrometry (MRN) score system for predicting post-cryotherapy renal function in T1 renal mass patients.

**METHOD AND MATERIALS**

A total of 75 patients with a T1 renal mass were enrolled. The MRN score is based on the tumor size (radius, R), the tumor's exophytic/endophytic properties (E), the tumor's nearness to the collecting system (N), the anterior/posterior location of the kidney (A), and the location relative to the polar lines (L). The change in the estimated glomerular filtration rate (ΔeGFR) was calculated as follows: ΔeGFR = 100 [(pretreatment eGFR - eGFR at 6 months after cryotherapy)/pretreatment eGFR]. Based on the ΔeGFR results, we classified the patients into two groups: the preserved renal function group (ΔeGFR <10%, n=44) and the impaired group (ΔeGFR >=10%, n=31). We analyzed the relationship between the MRN score and the ΔeGFR and the chronic kidney disease (CKD) stage.

**RESULTS**

The mean ΔeGFR for all patients was 5.5%. The preserved group's MRN scores (5.8±0.3) were significantly lower than those of the impaired group (7.4±0.3) (p<0.001). With the MRN score cutoff value set at 7 points, the following values for predicting impaired status were obtained: 67.7% sensitivity, 72.7% specificity, 61.8% positive predictive value (PPV), 76.1% negative predictive value (NPV), and 72% accuracy. Those of predicting a down-stage of CKD status were 92.9% sensitivity, 67.2% specificity, 39.4% PPV, 97.6% NPV, and 72% accuracy.

**CONCLUSION**

The modified RENAL nephrometry score may be useful in predicting renal function after renal cryotherapy.

**CLINICAL RELEVANCE/APPLICATION**

(dealing with renal function after cryoablation for renal mass) Our newly proposed modified RENAL nephrometry score may be useful for predicting impairment of renal function (especially in CKD down-stages) with high sensitivity and a high negative predictive value and is recommended as a part of a pretreatment workup.

**VSIO11-11 Bone Ablation and Augmentation Outside the Spine**

**Participants**
Sean M. Tutton, MD, Milwaukee, WI (Presenter) Medical Director, Benvenue Medical, Inc; Consultant, Benvenue Medical, Inc; Researcher, Siemens AG; Consultant, BTG International Ltd

**LEARNING OBJECTIVES**

1) Better understand the various ablative modalities available including their specific differences and relative benefits and limitations in certain clinical scenarios. 2) Be familiarized with the existing literature supporting ablative therapies.

**VSIO11-12 Interventional Oncology Palliative Treatment for Bone Metastases: Technique and Outcomes**
**Purpose**
Evaluate combined metal artifact reduction (MAR) and monoenergetic spectral analysis by dual energy computed tomography (DECT) for assessment of ice ball ablation margins during cryoablation of musculoskeletal (MSK) metastases.

**Method and Materials**
We retrospectively evaluated image with greatest cryoprobe metallic artifact from CT-guided cryoablation of MSK metastases (Somatom Edge 128 slice, Siemens Healthineers, Germany) in 9 patients (11 lesions, 8:3 bone:soft tissue adjacent to bone) from November 2017 to March 2018. Low and high KV images from DECT acquisition were first reconstructed with iterative MAR, then processed by monoenergetic spectral analysis. MAR+DECT monoenergetic images at 60KeV, 90KeV, and 120KeV were compared to corresponding DECT-only monoenergetic images, MAR-only composite CT images, and composite CT images at 120KV. All images were qualitatively ranked by 3 board-certified radiologists for visualization of ice ball margins and least amount of metal artifact in front of and adjacent to cryoprobe. Quantitative evaluation of contrast to noise ratio (CNR) was measured between ice adjacent to probes and soft tissue or bone at DECT 60, 90, and 120 KeV with and without MAR. Wilcoxon Signed Ranks test was used to compare CNR at the same KeV setting.

**Results**
The combined MAR+DECT at 120KeV and 90KeV were first and second most preferred for least metal artifact in front of and adjacent to probe respectively, with DECT-only at 120KeV ranked third. For ice ball margin assessment, MAR+DECT at 90KeV and 120KeV and DECT-only at 120KeV were most preferred in order. Overall, both DECT-only at 120KeV and MAR+DECT at 120KeV were most preferred images, followed by MAR-only images. Composite CT image at 120KeV that mimics standard CT acquisition was least preferred image. CNR in soft tissue at 90KeV showed a significant difference between DECT with and without MAR (DECT + MAR 2.6 ± 1.8 vs. DECT 2.0 ± 1.3, p < 0.05).

**Conclusion**
Combination of MAR and DECT analysis shows improved visualization for MSK cryoablation compared to standard CT acquisition, MAR-only, or DECT-only images.

**Clinical Relevance/Application**
Advanced image processing with combination of metal artifact reduction and dual energy CT may provide a real clinical advantage to delineate ice ball margins during MSK cryoablation.

**LEARNING OBJECTIVES**
1) Identify the different type of malignant bone lesions associated with Augmentation. 2) Classify the available support systems for Augmentation. 3) Assess and recommend proper lesion management and Augmentation technique.
Opportunistic CT Screening for Osteoporosis, Sarcopenia, and Adiposity

Sunday, Nov. 25 2:00PM - 3:30PM Room: E450B

Participants
Robert D. Boutin, MD, Davis, CA (Director) Nothing to Disclose
Leon Lenchik, MD, Winston-Salem, NC (Presenter) Nothing to Disclose

For information about this presentation, contact:
rdboutin@ucdavis.edu
llenchik@wakehealth.edu

LEARNING OBJECTIVES
1) Discuss proposed CT-based definitions of osteoporosis, sarcopenia, and adiposity. 2) Review the potential for clinical impact when using routine CT to screen for osteoporosis, sarcopenia, and adiposity. 3) Highlight practical pearls and pitfalls for diagnostic imagers using opportunistic CT.

ABSTRACT
Non-communicable diseases are now "the world's main killer" [WHO, 2011]. The pandemics of osteoporosis, sarcopenia, and adiposity continue to grow globally as populations age. With more than 100 million CT exams performed annually worldwide, how might CT be used to screen patients efficiently for body composition derangements? This course focuses on the rapidly evolving field of "opportunistic" CT screening for the value-added diagnosis of osteoporosis, sarcopenia, and adiposity, with an emphasis on the clinical consequences of diagnostic imaging, as well as practical pearls and pitfalls.

Sub-Events

Opportunistic CT: Boom or Bust
Participants
Leon Lenchik, MD, Winston-Salem, NC (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Define opportunistic CT screening.

Muscle CT: Value-added Assessment for Sarcopenia
Participants
Robert D. Boutin, MD, Davis, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Discuss clinical and CT-based definitions of sarcopenia. 2) Review the potential clinical impact of screening for sarcopenia at the point of imaging care. 3) Highlight practical pearls and pitfalls for diagnostic imagers using opportunistic CT to screen for sarcopenia.

Bone CT: Opportunities for Osteoporosis
Participants
Robert J. Ward, MD, Boston, MA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) To apply currently available CT technologies, both retrospective and prospective, for the identification of patients at risk for osteoporosis in their daily practice.
**RC104D  Fat CT: From Research to Patient Care**

Participants
Miriam A. Bredella, MD, Boston, MA *(Presenter)* Nothing to Disclose

For information about this presentation, contact:
mbredella@mgh.harvard.edu

**LEARNING OBJECTIVES**

1) Be familiar with assessment of abdominal and intermuscular fat compartments and fat depots in the head and neck using CT. 2) Understand the effects of different fat compartments on cardiometabolic risk. 3) Be familiar with the bone-fat connection.

**RC104E  Machine Learning for Body Composition**

Participants
Martin Torrani, MD, Lincoln, MA *(Presenter)* Nothing to Disclose

For information about this presentation, contact:
mtorrani@mgh.harvard.edu

**LEARNING OBJECTIVES**

1) Understand basic concepts of artificial intelligence and machine learning. 2) Understand how such techniques can extract body composition data from images. 3) Discuss other applications of machine learning in body composition.

**RC104F  Osteosarcopenic Obesity: Why Bother**

Participants
Leon Lenchik, MD, Winston-Salem, NC *(Presenter)* Nothing to Disclose

For information about this presentation, contact:
llenchik@wakehealth.edu

**LEARNING OBJECTIVES**

1) Define osteosarcopenic obesity.
Imaging of Musculoskeletal Injuries (Interactive Session)

Sunday, Nov. 25 2:00PM - 3:30PM Room: E451B

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

LEARNING OBJECTIVES

1) The learner will be exposed to a wide gamut of common and uncommon presentation of soft tissue and subtle bony injuries of the ankle and hind foot. Injuries will be elucidated with CT and MRI.
2) Understand in depth the normal anatomy of the ankle and hind foot on CT and MRI.
3) Appreciate subtle and catastrophic injury patterns of the ankle and hind foot.
4) Evaluate post-operative imaging.
5) Effectively utilize CT and MRI in management of patients with ankle and hind foot injuries.
6) To understand the anatomy and biomechanics of hip joint.
7) To recognize easily missed injuries.
8) Describe normal elbow anatomy.
9) Identify subtle and catastrophic injury patterns to elbow.
10) Recommend CT or MR when appropriate.
11) Detect imaging abnormalities commonly seen in the hand and wrist in the emergency setting.
12) Identify commonly encountered hand and wrist pathology in the emergency setting.
13) Recommend appropriate follow up for various findings in the hand and wrist in the emergency setting.

GENERAL INFORMATION

This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

Sub-Events

RC108A  Ankle & Hindfoot

Participants
Manickam Kumaravel, MD, FRCR, Houston, TX (Moderator) Nothing to Disclose

For information about this presentation, contact:
manickam.kumaravel@uth.tmc.edu

LEARNING OBJECTIVES

1) The learner will be exposed to a wide gamut of common and uncommon presentation of soft tissue and subtle bony injuries of the ankle and hind foot. Injuries will be elucidated with CT and MRI.
2) Understand in depth the normal anatomy of the ankle and hind foot on CT and MRI.
3) Appreciate subtle and catastrophic injury patterns of the ankle and hind foot.
4) Evaluate post-operative imaging.
5) Effectively utilize CT and MRI in management of patients with ankle and hind foot injuries.

RC108B  Hip

Participants
Bharti Khurana, MD, Boston, MA (Presenter) Nothing to Disclose

For information about this presentation, contact:
bkhurana@bwh.harvard.edu

LEARNING OBJECTIVES

1) To understand the anatomy and biomechanics of hip joint.
2) To recognize easily missed injuries.
3) To review common hip injuries.

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/

Bharti Khurana, MD - 2014 Honored Educator
Bharti Khurana, MD - 2018 Honored Educator

RC108C  Elbow

Participants
Claire K. Sandstrom, MD, Seattle, WA (Presenter) Royalties, Cambridge University Press; Spouse, Advisory Board, BTG International Ltd;

LEARNING OBJECTIVES

1) Describe normal elbow anatomy.
2) Identify subtle and catastrophic injury patterns to elbow.
3) Recommend CT or MR when appropriate.
1) Describe normal elbow anatomy. 2) Identify subtle and catastrophic injury patterns to elbow. 3) Recommend CT or MR when appropriate.

RC108D Wrist & Hand

Participants
Jonathan A. Flug, MD, MBA, Phoenix, AZ (Presenter) Nothing to Disclose

For information about this presentation, contact:
flug.jonathan@mayo.edu

LEARNING OBJECTIVES

1) Detect imaging abnormalities commonly seen in the hand and wrist in the emergency setting. 2) Identify commonly encountered hand and wrist pathology in the emergency setting. 3) Recommend appropriate follow up for various findings in the hand and wrist in the emergency setting.
**RC152**

**Nerve Ultrasound Based on a Regional Approach: Hip to Knee (Hands-on)**

**Sunday, Nov. 25 2:00PM - 3:30PM Room: E264**

**AMAPRA Category 1 Credit: 1.50**

**ARRT Category A+ Credit: 1.75**

**Participants**

Jon A. Jacobson, MD, Ann Arbor, MI (Presenter) Research Consultant, BioClinica, Inc; Advisory Board, General Electric Company; Advisory Board, Koninklijke Philips NV; Royalties, Reed Elsevier

Kenneth S. Lee, MD, Madison, WI (Presenter) Grant, General Electric Company Research support, SuperSonic Imagine Research support, Johnson & Johnson Consultant, Echometrix, LLC Royalties, Reed Elsevier

J. Antonio Bouffard, MD, Detroit, MI (Presenter) Research Consultant, BioClinica, Inc; Advisory Board, General Electric Company; Advisory Board, Koninklijke Philips NV; Royalties, Reed Elsevier

Kenneth S. Lee, MD, Madison, WI (Presenter) Grant, General Electric Company Research support, SuperSonic Imagine Research support, Johnson & Johnson Consultant, Echometrix, LLC Royalties, Reed Elsevier

Marnix T. van Holsbeeck, MD, Detroit, MI (Presenter) Minor stockholder, Koninklijke Philips NV; Minor stockholder, General Electric Company; Stockholder, MedEd3D; Grant, Siemens AG; Grant, General Electric Company;

Joseph H. Introcaso, MD, Neenah, WI (Presenter) Nothing to Disclose

Viviane Khoury, MD, Philadelphia, PA (Presenter) Nothing to Disclose

Marina Kislyakova, MD, Moscow, Russia (Presenter) Nothing to Disclose

Ximena L. Wortsman, MD, Santiago, Chile (Presenter) Nothing to Disclose

Federico Zaottini, Genova, Italy (Presenter) Nothing to Disclose

Ghiyath Habra, MD, Troy, MI (Presenter) Nothing to Disclose

Lodewijk J. van Holsbeeck, MD, Lansing, MI (Presenter) Nothing to Disclose

Carlo Martinoli, MD, Genova, Italy (Presenter) Nothing to Disclose

Etienne Cardinal, MD, Montreal, QC (Presenter) Nothing to Disclose

Humerto G. Rosas, MD, Madison, WI (Presenter) Nothing to Disclose

Joseph H. Introcaso, MD, Neenah, WI (Presenter) Grant, Siemens AG; Grant, General Electric Company

J. Antonio Bouffard, MD, Detroit, MI (Presenter) Research Consultant, BioClinica, Inc; Advisory Board, General Electric Company; Advisory Board, Koninklijke Philips NV; Royalties, Reed Elsevier

Kenneth S. Lee, MD, Madison, WI (Presenter) Grant, General Electric Company Research support, SuperSonic Imagine Research support, Johnson & Johnson Consultant, Echometrix, LLC Royalties, Reed Elsevier

Marnix T. van Holsbeeck, MD, Detroit, MI (Presenter) Minor stockholder, Koninklijke Philips NV; Minor stockholder, General Electric Company; Stockholder, MedEd3D; Grant, Siemens AG; Grant, General Electric Company;

Joseph H. Introcaso, MD, Neenah, WI (Presenter) Nothing to Disclose

Viviane Khoury, MD, Philadelphia, PA (Presenter) Nothing to Disclose

Marina Kislyakova, MD, Moscow, Russia (Presenter) Nothing to Disclose

Ximena L. Wortsman, MD, Santiago, Chile (Presenter) Nothing to Disclose

Federico Zaottini, Genova, Italy (Presenter) Nothing to Disclose

Ghiyath Habra, MD, Troy, MI (Presenter) Nothing to Disclose

Lodewijk J. van Holsbeeck, MD, Lansing, MI (Presenter) Nothing to Disclose

Carlo Martinoli, MD, Genova, Italy (Presenter) Nothing to Disclose

Etienne Cardinal, MD, Montreal, QC (Presenter) Nothing to Disclose

Humerto G. Rosas, MD, Madison, WI (Presenter) Nothing to Disclose

David P. Fessell, MD, Ann Arbor, MI (Presenter) Nothing to Disclose

Grish Gandikota, MBBS, Ann Arbor, MI (Presenter) Nothing to Disclose

For information about this presentation, contact:

viviane.khoury@uphs.upenn.edu
jjacobsn@umich.edu
carlo.martinoli@unige.it
mkisliakova@yandex.ru
klee2@uwhealth.org

**LEARNING OBJECTIVES**

1) Familiarize course participants with the ultrasound appearance of nerves and the scanning techniques used to image them about the hip and knee. 2) Emphasize the ultrasound anatomy of the femoral, sciatic and peroneal nerves and their divisional branches at their common sites of entrapment. 3) Learn the technique to image some minor nerves in their course throughout the proximal lower extremity, such as the lateral and posterior femoral cutaneous, the obturator, the saphenous and the sural. 4) Outline the range of clinical conditions where ultrasound is appropriate as the primary imaging modality for nerve assessment.

**ABSTRACT**

In recent years, ultrasound of the musculoskeletal and peripheral nervous systems is becoming an increasingly imaging tool with an expanding evidence base to support its use. However, the operator dependent nature and level of technical expertise required to perform an adequate ultrasound assessment means that appropriate training is required. For this purpose, the present course will demonstrate the basic principles of musculoskeletal ultrasound with a special focus on nerves of the proximal lower extremity (hip to knee). The standardized techniques of performing an adequate ultrasound study of the femoral, lateral and posterior femoral cutaneous, obturator, peroneal, saphenous, sciatic, sural nerves and their divisional branches will be illustrated. The hands-on workshops will provide the opportunity to interactively discuss the role of ultrasound in this field with expert instructors. Participants will be encouraged to directly scan model patients. A careful ultrasound approach with thorough understanding of soft-tissue planes and extensive familiarity with anatomy are prerequisites for obtaining reliable information regarding the affected structure and the site and nature of the disease process affecting it.

**Active Handout: Carlo Martinoli**


**Honored Educators**

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Jon A. Jacobson, MD - 2012 Honored Educator Jon A. Jacobson, MD - 2017 Honored Educator
Sunday Afternoon Plenary Session

Sunday, Nov. 25 4:00PM - 5:45PM Room: Arie Crown Theater

Participants
Vijay M. Rao, MD, Philadelphia, PA (Presenter) Nothing to Disclose

Sub-Events
PS12A Report of the RSNA Research and Education Foundation
Participants
N. Reed Dunnick, MD, Ann Arbor, MI (Presenter) Royalties, Wolters Kluwer nv; Editor, Reed Elsevier

PS12B Image Interpretation Session
Participants
Donald P. Frush, MD, Durham, NC (Moderator) Nothing to Disclose
John Eng, MD, Cockeysville, MD (Introduction) Nothing to Disclose
Laura W. Bancroft, MD, Orlando, FL (Presenter) Author with royalties, Wolters Kluwer nv; Speaker, World Class CME; Editor, Thieme Medical Publishers, Inc; Travel support, Thieme Medical Publishers, Inc
Matthew S. Davenport, MD, Ann Arbor, MI (Presenter) Nothing to Disclose
Tomas C. Franquet, MD, Barcelona, Spain (Presenter) Nothing to Disclose
R. Paul Guillerman, MD, Houston, TX (Presenter) Consultant, Guerbet SA
Christopher P. Hess, MD, Mill Valley, CA (Presenter) Nothing to Disclose
Andrea Laghi, MD, Rome, Italy (Presenter) Nothing to Disclose
Elizabeth A. Morris, MD, New York, NY (Presenter) Nothing to Disclose
Pamela K. Woodard, MD, Saint Louis, MO (Presenter) Research agreement, Siemens AG; Research, Eli Lilly and Company; Research, F. Hoffmann-La Roche Ltd

For information about this presentation, contact:
woodardp@wustl.edu
ED008-MO

Musculoskeletal Monday Case of the Day

Monday, Nov. 26 7:00AM - 11:59PM Room: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants
Daniel E. Wessell, MD, PhD, Jacksonville, FL (Presenter) Nothing to Disclose
Jonathan A. Flug, MD, MBA, Phoenix, AZ (Abstract Co-Author) Nothing to Disclose
Jeremiah R. Long, MD, Ft Belvoir, VA (Abstract Co-Author) Nothing to Disclose
Joseph M. Bestic, MD, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose
Hillary W. Garner, MD, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose
Andrew Z. Chow, MD, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose
Sara Eckloff, MD, Eau Claire, WI (Abstract Co-Author) Nothing to Disclose
Matthew A. Frick, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Nicholas G. Rhodes, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Sujan C. Fernando, MD, Milwaukee, WI (Abstract Co-Author) Nothing to Disclose
John S. Symanski, MD, Milwaukee, WI (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) Participants will test their diagnostic skills and become familiar with the imaging findings of a variety of challenging and interesting musculoskeletal cases.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Daniel E. Wessell, MD, PhD - 2013 Honored Educator
You Take the Red Pill-You Stay in Wonderland and I Show You How Deep the Rabbit Hole Goes (Case-based Competition)

Monday, Nov. 26 7:15AM - 8:15AM Room: E451B

Participants
Adam E. Flanders, MD, Philadelphia, PA (Presenter) Nothing to Disclose
Sandeep P. Deshmukh, MD, Philadelphia, PA (Presenter) Nothing to Disclose
Vishal Desai, MD, Philadelphia, PA (Presenter) Nothing to Disclose
Christopher G. Roth, MD, MS, Philadelphia, PA (Presenter) Nothing to Disclose

For information about this presentation, contact:

vishal.desai@jefferson.edu

LEARNING OBJECTIVES

1) Be introduced to a series of radiology case studies via an interactive team game approach designed to encourage 'active' consumption of educational content. 2) Use their mobile wireless device (tablet, phone, laptop) to electronically respond to various imaging case challenges; participants will be able to monitor their individual and team performance in real time. 3) Receive a personalized self-assessment report via email that will review the case material presented during the session, along with individual and team performance. This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.
LEARNING OBJECTIVES

1) Demonstrate the imaging appearances of the types of meniscus tears. 2) Describe the most common locations of displaced flap tears of the menisci. 3) Determine the best sequences for identifying tears of the meniscal root ligaments. 4) Identify signs that indicate likely presence of flap tears of the menisci.

Participants

Naveen Subhas, MD, Shaker Heights, OH (Moderator) Research support, Siemens AG
Kirkland W. Davis, MD, Madison, WI (Moderator) Author with royalties, Reed Elsevier; Editor with royalties, Reed Elsevier
Thomas M. Link, MD, PhD, San Francisco, CA (Moderator) Research Grant, General Electric Company; Research Consultant, General Electric Company; Research Consultant, InSightec Ltd; Research Grant, InSightec Ltd; Royalties, Springer Nature; Consultant, Springer Nature; Research Consultant, Pfizer Inc;

For information about this presentation, contact:
thomas.link@ucsf.edu
llenchik@wakehealth.edu

LEARNING OBJECTIVES

1) Describe the normal imaging appearance of the cruciate ligaments. 2) Examine common mechanisms of cruciate ligament injury. 3) Describe the imaging appearance of cruciate ligament injuries. 4) Identify secondary imaging signs of cruciate ligament injuries.

Participants

Daniel E. Wessell, MD, PhD, Jacksonville, FL (Presenter) Nothing to Disclose

For information about this presentation, contact:
Wessell.Daniel@mayo.edu

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Daniel E. Wessell, MD, PhD - 2013 Honored Educator
Previous Meniscal Surgery is Associated with Higher Cartilage T2 Values Indicating More Advanced Cartilage Deterioration: Data from the Osteoarthritis Initiative

Monday, Nov. 26 9:30AM - 9:40AM Room: E451B

Participants

Jan Neumann, MD, San Francisco, CA (Presenter) Nothing to Disclose
Kai P. Kern, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Sarah C. Foreman, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Dong Sun, Wuhan, China (Abstract Co-Author) Nothing to Disclose
Michael C. Nevitt, PhD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Charles E. McCulloch, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Gabby B. Joseph, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Azien Laqnami, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Thomas M. Link, MD,PhD, San Francisco, CA (Abstract Co-Author) Research Grant, General Electric Company; Research Consultant, General Electric Company; Research Consultant, InSightec Ltd; Research Grant, InSightec Ltd; Royalties, Springer Nature; Consultant, Springer Nature; Research Consultant, Pfizer Inc;

For information about this presentation, contact:
Jan.Neumann@ucsf.edu

PURPOSE

To determine if participants with prior meniscal surgery show altered cartilage composition when compared to non-surgical controls and whether the grade of deterioration is different for non-injury related meniscal surgery or meniscal surgery performed to repair a previous injury.

METHOD AND MATERIALS

In this cross-sectional study, semi-automatic cartilage segmentation of the right knee of 230 participants from the Osteoarthritis Initiative (OAI) was performed on 2D multi-slice multi-echo sequences, acquired with 3T MRI, and analyzed in a mono-exponential decay model with fitting function for the signal intensity and calculation of T2 maps. Based on the medical history, participants were divided into four groups (i) with meniscal surgery due to an injury, (ii) with meniscal surgery performed to repair a previous injury, (iii) with non-injury related meniscal surgery, and (iv) controls without meniscal surgery or prior knee injury. All groups were matched for sex, KL score, age, and BMI. Linear regression analysis was used to compare the T2 values in each compartment, as well as the mean values across all compartments.

RESULTS

The average age of all study participants was 57.7 years (SD 8.9) with a BMI of 27.9 (SD 4.0) and 76 (33.0%) female participants. Participants with previous meniscal surgery showed significantly higher mean T2 values across all compartments when compared to surgical participants with previous meniscal knee surgery, separately for surgical participants with (p<0.001) and without (p<0.001) previous injury. Similar results were obtained when analyzing the compartments separately: In all weight-bearing compartments (lateral/medial femur and tibia) participants with previous surgery showed significantly higher mean T2 values, when compared to controls without surgery (p<0.05). The subanalysis of
cartilage T2 values between the two surgical groups did not show significant differences.

CONCLUSION
Participants that underwent meniscal surgery with and without previous meniscal injury exhibited overall higher cartilage mean T2 values when compared to non-surgical controls, while no significant differences were found within the surgical groups. Our results indicate that meniscal surgery contributes to cartilage matrix degeneration, possibly independent of surgical indication.

CLINICAL RELEVANCE/APPLICATION
Indication for meniscal surgery should be thoroughly considered to prevent early or accelerated cartilage degeneration.

RC204-05  Collagen Meniscal Implant: A Long Term MRI Follow-Up in Asymptomatic Patients
Monday, Nov. 26 9:40AM - 9:50AM Room: E451B

Participants
Balazs Krisztian Kovacs, Basel, Switzerland (Presenter) Nothing to Disclose
Dorothee Harder, Basel, Switzerland (Abstract Co-Author) Nothing to Disclose
Felix Amsler, Basel, Switzerland (Abstract Co-Author) Nothing to Disclose
Leoni Keller, Uster, Switzerland (Abstract Co-Author) Nothing to Disclose
Roger Berbig, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Michael T. Hirschmann, MD, Bruderholz, Switzerland (Abstract Co-Author) Nothing to Disclose
Anna Hirschmann, MD, Basel, Switzerland (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
balazskrisztian.kovacs@usb.ch

PURPOSE
Long term evaluation of morphology and size of collagen meniscal implants (CMI) and signs of osteoarthritis on MRI in patients with good clinical outcome.

METHOD AND MATERIALS
79 patients were prospectively included for follow-up (FU) after arthroscopic CMI. Of these, 57 patients (mean age, 44±11 years; gender, 41 male/16 female; side, 48 medial/9 lateral) showed good clinical outcome (Lysholm-score >85; visual analogue satisfaction scale <2) and 79 MRI 1-8 years postoperatively were independently evaluated by two radiologists. CMI morphology, signal intensity (SI), homogeneity and size were assessed and of these results a meniscal score was calculated. Degree of chondral defects and amount of bone marrow edema (BME) were reported as chondral score. Additionally, meniscal extrusion was evaluated. Inter-reader reliability was calculated, Pearson was used to determine correlation between imaging findings and time after operation (P<0.05).

RESULTS
One year postoperatively, the CMI varied in size (10% normal, 30% small, 60% hypertroph) and was hyperintense in all patients. During FU (>3 years postoperatively) the size of CMI decreased (6% resorbed, 18% normal, 41% small, 35% hypertroph). CMI was initially hyperintense in all patients and changed to normal SI in only 13% during FU. The meniscal score improved significantly over time (r=0.28). Less meniscal extrusion was present during FU (93% initially, 71% FU; r=0.28). During FU, full-thickness chondral defects were increasingly present at the femoral side (65%; initially 33%). The chondral score was significantly worse during FU (P=0.017). Inter-reader reliability was fair for morphology and SI, moderate for size (0.48), homogeneity (0.41) and meniscal extrusion (0.55) and good for femoral cartilage (0.62) and almost perfect for BME (0.84-0.88).

CONCLUSION
In the long-term FU CMI varies in size, is typically hyperintense in SI and appears extruded. Despite asymptomatic knees, full-thickness cartilage defects were present in the majority of knees after CMI.

CLINICAL RELEVANCE/APPLICATION
Demonstrate the MR-variety of meniscal morphologies after CMI in asymptomatic patients and heighten the awareness of radiologist and referring physicians.

RC204-06  Extensor Mechanism
Monday, Nov. 26 9:50AM - 10:10AM Room: E451B

Participants
Kirkland W. Davis, MD, Madison, WI (Presenter) Author with royalties, Reed Elsevier; Editor with royalties, Reed Elsevier

LEARNING OBJECTIVES
1) Identify the anatomic components of the extensor mechanism on XR, CT, and MRI. 2) Assess the extensor mechanism, determine the pathology, and explain mechanism of injury.

RC204-07  Articular Cartilage
Monday, Nov. 26 10:20AM - 10:40AM Room: E451B

Participants
Thomas M. Link, MD,PhD, San Francisco, CA (Presenter) Research Grant, General Electric Company; Research Consultant, General Electric Company; Research Consultant, InSightec Ltd; Research Grant, InSightec Ltd; Royalties, Springer Nature; Consultant, Springer Nature; Research Consultant, Pfizer Inc;
**RC204-08  Quantitative DCE-MRI Perfusion Imaging of the Subchondral Bone in Knee Osteoarthritis**

**Participants**
Bas A. de Vries, MSc, Rotterdam, Netherlands (*Presenter*)
Jos Gut, PhD, Rotterdam, Netherlands (*Abstract Co-Author*)
Dirk Poot, PhD, Rotterdam, Netherlands (*Abstract Co-Author*)
Gabriel P. Krestin, MD, PhD, Rotterdam, Netherlands (*Abstract Co-Author*)
Edwin H. Oei, MD, PhD, Palo Alto, CA (*Abstract Co-Author*)

**PURPOSE**
Osteoarthritis (OA) is characterized by articular cartilage degeneration, synovial inflammation and subchondral bone changes. Although subchondral bone changes are believed to have an important role in the progression of OA, the mechanism is insufficiently understood and might be related to locally increased perfusion and inflammation. Perfusion can be visualized and quantified with gadolinium-based dynamic contrast-enhanced MRI (DCE-MRI). The goal of this study was to evaluate subchondral bone perfusion of affected and non-affected compartments in osteoarthritic knees with DCE-MRI.

**METHOD AND MATERIALS**
23 patients with unicompartmental knee OA were prospectively included. Multisequence MRI including DCE-MRI was performed at 3T (GE Discovery MR750) using an 8-channel knee coil. Perfusion was measured in subchondral regions of interest (ROI) in both the affected and non-affected knee compartment on three sagittal slices. Perfusion was also measured in ROIs of the bone marrow lesions (BMLs). The main outcome was Ktrans, a measure of capillary permeability. In addition, the flux rate constant Kep was measured. Perfusion parameters of the affected side were compared to the non-affected side. In BMLs these parameters were compared to surrounding subchondral bone without BMLs. Statistical analyses included the Wilcoxon-signed-rank test.

**RESULTS**
The mean Ktrans and Kep were significantly increased (p<0.05) in the affected compared to the non-affected compartment in the subchondral bone of the knee in both the femur and the tibia. Subchondral BMLs detected on fat-saturated T2-weighted images were present in all 23 patients, of which most BMLs close to the articular surface. Ktrans and Kep were significantly (p<0.001) higher within subchondral BMLs compared to surrounding subchondral bone without BMLs.

**CONCLUSION**
Perfusion of the subchondral bone measured with DCE-MRI is significantly increased in the affected compared to the non-affected side in patients with unicompartmental knee OA. Since subchondral BMLs are highly associated with increased perfusion parameters compared to subchondral bone regions without BMLs, BMLs most likely account for the increased subchondral bone perfusion in knee OA.

**CLINICAL RELEVANCE/APPLICATION**
Subchondral bone inflammation is suggested to affect cytokine excretion, which accelerates cartilage degeneration. Increased subchondral perfusion, related to inflammation was present in the OA knee.
(MOAKS) system. Cartilage thickness and cartilage T2 relaxation time were measured in the patella, trochlea, medial and lateral femoral condyle, and medial and lateral tibia plateau using the 3D-FSE and T2 mapping images respectively. Mann-Whitney-Wilcoxon tests and ANCOVA tests adjusted for age and gender were used to compare biomechanical parameters and MRI parameters respectively between fore-foot and rear-foot runners.

RESULTS
Fore-foot runners had a significantly lower foot angle at contact (p<0.001), vertical loading rate (p=0.010), and knee negative work load (p=0.001), but no significant difference in cadence (p=0.439), speed (p=0.090), or external knee adductor moment (p=0.891) when compared to rear-foot runners. Cartilage lesions and bone marrow edema lesions were present in the patella and trochlea of both fore-foot and rear-foot runners, but there was no significant difference (p=0.271-0.512) in MOAKS scores within the patellofemoral compartment. No runner had evidence of morphologic joint degeneration on MRI within the medial or lateral compartments. There was no significant difference (p=0.151-0.854) in cartilage thickness on any articular surface between fore-foot and rear-foot runners. Fore-foot runners had significantly higher cartilage T2 on the medial tibia plateau (p=0.008), but no significant difference (p=0.056-0.930) in cartilage T2 on the remaining articular surfaces when compared to rear-foot runners.

CONCLUSION
While fore-foot runners had significantly lower vertical loading rate and knee negative work load than rear-foot runners, morphologic and quantitative MRI showed no benefits of the fore-foot strike pattern on reducing the risk of knee joint degeneration.

CLINICAL RELEVANCE/APPLICATION
While the fore-foot running pattern has beneficial biomechanical effects, our preliminary cross-sectional study using MRI showed no evidence that the improved biomechanics could reduce the risk of knee joint degeneration.
LEARNING OBJECTIVES

1) Analysis of Hoffa fat pad for impingement, synovitis, fibrosis, and mass. 2) Recognition of muscle injury patterns and anatomic variants. 3) Recognition of nerve and vascular abnormalities. 4) Evaluation of the iliotibial band. 5) Recognition of Morel-Lavallee lesion and its distinction from other masses around the knee.

Participants
Naveen Subhas, MD, Shaker Heights, OH (Presenter) Research support, Siemens AG

LEARNING OBJECTIVES

1) Review the postoperative meniscus: Normal postoperative appearance, postoperative tears, and postoperative complications. 2) Review the postoperative ACL: Normal postoperative appearance, ACL graft tears, and postoperative complications. 3) Review articular cartilage repair: Normal postoperative appearance and postoperative complications.
Whole-body MRI for Oncologic Decision Making in Bone Disease

Monday, Nov. 26 8:30AM - 10:00AM Room: S103AB

BQ   MR   MK   OI

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

FDA Discussions may include off-label uses.

Participants
Evis Sala, MD, PhD, Cambridge, United Kingdom (Moderator) Nothing to Disclose

LEARNING OBJECTIVES
1) Describe the limitations of current imaging modalities in evaluation of metastatic bone disease. 2) Learn the added value of whole body MRI in evaluation of metastatic bone disease in various malignancies including prostate cancer and multiple myeloma. 3) Understand the role of quantitative whole body MRI in delivering precision medicine in oncology.

Sub-Events
RC218A Imaging of Metastatic Bone Disease: Current Limitations

Participants
Hebert Alberto Vargas, MD, Cambridge, United Kingdom (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Discuss the challenges associated with the diagnosis and interpretation of bone findings in patients with metastatic disease.

ABSTRACT
Conventional imaging of metastatic disease to the bone is notoriously difficult. Unlike soft tissue metastases, significant cortical disruption is required before a bone metastases is visible on CT, and bone scan demonstrates the effect of the metastases on bone, rather than the metastases themselves. MR partially overcomes these limitations, as early bone metastases can be detected. However, even after bone metastases are apparent on imaging, it is difficult to assess their evolution with regards to therapy response.

RC218B WB-MRI of Metastatic Bone: MET-RADS

Participants
Anwar R. Padhani, MD, FRCR, Northwood, United Kingdom (Presenter) Advisory Board, Siemens AG ; Speakers Bureau, Siemens AG ; Speakers Bureau, sanofi-aventis Group; Speakers Bureau, Johnson & Johnson

For information about this presentation, contact:
anwar.padhani@sticklandscanner.org.uk

LEARNING OBJECTIVES
1) To show how measurements are acquired distinguishing between tumor detection (core) and response assessment (comprehensive) protocols that are MET-RADS compliant. 2) To highlight and review the MET-RADS response assessment criteria and their application. 3) To illustrate MET-RADS usage with case examples and to provide data on MET-RADS use in clinical practice. 4) Outline the next steps for MET-RADS development.

ABSTRACT
MET-RADS provides the minimum standards for whole body MRI with DWI regarding image acquisitions, interpretation, and reporting of both baseline and follow-up monitoring examinations of patients with advanced, metastatic cancers. MET-RADS is suitable for guiding patient care in practice (using the regional and overall assessment criteria), but can also be incorporated into clinical trials when accurate lesion size and ADC measurements become more important (the recording of measurements is not mandated for clinical practice). MET-RADS enables the evaluation of the benefits of continuing therapy to be assessed, when there are signs that the disease is progressing (discordant responses). MET-RAD requires validation within clinical trials initially in studies that assess the effects of known efficacious treatments. MET-RADS measures should be correlated to other tumor response biomarkers, quality of life measures, rates of skeletal events, radiographic progression free survival and overall survival. The latter will be needed for the introduction of WB-MRI into longer term follow-up studies, that will allow objective assessments of whether WB-MRI is effective in supporting patient care.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Anwar R. Padhani, MD, FRCR - 2012 Honored Educator
LEARNING OBJECTIVES

1) List indications for WB-MRI in multiple myeloma.
2) Describe the core and comprehensive protocols for WB-MRI in multiple myeloma.
3) Apply a systematic approach to reporting WB-MRI in multiple myeloma as outlined in MY-RADS.
4) Review the MY-RADS criteria for assessing disease phenotype, burden and response assessment with case examples.

ABSTRACT

Acknowledging the increasingly important role of WB-MRI for directing myeloma patient care, a multidisciplinary international expert panel of radiologists, medical physicists and haematologists convened to discuss the performance standards, merits and limitations of WB-MRI in myeloma. The MY-RADS imaging recommendations are designed to promote standardization and diminish variations in the acquisition, interpretation, and reporting of WB-MRI in myeloma both in the clinical setting and within clinical trials. MY-RADS comprehensive disease classification requires validation within clinical trials including assessments of reproducibility.

Active Handout: Christina Messiou


LEARNING OBJECTIVES

RC218D Quantitative WB-MRI for Promoting Precision Oncology

1) To review the quantitative parameters that can be derived from WB-MRI studies.
2) To understand the evolving role of quantitative WB-MRI for the evaluation of metastatic bone disease.
3) To appreciate the application of quantitative WB-MRI for precision oncology in assessing tumour treatment response and disease heterogeneity.
ABSTRACT

CT has become a leading medical imaging modality, thanks to its superb spatial and temporal resolution to depict anatomical details. New advances have enabled extending the technology to depict physiological information. This has enabled a wide and expanding range of clinical applications. These advances are highlighted in this multi-session course. The course offers a comprehensive and topical depiction of these advances with material covering CT system innovations, CT operation, CT performance characterization, functional and quantitative applications, and CT systems devised for specific anatomical applications. The sessions include advances in CT system hardware and software, CT performance optimization, CT practice management and monitoring, spectral CT techniques, quantitative CT techniques, functional CT methods, and special CT use in breast, musculoskeletal, and interventional applications.

LEARNING OBJECTIVES

1) Introduce the technology of cone beam breast CT to audience. 2) Show both qualitative parameters describing image quality and qualitative images. 3) Demonstrate breast CT performance using metrics such as anatomical noise metrics, computer and human observer studies. 4) Illustrate the future potential of breast CT in diagnostic and screening breast imaging.

LEARNING OBJECTIVES

1) Explain the technology of musculoskeletal (MSK) cone-beam CT (CBCT). 2) Identify key differences between MSK CBCT and other orthopedic imaging modalities. 3) Discuss emerging clinical applications of MSK CBCT.
Hands-on Musculoskeletal Ultrasound: A Forum for Question and Answer (Hands-on)

Monday, Nov. 26 8:30AM - 10:00AM Room: E258

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

Participants
Marnix T. van Holsbeeck, MD, Detroit, MI (Presenter) Minor stockholder, Koninklijke Philips NV; Minor stockholder, General Electric Company; Stockholder, MedEd3D; Grant, Siemens AG; Grant, General Electric Company;
Lodewijk J. van Holsbeeck, MD, Lansing, MI (Presenter) Nothing to Disclose
Joseph H. Introcaso, MD, Neenah, WI (Presenter) Nothing to Disclose
Humberto G. Rosas, MD, Madison, WI (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Recognize and identify pitfalls of scanning that lead to false positive or false negative musculoskeletal ultrasound results. 2) Perform skills for scanning difficult patients. 3) Follow rigorous protocols for the examination of different anatomic regions. 4) Position patients for more complicated musculoskeletal ultrasound examinations. 5) Recognize and integrate the importance of tissue movement in judging the functionality of the extremities.

ABSTRACT
In this Musculoskeletal Ultrasound Master class, an opportunity will be given to participants to start a written dialogue in advance to RSNA 2018. The electronically submitted questions will be sorted by instructors and organized per topic. A select number of recurrent themes in these questions will be prepared for dialogue on stage. When the questions focus on a particular scanning skill, the authors of the questions will be invited on the examination platform to show problems they encounter in their practice. By using a step-by-step approach in solving the scanning issues, all who are present should benefit from the technical interactions on stage. Cameras will project scanning details on large screens. The seating in the class will guarantee close proximity for an enriching interaction between audience and stage.
PURPOSE
Sarcopenia consists of loss of muscle mass and strength/function. As adipose tissue expands and muscle and bone tissue decrease with aging, there is a concomitant increase in proinflammatory and a reduction in anti-inflammatory factors contributory to chronic inflammation. We aimed to evaluate associations of several inflammatory markers with DXA-measured sarcopenia markers in a representative sample of European healthy adults aged 65-79 years.

METHOD AND MATERIALS
Baseline whole-body DXA scan was performed and fresh blood samples collected in 1122 participants enrolled in the NU-AGE trial, a one-year, multicenter, randomized, single-blind, controlled trial (NCT01754012) testing the effects of a dietary intervention. Appendicular lean mass (ALMI, lean mass from arms plus legs/height2) and skeletal mass index (SMI, lean mass from arms plus legs/weight) were used as DXA markers of sarcopenia. Quantitative determination of inflammatory markers was performed by ELISA. After a log-transformation of DXA parameters the Pearson Product-Moment Correlation was applied to test the associations between body composition and inflammation markers in both genders.
**RESULTS**

In male population, a positive association was found between ALMI and albumin ($p=0.26; p < .05$) and SMI and ghrelin ($p=0.19; p < .05$). A negative association was found between ALMI and adiponectin ($p=-0.23; p < .001$), while SMI was negatively correlated with leptin ($p=-0.70; p < .001$) and C-Reactive Protein (CRP) ($p=0.24; p < .001$). In females, ALMI was positively associated with leptin ($p=0.19; p < .01$), and CRP ($p=0.22; p < .01$). SMI was positively associated with ghrelin ($p=0.24; p < .001$), while negatively with leptin ($p=-0.62; p < .01$), CRP ($p=-0.23; p < .01$), and AGP ($p=-0.26; p < .01$).

**CONCLUSION**

Sarcopenia correlates with an increase of inflammatory status in elderly. In males and females, SMI correlates positively with ghrelin, an anti-inflammatory molecule, and negatively with pro-inflammatory markers such as leptin, CRP and AGP; while ALMI showed ambiguous associations with inflammatory markers. Thus, SMI appears to be a better predictor of inflammatory risk status in the elderly.

**CLINICAL RELEVANCE/APPLICATION**

DXA-derived sarcopenia markers show a correlation with inflammatory markers useful to picture patients' risk status. SMI may predict inflammatory status better than ALMI; but further research is required.

**SSC10-04 Automated Segmentation of Thoracic Paraspinal Muscles: Pipeline for Large-Scale Data Mining on CT**

Monday, Nov. 26 11:00AM - 11:10AM Room: S102CD

Participants

Leon Lenchik, MD, Winston-Salem, NC (Presenter) Nothing to Disclose
Ryan T. Barnard, MS, Winston-Salem, NC (Abstract Co-Author) Nothing to Disclose
Stephen B. Kritchevsky, PhD, Winston-Salem, NC (Abstract Co-Author) Nothing to Disclose
Ashley A. Weaver, PhD, Winston Salem, NC (Abstract Co-Author) Nothing to Disclose
Robert D. Boutin, MD, Davis, CA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
llenchik@wakehealth.edu

**PURPOSE**

To compare automated pipeline for thoracic paraspinal muscle segmentation with manual segmentation on chest CT examinations.

**METHOD AND MATERIALS**

Atlas-based automated pipeline for thoracic paraspinal muscle segmentation was developed using open-source medical image analysis tools: Advanced Normalization Tools (ANTs), the Oxford Centre for Functional Magnetic Resonance Imaging of the Brain Software Library (FSL), and the scikit-image Python image processing library. After the correct image at T12 level was identified, the left paraspinal muscle was automatically segmented and the muscle attenuation and cross-sectional area were recorded. Ground truth was obtained using 475 non-contrast chest CT exams by manually segmenting the left paraspinal muscle at T12 level with muscle thresholds set at -29 to +150 HU (Mimics software version 19.0; Materialise, Leuven, Belgium). The CT images are heterogeneous in field of view, voxel spacing, convolution kernel, scanner manufacturer and model, reconstruction algorithm, and image quality. Dice and Jaccard similarity indices were determined.

**RESULTS**

Compared to manual segmentation, the automated pipeline had a mean Dice index of 0.85 (SD=0.07) and a mean Jaccard index of 0.74 (SD=0.09). Mean accuracy error for muscle attenuation was 1.2 HU; range: 0-4.9 HU. Mean accuracy error for muscle cross-sectional area was 1.83 cm²; range: 0-9.3 cm².

**CONCLUSION**

The automated pipeline for thoracic paraspinal muscle segmentation is sufficiently accurate to allow for large-scale data mining of heterogeneous chest CT images.

**CLINICAL RELEVANCE/APPLICATION**

Current CT image evaluation of sarcopenia requires manual segmentation, unrealistic for large datasets. The automated pipeline for sarcopenia evaluation on chest CTs could be adapted to other body regions including abdomen, pelvis, and extremities.

**SSC10-05 Assessment of Sarcopenia on Computed Tomography (CT): A Systematic Review of Technical Parameters**

Monday, Nov. 26 11:10AM - 11:20AM Room: S102CD

Participants

Behrang Amini, MD, PhD, Houston, TX (Presenter) Nothing to Disclose
Robert D. Boutin, MD, Davis, CA (Abstract Co-Author) Nothing to Disclose
Leon Lenchik, MD, Winston-Salem, NC (Abstract Co-Author) Nothing to Disclose
Sean P. Boyle, Sacramento, CA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
Bamini@mdanderson.org

**PURPOSE**

Computed tomography (CT) is being increasingly used for the assessment of sarcopenia, often by non-radiologists who may not be aware of the impact of technical parameters on muscle metrics. We sought to perform a systematic review of all relevant studies that used CT muscle measurements to assess sarcopenia to identify the differences between technical parameters used.
METHOD AND MATERIALS

A comprehensive search of PubMed from 1983-2017 was performed to identify studies that used CT measurements of muscle to assess for sarcopenia. Review articles were excluded. The following technical parameters used to measure muscle metrics were compared: slice thickness, kVp, mAs, helical pitch, reconstruction method, and use of intravenous (IV) contrast.

RESULTS

From the 654 articles identified, 388 studies met the inclusion criteria for the systematic review. Slice thickness was not reported in 63% of studies. When reported, the most commonly used slice thickness was 10 mm (14%). kVp was not reported in 73% of studies. When reported, the most common kVp value was 120 (19%). mAs was not reported in 75% of studies. When reported, the most common mAs values were between 200 and 300 (7%). Helical pitch and reconstruction algorithm were not reported in 98% of studies and IV contrast use was not reported in 94% of studies.

CONCLUSION

There is a significant deficiency in reporting of CT technical parameters used for measuring muscle indices which may affect the generalizability of results in the sarcopenia literature.

CLINICAL RELEVANCE/APPLICATION

Comparison between publications in the sarcopenia field is hampered by deficiency in reporting of CT technical parameters.

SSC10-06 Inter- and Intraobserver Variability of an Anatomical Landmark-Based, Manual Segmentation Method by MRI for the Assessment of Skeletal Muscle Fat Content and Area in Subjects from the General Population

Participants
Lena Sophie Kiefer, MD, Tubingen, Germany (Presenter) Nothing to Disclose
Jana Fabian, BSC, Tubingen, Germany (Abstract Co-Author) Nothing to Disclose
Roberto Lorbeer, Greifswald, Germany (Abstract Co-Author) Nothing to Disclose
Juergen Machann, MD, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Corinna Storz, MD, Tubingen, Germany (Abstract Co-Author) Nothing to Disclose
Maren S. Kraus, MD, Tubingen, Germany (Abstract Co-Author) Nothing to Disclose
Christopher L. Schlelt, MD, MPH, Heidelberg, Germany (Abstract Co-Author) Nothing to Disclose
Frank W. Roemer, MD, Erlangen, Germany (Abstract Co-Author) Officer, Boston Imaging Core Lab, LLC; Research Director, Boston Imaging Core Lab, LLC; Shareholder, Boston Imaging Core Lab, LLC
Annette Peters, Neuberger, Germany (Abstract Co-Author) Nothing to Disclose
Konstantin Nikolau, MD, Tuebingen, Germany (Abstract Co-Author) Advisory Panel, Siemens AG; Speakers Bureau, Siemens AG; Speaker Bureau, Bayer AG
Fabian Bamberg, MD, Tuebingen, Germany (Abstract Co-Author) Speakers Bureau, Bayer AG; Speakers Bureau, Siemens AG; Research Grant, Siemens AG

For information about this presentation, contact:
lena.kiefer@med.uni-tuebingen.de

PURPOSE

Changes in skeletal muscle composition, such as fat content and mass, may exert unique metabolic and musculoskeletal risks; however, the reproducibility of their assessment is unknown. We determined the variability of the assessment of skeletal muscle fat content and area by magnetic resonance imaging (MRI) in a population-based sample.

METHOD AND MATERIALS

A random sample from a prospective, community-based cohort study (KORA-FF4) was included. Skeletal muscle fat content was quantified as proton-density fat-fraction (PDFF) and area as cross-sectional area (CSA) in multi-echo Dixon sequences (TR 8.90ms, six echo times, flip-angle 4°) by a standardized, anatomical landmark-based, manual skeletal muscle segmentation at level L3 vertebra by two independent observers. Reproducibility was assessed by intra-class correlation coefficients (ICC), scatter and Bland-Altman plots.

RESULTS

In 50 included subjects (mean age 56.1±8.8years, 60.0% males, mean BMI 28.3±5.2) 2'400 measurements were obtained. Inter-observer agreement was excellent for all muscle compartments (PDFF: ICC0.99, CSA: ICC0.98) with only minor absolute and relative differences (-0.2±0.5%, 31±44.7mm2; -2.6±6.4% and 2.7±3.9%, respectively). Intra-observer reproducibility was similarly excellent (PDFF: ICC1.0, 0.0±0.4%, 0.4%; CSA: ICC1.0, 5.5±25.3mm2, 0.5%, absolute and relative differences, respectively). All agreement was independent of age, gender, BMI, body height and visceral adipose tissue (ICC0.96-1.0). Furthermore, PDFF-reproducibility was independent of CSA (ICC0.93-0.99).

CONCLUSION

Quantification of skeletal muscle fat content and area by MRI using an anatomical landmark-based, manual skeletal muscle segmentation is highly reproducible.

CLINICAL RELEVANCE/APPLICATION

An anatomical landmark-based, manual skeletal muscle segmentation provides high reproducibility of skeletal muscle fat content and area and may therefore serve as a robust proxy for myosteatosis and sarcopenia in large cohort studies.

SSC10-07 Cortical Bone Porosity Assessment in Human Tibial and Fibular Cortex Using Ultrashort Echo Time Magnetization Transfer (UTE-MT) MRI

Participants
Lena Sophie Kiefer, MD, Tubingen, Germany (Presenter) Nothing to Disclose
Jana Fabian, BSC, Tubingen, Germany (Abstract Co-Author) Nothing to Disclose
Roberto Lorbeer, Greifswald, Germany (Abstract Co-Author) Nothing to Disclose
Juergen Machann, MD, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Corinna Storz, MD, Tubingen, Germany (Abstract Co-Author) Nothing to Disclose
Maren S. Kraus, MD, Tubingen, Germany (Abstract Co-Author) Nothing to Disclose
Christopher L. Schlelt, MD, MPH, Heidelberg, Germany (Abstract Co-Author) Nothing to Disclose
Frank W. Roemer, MD, Erlangen, Germany (Abstract Co-Author) Officer, Boston Imaging Core Lab, LLC; Research Director, Boston Imaging Core Lab, LLC; Shareholder, Boston Imaging Core Lab, LLC
Annette Peters, Neuberger, Germany (Abstract Co-Author) Nothing to Disclose
Konstantin Nikolau, MD, Tuebingen, Germany (Abstract Co-Author) Advisory Panel, Siemens AG; Speakers Bureau, Siemens AG; Speaker Bureau, Bayer AG
Fabian Bamberg, MD, Tuebingen, Germany (Abstract Co-Author) Speakers Bureau, Bayer AG; Speakers Bureau, Siemens AG; Research Grant, Siemens AG

For information about this presentation, contact:
lena.kiefer@med.uni-tuebingen.de

PURPOSE

Changes in skeletal muscle composition, such as fat content and mass, may exert unique metabolic and musculoskeletal risks; however, the reproducibility of their assessment is unknown. We determined the variability of the assessment of skeletal muscle fat content and area by magnetic resonance imaging (MRI) in a population-based sample.

METHOD AND MATERIALS

A random sample from a prospective, community-based cohort study (KORA-FF4) was included. Skeletal muscle fat content was quantified as proton-density fat-fraction (PDFF) and area as cross-sectional area (CSA) in multi-echo Dixon sequences (TR 8.90ms, six echo times, flip-angle 4°) by a standardized, anatomical landmark-based, manual skeletal muscle segmentation at level L3 vertebra by two independent observers. Reproducibility was assessed by intra-class correlation coefficients (ICC), scatter and Bland-Altman plots.

RESULTS

In 50 included subjects (mean age 56.1±8.8years, 60.0% males, mean BMI 28.3±5.2) 2'400 measurements were obtained. Inter-observer agreement was excellent for all muscle compartments (PDFF: ICC0.99, CSA: ICC0.98) with only minor absolute and relative differences (-0.2±0.5%, 31±44.7mm2; -2.6±6.4% and 2.7±3.9%, respectively). Intra-observer reproducibility was similarly excellent (PDFF: ICC1.0, 0.0±0.4%, 0.4%; CSA: ICC1.0, 5.5±25.3mm2, 0.5%, absolute and relative differences, respectively). All agreement was independent of age, gender, BMI, body height and visceral adipose tissue (ICC0.96-1.0). Furthermore, PDFF-reproducibility was independent of CSA (ICC0.93-0.99).

CONCLUSION

Quantification of skeletal muscle fat content and area by MRI using an anatomical landmark-based, manual skeletal muscle segmentation is highly reproducible.

CLINICAL RELEVANCE/APPLICATION

An anatomical landmark-based, manual skeletal muscle segmentation provides high reproducibility of skeletal muscle fat content and area and may therefore serve as a robust proxy for myosteatosis and sarcopenia in large cohort studies.
METHOD AND MATERIALS

Eighteen cortical bone specimens were harvested from human tibial and fibular midshafts (63±19 and 52±18 years old). Specimens were scanned using an 8-channel knee coil on a 3T clinical scanner (MR750, GE). The UTE-MRI scans involved: A) an actual flip angle-variable TR (AFI-VTR) method, (AFI: TE=0.032, TR=20,100 ms, FA=45°; VTR: TE=0.032, TR=20 to 100 ms, FA=45°) for T1 measurement, which is a prerequisite for accurate MT modeling, and B) a 3D UTE-Cones-MT sequence (saturation pulse power=500,1000,1500°, frequency offset=2 to 50 kHz, FA=7°) for MT modelling. Field of view (FOV), matrix dimension, nominal in-plane pixel size, and slice thickness were 14 cm, 256×256, 0.54 mm, and 2 mm, respectively. Afterward, specimens were scanned using a SkyScan 1076 (Kontich, Belgium) µCT at 9 µm3 voxel size. Pearson's correlations were calculated between UTE-MT results and µCT-based measures (porosity and bone mineral density, BMD) using the data in 12 and 4 ROIs in each tibial and fibular sample, respectively. ROIs were selected at different cortical bone bands to provide an adequate range of porosity.

RESULTS

Figures 1a-f show MMF, porosity, and BMD pixel maps for a representative tibial and fibular specimen, respectively. Regions of higher MMF corresponded to the regions of lower porosity in the porosity maps. Figures 1g-j demonstrate the correlations between MMF and µCT measures for tibial and fibular bone specimens, respectively. MMF presented very good correlations with µCT measures.

CONCLUSION

MMF obtained from MT modeling, as a measure for collagen content, showed very good correlations with µCT measures regardless of the fibular of tibial harvesting sites. This study highlighted UTE-MT MRI techniques as a useful method to assess bone porosity, which may be used in future clinical studies.

CLINICAL RELEVANCE/APPLICATION

A UTE-MRI-based technique, to estimate the collagen backbone content which correlates greatly with the bone porosity may help diagnose bone diseases earlier and more accurately.

SSC10-08 Diagnostic Performance of Phantomless Dual-Energy CT for Volumetric Bone Mineral Density Assessment in Comparison to CT Hounsfield Unit Measurements Using Dual X-Ray Absorptiometry as Standard of Reference

Monday, Nov. 26 11:40AM - 11:50AM Room: S102CD

Participants

Lukas Lenga, Frankfurt, Germany (Presenter) Nothing to Disclose
Moritz H. Albrecht, MD, Frankfurt am Main, Germany (Abstract Co-Author) Speaker, Siemens AG
Stefan Wesarg, MS, Darmstadt, Germany (Abstract Co-Author) Nothing to Disclose
Simon S. Martin, MD, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose
Julian L. Wichmann, MD, Frankfurt, Germany (Abstract Co-Author) Speaker, General Electric Company; Speaker, Siemens AG
Christian Booz, MD, Frankfurt am Main, Germany (Abstract Co-Author) Nothing to Disclose
Marcel C. Langenbach, MD, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose
Ibrahim Yel, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
boozchristian@gmail.com

PURPOSE

To evaluate the diagnostic performance of a phantomless dual-energy computed tomography (DECT) postprocessing algorithm for volumetric bone mineral density (BMD) assessment of the lumbar spine compared to Hounsfield unit (HU) measurements.

METHOD AND MATERIALS

We retrospectively analyzed 200 lumbar vertebrae in 53 patients who had undergone third-generation dual-source DECT and dual x-ray absorptiometry (DXA) examinations of the lumbar spine within 7 days between March and December 2017. For volumetric BMD assessment, dedicated phantomless DECT postprocessing software which allows for freely rotatable color-coded three-dimensional visualization of trabecular BMD distribution using three-material decomposition was applied. In addition, HU measurements were performed on standard bone reconstructions by defining five trabecular regions of interest (ROI) per vertebra. Results of both approaches were compared regarding the diagnostic accuracy using the DXA T-score according to the World Health Organization as standard of reference for detecting osteoporosis.
RESULTS

DXA revealed a total of 92 osteoporotic lumbar vertebrae. A BMD cut-off of 92 mg/cm² at phantomless DECT yielded 98.9% sensitivity and 91.6% specificity for detecting osteoporosis; 93.3% of vertebrae below this threshold were diagnosed with osteopenia/osteoporosis according to DXA and 80.2% above showed normal BMD at DXA. A trabecular ROI attenuation cut-off of 157 HU showed 71.0% sensitivity and 66.4% specificity for osteoporosis; 73.3% of vertebrae below this threshold were diagnosed with osteopenia/osteoporosis according to DXA and 41.0% above showed normal BMD at DXA. Area under the curve for detecting osteoporosis was 0.953 for phantomless DECT and 0.754 for HU-based analysis ($p<0.001$). Pearson product-moment correlation showed higher correlation between BMD results of phantomless DECT and DXA ($r=0.848$) compared to HU and DXA values ($r=0.438$) ($p<0.001$).

CONCLUSION

A phantomless DECT postprocessing algorithm for volumetric BMD assessment of the lumbar spine is significantly superior compared to HU measurements regarding the diagnostic accuracy for detecting osteoporosis.

CLINICAL RELEVANCE/APPLICATION

Opportunistic screening for osteoporosis using HU measurements on CT images as previously suggested in recent literature is less accurate than a phantomless color-coded DECT postprocessing algorithm which can be applied to routine DECT without requiring protocol changes.

PURPOSE

In long-term HIV-infected individuals, low bone density and increased fracture risk have emerged as significant comorbidities. Our aim was to assess the influence of exercise, nutrition, and medications on bone microarchitecture using high-resolution peripheral quantitative CT (HR-pQCT) in long-term HIV-infected individuals.

METHOD AND MATERIALS

Twenty-nine HIV-infected subjects (3 postmenopausal women, 26 men) were prospectively enrolled in our study (BMI 26.1±4.3 kg/m², age 56.9±5.6, years diagnosed with HIV 20.7±8.8). Questionnaires included the revised Community Healthy Activities Model Program for Seniors (CHAMPS), the Mini Nutritional Assessment (MNA) as well as medication assessments. Participants underwent radius and tibia HR-pQCT and laboratory evaluation. Multivariable linear regression models were used to evaluate the effects of exercise, nutritional status, tenofovir disoproxil fumarate (TDF) and protease inhibitor (PI) use on bone microarchitecture, adjusting for all demographic risk factors.

CONCLUSION

Cortical bone in HIV-infected individuals is detrimentally affected by malnutrition, while trabecular bone is detrimentally affected by previous use of TDF in combination with a PI. In long-term HIV-infected subjects, nutritional support could potentially be more relevant for bone health compared to physical activity.

CLINICAL RELEVANCE/APPLICATION

Long-term HIV-infected individuals could particularly benefit from nutritional assessment and intervention as well as avoiding use of TDF with PIs to prevent compromised bone health.
PURPOSE

To evaluate whether parameters of empirical mathematical model (EMM) for the dynamic contrast-enhanced MRI (DCE-MRI) correlate with clinical disease activity in patients with rheumatoid arthritis (RA).

METHOD AND MATERIALS

27 consecutive patients with RA underwent an IRB-approved MRI scan including DCE-MRI using a 1.5T system. 20 post-contrast series of DCE-MRI were repeatedly acquired with temporal resolution of 20 seconds per image. ROIs were placed within each lesion where the highest signal increase was observed on DCE-MRI. The kinetic curve obtained from DCE-MRI was analyzed using an empirical mathematical model: \( \Delta S(t) = A^*(1-e^{-at}) \cdot e^{-bt} \). Where, \( \Delta S \) is relative enhancement, \( A \) is the upper limit of the signal intensity, \( a \) (min\(^{-1}\)) is the rate of signal increase, \( \beta \) (min\(^{-1}\)) is the rate of the signal decrease during washout. The initial slope of the kinetic curve is given by ‘\( A^*a \)’. Initial area under curve (AUC30) was calculated by integrating the kinetic curve. The time at which the kinetic curve reached peak (Tpeak) can be solved by setting the derivative of \( \Delta S(t) \) equals to zero. Signal enhancement ratio (SER) was defined as the signal intensity change at the first time point (\( \Delta S_{200} \)) relative to the last time point (\( \Delta S_{400} \)). The parameters from EMM for DCE-MRI were compared with Disease Activity Score (DAS28)-CRP using Pearson’s correlation analysis. After Bonferroni correction of 7 multiple comparisons, the critical value became < 0.0071 (0.05/7).

RESULTS

EMM was able to accurately fit the curves of DCE-MRI, with a goodness of fit parameter R2 greater than 0.90 for all cases studied here. Of the parameters of DCE-MRI, A showed the highest correlation with DAS28-CRP (\( r=0.67; \) P =0.0001). AUC30 also correlated with DAS28-CRP with a lesser degree (\( r=0.62; \) P =0.0005). a, \( \beta \), \( A^*a \), Tpeak and SER did not correlated with DAS28-CRP (\( r=0.39; \) p=0.03, \( r=0.45; \) p=0.018, \( r=0.43; \) p=0.023, \( r=0.37; \) p=0.21, \( r=0.50; \) P =0.0082, respectively).

CONCLUSION

The parameters of the EMM for DCE-MRI were correlated with clinical disease activity in patients with RA. Especially, A or the upper limit of signal intensity showed the highest correlation.

CLINICAL RELEVANCE/APPLICATION

The parameters obtained from EMM analysis for DCE-MRI, especially A or the upper limit of signal intensity showed significant correlation with clinical disease activity in patients with RA.

PURPOSE

The comma sign is an important arthroscopic marker of the superolateral corner of the torn subscapularis tendon (SCT) in cases of...
chronic and retracted SCT tears. However, it has not been evaluated on MRI until now. Thus the aim of this study was to determine accuracy of shoulder MRI in the evaluation of the comma sign.

**METHOD AND MATERIALS**

Consecutive 37 patients (17 men, 20 women; mean age, 61 years) who underwent the preoperative shoulder MRI and were confirmed full-thickness tear of SCT in arthroscopy were included. The presence of the comma sign, size of SCT tear, presence of fibrotic scarring in SCT, thickness of coracohumeral ligaments (CHL), and presence and characteristics of the posterosuperior rotator cuff (PS cuff) tears (i.e., full-thickness tears or partial-thickness tears; tear size) were evaluated on MRI. Comma sign on MRI was defined as the band-like structure connecting the superolateral corner of torn SCT and the anterior margin of PC cuffs. Fibrotic scarring of SCT was defined as the relatively thin structure at the lateral aspect of SCT where the comma was connected. Tear size of SCT and PS cuff and thickness of CHL were measured on axial, coronal and sagittal planes of MRI, respectively. With arthroscopic results as the reference standards, sensitivity, specificity, and accuracy for the evaluation of the comma sign on MRI was calculated.

**RESULTS**

Arthroscopy showed the comma sign in 30 shoulders and MRI detected the comma sign in 28, resulting in sensitivity of 93%, specificity of 86%, and accuracy of 89%. The tear size of SCT and thickness of CHL were significantly greater in shoulders with the comma sign than in those without the comma sign (p = 0.042 and 0.005, respectively). All 30 shoulders with the comma sign were combined with PS cuff tears. Among them, 29 were full-thickness tears and the size of PS cuffs full-thickness tears was not significantly different between shoulders with and without the comma sign. Fibrotic scarring of SCT was found in 6 shoulders with the comma sign.

**CONCLUSION**

Shoulder MRI had a high accuracy to diagnose the comma sign.

**CLINICAL RELEVANCE/APPLICATION**

Shoulder MRI can be helpful to predict the presence of comma sign before arthroscopy. Comma sign can be helpful to differentiate between the retracted tendons and the fibrotic scarring of SCT.

**MK358-SD-MOA3**

**Arterial Spin-Labeling MR Imaging of Painful Shoulder Disorders**

**Station #3**

**Participants**

Katsumi Nakamura, MD, Kitakyushu, Japan (Presenter) Nothing to Disclose

Fumihide Arakami, RT, Kitakyushu, Japan (Abstract Co-Author) Nothing to Disclose

Tomokio Nishi, RT, Kitakyushu, Japan (Abstract Co-Author) Nothing to Disclose

Kenichi Inoue, RT, Kitakyushu, Japan (Abstract Co-Author) Nothing to Disclose

Satoshi Masuda, MD, Kitakyushu, Japan (Abstract Co-Author) Nothing to Disclose

Asaka Aso, Kasuga, Japan (Abstract Co-Author) Employee, Canon Medical Systems Corporation

Akiyoshi Yamamoto, RT, Kitakyushu, Japan (Abstract Co-Author) Nothing to Disclose

Mitsue Miyazaki, PhD, La Jolla, CA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact: nakamura.katsumi@gmail.com

**PURPOSE**

To evaluate the value of arterial spin-labeling (ASL) perfusion MR imaging for the assessment of painful shoulder disorders, especially rotator cuff (RC) tear and adhesive capsulitis.

**METHOD AND MATERIALS**

A total of 72 patients (41 men and 31 women [12-86 y.o., mean, 53.6 y.o.]) was involved in this study. The patients were divided into 5 groups; group 1 with no abnormality (n=12); group 2 with degenerative changes or partial tear of RC (n=12); group 3 with full thickness tear of RC (n=32), which subdivided into group 3a, small tear (n=10), 3b, medium (n=6), 3c, large and extensive (n=16); group 4 with adhesive capsulitis (painful stage) (n=12); and group 5 with biceps tendinitis (n=4). All patients underwent the ASL perfusion study as well as routine shoulder MRI examinations using a 1.5-T clinical imager. The acquisition with a 10-mm thick slice was placed longitudinally on the humeral head, including rotator cuff, subacromial bursa, and acromioclavicular joint. A tag IR pulse of a 30-mm thick slice was placed on the subclavian artery. The ASL perfusion was evaluated by three observers regarding the degree of enhancement at the subacromial region using a five-point scoring system; the score 1 has no enhancement and the score 5 is severe enhancement.

**RESULTS**

Group 3, in which joint space communicated with subacromial space, demonstrated significantly higher ASL perfusion score than groups 2 and 1, 3.41±0.90, 1.33±0.47, 1.42±0.49, respectively (p<0.01). Larger RC tear tended to show a higher ASL score; however, there was no significant difference between groups 3a, 3b, and 3c. Adhesive capsulitis (painful stage) showed significantly higher ASL score (2.25±0.72) than groups 2 and 1 (p<0.01). Biceps tendinitis also showed enhancement and thickening of rotator interval, which might be resemble to adhesive capsulitis.

**CONCLUSION**

Full-thickness tear of RC, symptomatic adhesive capsulitis, and biceps tendinitis showed significant enhancement at the subacromial region, which could reflect increased blood flow due to inflammatory changes around joint. The additional physiological information obtained by ASL perfusion must be valuable for the management of the shoulder disorders.

**CLINICAL RELEVANCE/APPLICATION**

Non-contrast perfusion using arterial spin labeling MR imaging depicts increased blood flow due to inflammatory response of painful shoulder disorders, and provides useful physiological information for the differential diagnosis.

**MK359-SD**

**Imaging Quantification of Glenoid Bone Loss in Patients with Glenohumeral Instability: A Systematic
1.0, 1.6, and 1.2 °C, respectively. The continuous 30-min clinical HBW TSE protocol had a WBSAR of 1.3 W/kg and caused a
the non-clinical high energy sequence. The HBW-TSE, SEMAC, and CS-SEMAC protocols resulted in maximum temperature rises of
Scanner calculated WBSAR values for our experimental setup ranged from 0.6 to 1.3 W/kg with clinical protocols and < 2 W/kg for
RESULTS
sequence was also run for 30 min with non-clinical high energy imaging parameters following disabling of protection limits.
the highest scanner estimated whole-body (WB) specific absorption rate (SAR) value was additionally run continuously for 30-min
Metal-Artifact-Correction (SEMAC, 54-min) TSE, and compressed sensing (CS) SEMAC TSE (34-min) were acquired at 3T including
fibers, properties similar to those of the human body. Fiber optic sensors were used to measure the temperature rise at seven points at
A cobalt-chromium-on-polyethylene total hip arthroplasty system was placed in a standard ASTM gel phantom with electrical
METHOD AND MATERIALS
A comprehensive literature search including 5 medical databases. Inclusion criteria were original research that measured glenoid
bone loss on x-ray, CT, or MRI, using prospective or retrospective cohort, case control, cadaveric, or clinical study designs.
Studies published in a language other than English were excluded. The Quality Assessment of Diagnostic Accuracy Studies 2
(QUADAS-2) tool aided qualitative assessment of methodology regarding risk of bias and applicability of the analyzed studies. Study
results and accuracy were also assessed for possible quantitative analysis.
RESULTS
Of 1422 abstracts, 73 met inclusion criteria based upon title and abstract text review. Among these, 42 studies were ultimately
extracted for analysis and 29 included after full-text review by two independent readers with disagreements resolved in consensus.
Study designs included retrospective (n=15) or prospective (n=5) cohort, case control (n=2), or cadaveric (n=7). Glenoid bone loss
was measured using several different index tests: radiography (n=5), CT (n=9), 3D-CT (n=16), MRI (n=8), and 3D-MRI (n=6).
Measurements were compared to reference standards of CT (n=11), surgery (n=10), or digital photographs (n=6). Risk of bias was
low in 14 studies, questionable in 7, and high in 6. All studies had high (17) or questionable (10) applicability to our study purpose.
Only 2 studies reported sensitivity and specificity of glenoid bone loss measurements, both comparing CT to arthroscopy, using
different thresholds of bone loss. Heterogeneous measurement techniques and statistical methods precluded quantitative meta-
analysis assessing accuracy of imaging measurement techniques.
CONCLUSION
Both CT and MRI appear to accurately measure glenoid bone loss among patients with glenohumeral instability. The current body of
literature is heterogeneous with many studies containing significant risk of bias and few studies providing quantitative assessment
of imaging techniques for glenoid bone measurements.
CLINICAL RELEVANCE/APPLICATION
Both MRI and CT appear to provide accurate measurements of glenoid bone loss, but heterogeneity of the existing literature
precludes rigorous quantitative assessment of measurement techniques.
MK360-SD- MOA5
Periprosthetic Heating During Metal Artifact Reduction Sequence Magnetic Resonance Imaging of Hip Arthroplasty Implants at 3T

Participants
Iman Khodarahmi, MD, PhD, Baltimore, MD (Presenter) Nothing to Disclose
Luke W. Bonham, BS, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Robert Sterling, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
John Kirsch, PhD, Charlestown, MA (Abstract Co-Author) Nothing to Disclose
Sunder S. Rajan, PhD, Silver Spring, MD (Abstract Co-Author) Nothing to Disclose
Jan Fritz, MD, Baltimore, MD (Abstract Co-Author) Research Grant, Siemens AG; Scientific Advisor, Siemens AG; Scientific Advisor,
Alexon Pharmaceuticals, Inc.; Speaker, Siemens AG

For information about this presentation, contact:
ikhodar1@jhmi.edu

PURPOSE
To quantify periprosthetic heating around total hip arthroplasty implants during Metal Artifact Reduction Sequence (MARS) MRI at
3T.

METHOD AND MATERIALS
A cobalt-chromium-on-polyethylene total hip arthroplasty system was placed in a standard ASTM gel phantom with electrical
properties similar to those of the human body. Fiber optic sensors were used to measure the temperature rise at seven points at
the implant interface. Clinical MARS MR protocols including high-bandwidth turbo spin echo (HBW-TSE, 28-min), Slice-Encoding-for-
Metal-Artifact-Correction (SEMAC, 54-min) TSE, and compressed sensing (CS) SEMAC TSE (34-min) were acquired at 3T including
coronal PD, STIR, sagittal PD, sagittal STIR, axial PD, and axial STIR sequences. The clinical sequence (sagittal HBW-TSE PD) with
the highest scanner estimated whole-body (WB) specific absorption rate (SAR) value was additionally run continuously for 30-min
to assess maximum heating and exclude the effect of preparation pulses that may interleave the clinical sequences. Finally, this
sequence was also run for 30 min with non-clinical high energy imaging parameters following disabling of protection limits.

RESULTS
Scanner calculated WBSAR values for our experimental setup ranged from 0.6 to 1.3 W/kg with clinical protocols and < 2 W/kg for
the non-clinical high energy sequence. The HBW-TSE, SEMAC, and CS-SEMAC protocols resulted in maximum temperature rises of
1.0, 1.6, and 1.2 °C, respectively. The continuous 30-min clinical HBW TSE protocol had a WBSAR of 1.3 W/kg and caused a
temperature rise of 1.3 °C. The 30-min non-clinical, high energy sequence caused maximum heating of 1.7 °C.

CONCLUSION

In our experimental setting, various 3T MARS techniques for MRI of hip arthroplasty implants showed a periprosthetic temperature rise of < 2 °C, which may indicate a low risk of thermal injury when using typical clinical pulse sequences ≤ 5 min and a WBSAR of < 2 W/kg. Our results provide a baseline for additional research that is required to estimate the actual in-vivo heating, which may be higher due to scanner specific parameters, implant position, and patient-specific local and WBSAR.

CLINICAL RELEVANCE/APPLICATION

In an experimental setting, 3T MARS MRI of hip arthroplasty implants caused only modest periprosthetic temperature rises, which provides baseline data for additional research that is required for extrapolation into patients.

**MK361-SD-MOA6**


Station #6

Participants

Alexey Petraikin, MD, PhD, Moscow, Russia (Presenter) Nothing to Disclose
Kristina Sergunova, Moscow, Russia (Abstract Co-Author) Nothing to Disclose
Sergey Morozov, MD, MP, Moscow, Russia (Abstract Co-Author) Clinical Advisory Board, Agfa-Gevaert Group; Clinical Advisory Board, Bayer AG
Fedor A. Petraikin, Moscow, Russia (Abstract Co-Author) Nothing to Disclose
Anton V. Vlazymyrs'ky, MD, PhD, Moscow, Russia (Abstract Co-Author) Nothing to Disclose
Ekaterina S. Ahmad, Moscow, Russia (Abstract Co-Author) Nothing to Disclose
Dmitry S. Semenov, Moscow, Russia (Abstract Co-Author) Nothing to Disclose
Ludmila A. Nizovtsova, MD, PhD, Moscow, Russia (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
alexeypetraikin@gmail.com

PURPOSE

Our goal was to compare quantitative computed tomography (QCT) for bone mineral density (BMD) measurement in two outpatient clinics with similar populations.

METHOD AND MATERIALS

QCT results from two outpatient clinics from Sep 2017 to Feb 2018 were analyzed. During this period, 831 women were examined, 420 in clinic A (90.9% aged from 50 to 80 years) and 411 in clinic B (89.8% in the same range). We performed QCT on 64-detector unit with the following parameters: 120 kV, 0.82 pitch, 50-100 mA (depending on the body mass index), kernels FC08 (clinic A) and FC17 (clinic B). Spine (Zsp), femoral neck (Zfn) and total hip (Zth) Z-values were compared using multiple regression analysis. Asynchronous QCT calibration was performed. Comparability of the results between two scanners was evaluated using a cross-calibration phantom (five measurements for 4 different dilutions of K2HPO4 in the range 0-200 mg/cc).

RESULTS

The data was compared with the UCSF database. Mean BMD values decreased with age. For instance, in clinic A the mean Zsp criteria was -0.43, in clinic B Zsp = -0.77. Similar results were obtained for total hip BMD, in clinic A Zth = -0.69, in the clinic B Zth = -1.42. The average femoral neck BMD values for clinics A and B were Zfn = -0.49 and Zfn = -0.96. Multiple regression analysis had shown that linear regressions of both patient groups differed significantly in their displacement. No significant differences in the slopes of the regressions were found. Phantom studies have shown that BMD values did not depend on CT scanners. The total population per clinic is comparable and amounts to 170 thousand people. Referring physicians were interviewed retrospectively. We found differences in referral justification for QCT. In the clinic A, appointments were less systematic, and the BMD values neared the average population. In the clinic B, mostly high-risk patients with the history of low-energy fractures were assigned to QCT, although the FRAX scale was not used.

CONCLUSION

In one of the clinics we observed significantly lower QCT-measured BMD values for all regions. Phantom cross-calibration proved comparability of the BMD measurements. Different results in two groups may be attributed to different referral strategies.

CLINICAL RELEVANCE/APPLICATION

When referring a patient to densitometry, general screening principles as well as FRAX tool should be used. This will increase diagnostic yield and decrease unnecessary procedures.

**MK362-SD-MOA7**

Structural Abnormalities on Knee MRI Associated with Normal Aging over 6 years: Data from the Osteoarthritis Initiative

Station #7

Awards

Student Travel Stipend Award

Participants

Joe Darryl Baal, BS, San Francisco, CA (Presenter) Nothing to Disclose
Jan Neumann, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Julio B. Guimaraes, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Gabby B. Joseph, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Charles E. McCulloch, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Thomas M. Link, MD, PhD, San Francisco, CA (Abstract Co-Author) Research Grant, General Electric Company; Research Consultant, General Electric Company; Research Consultant, InSightec Ltd; Research Grant, InSightec Ltd; Royalties, Springer Nature; Consultant, Springer Nature; Research Consultant, Pfizer Inc;
A Name to Remember: What is the Eponym of the Fracture?

PURPOSE
To describe aging-associated structural knee abnormalities in clinically asymptomatic subjects without risk factors for knee osteoarthritis (OA) using semi-quantitative MRI scoring over a period of six years.

METHOD AND MATERIALS
Sixty-three subjects with no risk factors, clinical symptoms or radiographic evidence of knee OA (Kellgren-Lawrence [KL] grade 0 or 1) at baseline were selected from the Osteoarthritis Initiative (OAI) normal cohort. Subjects that developed KL grade ≥2 or experienced maintained knee pain or stiffness (≥2 consecutive follow-up periods) in the follow-up period were excluded. All subjects were serially studied at 2-year intervals with radiographs and 3T MR imaging of the right knee over 6 years. Sagittal and coronal 2D fast spin echo and 3D fat saturated gradient echo sequences were acquired. OA-related knee abnormalities were assessed through the modified whole-organ MR imaging scoring method (WORMS). McNemar’s test and paired T-tests were used to compare changes in proportion of patients with WORMS >0 and average WORMS from baseline to the 6-year follow-up period.

RESULTS
The proportion of patients with WORMS >0 differed significantly from baseline to the 6-year follow-up for meniscal lesions (p=0.020), cartilage lesions (p=0.005), bone marrow lesions (p=0.020) and subarticular cysts (p=0.005). Change in mean WORMS was significantly different for meniscal lesions (p=0.005), cartilage lesions (p<0.001) and subarticular cysts (p=0.019) (Table 1). Significant differences in the proportion of patients with WORMS >0 were observed in the medial and lateral posterior horns of the meniscus (p=0.007, 0.045, respectively), patellar (p<0.001), trochlear (p<0.001), medial femoral (p<0.001) and medial tibia (p=0.045) cartilage compartments.

CONCLUSION
This study demonstrates that the menisci and cartilage have the highest prevalence of knee abnormalities observed on MRI in asymptomatic subjects without risk factors for OA. Moreover, the regions that are most susceptible to morphologic change over time included the posterior horns of the menisci and the cartilage at the patellar, trochlear and the medial femoro-tibial compartments of the knee.

CLINICAL RELEVANCE/APPLICATION
Our study demonstrates knee abnormalities seen with normal aging of the knee and can help guide the identification of knee MRI findings that are likely not functionally or clinically relevant.

TABLE OF CONTENTS/OUTLINE
The information will be presented in a quiz format. Key images and information will be provided to the reader to answer each question, with subsequent feedback, including differential diagnoses, clinical features, image recommendations and radiological description concepts. The list of cases includes: Bone bankart lesion Colles fracture (explaining Smith, Barton, Barton’s reverse fracture as differentials diagnosis) Jumper’s fracture Pellegrini- Stieda lesion Salter- Harris Classification with some examples Todder’s fracture Jones fracture Weber fracture classification Gamekeeper thumb Bennett and Pseudo Bennett’s fracture
MK363-SD-MOB1

Fast MR Imaging of Isotropic Volumetric Ankle: Acceleration of Three-Dimensional Fast Spin Echo Sequence Using Compressed Sensing Combined with Parallel Imaging

PURPOSE
To investigate the feasibility of three-dimensional fast spin echo (3D-FSE) sequence with compressed sensing (CS) combined with parallel imaging (PI) compared to conventional 3D-FSE imaging in evaluating ankle joint pathology.

METHOD AND MATERIALS
Twenty patients underwent ankle MRI including image sets of 2D-FSE sequences, intermediate weighted (IW) 3D-FSE sequence without CS and with CS. Ankle MRI was performed using a 3.0-T magnetic resonance system with a 16-channel GEM Flex-medium flexible coil. Acceleration factors of 2x2 were used for parallel imaging, and 1.5 k-space undersampling factor was used for CS acceleration. The image sets were independently rated by two radiologists for the presence or absence of ankle pathology and interobserver agreements were analyzed. Overall image quality (structural similarity index) and subjective image quality (using a 4-point scale) of IW 3D-FSE sequence without CS and with CS-PI were evaluated. Inter-sequence agreement between IW 3D-FSE sequence with and without CS showed nearly perfect for all evaluated structure in both readers.

RESULTS
IW 3D-FSE with CS-PI provided good intersequence and interobserver agreements in evaluating ankle pathology with 33% decreased scan time. Interobserver agreement showed good agreement for anterior talofibular (k=0.773), osteochondral lesion of talus (k=0.763-0.877), and os subfibulare (k=0.615-0.643). Structural similarity index was acceptable (mean, 0.996; range, 0.990-0.997), and there was no statistically significant difference in subjective image quality between two imaging sequences. Intersequence agreement between IW 3D-FSE sequence with and without CS showed nearly perfect for all evaluated structure in both readers.

CONCLUSION
Compressed sensing accelerated isotropic 3D-FSE ankle MRI provides acceptable diagnostic performance with reduced scan time. Compressed sensing-related artifacts could be minimized with CS reconstruction enhancement, allowing better image quality for evaluation of ankle joint pathology.

CLINICAL RELEVANCE/APPLICATION
Volumetric isotropic 3D-FSE sequence of ankle MRI is potential fast imaging tools with a reduced scan time as well as acceptable diagnostic performance, proper spatial resolution, and soft tissue contrast.

MK364-SD-MOB1
Evaluation of CT Fat Quantification Techniques for Assessing the Rotator Cuff Musculature

PURPOSE
To determine the best CT fat quantification technique of the rotator cuff musculature by comparing single energy (SE) and dual-energy (DE) CT fat quantification using Goutallier's grading system as the reference standard.
Method and Materials
With IRB approval, 12 shoulders from 10 patients who underwent clinically indicated, routine shoulder CT using the DECT technique (100/Sn150kV, Force, Siemens Healthcare) were evaluated. Fat fraction was calculated from the DECT data by using basis material decomposition. Region of interest (ROI) were placed on the supraspinatus, infraspinatus, teres minor, subscapularis and teres major muscles in the sagittal plane and deltoid muscle in the axial plane to obtain quantitative measurements of the fat fraction within each ROI (Syngo.Via VB10, Liver VNC application). An ROI was also obtained in the sagittal plane of the subcutaneous fat to be used as an internal standard. Hounsfield units (HU) of each region on the SE 100 kV images and the 70 keV virtual monochromatic images were also recorded and used for fat fraction calculation. Fatty degeneration of the rotator cuff muscles was assessed using Goutallier's system.

Results
The fat fraction determined from DECT quantification was highly correlated with the Goutallier score for all muscles evaluated (Pearson product-moment correlation coefficient R=0.93, 95% CI: [0.88, 0.96]). The fat fraction of teres major muscle was 2.8%±4.0%, which is close to 0% fat, and the fat fraction of the subcutaneous fat was 99.5%±2.6%, which is close to 100% fat, indicating reliable internal standards for using the material decomposition technique. The DE fat fraction correlated better with the Goutallier score than using the HU of DE monochromatic images (R=0.90, 95% CI: [0.84, 0.94]) or from the SE 100 kV images (R=0.89, 95% CI: [0.82, 0.93]).

Conclusion
Fatty atrophy of the rotator cuff musculature plays a significant role in determining functional outcome after cuff repair. High grades of fatty infiltration are associated with higher rates of repair failure. Our study shows that DECT fat quantification is a reliable technique for assessing rotator cuff muscle atrophy, and that it correlates better with Goutallier score than single energy CT or virtual monochromatic images from DECT using HU.

Clinical Relevance/Application
DECT fat quantification is a reliable technique for assessing rotator cuff muscle atrophy and can be used for preoperative evaluation.
In subjects aged from 10-29 years, 30-59 years, and 60 years or more, the mean T2* value of the whole PCL was 17.1 (SD 5.2).

RESULTS

A correlation between the age and the T2* value was investigated with Pearson's correlation coefficient.

METHOD AND MATERIALS

Regions of interest were manually placed on the proximal-, middle-, and distal portion of the PCL. The MR images were obtained using a 3.0-, 5.0 ms; flip angle, 5; field of view, 20 cm; slice thickness, 1 mm. We generated T2* maps using a post-processing function of the MRI scanner. The knee joint was firmly fixed and centered in a 16 ch SPEEDER knee coil. The UTE sequence was 3D fast field echo; the generation of T2* maps was useful for evaluating degenerative changes in the PCL. We examined the correlation between the patient age and the T2* maps.

PURPOSE

Joint replacement survival is associated with the quality of the surrounding bone. Dual-energy X-ray absorptiometry (DXA) can measure periprosthetic bone mineral density (BMD) with metal removal software. We evaluated short-term reproducibility of the periprosthetic BMD measurements after total ankle arthroplasty (TAA) in 15 patients.

METHOD AND MATERIALS

We enrolled 32 healthy volunteers (23 women, 9 men, age range 13-82 years, median 61 years) with asymptomatic knee joints. We measured periprosthetic BMD at up to 6 different regions of interest (ROIs) in the two projections, at the level of periprosthetic bone around the tibia and talus; an additional ROI was placed in the lateral projection over the calcaneus. Metallic elements were automatically excluded with dedicated software (‘metal removal’). Precision was expressed as a coefficient of variation (CV%).

RESULTS

In the frontal projection, the average precision error was 1.88%, with the lowest value at the tibial side (0.77%) and the highest value at the talus side (4.19%). In the lateral projection, the average precision error was 1.74%, with the lowest CV values at the calcaneus (1.08%) and the highest CV value at the anterior tibial side (3.37%). Both in the frontal and lateral projection the highest variability was found in the nearby of metallic implants (screws, plates).

CONCLUSION

As for previous studies at other joint prostheses, our results show that DXA is able to precisely measure small bone mineral changes around TAA, making it possible to eventually monitor bone remodeling around TAA. Further prospective studies are warranted in the future.

CLINICAL RELEVANCE/APPLICATION

Low reproducibility values are mandatory in order to open the use of periprosthetic DXA for monitor bone remodeling around TAA.

Evaluation of Age-related Changes in the Posterior Cruciate Ligament using T2* Maps Derived from MR Images with an Ultra-short TE Sequence

PURPOSE

The generation of T2* maps from MR images with an ultra-short TE sequence (UTE-MRI) is a novel quantitative MR technique. T2* maps may allow the evaluation of fast-relaxing tissues such as the posterior cruciate ligament (PCL) whose T2* is short. They are useful for the in vivo evaluation of degenerative changes in the PCL. We examined the correlation between the patient age and the T2* value of the PCL on T2* maps derived from UTE-MRI scans.

METHOD AND MATERIALS

We enrolled 32 healthy volunteers (23 women, 9 men, age range 13-82 years, median 61 years) with asymptomatic knee joints. The knee joint was firmly fixed and centered in a 16 ch SPEEDER knee coil. The UTE sequence was 3D fast field echo; data were obtained along non-Cartesian trajectories for ultra-short TE. The scan parameters were TR, 9 ms; TE, 0.5-, 0.7-, 2.5-, 3.0-, 5.0 ms; flip angle, 5; field of view, 20 cm; slice thickness, 1 mm. We generated T2* maps by using a post-processing function of the MRI scanner. Regions of interest were manually placed on the proximal-, middle-, and distal portion of the PCL. The correlation between the age and the T2* value was investigated with Pearson's correlation coefficient.
In subjects aged from 10-29 years, 30-59 years, and 60 years or more, the mean T2* value of the whole PCL was 17.1 (SD 5.2), 41.2 (SD 9.8), and 71.7 (SD 7.2), respectively. There was a positive linear correlation between the age and the T2* value ($r=0.465$, $p=0.0072$). The proximal PCL portion showed the strongest correlation with the age ($r=0.512$, $p=0.0027$) followed by the middle- and the distal portion ($r=0.364$, $p=0.04$ and $r=0.276$, $p=0.126$, respectively).

**CONCLUSION**

There was a significant positive correlation between the T2* value of the proximal portion of the PCL and the subjects’ age, suggesting it as the first site of PCL degeneration.

**CLINICAL RELEVANCE/APPLICATION**

T2* maps derived from UTE-MRI scans may allow the in vivo evaluation of degenerative changes in tendons and ligaments with very short T2* values.

**Participants**

Marc Garetier, MD, Brest, France (Presenter) Nothing to Disclose
Bhushan Borotikar, Brest, France (Abstract Co-Author) Nothing to Disclose
Karim Makki, Brest, FL (Abstract Co-Author) Nothing to Disclose
Jean Rousseau, MD, Brest, France (Abstract Co-Author) Nothing to Disclose
Francois Rousseau, Brest, France (Abstract Co-Author) Nothing to Disclose
Dourade Ben Salem, MD, PhD, Brest, France (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To evaluate the feasibility of a real-time sequence using balanced Fast Field Echo (bFFE) sequence to study tendon and bone motion during dynamic MRI of the finger.

**METHOD AND MATERIALS**

A real-time bFFE sequence was used to acquire dynamic data in sagittal plane on 10 index finger, without history of injury or inflammatory rheumatism, on 3T MRI scanner (Philips Achieva dStream). Following sequence parameters were used: TR=4.7, TE=2.3, FOV=176X176, FA=45°, pixel=1.09X1.46, acquisition time=18s, slice thickness=4mm, time frames=16. Surface coils were placed on proximal phalanx bone using a custom build fixture. Patients performed two dynamic trials, one using only metacarpophalangeal (MCP) joint, and another using only proximal and distal inter-phalangeal (IP) joint with MCP joint constrained. During each trial, two cycles of flexion-extension of the joint of interest were performed. Flexor tendon and cortical bone contrast with surrounding tissues was determined by measuring the signal-difference-to-noise ratio (dSNR) with a ROI in flexor tendon, subcutaneous fat, cortical bone and bone marrow of proximal phalanx, and background area on each image during motion from hyperextension (E) to full flexion (F). Data were compared with those obtained on a sagittal T2-weighted spin echo sequence of the index finger in extension.

**RESULTS**

The average dSNR of flexor tendon was 278 during MCP motion (E=355, F=206), and 124 during IP motion (E=181, F=134). The average dSNR of cortical bone with subcutaneous fat was 320 during MCP motion (E=369, F=280) and 139 during IP motion (E=152, F=212), and with bone marrow was 418 during MCP motion (E=508, F=334) and 118 during IP motion (E=204, F=90). On sagittal T2-weighted sequence, the average dSNR was 148 for flexor tendon, 149 for cortical bone with subcutaneous fat, and 276 for cortical bone with bone marrow.

**CONCLUSION**

Contrast for flexor tendon and cortical bone visualisation was good on real-time bFFE sequence during MCP flexion-extension motion, compared to T2-weighted sequence, but dSNR of these structures decreased in full flexion. Contrast was better for cortical bone than flexor tendon during motion.

**CLINICAL RELEVANCE/APPLICATION**

Real-time bFFE sequence is a quick and useful sequence for in vivo evaluation of finger joint movement, with good contrast between structures.

**Participants**

Davide Orlandi, MD, PhD, Genova, Italy (Presenter) Nothing to Disclose
Pietro Caruso, MD, Genova, Italy (Abstract Co-Author) Nothing to Disclose
Francesca La Mantia, Palermo, Italy (Abstract Co-Author) Nothing to Disclose
Pietro Francaviglia, Genova, Italy (Abstract Co-Author) Nothing to Disclose
Luigi Satragno, MD, Genova, Italy (Abstract Co-Author) Nothing to Disclose
Enzo Silvestri, MD, Genoa, Italy (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
my.davideorlandi@gmail.com

**PURPOSE**

To assess the clinical effectiveness of an advanced quantitative echographic method for osteoporosis diagnosis on lumbar spine and femoral neck, compared to dual energy x-ray absorptiometry.

**METHOD AND MATERIALS**

50 female patients (mean age 63 years, range 50 - 70 years) underwent both a lumbar spine and femoral DXA (QDR-Discovery W
Hologic densitometer, Hologic, Marlborough, US) and an echographic scan of the lumbar spine and proximal femur (Echosound, Ecolith SPA, Lecce, Italy). Both lumbar and femoral bone mineral density (BMD) were calculated in all patients using the two methods and diagnostic agreement between DXA, assumed as the gold standard reference, and the proposed echographic method was assessed by accuracy calculation. Statistical analysis of the obtained data were performed using Cohen's k, Pearson correlation coefficient (r), and Bland-Altman analysis.

RESULTS
The overall agreement with DXA patient classification was 88.1% for the lumbar spine (k=0.757, p<0.01) and 80.9% for the femoral neck (k=0.698, p<0.01). A significant correlation was found between the US values of BMD and the corresponding DXA-measured ones (r=0.86, p<0.001).

CONCLUSION
REMS BMD evaluation is comparable to DXA representing a valuable and radiation-free diagnostic imaging technique for osteoporosis detection and follow-up.

CLINICAL RELEVANCE/APPLICATION
Ultrasound-aided BMD assessment is comparable to DXA

MK345-ED- MOB8

Guess Who is Who: Tumor versus Tumor Mimicker-Bone and Soft Tissue Tumor Mimickers

Participants
Young Kwang Lee, MD, Jeonju, Korea, Republic Of (Presenter) Nothing to Disclose
Jin Hee You, MD, Jeonju, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Ji Soo Song, MD, Jeonju, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Eun Hae Park, Jeonju, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Eun Jung Choi, MD, PhD, Jeonju, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Gong Yong Jin, MD, PhD, Jeonju, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:

jim0826@gmail.com

TEACHING POINTS
Most noticeable point in this presentation is that we carefully selected 1:1 matched tumor vs tumor mimicker cases. By solving this 1:1 matched quiz, readers will be able to involve actively. In pages that give answers, we stressed two key points in each mimicking lesion at the top of the page, followed by detail explanation at the below of the page.

TABLE OF CONTENTS/OUTLINE
1. Soft tissue tumor mimicker : Hematoma / Proliferative myositi / Tumoral calcinosis
2. Bone tumor mimicker : Osteomyelitis / Brodie's abscess / Stress fracture / BPOP / Periosteal desmoid / Brown tumor / Post procedural site
3. In radiograph : Humeral pseudocyst / Light bulb appearance / Supracondylar process / Radial tuberosity / Herniation Pit / Ward's triangle / Ischiopubic synchondrosis / Dorsal defect of patella / Calcaneal pseudocyst
**Purpose**
We evaluated the correlation between organic parenchymal density in Hounsfield Units (HU) with the radiological alteration index (RAI) level as surrogate for postmortal alteration in postmortem computed tomography (PMCT).

**Method and Materials**
We retrospectively included 14 human cadavers (6 females, 8 males) undergoing whole body PMCT. RAI was assessed in 7 localizations reflecting the presence of gas. Based on the total RAI-score cadavers were divided into three groups. [Group 1: low RAI (total score: 0-30); Group 2: medium RAI (total score: 30-60) and Group 3: high RAI (total score: 60-100)]. Density values (HU) were measured in 8 different localizations (1. frontal lobe, 2. basal-ganglia, 3. myocardium, 4. pectoral muscle, 5. liver, 6. left kidney, 7. m. iliopsoas, 8. first lumbar vertebral body[L1]). Correlation between density values and RAI was tested.

**Results**
7 cadavers were included in group 1 with a mean RAI-score of 8.9±9.8, 4 cadavers in group 2 with a mean RAI-score of 46.1±5.8 HU; 3 cadavers in group 3 with a mean RAI-score of 46.1±5.8 HU; myocardium: 49.4±9.7 vs. 44.7±8.3 vs. 45.9±8.6 HU; pectoral muscle: 52.9±7.2 vs. 47.0±5.8 vs. 50.8±14.3; liver: 61.5±10.4 vs. 76.1±12.0 vs. 64.1±9.6; left kidney: 49.1±9.5 vs. 43.9±10.7 vs. 35.6±9.8; m. iliopsoas: 48.7±9.2 vs. 51.4±10.3 vs. 55.1±9.8; L1: 169.8±40.5 vs.165.8±46.8 vs. 141.9±30.0; p> 0.05 for all). There was no significant correlation between density measurements and RAI.

**Conclusion**
There was no correlation between RAI and density measurements in 8 evaluated organs irrespective of the patients’ RAI index.

**Clinical Relevance/Application**
CT organ density measurements cannot be reliably used to assess decay in postmortem CT.
A Hill-Sachs (HS) lesion is a potential indicator of shoulder joint instability. Diagnosis is based on a flat or concave defect in the superior aspect of the humeral head on an internal rotation (IR) radiograph but the finding is often subtle. The purpose of this study was to describe a new method designed to increase the sensitivity for HS lesions.

METHOD AND MATERIALS
A retrospective search for patients who sustained a prior dislocation, were evaluated with x-rays, and had a HS lesion on MRI was performed for a 10-yr period. In Part 1, only the AP IR x-ray was utilized and these were randomized with controls. Three readers were asked to independently score all x-rays with 'yes' if they detected a HS lesion or 'no' if they did not or were unsure. One month later, the readers were taught the Broken Circle Sign, and re-scored the x-rays using the new technique. In Part 2, 15 MRI-confirmed cases of HS lesions that were missed on initial review were mixed with normal x-rays and shown to 17 residents individually before and after teaching the new method. A paired t-test was used to evaluate the differences in sensitivity, specificity, accuracy, positive predictive value (PPV) and negative predictive value (NPV).

RESULTS
Specificity, accuracy, positive predictive value (PPV) and negative predictive value (NPV).
A total of 256 patients met the selection criteria (199 men, 57 women; age range: 15-82 yrs, mean: 31.2 yrs). There were 127 right and 129 left shoulders. In Part 1, sensitivity for all 3 readers increased by an average of 20.6% (54.1% to 74.7%; p<0.02), accuracy increased by an average of 7.4% (69.1% to 76.5%; p<0.05), and NPV increased by an average of 10.8% (62.4% to 73.3%; p<0.005). In Part 2, sensitivity for the residents increased by an average of 20.4% (54.1% to 74.9%; p<0.0001), accuracy increased by an average of 14.6% (65.1% to 79.7%; p<0.0001), and NPV increased by an average of 15.3% (41.6% to 56.9%; p<0.001) independent of their level of training. Only 2 residents did not improve due to high initial scores in sensitivity and accuracy.

CONCLUSION
The Broken Circle Sign is a simple tool that helps to increase the conspicuity of a Hill-Sachs lesion on internal rotation shoulder radiographs. It appears to increase the sensitivity, accuracy, and NPV at all levels of training.

CLINICAL RELEVANCE/APPLICATION
The Hill-Sachs lesion occasionally is a difficult diagnosis to make on radiographs. The Broken Circle Sign is a simple method that can aid in increasing the diagnostic acumen for this abnormality.

SSE06-06 Radiology "Forensics": Determination of Age and Gender from Chest X-Rays Using Deep Learning

Participants
Paul H. Yi, MD, Baltimore, MD (Presenter) Nothing to Disclose
Tae Kyung Kim, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Jinchi Wei, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Ji Won Shin, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Tae Soo Kim, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Gregory D. Hager, PhD, MSc, Baltimore, MD (Abstract Co-Author) Co-founder, Clear Guide Medical LLC CEO, Clear Guide Medical LLC
Haris I. Sair, MD, Baltimore, MD (Abstract Co-Author) Speakers Bureau, Terumo Corporation Speakers Bureau, Penumbra, Inc
Ferdinand K. Hui, MD, Richmond, VA (Abstract Co-Author) Speakers Bureau, Blockade Medical Inc
Cheng Ting Lin, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
pyi10@jhi.edu

PURPOSE
To develop and test the performance of deep convolutional neural networks (DCNNs) for the automated detection of 1) age and 2) gender on chest radiographs (CXRs).

METHOD AND MATERIALS
We obtained 112,120 frontal CXRs from the NIH ChestX-ray14 database performed in 48,780 females (44%) and 63,340 males (56%) ranging from 1 to 95 years old; amongst 5941 pediatric CXRs (5%), 2546 (43%) were female (p=0.3). The entire dataset was split into training (70%), validation (10%), and test (20%) datasets and used to train, validate, and test the ResNet-18 DCNN pretrained on ImageNet for: 1) determination of gender (using both entire dataset and only pediatric CXRs); 2) determination of age <18 years old or >=18 years old (using entire dataset); and 3) determination of age <11 years old or 11-18 years old (using only pediatric CXRs). During each training epoch, each image was augmented via random rotations, cropping, and flipping. We also tested the DCNNs on an external dataset of 662 CXRs performed in adults and children from China. Receiver operating characteristic (ROC) curves with area under the curve (AUC) and standard diagnostic measures (e.g, accuracy) were used to evaluate DCNN test performance with AUCs statistically compared between DCNNs.

RESULTS
The DCNNs trained to determine gender on the entire dataset and pediatric CXRs only had AUC of 1.0 and 0.91, respectively (p<0.0001) and accuracy of 98% and 83%, respectively. The DCNNs trained to determine age <18 years old or >=18 years old and <11 years old or 11-18 years old had AUCs of 0.99 and 0.96 (p<0.0001), respectively, with accuracy of 98% and 89%, respectively. On the external dataset, the DCNNs achieved AUC of 0.98 for gender (p=0.01) and 0.91 for determining age < or >=18 years old (p<0.001), with accuracy of 94% and 97%, respectively.

CONCLUSION
DCNNs can accurately predict gender from CXRs, as well as distinguish between adult and pediatric patients, in both American and Chinese populations, and between pre-pubescent and pubescent children in American populations. The ability to glean demographic information from CXRs may aid forensic investigations, as well as help identify novel anatomic landmarks for gender and age.

CLINICAL RELEVANCE/APPLICATION
Deep convolutional neural networks can accurately infer gender and age from chest radiographs from American and Chinese populations, which may be a useful tool in "forensic" radiology.
SSE15
Musculoskeletal (Upper Extremity)
Monday, Nov. 26 3:00PM - 4:00PM Room: N228

Participants
Ambrose J. Huang, MD, New York, NY (Moderator) Nothing to Disclose
Connie Y. Chang, MD, Boston, MA (Moderator) Nothing to Disclose

Sub-Events
SSE15-01 Dynamic MRI of the Midcarpal Compartment in 20 Seconds: Normal Motion Pattern Analysis and Reader Reliability
Monday, Nov. 26 3:00PM - 3:10PM Room: N228

Participants
Stephen S. Henrichon, MD, Sacramento, CA (Presenter) Nothing to Disclose
Brent Foster, Sacramento, CA (Abstract Co-Author) Nothing to Disclose
Calvin B. Shaw, MD, Sunnyvale, CA (Abstract Co-Author) Nothing to Disclose
Christopher Bayne, Sacramento, CA (Abstract Co-Author) Nothing to Disclose
Robert M. Szabo, MD,MPH, Sacramento, CA (Abstract Co-Author) Research Grant, Medartis AG
Abhijit J. Chaudhari, PhD, Sacramento, CA (Abstract Co-Author) Nothing to Disclose
Robert D. Boutin, MD, Davis, CA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
rdboutin@ucdavis.edu

PURPOSE
To describe the normal motion pattern of the scaphotrapezial joint (STJ) and capitate-triquetrum interval (CTI) during active radial and ulnar deviation of the wrist during dynamic MRI, and to determine the observer performance of measurements in asymptomatic volunteers.

METHOD AND MATERIALS
In this prospective study, real-time 3T MRI examinations were performed in 35 wrists (19 asymptomatic volunteers; age mean: 30.5 yrs [range: 20-55]; M/F:10/9). Using a radial fast-GRE coronal sequence with 315 ms temporal resolution and a total acquisition time of ~ 20 seconds, 60 images were acquired during continuous imaging of the moving wrist through the full range of motion from radial to ulnar deviation. Two independent readers measured 1) the transverse translation of the trapezium at the STJ and 2) the CTI. A two-sample Kolmogorov-Smirnov goodness-of-fit hypothesis test was performed to evaluate the relationship between these measurements with laterality (right vs. left), sex, lunate type, and wrist kinematic pattern (row vs. column kinematics). Intra-observer and inter-observer correlation coefficients were determined.

RESULTS
Translation of the trapezium at the STJ in neutral, radial, and ulnar deviation averaged 0.3±0.8 mm, 1.9±1.2 mm, and -0.4±1.0 mm, respectively. There was no significant difference in trapezium translation with wrist laterality, sex, lunate type, or wrist kinematic pattern. The CTI in neutral, radial, and ulnar deviation averaged 5.3±1.4 mm, 3.6±1.1 mm, and 6.0±1.4 mm, respectively. The mean CTI was greater in men than women in the neutral position only (p=0.019). The mean CTI was increased in wrists with type II lunate compared to type I lunate during radial (p=0.001) and ulnar deviation (p=0.014). There was no difference in CTI with wrist laterality or wrist kinematic pattern. Mean intraobserver and interobserver correlation coefficient was 0.79 and 0.77, respectively.

CONCLUSION
Using dynamic MRI, this study provides a normal range of expected STJ and CTI measurements in asymptomatic volunteers. Dynamic MRI with a short acquisition time may be used as a supplement to conventional static MRI in the diagnostic evaluation of the midcarpal compartment.

CLINICAL RELEVANCE/APPLICATION
Understanding midcarpal motion patterns is a key step in efforts to establish an accurate diagnosis and promote optimized treatment regimes including nonoperative rehabilitation and surgical planning.

SSE15-02 Distal Radioulnar Joint MR Arthrography for Diagnosing Foveal Tear of Triangular Fibrocartilage: Comparison of MR imaging and MR Arthrography with Arthroscopic Correlation
Monday, Nov. 26 3:10PM - 3:20PM Room: N228

Participants
Sung Tae Hwang, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
PURPOSE
To evaluate the value of distal radioulnar joint (DRUJ) MR arthrography for diagnosing foveal tear of triangular fibrocartilage (TFC).

METHOD AND MATERIALS
A total of 83 patients (54 men, 29 women; mean age, 32.7 years) who underwent DRUJ MR arthrography and arthroscopy were retrospectively reviewed. MR protocol includes pre-injection T2- and T1-weighted coronal images and post-injection T2-weighted coronal and T1-weighted fat suppressed coronal, sagittal, and axial images. Two radiologists graded the foveal lamina of the TFC as normal, partial tear, or complete tear after the review of pre-injection image sets and post-injection image sets separately. Diagnostic performance of MR imaging and MR arthrography was assessed based on the arthroscopic findings and compared by using McNemar test.

RESULTS
On arthroscopy, 71 of 83 patients had foveal tear of TFC; 51 cases were isolated foveal tear and 20 cases were combined foveal and styloid tear. On the review of MR images, the sensitivity, specificity, and accuracy for diagnosing foveal tear were 62.0%, 41.7%, and 59.0%. In MR arthrography, the values were 94.4%, 41.7%, and 86.7%, respectively. Sensitivity was significantly higher in DRUJ MR arthrography (P < .001).

CONCLUSION
DRUJ MR arthrography increase the accuracy for diagnosing foveal tear of TFC compared to standard MR imaging. The benefit of pre-injection images was minimal in diagnosing foveal tear of TFC.

CLINICAL RELEVANCE/APPLICATION
DRUJ MR arthrography increase the accuracy for diagnosing foveal tear of TFC compared to standard MR imaging.

SSE15-03 Bennett Lesions in Overhead Throwers and Associated Shoulder Abnormalities on MRI

Participants
Jenika Karcich, MD, New York, NY (Presenter) Nothing to Disclose
Jonathan K. Kazam, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Michael J. Rasiej, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Tony T. Wong, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
jek9125@nyp.org

PURPOSE
To determine if the presence of a Bennett lesion in overhead throwers is associated with additional shoulder abnormalities on MRI.

METHOD AND MATERIALS
An IRB approved retrospective review of our database from 1/2012 to 4/2018 identified 35 overhead throwers with a Bennett lesion on MRI. An additional control group consisting of 35 overhead throwers without a Bennett lesion were matched for age, level of play (professional vs. non-professional), and type of study (arthrogram vs. non-arthrogram). Each study was assessed independently by 2 MSK fellowship trained radiologists. The sizes of the Bennett lesions were measured. Each MRI was assessed for the presence of a labral tear, posterior glenoid cartilage deficiency, humeral head notching/cysts, and posterior supraspinatus/infraspinatus tendon fraying or tear. Discrepancies were adjudicated by a third MSK fellowship trained radiologist. Statistical analysis was performed with a chi-squared test.

RESULTS
Average Bennett lesion volume in a professional vs. non-professional overhead thrower: 708 mm³ vs. 545 mm³ (p=0.43). Total Bennett lesions resected: 6% (2/35) Associated MRI abnormalities in Bennett vs. Non-Bennett overhead throwers: SLAP tear: 51% vs. 31% (p = 0.09) Posterior labral tear: 51% vs. 31% (p=0.09) Antero-inferior labral tear: 26% vs. 17% (p=0.38) Posterior glenoid cartilage abnormality (fissure, delamination, partial/full thickness): 23% vs. 3% (p = 0.01) Humeral head notching/cysts: 77% vs. 63% (p = 0.19) Articular surface rotator cuff fraying/tear: 26% vs. 17% (p = 0.38)

CONCLUSION
Overhead throwers with Bennett lesions have an increased frequency of posterior glenoid cartilage abnormalities, but not labral tears or findings of internal impingement.

CLINICAL RELEVANCE/APPLICATION
The presence of a Bennett lesion in an overhead thrower warrants close examination for an adjacent posterior glenoid cartilage abnormality.

SSE15-04 Comparison Between High-Resolution Isotropic Three-Dimensional Cube FS PD and Conventional Two-Dimensional FS PD MR Images of the TFCC at 3 Tesla

Participants
For information about this presentation, contact:
1424125302@qq.com

PURPOSE
To compare a newly developed high-resolution isotropic 3D Cube FS PD sequence with conventional high-resolution sequences in assessing TFCC of the wrist in terms of image quality and diagnostic performance.

METHOD AND MATERIALS
12 volunteers were enrolled in the study with an average age 22.7 years (range 22-27 years). All the sequences were carried out on all volunteers at 3.0T MR scanner (Signa HDxt, GE Healthcare, Milwaukee, WI) and a Wrist Array coil. Each imaging was performed with 2D PD FS (coronal, axial and sagittal: TR=2900ms, TE=32.0ms, Matrix=320×256, FOV=10×7cm2, Slice thickness =0.2mm, gap=0.3mm, NEX=2, acquisition time=99s) and 3D isotropic PD FS (coronal: TR=1400ms, TE=36.4, Matrix=256×256, FOV=10×10×9cm2, Slice thickness =0.4mm, gap=0.2mm, NEX=0.5, acquisition time=279s). Delineation of anatomic structures of the wrist, amount of artifact, effect of fat suppression, image blur, and overall quality were qualitatively evaluated using the 5-point scoring system: 5: excellent, 4: good, 3: satisfactory, 2: poor, and 1: nonidentified. Signal-to-noise-ratios (SNR) of each structure and contrast-to-noise ratios (CNR) between structures of the TFCC were quantitatively measured using vendor supplied software (AW4.6, workstation, GE).

RESULTS
The 2D MRI demonstrated higher scores than 3D in anatomic structure of the SL ligament (P=0.043), the LT ligament (P=0.022), cartilage (P=0.043), artifact (P=0.007) and image blur (P=0.015). However, there were no statistical significance between 2D and 3D MRI in disc and overall quality. Higher SNR values were found for in the 2D sequence (6.32±3.32) than the 3D (4.20±1.66). The corresponding CNR values were (4.87±3.10) for the 2D and (3.45±1.97) for the 3D. To better control for voxel size, we also measured the SNR and CNR values in the reconstructed 2-mm images from original 3D anatomic images and obtained similar values as in the 2D (5.86±3.05 and 3.01±0.86, respectively), indicating that reconstruction with larger slice thickness improved SNR and CNR.

CONCLUSION
Although, isotropic 3D Cube FS PD sequence may enhance standard wrist MRI by increased visualization of multiplanar and postprocessing capabilities, however, the 3D Cube image quality was lower.

CLINICAL RELEVANCE/APPLICATION
With regard to clinical applications, 3D Cube image of the wrist has almost equal potential to 2D MRI.

SSE15-05 Correlation Between Fat Fraction, Cross Sectional Area of Rotator Cuff and Muscle Strength: Using MRI DIXON Sequence and Biodex Isokinetic Test

Monday, Nov. 26 3:40PM - 3:50PM Room: N228

Participants
Sung Tae Hwang, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Chang Ho Kang, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Kyung-Sik Ahn, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Woong-Kyo Jeong, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Suk-Joo Hong, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Bae Hyun Kim, MD, Ansan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Eudeem Shim, Ansan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the correlation between fat fraction (FF), cross sectional area (CSA) of rotator cuff and muscle strength using T2-weighted Dixon Spin-Echo Fat image and biodex isokinetic test.

METHOD AND MATERIALS
37 patients (13 men, 24 women; age range, 45-78 years) undergoing shoulder MR imaging with concomitant biodex isokinetic test were enrolled in this study. Quantitative fat analysis and CSA measurement of rotator cuff (supraspinatus [SS], infraspinatus [IS], teres minor [TM]) in the image plane of scapular Y-shape were performed by one musculoskeletal radiologist using a post-processing software (Syngo via, Siemens healthineers, Erlangen, Germany) for T2-weighted Dixon Spin-Echo fat image. Multivariate regression and multiple linear regression analysis were used to investigate the relationship between 4 biodex isokinetic test parameters (peak torque [PT], peak torque/body weight [BW], torque at 30° [T30], total work [TW]) for 8 shoulder movements (60°, 180° flexion [FL] and extension [EX], 60°, 180° internal rotation [IR] and external rotation [ER]) and FF and CSA of the rotator cuff.

RESULTS
Multiple linear regression analysis shows significant correlation between CSA of SS and T30, TW of 180° ER; PT, T30, TW of 60° IR; PT, T30, TW of 180° IR, and between CSA of IS and T30 of 60° IR; PT, BW, TW of 180° ER (all p<0.04). A significant correlation between FF of IS with all parameters of 180° IR and 180° ER, and between CSA of IS with all parameters of 180° IR was found on multivariate regression analysis (all p<0.04). FF of TM was significantly associated with PT, T30, TW of 60° IR (p<0.03). There was no significant correlation between CSA and FF of rotator cuff and parameters of FL and EX, whereas age and sex were significantly associated with parameters of FL and EX, as well as with some parameters of ER and IR (all p<0.05).

CONCLUSION
...
CSA and FF of SS and IS measured on T2-weighted Dixon Spin-Echo Fat image correlated with the strength of shoulder movements, especially IR and ER. Therefore, the strength of rotator cuff could be more elaborately evaluated by measuring both FF and CSA of the muscles.

**CLINICAL RELEVANCE/APPLICATION**

CSA measurements and fat quantification using DIXON have the potential to become an important clinical resource when evaluating the muscles of the rotator cuff.

**SSE15-06 Intra and Inter Observer Variability among Different Methods of Measuring Carpal Collapse**

Monday, Nov. 26 3:50PM - 4:00PM Room: N228

**Awards**

**Student Travel Stipend Award**

**Participants**

Muhil Kannan, MD, Coimbatore, India (Presenter) Nothing to Disclose

Sumit Agrawal, MS, Katmandu, Nepal (Abstract Co-Author) Nothing to Disclose

Tarun Chabra, Coimbatore, India (Abstract Co-Author) Nothing to Disclose

Praveen Bhardwaj, MS, Coimbatore, India (Abstract Co-Author) Nothing to Disclose

Pushpa Bhathi Thippeswamy, MD, MBBS, Coimbatore, India (Abstract Co-Author) Nothing to Disclose

Anupama N. V., MBBS, FRCR, Coimbatore, India (Abstract Co-Author) Nothing to Disclose

Raja Sabapathy S, MS, Coimbatore, India (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:

dr.muhil@gmail.com

**PURPOSE**

To find out that the method with least intraobserver and interobserver variability among different methods used for determining carpal collapse.

**METHOD AND MATERIALS**

Retrospective radiographic evaluation of 50 normal wrist PA radiographs were done by 3 observers, measuring normitative values of Carpal height ratio (CHR), Revised Carpal Height Ratio (RCH ratio), Capitate radius (CR index). 1) Carpal Height Ratio (CHR) measured by carpal height divided by the length of 3rd metacarpal. 2) Revised Carpal Height Ratio (RCH ratio) measured by dividing the carpal height by the length of capitate. 3) Capitate radius (CR index) measured by closest distance between the distal edge of radius and the proximal edge of capitate. The measurements were repeated after one month by all the observers. Data was collected and statistical analysis was done by using SPSS 21 version. Data from all the observers were described in descriptive terms with mean and standard deviation. For intra observer variability, correlation coefficient was calculated for every individual observer. For inter observer variability intraclass correlation coefficient was calculated and presented with r and p value.

**RESULTS**

Total of 50 normal wrist PA radiographs (17 females and 33 males) were studied between the age 13 to 71 years with mean age of 37.52 years. The mean range of values in our study for CHR was 0.49 ± .03 to .51 ±.03; RCHR 1.51 ± .077 to 1.57 ± .059 and CRI 0.972 ± .09 to 1.06 ± .12. The r value was close to 0.91 and p value was <0.001 in all the three observers in CR Index meaning that the intra observer variability was least in CR Index. For the inter observer variability Intra Class Coefficient of 0.9 indicates that the CR Index has the least variability. RCH Ratio has the maximum variability in both inter and intra observer comparisions

**CONCLUSION**

We conclude that CR Index is the best method to measure carpal collapse in terms of reproducibility of the results.

**CLINICAL RELEVANCE/APPLICATION**

With regard to intra and inter observer variability, CR Index was most reliable measurement for carpal collapse, as only one measurement is taken in CR index and the measurement points are well defined.
Purpose
To compare fully sampled slice-encoding for metal artifact correction (SEMAC) and vastly undersampled compresses sensing-(CS)-SEMAC sequences for metal artifact reduction MRI in patients with total hip arthroplasty (THA).

Method and Materials
Following internal review board approval and informed consent, 30 patients with pain and dysfunction following THA underwent prospectively 1.5 T MRI, including coronal intermediated-weighted (IW)- and short tau inversion recovery (STIR) SEMAC (22:39 min) and CS-SEMAC (9:55 min) pulse sequences with otherwise identical parameters. Following anonymization and randomization, two fellowship-trained musculoskeletal radiologists independently evaluated the datasets. Outcome variables included image quality parameters, bone implant interface visibility, overall reader satisfaction, detection rate of abnormalities of the hip joint. Statistical analysis included kappa statistics and paired rank sum tests. P-values <= 0.05 were considered significant.

Results
The inter-observer agreements were at least adequate for all categories (kappa > 0.58). There was no significant difference for the technical parameters, including motion (p = 0.69), blur (p = 0.37), noise (p = 0.06), metal artifact reduction (p = 0.46), tissue contrast (p = 0.81), and fat-suppression (p > 0.99). The visibility of bone implant interface of the acetabular and femoral component was rated on average as "good" indicating minimal impairment with preservation of all structural details without significant differences between SEMAC and CS-SEMAC (p = 0.51). The overall reader satisfaction was "good" for both SEMAC and CS-SEMAC (p=0.85). For SEMAC versus CS-SEMAC, readers found an average of 18 versus 18 osteolyses (p = 0.87), 15 versus 17 cases of synovitis (p = 0.38), 23 versus 21 peritrochanteric fluid accumulations (p = 0.55) and 23 versus 19 abductor tendon tears (p = 0.34), respectively.

Conclusion
In patients with painful hip arthroplasty implants, fully sampled and vastly undersampled SEMAC pulse sequences produce similar image quality and afford similar detection rates of abnormalities.

Clinical Relevance/Application
The vastly undersampled CS-SEMAC technique allows for 55% faster MRI of THA implants, thereby preserving the detection rates of abnormalities, when compared to fully sampled SEMAC technique.
Chankue Park, Yangsan, Korea, Republic Of (Presenter) Nothing to Disclose
Eugene Lee, Seongnam-Si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Yusun Kang, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Joon Woo Lee, MD, PhD, Sungnamsi, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Joong Mo Ahn, MD, PhD, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
Heung Sik Kang, Gyeonggi-Do, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To compare the Slice-encoding metal artifact correction (SEMAC)-View-angle tilting (VAT) sequence with the standard turbo-spin echo (TSE) MR sequence for image quality, visibility of periprosthetic structures, and diagnostic confidence for detection of postoperative complications in patients with pedicle screw fixation at 1.5 T.

METHOD AND MATERIALS
Seventy patients with pedicle screw fixation between the thoracic vertebrae and the sacrum were included. SEMAC-VAT imaging were compared with standard TSE images. The MR imaging were retrospectively evaluated by two radiologists for SNR (signal-to-noise ratio) of anatomical structures and size of artifacts, visibility of periprosthetic anatomical structures, and diagnostic confidence for detection of postoperative complications. Paired t-tests and Wilcoxon signed-rank tests were used for comparisons, and intra-class correlation and kappa values were used for inter-observer agreement.

RESULTS
For all anatomical structures, the signal-to-noise ratio was significantly lower for SEMAC-VAT than for TSE images (p < 0.001). SEMAC-VAT images demonstrated effective artifact reduction compared to TSE images (p < 0.001). The visibility of most periprosthetic anatomical structures, and diagnostic confidence for detection of postoperative complications, were better for SEMAC-VAT than for TSE imaging (p < 0.001). For the spinal canal, however, TSE was better (p < 0.001).

CONCLUSION
MR images with SEMAC-VAT can significantly reduce metal artifact, providing improved delineation of periprosthetic anatomical structures and diagnostic confidence for detection of postoperative complication compared with standard TSE images. For the spinal canal, however, TSE was better.

CLINICAL RELEVANCE/APPLICATION
Taking into account the results of our own, we propose the following guidelines for performing SEMAC-VAT image on patients with pedicle screw fixation.

SSE16-03 Metal Artifact Reduction on Photon-Counting-Detector CT Using Tin Filtration and Detection of High-Energy Photons
Monday, Nov. 26 3:20PM - 3:30PM Room: N227B

Awards
Student Travel Stipend Award

Participants
David J. Bartlett, MD, Rochester, MN (Presenter) Nothing to Disclose
Amy L. Kotsenas, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Felix E. Dehn, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Katrina N. Glazebrook, MBChB, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Wei Zhou, PhD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Joel G. Fletcher, MD, Rochester, MN (Abstract Co-Author) Grant, Siemens AG; Consultant, Medtronic plc;
Jayse Weaver, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Shuai Leng, PhD, Rochester, MN (Abstract Co-Author) License agreement, Bayer AG
Cynthia H. McCollough, PhD, Rochester, MN (Abstract Co-Author) Research Grant, Siemens AG
Rickey E. Carter, PhD, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
bartlett.david@mayo.edu

PURPOSE
To evaluate the use of photon-counting-detector CT with tin filtration (PCD-CT Sn) to improve diagnosis in patients with orthopedic metal implants.

METHOD AND MATERIALS
Adult patients with orthopedic metal implants underwent CT using commercial energy-integrating-detector CT (EID-CT) followed by PCD-CT Sn (140 kV, 0.4 mm Sn, energy thresholds of 25 and 75 keV). EID-CT and PCT-CT Sn Bin 2 (75 - 140 keV) 2-mm images were reconstructed. Three radiologists blindly evaluated images in a side-by-side fashion, comparing predefined anatomic structures using a 6-point scale (0 = critical structures totally obscured to 5 = anatomic recognition with high confidence in diagnosis). Preference for PCD-CT Sn was assessed using a 5 point scale (-2 = decline in confidence; 0 = no difference; +2 = improvement in diagnostic confidence). The effect of artifact on the ability to make a diagnosis was also graded (1= artifact has no/minimal effect to 3= artifact impedes diagnosis), with quantitative analysis measuring the width of most prominent artifact at the axial plane. Statistical analysis was performed using the Wilcoxon signed rank test, where p<0.05 was considered statistically significant.

RESULTS
20 patients with orthopedic metal implants were included in the study, with hardware in the spine in 12 patients, shoulder in 3, and extremities in 5. The mean overall visualization scores of the cortex, trabeculae, and implant-trabecular interface were significantly better for PCT-CT Sn (4.4 vs. 3.3, p<0.0001). For spinal hardware, PCD-CT Sn showed improved image quality score for the central canal (3.3 v 0.9, p<0.0001), with similar findings for neural foramina. The mean overall preference score for PCT-CT Sn was +1.6 ± 0.7 compared to EID (p<.0001), indicating improved diagnostic confidence. The effects of metal artifact on diagnosis were
less at PCD-CT Sn (1.9 v 2.6, p<0.0001), and the width of the metal artifact was substantially reduced (from 1.1 ± 1.4 cm to 0.5 ± 0.5 cm, p<0.0001).

CONCLUSION
Selection of high-energy photons using a Sn filter and PCD-CT bin 2 images markedly improves visualization of key anatomic structures and improves diagnostic confidence by reducing the size of metal-related artifacts.

CLINICAL RELEVANCE/APPLICATION
PCD-CT with tin filtration and reconstruction of images obtained using high-energy photons provides additional critical diagnostic information compared to commercial EID-CT systems to patients with metal implants.

SSE16-04 Utility of CT Metal Artifact Reduction Algorithms for Intervertebral Devices: Experimental Study in Ex Vivo Bovine Coccyx Using Micro-CT as the Reference Standard

Monday, Nov. 26 3:30PM - 3:40PM Room: N227B

Participants
Miyuki Takasu, MD, Hiroshima, Japan (Presenter) Nothing to Disclose
Kazuyoshi Nakanishi, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Chikako Fujioka, RT, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Shota Kondo, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Tomoyo Fujii, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Masao Kiguchi, RT, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Chihiro Tani, MD, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Kazuo Awai, MD, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Reiichi Hashiguchi, Canon Medical Systems Corporation; Research Grant, Hitachi, Ltd; Research Grant, Fujitsu Limited; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Medical Advisory Board, General Electric Company;

PURPOSE
The accuracy of radiological assessments of bony fusion following spinal fusion is affected by radiographic interference from metallic components of the intervertebral devices. Therefore, this study evaluated the utility of dedicated CT metal artifact reduction algorithms (SEMAR and MAR) for measuring trabecular bone microarchitecture in a comparison using micro-CT as the gold standard.

METHOD AND MATERIALS
Twenty bovine coccyges with and without titanium or poly-ether-ether-ketone (PEEK) interbody devices were scanned by ultra-high resolution MDCT (Aquilion Precision, SEMAR), 256-MDCT (Revolution CT, MAR), and micro-CT as the gold standard. The quality of the MDCT images was evaluated in terms of the visibility of trabecular bone using a 3-point Likert scale. Trabecular thickness (Tb.Th), trabecular number (Tb.N), trabecular separation (Tb.Sp), fractal dimension (FD), and volumetric bone mineral density (vBMD) of the same 10-mm-thick portion of coccyx including a metal artifact were obtained for MDCTs and micro-CT. Relationships between MDCT- and micro-CT-derived trabecular bone indices were compared.

RESULTS
The mean reduction in the width of the artifact was 48.7% for SEMAR/titanium, 20.6% for SEMAR/PEEK, 15.8% for MAR/titanium, and 18.9% for MAR/PEEK. The image quality analysis revealed that the artifact was removed from the trabecular bone space in 72.7% of the SEMAR/titanium images and 18.2% of the images obtained using the three other combinations. FD, Tb.Th, Tb.Sp, and vBMD measured by ultra-high resolution MDCT were found to be significantly correlated with micro-CT values (p=0.486~0.499, p<0.001~0.05) while no significant correlation was observed between 256-MDCT- and micro-CT values. For coccyx with titanium, the correlations of Tb.Th, Tb.Sp, and vBMD with micro-CT values were improved by SEMAR (p=0.491~0.489, p<0.001~0.05). For coccyx with PEEK, correlations of FD, Tb.Sp, and vBMD with micro-CT values were improved by SEMAR (p=0.502~0.525, p<0.001~0.05).

CONCLUSION
SEMAR combined with ultra-high resolution MDCT objectively and subjectively decreases metal artifacts when compared to 256-MDCT with MAR. Correlations of trabecular indices and vBMD with micro-CT values were improved with SEMAR.

CLINICAL RELEVANCE/APPLICATION
Trabecular bone architecture can be assessed using ultra-high resolution MDCT with a metal artifact reduction algorithm, suggesting that it is possible to evaluate bony fusion after spinal fusion.

SSE16-05 Combined Iterative Metal Artifact Reduction Reconstruction and Virtual Monoenergetic Extrapolation at Higher Photon Energies in CT Imaging of Ankle Arthroplasty Implants

Monday, Nov. 26 3:40PM - 3:50PM Room: N227B

Awards
Student Travel Stipend Award

Participants
Iman Khodarahmi, MD, PhD, Baltimore, MD (Presenter) Nothing to Disclose
Reham R. Haroun, MD, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
George S.K. Fung, PhD, Ellicott City, MD (Abstract Co-Author) Employee, Siemens AG
Matthew K. Fuld, PhD, Malvern, PA (Abstract Co-Author) Employee, Siemens AG
Elliott K. Fishman, MD, Baltimore, MD (Abstract Co-Author) Institutional Grant support, Siemens AG; Institutional Grant support, General Electric Company; Co-founder, HipGraphics, Inc
Jan Fritz, MD, Baltimore, MD (Abstract Co-Author) Research Grant, Siemens AG; Scientific Advisor, Siemens AG; Scientific Advisor, Alexion Pharmaceuticals, Inc; Speaker, Siemens AG

For information about this presentation, contact:
ikhodarahmi@jhmi.edu
PURPOSE
To compare the effects of combined virtual monoenergetic extrapolation (VME) and iterative metal artifact reduction (iMAR) at higher photon energies on low and high-density metal artifacts and overall image quality.

METHOD AND MATERIALS
Six total ankle arthroplasties were implanted into human cadaveric ankles and underwent computed tomography with a dual-source scanner at tube voltages of 80 and tin-filtered 150 kVp to produce mixed 120 kVp equivalent polychromatic images. Image datasets were created with six protocols including polychromatic weighted filtered back projection (WFBP), polychromatic iMAR, monoenergetic WFBP at 150 and 190 keV, and monoenergetic iMAR at 150 and 190 keV. High- and low-density artifacts were separately quantified with a threshold-based MATLAB script. After anonymization and randomization, two observers independently ranked the datasets for overall image quality. A conservative p-value of less than 0.001 was considered significant for all statistical analyses.

RESULTS
Least amount of high-density artifacts were visualized with iMAR 190 keV and iMAR 150 keV (all p-values < 0.001), whereas polychromatic iMAR was the most effective method of mitigating low-density streaks (p-values < 0.001). For both low and high-density artifacts, polychromatic iMAR acquisition was superior to WFBP 150 keV and WFBP 190 keV (p-values < 0.001). Readers ranked the overall image quality of polychromatic iMAR images highest on sharp kernel reconstructions (p-values < 0.001). Similarly, on soft tissue kernel reconstructions, the polychromatic iMAR images were ranked the highest with a statistically significant difference over other techniques (p-values < 0.001), except for iMAR 150 keV (p = 0.356).

CONCLUSION
iMAR with polychromatic spectra and VME result in fewer metal artifacts and better image quality than WFBP with polychromatic spectra and VME. The combination of iMAR and VME at higher photon energies results in mixed effects on implant-induced metal artifacts, including decreasing high-density artifacts and increasing low-density artifacts, which in combination may not improve image quality for a particular implant when compared to polychromatic iMAR images at lower photon energies.

CLINICAL RELEVANCE/APPLICATION
Combined iMAR and VME at higher photon energies results in mixed effects on metal-related artifacts, which overall may not improve image quality for a particular implant.

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/ Elliot K. Fishman, MD - 2012 Honored Educator Elliot K. Fishman, MD - 2014 Honored Educator Elliot K. Fishman, MD - 2016 Honored Educator Elliot K. Fishman, MD - 2018 Honored Educator

SSE16-06 Improved Visualization of Juxtaprosthetic Tissue Using Metal Artifact Reduction MRI: Experimental and Clinical Optimization of Compressed Sensing SEMAC

Monday, Nov. 26 3:50PM - 4:00PM Room: N227B

Participants
Pia M. Jungmann, MD, Zurich, Switzerland (Presenter) Nothing to Disclose
Susanne Bensler, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Patrick Zingg, MD, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Benjamin Fritz, MD, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Christian W. Pfirrmann, MD, MBA, Forch, Switzerland (Abstract Co-Author) Nothing to Disclose
Reto Sutter, MD, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose

PURPOSE
To identify an optimal imaging protocol for metal artifact reduced MRI by application of different post-processing parameters in compressed sensing slice-encoding for metal artifact correction (CS-SEMAC).

METHOD AND MATERIALS
In an experimental setup, a total hip arthroplasty (THA) embedded in gadolinium containing agarose was scanned at 1.5T. Pulse sequences included coronal STIR, T1w and T2w CS-SEMAC sequences. All pulse sequences were acquired with 11, 19 and 27 slice-encoding steps (SES). Post-processing was performed with variations of the parameters (i) number of iterations (5, 10, 20, 30, 50) and (ii) normalization factor (0.0005, 0.001, 0.002, 0.003, 0.005). Following, identical STIR, T1w and T2w pulse sequences with 11 and 19 SES were acquired in patients with THA. Semi-quantitative outcome measures were assessed on a five-point scale (1=best, 5=worst). The overall best image quality was determined. Statistical analyses included descriptive statistics, t-tests, multivariate regression models and partial Spearman correlations.

RESULTS
Scan times varied between 2:24 and 8:49 minutes. Reconstruction times varied between 3:14 and 85:00 minutes. Artifact reduction was optimal with an intermediate normalization factor (0.001) and improved with higher SES and iterations. Iterations >20 did not improve artifact reduction or image quality further. Ripple artifacts increased with higher SES and iterations. A normalization factor of 0.001 or 0.002 was best for reduction of blurring, while the soft tissue contrast was better and the distortion of soft tissue was less severe with lower normalization factors. Overall best soft tissue image quality was found for STIR and T1w images with 19 SES, 10 iterations and a normalization factor of 0.001 and for T2w images with 11 SES, 10 iterations and a normalization factor of 0.0005.

CONCLUSION
For the advanced acceleration and reconstruction algorithms of CS-SEMAC, optimal SES, iterations and normalization factors could
be identified. 19 SES and 20 iterations were sufficient for optimal artifact reduction, enabling an imaging protocol with clinically feasible acquisition and reconstruction times.

**CLINICAL RELEVANCE/APPLICATION**

Identified optimal CS-SEMAC MRI parameters may be applied in clinical practice and allow for improved evaluation of juxtaprosthetic tissue in patients with THA due to excellent artifact reduction.
Participants
Adnan M. Sheikh, MD, Ottawa, ON (Moderator) Nothing to Disclose
Frank J. Rybicki III, MD, PhD, Ottawa, ON (Moderator) Medical Director, Imagia Cybernetics Inc
For information about this presentation, contact:
frybicki@toh.ca

LEARNING OBJECTIVES
Dr. Rybicki will moderate this session and synthesize input from the speakers regarding the operations and applications of medical 3D printing and anatomic modeling.

ABSTRACT
Not applicable (moderator).

Sub-Events
RCC25A   Establishing a Radiology-based 3D Medical Printing Practice
Participants
William J. Weadock, MD, Ann Arbor, MI (Presenter) Owner, Weadock Software, LLC

LEARNING OBJECTIVES
1) Describe the process of creating a 3D printed model using DICOM images. 2) List the common musculoskeletal applications of 3D printing.

RCC25B   Key Technologies for Medical 3D Printing: Applications and Experiences
Participants
Sang Joon Park, PhD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose

RCC25C   3D Printing for Renal Sparing Surgery 3D
Participants
Bernard F. King JR, MD, Rochester, MN (Presenter) Nothing to Disclose

RCC25D   Medical 3D Printing for MSK Applications
Participants
Adnan M. Sheikh, MD, Ottawa, ON (Presenter) Nothing to Disclose

RCC25E   FDA Current Practices and Regulations: 3D Printed Patient-Specific Anatomic Models
Participants
Nooshin Kiarashi, PhD, Silver Spring, MD (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
- Overview of FDA Guidance Document: Technical Considerations for Additive Manufactured Medical Devices - Design - Manufacturing - Testing - 3D Printed Patient-specific Anatomic Models - What is considered diagnostic use of these models? - What is regulated? The models, the 3D printers, or the software? - What information is required for FDA clearance? - Who should apply for FDA clearance?
Muscloskeletal Tuesday Case of the Day

Tuesday, Nov. 27 7:00AM - 11:59PM Room: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants
Daniel E. Wessell, MD, PhD, Jacksonville, FL (Presenter) Nothing to Disclose
Jonathan A. Flug, MD, MBA, Phoenix, AZ (Abstract Co-Author) Nothing to Disclose
Jeremiah R. Long, MD, Ft Belvoir, VA (Abstract Co-Author) Nothing to Disclose
Joseph M. Bestic, MD, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose
Hillary W. Garner, MD, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose
Andrew Z. Chow, MD, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose
Sara Eckloff, MD, Eau Claire, WI (Abstract Co-Author) Nothing to Disclose
Matthew A. Frick, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Nicholas G. Rhodes, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Sujan C. Fernando, MD, Milwaukee, WI (Abstract Co-Author) Nothing to Disclose
John S. Symanski, MD, Milwaukee, WI (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) Participants will test their diagnostic skills and become familiar with the imaging findings of a variety of challenging and interesting musculoskeletal cases.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Daniel E. Wessell, MD, PhD - 2013 Honored Educator
The RAD Files: The Truth is Out There (Case-based Competition)

Tuesday, Nov. 27 7:15AM - 8:15AM Room: E451B

Participants
Eric B. England, MD, Cincinnati, OH (Presenter) Nothing to Disclose
Carl C. Flink, MD, Cincinnati, OH (Presenter) Nothing to Disclose

For information about this presentation, contact:
eric.england@uc.edu

LEARNING OBJECTIVES

1) Be introduced to a series of radiology case studies via an interactive team game approach designed to encourage 'active' consumption of educational content. 2) Use their mobile wireless device (tablet, phone, laptop) to electronically respond to various imaging case challenges; participants will be able to monitor their individual and team performance in real time. 3) Receive a personalized self-assessment report via email that will review the case material presented during the session, along with individual and team performance. This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.
**RC304**

**Musculoskeletal Series: Ultrasound**

**Tuesday, Nov. 27 8:30AM - 12:00PM Room: E450A**

**AMTRA Category 1 Credits ™**: 3.50  
**ARRT Category A+ Credits**: 4.00

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

**Participants**

Viviane Khoury, MD, Philadelphia, PA *(Moderator)* Nothing to Disclose  
Linda Probyn, MD, Toronto, ON *(Moderator)* Nothing to Disclose  
Jon A. Jacobson, MD, Ann Arbor, MI *(Moderator)* Research Consultant, BioClinica, Inc; Advisory Board, General Electric Company; Advisory Board, Koninklijke Philips NV; Royalties, Reed Elsevier  
Marnix T. van Holsbeeck, MD, Detroit, MI *(Moderator)* Minor stockholder, Koninklijke Philips NV; Minor stockholder, General Electric Company; Stockholder, MedEd3D; Grant, Siemens AG; Grant, General Electric Company;

For information about this presentation, contact:

linda.probyn@sunnybrook.ca  
lenchik@wakehealth.edu

**LEARNING OBJECTIVES**

1) Describe the ultrasound anatomy of shoulder structures evaluated in a routine shoulder examination.  
2) Learn the standardized approach used in the evaluation of the shoulder with US.  
3) Demonstrate the scanning technique for the dynamic examination of common shoulder lesions.  
4) Outline how to position patients optimally for the evaluation of the shoulder respecting ergonomics.

**ABSTRACT**

**Moderator**

**Sub-Events**

**RC304-01**  
**Shoulder Ultrasound (Demonstration)**  
**Tuesday, Nov. 27 8:30AM - 9:05AM Room: E450A**

**Participants**

Viviane Khoury, MD, Philadelphia, PA *(Presenter)* Nothing to Disclose

For information about this presentation, contact:

viviane.khoury@uphs.upenn.edu

**RC304-02**  
**The Use of Dynamic Ultrasound in the Diagnosis and Follow-up of Patients with Clinically Suspected Slipping Rib Syndrome**  
**Tuesday, Nov. 27 9:05AM - 9:15AM Room: E450A**

**Participants**

Dane Carlisle Van Tassell, MD, Phoenix, AZ *(Presenter)* Nothing to Disclose  
Kevin Wong, DO, East Lansing, MI *(Abstract Co-Author)* Nothing to Disclose  
Lisa McMahon, MD, Phoenix, AZ *(Abstract Co-Author)* Nothing to Disclose  
Monique Riemann, Phoenix, AZ *(Abstract Co-Author)* Nothing to Disclose  
Craig E. Barnes, MD, Scottsdale, AZ *(Abstract Co-Author)* Nothing to Disclose

For information about this presentation, contact:

cbames1@phoenixchildrens.com

**PURPOSE**

Slipping Rib Syndrome (SRS) is a condition that affects adolescents and young adults. Dynamic Ultrasound imaging has a potential and likely significant role; however, limited data exists describing the protocol and techniques available. It is our intent to describe the development of an effective and reproducible protocol for dynamic imaging in patients with SRS.

**METHOD AND MATERIALS**

Retrospective review was performed of suspected SRS patients presenting to the Radiology or Surgery department from March to
December 2017. 29 patients were evaluated. Focused history was taken, and imaging was performed at the site of pain. Images of the bilateral 6th-11th ribs were obtained at rest and with dynamic maneuvers. Dynamic maneuvers included Valsalva, crunch, focal rib push/compression, and any provocative movement that elicited pain per the patient. Imaging was correlated with medical/surgical records generated by the pediatric surgeon specializing in treatment of slipping ribs. Group comparisons were conducted using the Wilcoxon rank sum and Fisher's exact test. Sensitivity and specificity were provided with the 95% confidence interval (CI) based on the binomial distribution and exact confidence limits.

RESULTS
21 of 29 patients had a clinical diagnosis of SRS, with an average age of 17 years. 4 patients were scanned twice for a total of 33 scans. 21 patients were female, while 8 were male. 66% (19/29) were athletes, with average BMI of 22.7. Dynamic ultrasound correctly detected SRS in 92% (23/25) of cases and correctly excluded SRS in 100% (8/8) of cases. The push maneuver demonstrated the highest sensitivity (87% (0.62,0.98)) followed by morphology (76% (0.55,0.91)) and then crunch maneuver (73% (0.50,0.89)). Valsalva was the least sensitive (10% (0.01,0.32)). Both false negative examinations did not utilize dynamic crunch or push maneuvers.

CONCLUSION
Dynamic Ultrasound imaging of the ribs, particularly with utilization of crunch and push maneuvers, is an effective and reproducible tool for the diagnosis of SRS. Valsalva has a limited role for the detection of slipping rib given low sensitivity. Ultrasound has the ability to give the surgeon morphological data and information on additional ribs that are at risk, thereby assisting in surgical planning.

CLINICAL RELEVANCE/APPLICATION
Dynamic Ultrasound is a valuable tool in the diagnosis and surgical planning of an uncommon and likely underrecognized entity; Slipping Rib Syndrome.

PURPOSE
The purpose of this study was to determine whether SWE can detect biomechanical changes in the supraspinatus muscle that occur with increasing supraspinatus tendon abnormality prior to morphologic gray-scale changes.

METHOD AND MATERIALS
An IRB approved, HIPAA compliant mixed retrospective/prospective study of shoulder ultrasounds from 2013-2018 was performed. Images were acquired by a single radiologist with 26 years musculoskeletal ultrasound experience on a Siemens Acuson S3000 with Virtual Touch™ IQ in longitudinal orientation to the supraspinatus muscle with shear wave velocity (SWV) point quantification. Tendon and muscle were graded in order of increasing tendinosis/tear (e.g. tendon grade 1=normal tendon or mild tendinosis without tear to grade 4=full-thickness tear) and increasing fatty infiltration (0-3 scale). Mixed model analysis of variance, analysis of covariance, and Spearman rank correlation were used for statistical analysis.

RESULTS
The cohort consisted of 79 patients (mean age 54±15 years-old; 47% male, 53% female) with 100 ultrasounds. There was no statistically significant age or sex dependence for supraspinatus muscle SWV (p=0.886, 0.119, respectively). There was no significant correlation between muscle SWV and muscle or tendon grade (p=0.744, 0.377, respectively). In patients with morphologically normal muscle on gray-scale ultrasound, there were significant differences in muscle SWV when comparing tendon grade 3 with grades 1, 2, and 4 (p=0.018, 0.025, 0.014, respectively), even when adjusting for gender and age (p=0.044, 0.028, 0.018, respectively). Pairwise comparison of tendon grades other than those mentioned did not achieve statistical significance (p>0.05).

CONCLUSION
SWE can detect biomechanical differences within the supraspinatus muscle that are not morphologically evident on gray-scale ultrasound. Specifically, supraspinatus partial tears with at least moderate tendinosis may correspond to biomechanically distinct muscle properties compared to both lower grades of tendon abnormality and full-thickness tears.

CLINICAL RELEVANCE/APPLICATION
SWE may be a novel tool to quantitatively evaluate muscle quality in the setting of rotator cuff disease. Further research is needed to determine whether this may aid prognosis for repair outcomes.

RC304-04 Prevalence of Pseudoerosions of the Hand and Wrist: Ultrasound Findings in 100 Asymptomatic Volunteers

Tuesday, Nov. 27 9:25AM - 9:35AM Room: E450A

Awards
Student Travel Stipend Award

Participants
Dana Lin, MD, New York, NY (Presenter) Nothing to Disclose
Christopher J. Burke, MBChB, New York, NY (Abstract Co-Author) Nothing to Disclose
James S. Babb, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose
Ronald S. Adler, MD, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose
PURPOSE

Identification of cortical erosions with ultrasound is an important finding that can indicate inflammatory arthritis. While cortical depressions have been described in several metacarpal heads that may potentially simulate an erosion, we have noted similar "pseudoerosions" more frequently than prior descriptions, and with more extensive involvement of the wrist. Thus, our purpose is to evaluate the frequency and location of these pseudoerosions in asymptomatic volunteers.

METHOD AND MATERIALS

After IRB approval and obtaining informed consent, 100 subjects without hand or wrist symptoms were examined bilaterally with ultrasound. Dorsal metacarpal heads, lunate, triquetrum, and distal ulna were examined. Cortical depressions were characterized with regard to location (central, marginal, both), morphology (irregularity, ring-down artifact), and dimensions (length and depth) by two fellow-trained musculoskeletal radiologists in consensus.

RESULTS

Study group consisted of 52 male and 48 female subjects with mean age of 47 ± 16 years. Metacarpal (MC) heads showed a central pseudoerosion in various frequencies (MC1: 21.5%; MC2: 92%; MC3: 85.5%; MC4: 59.5%; MC5: 81%). Only one marginal erosion was present at a MC5 and a marginal plus central at a MC2. Pseudoerosions were present at the lunate (82%), triquetrum (84%), and were multiple (lunate: 40%; triquetrum: 27%, ulna 5%). Ring-down artifact (30.25 - 49.7%) was present more than cortical irregularity (12.6 - 27.9%) of the pseudoerosions. Mean pseudoerosion length and depth of MC was 3 mm (range: 0.6 - 9 mm) and 0.7 mm (range: 0.2 - 8), respectively. Wrist dimensions for pseudoerosions varied slightly for the lunate (length: 2.1; depth: 0.8), triquetrum (length: 1.7; depth: 1.0), and ulna (length: 1.7; depth: 1.1) with a range of 0.3 - 6 mm in length, and 0.3 - 5 mm in depth.

CONCLUSION

Central pseudoerosions are a typical finding of metacarpal heads, lunate, triquetrum, and distal ulna in asymptomatic patients and should not be misinterpreted as inflammatory arthritis.

CLINICAL RELEVANCE/APPLICATION

Knowledge of erosion mimickers and their characteristics will enable the differentiation between a physiologic finding and a true inflammatory bone defect.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Jon A. Jacobson, MD - 2012 Honored Educator, Jon A. Jacobson, MD - 2017 Honored Educator.
Ultrasound Guided Targeted High Volume Injection (HVI) of the Rotator Cuff Interval versus Supervised Physical therapy for Primary Adhesive Capsulitis of Shoulder: A Randomized Control Study

Tuesday, Nov. 27 10:55AM - 11:05AM Room: E450A

Participants
Joban Babhulkar, MBBS,DMRD, Pune, India (Presenter) Nothing to Disclose
Vishal Walasangikar, MD,MBBS, Pune, India (Abstract Co-Author) Nothing to Disclose
Vishnu R. Unnithan, MBBS,DO, Pune, India (Abstract Co-Author) Nothing to Disclose
Ashish Babhulkar, MBBS,DO, Pune, India (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
jobanbabhulkar@gmail.com

PURPOSE
High volume injection (HVI) is a promising treatment option for severe adhesive capsulitis, for faster rehabilitation. We present a single center, single blinded, matched parallel randomized control trial (RCT) comparing ultrasound-guided HVI through rotator cuff interval followed by supervised physical therapy, versus supervised physical therapy alone for severe primary adhesive capsulitis of shoulder joint.

METHOD AND MATERIALS
40 patients were randomized in to two groups: Group-A (n=20) underwent supervised physiotherapy in addition to HVI, and Group-B (n=20) underwent supervised physiotherapy in isolation. A blinded researcher carried out assessments at 0,3 & 6 months. The primary outcome measure was shoulder range of motion (ROM), especially external rotation. In addition UCLA score, VAS score, cuff strength, failure rates and return to pre-disease activity levels were assessed.

RESULTS
Group-A fared better in all parameters at 2 weeks and 3 months, but by 6 months the outcome results of both the groups were similar. In Group-A, the external rotation improved significantly from 4.50 (-300 to 200) at baseline to 43.250 (150 to 800) at 3 months and 51.250 (150 to 850) at 6 months; which were 6.250 (-200 to 250), 36.750 (150 to 600) and 47.50 (150 to800) respectively in Group-B. Group-A had statistically significant improvement in UCLA score (p<0.05) compared to Group-B at 3 months, but which were almost similar by 6 months. In both the groups, all the outcome measures improved significantly from baseline to 6 months (p<0.05).

CONCLUSION
In conclusion, HVI is distinct from hydrodilation and patients who underwent HVI had rapid pain relief with earlier regaining of movements and earlier returning to their pre-disease activity levels.

CLINICAL RELEVANCE/APPLICATION
HVI is distinct from Hydrodilation in which the former targets the basic pathological component in adhesive capsulitis, namely Coroco-Humeral Ligament, unlike causing diffuse capsular breakage like the later procedure. HVI is a relatively simple, cost effective and safer procedure producing superior outcomes, if given as an adjunct to physical therapy.
were previously obtained with a 1.5 T unit. Ligament detection rate between US and MRA was calculated using the Chi-square test. Ligament thickness reproducibility between US and MRA was assessed using the Bland-Altman method.

RESULTS
On the dorsal side, US detected more ligaments (108/114, 94.7%) than MRA (96/114, 84.2%; P=0.016), while on the volar side the difference was not significant (149/171, 87.1% vs. 156/171, 91.2%, respectively; P=0.296). Among detectable ligaments, thickness reproducibility ranged between 44% (COR=0.9, bias=-0.8, P=0.001) of the volar unocapitate ligament and 71% (COR=0.05, bias=-0.1, P<0.001) of the volar scaphotriquetral ligament. Diagnostic performance of US for ligaments where a tear was found was 100% sensitivity, 100% specificity, 100% VPP, 100% VPN, 100% accuracy for the volar and dorsal scapholunate ligaments, and the ulnar collateral ligament; it was 100%, 94%, 50%, 100%, 94%, respectively, for the volar unoculate ligament.

CONCLUSION
US has similar diagnostic performance to MRA in the assessment of intrinsic and extrinsic carpal ligaments and ligamentous tears. Future studies focused on a larger cohort of patients are warranted.

CLINICAL RELEVANCE/APPLICATION
High-resolution US seems to be a valuable and promising technique for the assessment of intrinsic and extrinsic carpal ligaments and ligamentous tears.

RC304-09 Short and Long Term Outcomes of Ultrasound Guided Percutaneous Tenotomy for Lateral Epicondylitis

Tuesday, Nov. 27 11:15AM - 11:25AM Room: E450A

Participants
Faysal Altahawi, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Britani Demarest, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Michael C. Forney, MD, Cleveland, OH (Presenter) Nothing to Disclose

PURPOSE
In this study, we evaluate long and short-term outcomes of ultrasound guided percutaneous tenotomy of the common extensor origin in the elbow for patients with lateral epicondylitis.

METHOD AND MATERIALS
Institutional review board approval was obtained. 44 consecutive patients that had received ultrasound-guided percutaneous tenotomy of the common extensor origin for lateral epicondylitis were retrospectively identified. All included cases were performed by a single operator using the Tenex Health TXTM system. The patients were surveyed and asked to retrospectively evaluate their symptoms before the procedure, 2 weeks after the procedure, 3 to 6 months after the procedure, and 1 year after the procedure using the Disabilities of the Arm, Shoulder and Hand Score (QuickDASH) survey as well as the Oxford Elbow Score (OES) survey. Scores were compared using paired two-tailed students T-test.

RESULTS
QuickDASH survey scores were significantly improved for symptoms 3-6 months and 1 year after ultrasound guided percutaneous tenotomy as compared to symptoms before intervention (P=0.023 and P=0.008, respectively), but were not significantly changed for symptoms 2 weeks after the procedure (P=0.903). Oxford Elbow Score survey similarly demonstrated improved scores in the pain, elbow function, and social-psychological domain sub-scales as compared to pre-procedural scores for symptoms 3-6 months after the procedure (P=0.023, P=0.009, and P=0.008, respectively) and 1 year after the procedure (P=0.008, P=0.001, and P=0.038, respectively), but were not significantly changed for symptoms 2 weeks after procedure (P=0.903, P=0.718, and P=0.387, respectively).

CONCLUSION
When retrospectively surveyed, patients that receive ultrasound guided percutaneous tenotomy using the Tenex Health TXTM system for lateral epicondylitis feel their symptoms are significantly better 3-6 months and 1 year after the procedure, and that symptoms are not significantly better or worse 2 weeks after the procedure.

CLINICAL RELEVANCE/APPLICATION
Ultrasound guided percutaneous tenotomy for lateral epicondylitis is effective and may provide an alternative to surgical tenotomy.

RC304-10 Ankle Ultrasound (Demonstration)

Tuesday, Nov. 27 11:25AM - 12:00PM Room: E450A

Participants
Marnix T. van Holsbeeck, MD, Detroit, MI (Presenter) Minor stockholder, Koninklijke Philips NV; Minor stockholder, General Electric Company; Stockholder, MedEd3D; Grant, Siemens AG; Grant, General Electric Company;

LEARNING OBJECTIVES
1) Describe an approach to ultrasound examination of the ankle using a four quadrant approach and including dynamic imaging. 2) Identify potential pitfalls of scanning that mimic disease. 3) Review important anatomy of the ankle including retinacula, tendons, ligaments, nerves and common sites of pathology.
RC313

**Pediatric Series: Musculoskeletal Imaging**

Tuesday, Nov. 27 8:30AM - 12:00PM Room: N228

**Participants**

Arthur B. Meyers, MD, Orlando, FL *(Moderator)* Author with royalties, Reed Elsevier; Editor with royalties, Reed Elsevier
Tal Laor, MD, Boston, MA *(Moderator)* Nothing to Disclose
Karen Rosendahl, Bergen, Norway *(Moderator)* Nothing to Disclose
Jie C. Nguyen, MD, MS, Philadelphia, PA *(Moderator)* Nothing to Disclose

For information about this presentation, contact:

arthur.meyers@nemours.org
tal.laor@childrens.harvard.edu

**Sub-Events**

**RC313-01 Anterior Cruciate Ligament Imaging in Children and Adolescents**

Tuesday, Nov. 27 8:30AM - 8:50AM Room: N228

Participants

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

**LEARNING OBJECTIVES**

1) List two structures that can prevent reduction of tibial eminence fractures. 2) Describe the main types of anterior cruciate ligament reconstruction procedures that are used in skeletally immature children. 3) Identify the normal post-operative imaging appearance after physeal sparing anterior cruciate ligament reconstruction procedures.

**RC313-02 Insall-Salvati Ratio and Visual Diagnosis of Patella Alta on MR versus Radiography in the Pediatric Population**

Tuesday, Nov. 27 8:50AM - 9:00AM Room: N228

Participants

Darya Kurowecki, MD, Hamilton, ON *(Presenter)* Nothing to Disclose
Ravi Shergill, MD, Hamilton, ON *(Abstract Co-Author)* Nothing to Disclose
Kelly M. Cunningham, MD, Hamilton, ON *(Abstract Co-Author)* Nothing to Disclose
Devin Peterson, MD, Hamilton, ON *(Abstract Co-Author)* Nothing to Disclose
Heba S. Takrouni, MBBS, Toronto, ON *(Abstract Co-Author)* Nothing to Disclose
Neuman Habib, MD, Toronto, ON *(Abstract Co-Author)* Nothing to Disclose
Kelly E. Ainsworth, MD, Burlington, ON *(Abstract Co-Author)* Nothing to Disclose

For information about this presentation, contact:

darya.kurowecki@medportal.ca

**PURPOSE**

To determine whether the Insall-Salvati ratio (ISR) measured on MR images is equivalent to that measured on radiographs in the pediatric population, and whether a visual diagnosis of patella alta corresponds to an ISR diagnosis of patella alta on MR and radiographs.

**METHOD AND MATERIALS**

A retrospective review of 49 pediatric patients (age range 7.5-17 years) with unfused growth plates who underwent knee MR imaging and lateral knee radiographs. All patients had knee imaging obtained for a variety of reasons. Measurements for calculating ISR (ratio of the patella tendon length to patella length) and a visual estimate of the presence of patella alta were obtained by three independent radiologists. Data were analyzed using paired t-tests and Pearson's correlation. A reliability assessment and inter-rater and inter-method agreements were calculated. Patella alta was defined visually as the middle third of the patella bisecting the growth plate and as ISR >1.2. Additional cut-off values of ISR >1.3 and >1.4 were also analyzed.

**RESULTS**

There is a statistically significant but not clinically significant difference between ISR determined on MR (mean=1.19) and radiographs (mean=1.25, p < 0.05). There is a strong correlation between ISR as determined on MR and radiographs (Pearson's r=0.6) with moderate consistency (Cronbach's alpha=0.78). There is a good level of agreement between the diagnosis of patella
alta on MR and radiographs when defined as ISR greater than 1.2 and 1.3 (Cohen's Kappa=0.61), but not 1.4 (Kappa=0.22). There is low agreement between a visual diagnosis of patella alta and a diagnosis of patella alta based on ISR across the two modalities (Kappa=0.09), and no agreement within the two modalities.

CONCLUSION
The study results demonstrate a strong association between ISR derived from MR images and radiographs in the pediatric population who are 7.5 years of age or older. Additionally, the results suggest that patella alta cannot be diagnosed visually on either modality.

CLINICAL RELEVANCE/APPLICATION
Clinically, it has been presumed that because ISR correlates well between radiographic and MRI measurements in adults that the same holds true in the pediatric population. This study confirms that ISR correlates well between radiographs and MRI in patients 7.5 years of age and older.

Participants
Leah C. Davis, DO, Charleston, SC (Presenter) Nothing to Disclose
William Davis, MD, Detroit, MI (Abstract Co-Author) Nothing to Disclose
Bashir Hakim, MD, Detroit, MI (Abstract Co-Author) Nothing to Disclose
Heather R. Collins, PhD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Courtney E. Scher, DO, Detroit, MI (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
davislea@musc.edu

PURPOSE
The growth plate is a dynamic cartilaginous structure with distinct layers including resting, proliferative and hypertrophic zones. Focal periphyseal edema, or FOPE lesion, was originally described as focal bone marrow edema centered about a closing physis and is characterized by T2/STIR hyperintense and T1 hypointense signal on both sides of the physis. It may represent physiologic changes of physeal closure, with the marrow edema resulting from early osseous bridging, or tethering. Assuming this, FOPE lesions should be transiently present and resolve after physeal closure. No study has been performed to assess the clinical significance and natural course of FOPE lesions. The purpose of our study is to evaluate whether the presence of a FOPE lesion on MRI is associated with clinical symptoms of pain at the time of imaging, and whether symptoms resolve or persist on follow-up clinical examinations performed 9-12 months later.

METHOD AND MATERIALS
Inclusion criteria for our study was ages 11-18 years with knee pain and no acute trauma or surgery. 884 knee MRIs were returned from our initial search; 21 FOPE lesions were identified in 19 patients. Age and gender-matched patients were selected for the control group. Each FOPE lesion was evaluated for anatomic location, cross sectional location and size. Clinical data including age, gender, laterality, focal location of pain and reported trauma was obtained from a clinical note at or within 3 weeks of the MRI examination and from follow-up note 9-12 months later. When pain was reported using at least one cross-sectional descriptor in which the FOPE lesion was located, the lesion was described as ‘concordant.’

RESULTS
Patients with FOPE lesions were significantly more likely to report resolution/improvement in pain at follow-up (64.29%) than persistent pain (7.14%) or no mention of pain (28.57%) in the follow up note \(p = 0.03\), although there was no statistically significant difference in pain resolution at follow up between FOPE and control groups. FOPE patients were significantly more likely to have concordant rather than discordant pain \(p = 0.04\).

CONCLUSION
Our findings support previous suggestions that FOPE lesions themselves may be a symptomatic phenomenon of physeal closure.

CLINICAL RELEVANCE/APPLICATION
FOPE lesions on MRI should be recognized by their characteristic appearance and location around a closing physis and may be transiently painful.

Participants
Maria A. Bedoya-Velez, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Christian A. Barrera, MD, Philadelphia, PA (Presenter) Nothing to Disclose
J. C. Edgar, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Jorge Delgado, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Nancy A. Chauvin, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Diego Jaramillo, MD, MPH, Miami, FL (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
bedoya3@gmail.com

PURPOSE
It has been demonstrated that Diffusion-Tensor imaging (DTI) parameters of the femoral physis (ADC, track length and volume) are higher when the growth rate is fastest. The aim of this study is to determine the correlation between DTI tractography of the distal
femoral physis and the amount of height change during a 1-year period in children who are at puberty.

METHOD AND MATERIALS

Retrospectively, we identified children who had undergone DTI tractography of the knee and had recorded heights at the time of study and 10-14 months later. We included girls >= 11 yr. and boys >= 13 yr., all with open physes. DTI parameters of the femoral physis included: 20 directions, b values of 0 and 600 sec/mm², fractional anisotropy (FA) threshold of 0.15 and an angle threshold of 40°. We measured apparent diffusion coefficient (ADC), tract length, tract number, tract volume and tract concentration. Height change was calculated by subtracting the height at the DTI exam from the height recorded 10-14 months later. We correlated DTI parameters with height change during the following year.

RESULTS

25 children were included (10 girls, mean age 14.2 yr. range 11.9 - 16.1 yr.). The mean height at MRI was 165 cm (range 151 - 184 cm), and the mean height after 1 year was 169 cm (range 150 - 188 cm). Mean height change was 3.7 cm (range 0 - 12.7 cm). Children with higher tract volumes, tract lengths and ADC values had a greater height change in 1 year (all p < 0.001). Linear regression showed that age was a predictor of height change, accounting for 23% of the variance (p < 0.001). After accounting for the variance associated with age, DTI parameters predicting additional variance in height change included femoral tract number (R² change = 0.42), tract volume (R² change = 0.40), tract length (R² change = 0.38) and tract concentration (R² change = 0.31) (p < 0.001) (Figure 1).

CONCLUSION

Children with greater femoral tract number and volume have greater height change. DTI parameters can help predict subsequent growth, suggesting that DTI of the knee is a biomarker for short-term growth potential.

CLINICAL RELEVANCE/APPLICATION

DTI of the knee is a growth biomarker. This may be useful in the evaluation of growth hormone (GH) therapeutic effectiveness in children with idiopathic short stature, GH deficiency or GH resistance.

Participants

Yoshiko Matsubara, Hiroshima, Japan (Presenter) Nothing to Disclose
Chihiro Tani, MD, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Toru Higaki, PhD, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Shogo Kameoka, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Yuko Nakamuro, MD, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Kazuo Awai, MD, Hiroshima, Japan (Abstract Co-Author) Research Grant, Canon Medical Systems Corporation; Research Grant, Hitachi, Ltd; Research Grant, Fujitsu Limited; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Medical Advisory Board, General Electric Company; ;

PURPOSE

Computed tomography (CT) studies of fetuses can be used to evaluate systemic bone disorders. As radiation exposure is a critical issue, we developed a novel magnetic resonance imaging (MRI) sequence that demonstrates the bone cortex and compared MRI- and CT findings on fetal bones.

METHOD AND MATERIALS

We placed 14 normal human fetal speciments (gestational age 28-32 weeks) in a plastic cylindrical container and scanned them with a 3T MRI scanner (TRILLIUM OVAL, Hitachi, Tokyo, Japan). We used our original sequence based on T2*WI (TE=7.2 ms ,FA=40°) edited with the Dixon method. CT scans obtained with adaptive iterative dose reduction (AIDR) were the reference images. We evaluated metacarpal and a metatarsal images of the 5th finger and the shape of the spine. Their visualization on MRI scans was scored as 4=better than on-, 3=almost the same as on CT images, 2=not clearly visible but evaluable, and 1=not visible. A score of 2 or higher was considered diagnostically acceptable.

RESULTS

The average visualization score of the metacarpal and the metatarsal on MRI scans was 3.4 and 3.1, respectively. The visualization score of the spine differed by location, it was 3.3 for the cervical and thoracic- and 2.6 for the lumbar spine. None of the MRI scans had a score of 1.

CONCLUSION

With our MRI technique, the small bones were more clearly visible than on CT scans. Our MRI sequence can replace CT findings on fetal bones.

CLINICAL RELEVANCE/APPLICATION

We document the utility of MRI for fetal bone scanning. Our method can be used for evaluating human fetal bone systems without radiation exposure.

Participants

Laura S. Kox, MD, Amsterdam, Netherlands (Presenter) Nothing to Disclose
Rik B. Kraan, MSc, Amsterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Valentina Mazzoli, MSc, Amsterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Marieke A. Mens, BSC, Amsterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
PURPOSE
To reliably assess maturity- and stress-related metaphyseal water distribution in the wrists of gymnasts and non-gymnasts, using a semi-quantitative Dixon MRI-based method to aid early diagnosis of gymnastic physeal stress injury.

METHOD AND MATERIALS
Twenty-four gymnasts with wrist pain (12 girls), 18 asymptomatic gymnasts (9 girls), and 24 non-gymnast controls (12 girls) aged 12±1.5 years prospectively underwent hand radiographs and MRI of the wrist on a 3T scanner, including coronal T1-weighted and T2-weighted Dixon sequences. Skeletal age was determined using the radiographs. Two observers measured metaphyseal water signal fraction in 13 radial and ulnar regions of interest (ROIs) on Dixon MR images. Inter- and intra-rater reliability, inter-slice reliability (between 3 middle radial slices) and inter-ROI reliability (between 3 ROIs on same level) were assessed using intraclass correlation coefficients (ICCs). Water signal fractions and their within-person ratios in distal versus most proximal reference ROIs were compared between groups using one-way analysis of variance.

RESULTS
Inter- and intra-rater ICCs were 0.79-0.99 and 0.94-1.0 for T1-weighted, and 0.88-1.0 and 0.88-1.0 for T2-weighted Dixon. Inter-slice and inter-ROI ICCs were 0.55-0.94 and 0.95-0.97 for T1-weighted, and 0.70-0.96 and 0.96-0.97 for T2-weighted Dixon. Metaphyseal water signal fraction in symptomatic gymnasts was higher in six distal ROIs compared to asymptomatic gymnasts and in nine ROIs compared to non-gymnasts (p<0.05). Radial metaphyseal water score (defined as the ratio of a ROI located 5-10 mm proximal to the physis versus a ROI located 20-25 mm proximal to the physis) was 1.61 in symptomatic gymnasts and 1.35 in asymptomatic gymnasts on T2-weighted Dixon (p<0.05).

CONCLUSION
Semi-quantitative Dixon MRI-based water signal fraction assessment has good to excellent reproducibility and shows increased metaphyseal water scores in symptomatic gymnasts compared to asymptomatic gymnastic peers.

CLINICAL RELEVANCE/APPLICATION
This reliable, off-the-shelf semi-quantitative method for assessing metaphyseal bone marrow water content with short scan times can potentially be used as an indicator of bone marrow edema in the early diagnosis of gymnastic physeal stress injury.

LEARNING OBJECTIVES
1) Review the histoanatomy of the growth plate and the physiology behind endochondral ossification. 2) Review the key components of the growth plate complex and the different injury patterns 3) Review the role of imaging in the treatment algorithm.

ABSTRACT
The growth plates (physes) are visible on virtually all imaging studies obtained in skeletally immature children. The proper function of these growth plates depends on an intricate balance between chondrocyte proliferation (requiring nourishment by the epiphyseal vessels) and death (facilitated by the metaphyseal vessels). Therefore, injury to either the growth plate (direct insult) or vascular compromise on either side of the growth plate (indirect insult) can cause growth plate dysfunction. Direct growth plate insults most commonly occur with Salter-Harris fractures and injuries that allow for transphyseal communication of vessels are at a higher risk for subsequent bone bridge formation. Indirect insults produce different sequelae depending upon whether the epiphyseal or metaphyseal blood supply is compromised. Epiphyseal osteonecrosis can produce slowed longitudinal bone growth with possible growth plate closure and is often accompanied by an abnormal secondary ossification center. In contrast, the loss of metaphyseal blood supply disrupts endochondral ossification and allows the persistence of chondrocytes within the metaphysis, which appear as growth plate widening that can be either focal or diffuse. Imaging remains critical for detecting acute injuries and identifying subsequent growth disturbances. Depending on the imaging findings and patient factors, these growth disturbances may be amenable to conservative or surgical treatment options. Therefore, an understanding of the normal growth plate anatomy and physiology and associated pathophysiologies can increase diagnostic accuracy, allow anticipation of future growth disturbances, and ensure optimal imaging by the radiologist with the ultimate goal of timely and appropriate intervention.
The Glenohumeral Joint in Brachial Plexus Birth Palsy (BPBI): Cartilage and Shoulder Muscle Evaluation with T2 Relaxation Time Mapping and Correlation with Disease Severity

PURPOSE

To evaluate the T2 relaxation times of glenoid cartilage and shoulder muscles in children with brachial plexus birth injury (BPBI) as they relate to glenohumeral dysplasia and shoulder function.

METHOD AND MATERIALS

This retrospective study included children with unilateral BPBI who underwent bilateral shoulder 1.5T or 3T MRI. On axial images, mean T2 relaxation times were measured in the glenoid cartilage and in the deltoid, subscapularis, and infraspinatus muscles. Glenoid retroversion and posterior humeral head displacement were measured, and glenohumeral dysplasia was classified by Waters grade. Shoulder function measured by the Mallet Scale and Active Movement Scale (AMS) was evaluated in the subset of patients in whom an MRI and clinical examination were available prior to any surgery and less than 4 months apart. Relationships among all imaging and clinical data were assessed with Pearson correlations for continuous variables and Kendall's Tau-b for categorical variables. T2 values were compared between sides with paired t-tests.

RESULTS

74 children (age 5-216 months, mean 66 months) were included. Age negatively correlated with glenoid cartilage T2 values in unaffected (rho=-0.455, p<0.001) and affected (rho=-0.444, p<0.001) sides, but not with muscle T2 values. Glenoid cartilage T2 values did not differ between affected and unaffected sides. T2 values of all shoulder muscles were significantly higher on the affected side (all p<0.001) and positively correlated with Waters grade (tau=0.22, p=0.016 in deltoid; tau=0.21, p=0.019 in subscapularis; and tau=0.18, p=0.039 in infraspinatus). In the clinical subset (n=24), muscle T2 values did not correlate with global shoulder function on the Mallet scale, but individual muscle T2 values correlated inversely with corresponding specific AMS shoulder functions (tau=-0.33, p=0.036 for deltoid/abduction; tau=-0.55, p<0.001 for infraspinatus/external rotation).

CONCLUSION

Glenoid cartilage T2 relaxation time decreases with age in children, but is unaffected by BPBI. Shoulder muscle T2 relaxation time does not change with age, but is affected by BPBI and correlates with glenohumeral dysplasia and clinical muscle function.

CLINICAL RELEVANCE/APPLICATION

T2 relaxation time can be used to quantify denervation-induced atrophy of specific muscles and to assess the role of this atrophy in the pathophysiology, prognosis, and outcomes of BPBI in children.

How and How Much are the Muscles Affected in Juvenile Localized Scleroderma? A Qualitative and Quantitative MR Study

PURPOSE

Juvenile localized scleroderma (JLS) is characterized by skin thickening and subcutaneous tissue involvement, but it can also extend to the deep tissues affecting muscles and bones. Thus, aim of our study was to perform a qualitative and quantitative MR-based evaluation of muscles in JLS patients (JLSp).

METHOD AND MATERIALS

An electronic search of JLSp referring to our tertiary center from January 2012 to January 2018 was performed. Inclusion criteria were: at least one MR scan at diagnosis including axial T2w fat-sat and axial T1w images of both extremities. The last available follow-up MR, satisfying the above-mentioned criteria was also included. Fatty atrophy (Mercury Scale) and muscle edema (5 points scale) were assessed for the qualitative analyses. Subcutaneous area (SA), muscle perimeter (MP) and muscle area (MA)
were measured (i.e., single slice evaluation at the mostly affected level) on the injured (i) and healthy contralateral (hc) extremity (Student's T-test; p<0.05). Two radiologists performed each measurement independently and the intraclass correlation coefficient was computed.

**RESULTS**

Fourteen JLSp (9 females; mean age 7.1±3.6 yrs) met the inclusion criteria and 23 MR examinations (i.e., 14 at diagnosis and 9 at follow-up) were evaluated. Muscle edema was detected in 12 patients (mean value 1.36) whereas fatty replacement was identified only in one case (grade 2). At diagnosis all quantitative parameters were significantly lower on the injured side (SAi=27.72±17.15cm2 vs SAhc=35.72±26.54cm2; MPI=22.91±5.78cm vs MPhc=26.66±6.91cm; MAi=40.67±18.56cm2 vs MAhc=46.05±22.90cm2, p<0.05, each; ICC raters>.950, each). At follow-up the muscle edema decreased in 6 JLSp and SA, MP, and MA didn't show any significant difference between the two extremities (p>0.05).

**CONCLUSION**

JLSp showed low-grade muscle edema and significant hypoplasia rather than atrophic changes. The therapeutic treatment didn't reduce only the edema but also the quantitative differences between the two extremities. Further studies including a larger population and the evaluation of muscle volume should be performed to further assess this evidence.

**CLINICAL RELEVANCE/APPLICATION**

Muscle hypoplasia rather than atrophy affects JLSp thus an MR-based qualitative and quantitative muscle evaluation, at diagnosis and follow-up, is expected to have a strong clinical impact.

**PURPOSE**

The objective of the present study is to use a novel approach to automatically segment the femoral head from hip MR images and to extract biomarkers that represent early predictors of hip disease. These biomarkers will be related to BMI, physical activity and diet in a large population-based prospective cohort study.

**METHOD AND MATERIALS**

We collected hip MR images in 2870 children at the age of 9 years as part of a MRI study embedded in a prospective cohort study, which follows children from fetal life until early adulthood. The MRI hip protocol (3.0T) was identical for all participants and comprised of two coronal sequences; a T2 and a T1 -weighted sequence. The slice thickness was 1.2 mm for both sequences, all slices were contiguous. Automatic segmentation of the anatomical structure of interest from the MR image was performed using a multi-atlas appearance model, which is multi-modal in that it takes both weighted sequences as input. The model was evaluated using 10-fold cross-validation over a set of T2 and a T1 sequences with corresponding manually drawn femoral head segmentations. After segmentation, shape characteristics of the femoral head will be automatically extracted in a similar way.

**RESULTS**

We were able to segment the femoral bone from MR images accurately (with dice numbers of 0.793-0.869) and are currently working on a method to automatically extract several shape characteristics of the femoral head such as volume, neck-shaft angle and femoral neck width.

**CONCLUSION**

Automatic segmentation of the femoral head from MR images can be accurately done using a multi-atlas appearance model, and shape characteristics can be automatically derived from these segmentations.

**CLINICAL RELEVANCE/APPLICATION**

Automatic segmentation of biomarkers is the first step in relating biomarkers that are early identifiers of disease to BMI, physical activity and diet. With the knowledge obtained from a large population-based cohort, we could intervene in the diet or physical activity levels of young children with early disease characteristics.

**RC313-12**  **Semantic Labeling of Pediatric Musculoskeletal Radiographs Using Deep Learning**

Tuesday, Nov. 27 11:00AM - 11:10AM Room: N228

**Participants**

Paul H. Yi, MD, Baltimore, MD (Presenter) Nothing to Disclose
Tae Kyung Kim, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Jinchi Wei, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Tae Soo Kim, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
CONCLUSION

Combining results for a complete elbow radiographic series, sensitivity was 95%, and specificity was 50%.

EVALUATION (INFECTION) TAKES 0.4 SECONDS PER RADIOGRAPH. SENSITIVITY FOR AN INDIVIDUAL RADIOGRAPH WAS 88%, WITH A SPECIFICITY OF 68%.

RESULTS

Plateaued.

Training was performed for over 250 epochs until accuracy.

Training was performed with transfer learning from a CNN pre-trained on radiographs from the 2017 RSNA Pediatric Bone Age.

The Inception-v3 architecture (Szegedy et al.) was modified to accept an input layer of 1100 x 1100 pixel single-channel images.

Model 'fast-text' (Joulin et al.) was trained to assist classification of radiology reports into normal and abnormal. A CNN based on.

Radiology reports over a 12-month period from January-December 2017 at a dedicated children's hospital. A text-classification.

With IRB approval, we retrospectively retrieved 4311 radiographic studies containing 11988 images of the elbow and associated

The majority of pediatric elbow trauma requiring radiographic evaluation are initially interpreted by non-radiologists or by an adult

CONCLUSION

The purpose of this study is to determine if

musculoskeletal radiologist. Classification of test radiographs occurred at a rate of 33 radiographs per second.

CONCLUSION

DCNNs trained on a small set of images with 30x augmentation through standard processing techniques can classify pediatric

musculoskeletal radiographs into anatomic region with near-perfect to perfect accuracy at superhuman speeds. DCNNs such as

these may improve radiologist workflow through automated labeling of radiographs, identification of relevant comparison

examinations, and improvement of hanging protocols. The proof-of-concept from our work may apply to other body parts and radiographic views to create an all-encompassing semantic labeling DCNN.

CLINICAL RELEVANCE/APPLICATION

DCNNs have good-to-perfect accuracy for automatically classifying pediatric musculoskeletal radiographs into anatomic region at

superhuman speeds, which may enhance radiologist workflow.

RC313-13 MLAEMERG Pinew Branch Pediatric Elbow Emergencies Using a Convolutional

Neural Network: Initial Results

Tuesday, Nov. 27 11:20AM - 11:30AM Room: N228

Participants

Jesse C. Rayan, MD, Houston, TX (Presenter) Nothing to Disclose
Nakul Reddy, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
J. H. Kan, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Ananth Annapragnada, PhD, Houston, TX (Abstract Co-Author) Stockholder, Alzeca Biosciences, LLC Stockholder, Sensulin, LLC Stockholder, Abbott Laboratories Stockholder, Johnson & Johnson
Wei Zhang, PhD, Houston, TX (Abstract Co-Author) Nothing to Disclose

PURPOSE

The majority of pediatric elbow trauma requiring radiographic evaluation are initially interpreted by non-radiologists or by an adult radiologist unfamiliar with normal developmental variations. Accurate interpretation of acute orthopedic emergencies in the pediatric elbow can be challenging. Automated determination of normal versus abnormal radiographs can significantly improve workflow,

patient care, and allow the emergency room provider to focus on other clinical duties. The purpose of this study is to determine if

convolutional neural networks (CNN) can binomially classify pediatric elbow radiographs as normal versus abnormal.

METHOD AND MATERIALS

With IRB approval, we retrospectively retrieved 4311 radiographic studies containing 11988 images of the elbow and associated radiology reports over a 12-month period from January-December 2017 at a dedicated children's hospital. A text-classification model 'fast-text' (Joulin et al.) was trained to assist classification of radiology reports into normal and abnormal. A CNN based on the Inception-v3 architecture (Szegedy et al.) was modified to accept an input layer of 1100 x 1100 pixel single-channel images.

Training was performed with transfer learning from a CNN pre-trained on radiographs from the 2017 RSNA Pediatric Bone Age Challenge on a desktop system with a GTX 1080 Ti. A separate validation dataset was created and verified with two radiology residents examining 911 images and reported findings from 330 studies. Training was performed for over 250 epochs until accuracy plateaued.

RESULTS

Evaluation (inference) takes 0.4 seconds per radiograph. Sensitivity for an individual radiograph was 88%, with a specificity of 68%. Combining results for a complete elbow radiographic series, sensitivity was 95%, and specificity was 50%.

CONCLUSION

For information about this presentation, contact:
pyi10@jhmi.edu

PURPOSE

To develop and test the performance of deep convolutional neural networks (DCNNs) for the automated classification of pediatric musculoskeletal radiographs by anatomic area.

METHOD AND MATERIALS

We obtained 50 anonymized pediatric radiographs each of the shoulder (AP), elbow (lateral), hand (PA), pelvis (AP), and knee (AP) (250 total images). These radiographs were combined into a single database and used to train 5 DCNNs, one to detect each anatomic region. For each DCNN, the radiographs were randomly split into training (70%), validation (10%), and test (20%) datasets. The training and validation datasets were augmented 30x using multiple rotations, flipping, random cropping, and non-rigid deformation. These augmented images were used to train and validate the ResNet-18 DCNN pretrained on ImageNet. All DCNN development and testing was performed using PyTorch on a 2.5 GHz Intel Haswell dual socket (12-core processors) with 128 GB of RAM and 2 NVIDIA K80 GPUs. Receiver operating characteristic (ROC) curves with area under the curve (AUC) and standard diagnostic measures (e.g., sensitivity, specificity, and accuracy) were used to evaluate the DCNN's performance.

RESULTS

All 5 DCNNs trained for classification of the radiographs into anatomic region achieved AUCs of 1 (Table 1). Accuracy, sensitivity, and specificity were 100% for all DCNNs except for the shoulder DCNN, which had 97% accuracy, 90% sensitivity, and 100% specificity. The shoulder DCNN was incorrect in 2 of 60 test cases (both false negatives), which were correctly labeled by a musculoskeletal radiologist. Classification of test radiographs occurred at a rate of 33 radiographs per second.

CONCLUSION

DCNNs trained on a small set of images with 30x augmentation through standard processing techniques can classify pediatric musculoskeletal radiographs into anatomic region with near-perfect to perfect accuracy at superhuman speeds. DCNNs such as these may improve radiologist workflow through automated labeling of radiographs, identification of relevant comparison examinations, and improvement of hanging protocols. The proof-of-concept from our work may apply to other body parts and radiographic views to create an all-encompassing semantic labeling DCNN.
**Automated binomial classification of pediatric elbow radiographs into normal and abnormal is feasible using CNN. Initial results show that the product errs on sensitivity over specificity.**

**CLINICAL RELEVANCE/APPLICATION**

At high volume centers or centers without a radiologist such as stand alone urgent care centers, automated diagnosis of elbow or other diagnostically challenging pediatric appendicular radiographs after acute injury can potentially improve patient care and workflow. CNN facilitated radiographic interpretation is a potential viable tool as improvements in CNN algorithms improve specificity.

**RC313-14  SPARCC Magnetic Resonance Imaging Scoring System for Assessment of Sacroiliitis in Pediatric Patients with Juvenile Spondyloarthritis/Enthesitis Related Arthritis: A Reliability, Validity, and Responsiveness Study**

**Tuesday, Nov. 27 11:30AM - 11:40AM Room: N228**

Participants
Jyoti Panwar, MD, FRCR, Toronto, ON (Presenter) Nothing to Disclose
Shirley M. Tse Sr, MD, Toronto, ON (Abstract Co-Author) Nothing to Disclose
Lillian Lim, MBBS,MD, Toronto, ON (Abstract Co-Author) Nothing to Disclose
Miriamal A. Tolend, BSC, Toronto, ON (Abstract Co-Author) Nothing to Disclose
Andrea S. Doria, MD, Toronto, ON (Abstract Co-Author) Nothing to Disclose
Jennifer Stimec, MD, Toronto, ON (Abstract Co-Author) Nothing to Disclose
Rahim Moineddin, Toronto, ON (Abstract Co-Author) Nothing to Disclose
Shilpa Radhakrishnan, MBBS, DMRD, Chennai, India (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
dryoticmch@gmail.com

**PURPOSE**

Intra- and inter-reader reliability, construct validity and responsiveness of the Spondyloarthritis Research Consortium of Canada (SPARCC) MRI scoring system were investigated for scoring sacroiliitis in pediatric juvenile spondyloarthritis (JSpA)/enthesitis related arthritis (ERA) patients who have received biologic and/or non-biologic treatment.

**METHOD AND MATERIALS**

Ninety whole body MRI examinations with dedicated coronal oblique planes of the sacroiliac joints in 46 patients were independently reviewed and scored by two pediatric musculoskeletal radiologists, blinded to clinical details, using the SPARCC system. Intra- and inter-reader reliability was assessed by intra-class correlation coefficients (ICCs). Construct validity testing was done by 1) correlating the SPARCC MRI scores of sacroiliitis with clinical disease activity indicators (cross-sectional validity); 2) correlating the change in the MRI score with the change in clinical indicators before and after treatment (longitudinal validity). Responsiveness of the MRI and clinical indicators was also evaluated, grouped by biologic and non-biologic treatment.

**RESULTS**

When applied in children with JSpA/ERA, the SPARCC showed almost perfect (ICC 0.79-1.00) intra- and inter-reader reliability. There was poor cross-sectional and longitudinal correlation between clinical assessment indicators and MRI scoring. SPARCC scores showed higher responsiveness to treatment-related change than most clinical outcome measures. Three clinical outcome measures correlated longitudinally with SPARCC score in non-biologic treatment: active joint count (r=0.72, p<0.001), FABER test (r=0.58, p=0.012), and Physician Global Assessment (r=0.61, p=0.034).

**CONCLUSION**

SPARCC MRI scoring system is a reliable tool with relatively higher responsiveness than clinical indicators and is suitable for objective quantification of sacroiliitis when applied to pediatric JSpA/ERA patients. If the results of this pilot study are reproduced in larger series this scoring system may serve as a reliable quantitative method for early detection of axial disease, to monitor disease activity and response to therapy.

**CLINICAL RELEVANCE/APPLICATION**

The application of this radiologic scoring index into clinical practice may serve as a reliable quantitative method to assess the degree of SI joint inflammation even in the subclinical stage and potentially to monitor disease activity, and response to therapy.

**RC313-15  Imaging of Juvenile Idiopathic Arthritis**

**Tuesday, Nov. 27 11:40AM - 12:00PM Room: N228**

Participants
Karen Rosendahl, Bergen, Norway (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) To identify features of joint inflammation and destructive change on plain radiographs, ultrasound and MRI. 2) To appreciate the role of ultrasound for detecting and grading of inflammation in JIA. 3) To understand the appearances of synovitis and its mimickers on MRI.
Emerging Technology: Dual Energy and Spectral CT Update 2018

Tuesday, Nov. 27 8:30AM - 10:00AM Room: 5505AB

**Participants**

Savvas Nicolaou, MD, Vancouver, BC (*Moderator*) Institutional research agreement, Siemens AG

For information about this presentation, contact:
savvas.nicolaou@vch.ca

**LEARNING OBJECTIVES**

1) Briefly review the principles of Dual Energy CT/Spectral imaging. 2) Review virtual non-contrast imaging, iodine mapping, material decomposition, and monoenergetic imaging. 3) Review cases demonstrating abdominal organ perfusion and oncologic applications in the abdomen. 4) To outline novel applications of dual energy CT in assessing bone marrow edema, gout, ligament/tendon analysis and metal artifact reduction. 5) To outline novel techniques using Dual Energy CT in pulmonary embolism, cardiac ischemia assessment. 6) Review DECT/spectral imaging applications in the brain.

---

**Sub-Events**

**RC317A  Update on the Clinical Applications of Multi-Energy CT in Cardiothoracic Imaging**

Participants

Prabhakar Rajiah, MD, FRCR, Dallas, TX (*Presenter*) Nothing to Disclose

For information about this presentation, contact:
radpr73@gmail.com

**LEARNING OBJECTIVES**

1) To describe the different implementations of multi-energy CT technology. 2) To discuss the updates on the utility of multi-energy CT in cardiothoracic imaging. 3) To review the applications of multi-energy CT in cardiothoracic imaging.

**Honored Educators**

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

Prabhakar Rajiah, MD, FRCR - 2014 Honored Educator

**RC317B  Novel Neuroradiology Dual Energy/Spectral CT Clinical Applications**

Participants

Aaron D. Sodickson, MD,PhD, Boston, MA (*Presenter*) Institutional research agreement, Siemens AG; Speaker, Siemens AG; Speaker, General Electric Company

For information about this presentation, contact:
asodickson@bwh.harvard.edu

**LEARNING OBJECTIVES**

1) Review Dual Energy CT fundamentals and post-processing applications. 2) Demonstrate the utility of Dual Energy CT to add value in neuro-imaging, including pathology detection, lesion characterization, diagnostic confidence, and reduced length-of-stay.

**Honored Educators**

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

Aaron D. Sodickson, MD,PhD - 2014 Honored Educator  

Aaron D. Sodickson, MD,PhD - 2017 Honored Educator  

Aaron D. Sodickson, MD,PhD - 2018 Honored Educator

**RC317C  Dual Energy/Spectral CT of the Abdomen: What Matters Most to the Clinician**

Participants

Desiree E. Morgan, MD, Birmingham, AL (*Presenter*) Institutional Research Grant, General Electric Company

For information about this presentation, contact: dmorgan@uabmc.edu
LEARNING OBJECTIVES

1) Apply strategies of dual energy CT for streamlined characterization of incidentally detected intra-abdominal abnormalities such as hepatic steatosis, adrenal adenomas, and renal lesions. 2) Develop and utilize post processing techniques that improve detection and identification of clinically relevant imaging features of abdominal tumors. 3) Understand limitations and compare workflow differences among major dual/multienergy scanning systems for abdominal applications.

RC317D Current and New Clinical Applications in Musculoskeletal Dual Energy/Spectral CT

Participants
Fabio Becce, MD, Lausanne, Switzerland (Presenter) Nothing to Disclose

For information about this presentation, contact:
fabio.becce@chuv.ch

LEARNING OBJECTIVES

1) Comprehend the basic principles and technical aspects of dual- and multi-energy CT when imaging the musculoskeletal system. 2) Apply dual-energy CT when assessing various musculoskeletal disorders, from crystal-related arthropathies to bone marrow edema. 3) Identify potential new applications of dual-energy CT in musculoskeletal imaging, such as CT arthrography and iron-related disorders.
Case-based Review of Nuclear Medicine: PET/CT Workshop—Chest and Musculoskeletal PET/CT (In Conjunction with SNMMI) (Interactive Session)

Tuesday, Nov. 27 10:30AM - 12:00PM Room: E450B

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

Participants
Samuel E. Almodovar-Reteguis, MD, Orlando, FL (Director) Nothing to Disclose
Katherine A. Zukotynski, MD, Ancaster, ON (Director) Nothing to Disclose
Delphine L. Chen, MD, Saint Louis, MO (Moderator) Nothing to Disclose

Sub-Events

MSCC32A Chest
Participants
David M. Naeger, MD, San Francisco, CA (Presenter) Nothing to Disclose

For information about this presentation, contact:
david.naeger@ucsf.edu

LEARNING OBJECTIVES
1) Describe the classic PET/CT appearance of various types of lung cancer. 2) Compare the imaging features that are similar between different types of lung cancer.

ABSTRACT
The classic PET/CT appearance of various types of lung cancers will be reviewed. Similarities and differences between different types of lung cancer will be presented in an effort to help attendees interpret thoracic imaging with more confidence and be more helpful in interdisciplinary settings.

MSCC32B Musculoskeletal
Participants
Gary A. Ulaner, MD, PhD, New York, NY (Presenter) Research support, General Electric Company; Research support, F. Hoffmann-La Roche Ltd; Research support, Novartis AG

For information about this presentation, contact:
ulanerg@mskcc.org

LEARNING OBJECTIVES
1) Demonstrate how to integrate the FDG PET and CT components of an FDG PET/CT exam to distinguish benign and malignant osseous lesions. 2) Identify common benign causes of FDG-avidity in the musculoskeletal system.
SSG08

Musculoskeletal (Machine Learning and Artificial Intelligence)
Tuesday, Nov. 27 10:30AM - 12:00PM Room: S102CD

PURPOSE
To assess the performance of an fully automated deep learning method in producing radiological gradings of spinal MRI in the context of management of chronic back pain

METHOD AND MATERIALS
A dataset comprising images of 12,018 individual discs from 2009 patients were retrospectively collected from 6 different referral centers in the UK, Hungary, Slovenia and Italy in a previous EU project (Genodisc). The primary selection for recruitment to Genodisc was "patients who seek secondary care for their back pain or spinal problem" and were sourced from routine clinical management. The MRI machines and protocols varied between the sites but included at least one standard T2 sagittal MRI acquisition which, for consistency, was used for all of the results reported here, though the system is capable of using the T1 and axial images also. The scans were annotated with the following radiological scores by a single experienced spinal radiologist: Pfirrmann grade, disc narrowing, endplate defects, marrow changes, spondylolisthesis and central canal stenosis. To test the radiologist's intra-rater variability, they repeated their grading on a subset of 200 patients randomly interdispersed throughout the entire dataset. For training, the dataset was split into a 80:10:10 train:validation:test sets on a per patient basis (not per disc). This resulted in 1806 patients (10,836 discs) for training and 203 patients (1,224 discs) for testing. A multi-class Convolutional Neural Network (CNN) was trained using Deep Learning to predict all of the gradings. Accuracy was measured by comparing the output of the system to the radiologist annotations using class-balanced accuracy. Multi-way cross-validation was used to test the efficacy and repeatability of the system.

RESULTS
The average class balanced accuracy for the SpineNet system was 86.3% (+/- 0.3). This compares favourably to the radiologists intra-rater repeatability of 82.5%.

CONCLUSION
The SpineNet system can produce accurate and repeatable gradings for a range of spinal MRI radiological gradings used in chronic back-pain clinical management and research. Such gradings may be used to augment the radiologist report, improve consistency and communication with the referring physician.

CLINICAL RELEVANCE/APPLICATION
Quantitative gradings of spinal degeneration may be a useful adjunct to routine qualitative report of spinal MRI and improve communication with the referring physician.

SSG08-01 SpineNet: Automated Vertebra and Disc Gradings Using Deep Learning

Participants
Timor Kadir, Oxford, United Kingdom (Presenter) Employee, Optellum Ltd;
Andrew Zisserman, PhD, MA, Oxford, United Kingdom (Abstract Co-Author) Nothing to Disclose
Jeremy Fairbank, Oxford, United Kingdom (Abstract Co-Author) Nothing to Disclose
Amir Jamaludin, Oxford, United Kingdom (Abstract Co-Author) Nothing to Disclose
Jill Urban, Oxford, United Kingdom (Abstract Co-Author) Nothing to Disclose

SSG08-02 Can a Machine Diagnose an Anterior Cruciate Ligament Tear? Fully-Automated Detection System Using Deep Learning

Participants
Bochen Guan, Madison, WI (Abstract Co-Author) Nothing to Disclose
Fang Liu, PhD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Humberto G. Rosas, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Kevin Lian, Verona, WI (Abstract Co-Author) Nothing to Disclose
Ali Guermazi, MD, PhD, Boston, MA (Abstract Co-Author) Shareholder, Boston Imaging Core Lab, LLC; Research Consultant, Merck
PURPOSE
To investigate the use of a deep learning (DL) approach to create a fully-automated prediction model for detecting anterior cruciate ligament (ACL) tears of the knee joint.

METHOD AND MATERIALS
The proposed deep learning approach consisted of two neural networks connected in a cascaded fashion to create a fully-automated processing pipeline. The first network performed rapid segmentation of the intercondylar notch on two to three consecutive image slices, while the second classification network evaluated structural abnormalities within the segmented anatomic region. Sagittal proton density-weighted fast spin-echo (PD-FSE) and fat-suppressed T2-weighted fast spin-echo (T2-FSE) sequences were acquired using the same 3T scanner on the knees of 200 subjects (100 subjects with a torn ACL and 100 subjects with an intact ACL at subsequently performed knee arthroscopy). The DL method was trained to detect ACL tears using both the PD-FSE and T2-FSE images on 100 randomly chosen subjects and evaluated on the remaining 100 subjects. Diagnostic performance of the DL method was assessed with receiver operation characteristic (ROC) and area under curve (AUC) analysis using arthroscopy as the reference standard. The diagnostic performance of a musculoskeletal radiology fellow and an experienced fellowship-trained musculoskeletal radiologist for detecting ACL tears in the same subject population was also calculated.

RESULTS
For the fellow and radiologist, the sensitivity (95%CI) for detecting ACL tears was 94% (81%-99%) and 97% (86%-100%) respectively, while the specificity (95%CI) was 98% (92%-100%) and 98% (92%-100%) respectively. In comparison, the sensitivity (95%CI) and specificity (95%CI) for the DL method for detecting ACL tears at the optimal threshold by the Youden index was 89% (74%-97%) and 98% (92%-100%) respectively. The AUC (95%CI) for the DL method was 0.942 (0.876-0.979, p<0.001), indicating high overall diagnostic performance.

CONCLUSION
A fully-automated DL approach showed high diagnostic performance for detecting surgically confirmed ACL tears, but its sensitivity was slightly lower than human readers indicating the need for larger training datasets to maximize diagnostic performance.

CLINICAL RELEVANCE/APPLICATION
A fully-automated DL approach trained on a small image dataset shows promise for detecting ACL tears but requires further optimization to achieve diagnostic performance comparable to human readers.

Awards
Student Travel Stipend Award
Participants
Karen Cheng, MD, Orange, CA (Presenter) Nothing to Disclose
Charles Lin, Irvine, CA (Abstract Co-Author) Nothing to Disclose
Daniel S. Chow, MD, Orange, CA (Abstract Co-Author) Nothing to Disclose
Peter Chang, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
pchang077@gmail.com

PURPOSE
To evaluate a multi-step deep learning tool, based on convolutional neural networks (CNN), for fully-automated localization of vertebral bodies and detection of fracture on CT.

METHOD AND MATERIALS
After IRB approval, an institutional database was queried to identify patients with cervical, thoracic or lumbar CT obtained between January 2016 and 2017. For each patient, sagittal bone reconstructions were used to manually generate bounding cubes for each vertebral body. Additionally, all levels with a vertebral body fracture were identified. Final annotations were confirmed through visual inspection by a board-certified radiologist. A 3D mask R-CNN architecture based on a feature pyramid backbone was used to regress bounding cube locations for each vertebrae (Figure 1A). Subsequently, each vertebrae was cropped, resampled and used as input into a second 3D residual CNN for detection of fracture (Figure 1B). The 34-layer residual CNN architecture was implemented with bottleneck layers and all-convolutional design (no pooling). Performance was assessed on per vertebrae and per patient levels.

RESULTS
A total of 440 patients were included in this study, 88 of which had at least one vertebral body fracture. Overall, 174 of 3,206
individual levels contained a fracture. Accuracy, AUC, sensitivity, specificity, PPV and NPV were 0.961, 0.956, 0.845, 0.967, 0.590, 0.991 (per-vertebrae) and 0.859, 0.836, 0.875, 0.823, 0.558, 0.963 (per-patient). Combined, serial inference for the 3D mask R-CNN followed by the 3D residual CNN required 2.19 seconds per patient on a single GPU workstation.

CONCLUSION
A custom deep learning based tool is accurate for detection of vertebral body fracture. Given the potential subtle appearance of fractures and high resolution of CT spine imaging, a two-part serial architecture was required to integrate complimentary large field-of-view (vertebral body localization) and small field-of-view (fracture detection) information needed for this task.

CLINICAL RELEVANCE/APPLICATION
A high-performing deep learning tool for CT spine fracture detection can be used for rapid triage in the acute trauma setting, optimizing radiology workflow and expediting patient care.

SSG08-04  Automatic Detection of Distal Radius Fractures in X-Ray Images using Deep Learning

Participants
Christian A. Bluethgen, MD, MSc, Zurich, Switzerland (Presenter) Nothing to Disclose
Ilaria Vittoria de Martini, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Anton S. Becker, MD, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Thomas Frauenfelder, MD, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
christian.bluethgen@usz.ch

PURPOSE
The aim of this study was to evaluate the diagnostic performance of a multi-purpose, deep-learning based image analysis software for the detection of wrist fractures.

METHOD AND MATERIALS
In this retrospective study, patients with suspected wrist fractures on X-ray imaging studies ordered by the ER department between 2016 and 2017 were included. After applying exclusion criteria (e.g. presence of osteosynthesis material), the remaining X-ray images were labeled for the presence of radius fractures. In uncertain cases, CT studies were consulted, excluding cases missing CT confirmation. The cases were randomly split into training and test set (85% and 15%, respectively). A multi-purpose image analysis software was trained for the decision whether a distal radius fracture was present on the X-ray image. Training data was augmented (e.g. by horizontal flipping, shifting, rotating, scaling). The test set was subsequently processed by the trained system. Performance was measured as area under the ROC curve (AUC) from the score the software assigned to each image. Sensitivity and specificity were calculated at the optimal threshold as indicated by Youden's index. Finally, the test set was evaluated by an attending radiologist and a radiology resident with 16 and 2 years of experience, respectively.

RESULTS
The included images featured 171 cases with fractures and 562 controls, amounting to 733 X-ray images of 277 different patients. The training and evaluation set consisted of 573 and 160 X-ray images, respectively. The diagnostic performance of the trained software on the test set of 160 X-ray images was excellent with an AUC of 0.91 (95%-CI 0.85-0.95). It therefore performed comparable to a radiology resident (AUC 0.87, p=0.25) but worse than the attending radiologist (AUC 0.98, p<0.01). Sensitivity and specificity of the software at the optimal threshold were calculated to be 88.5% and 89.9%, respectively. Heatmaps drawn as an image overlay by the software indicated areas suspicious for defects as useful visual feedback. The interreader agreement of the human readers was substantial with a Cohen's kappa of 0.71 (95%-CI 0.60-0.82).

CONCLUSION
The software was able to detect wrist fractures with high sensitivity and specificity, using only a small dataset for training. It performed on a par with the radiology resident reader.

CLINICAL RELEVANCE/APPLICATION
Deep-learing based software is useful for the detection of wrist fractures.

SSG08-05  Multi-Tissue Segmentation for Body Composition Using a Deep Convolutional Neural Network

Participants
Benjamin Wang, MD, Boston, MA (Presenter) Nothing to Disclose
Andrew Tsao, Boston, MA (Abstract Co-Author) Nothing to Disclose
Martin Torriani, MD, Lincoln, MA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
torriani@mgh.harvard.edu

PURPOSE
To develop and test a deep convolutional neural network (CNN) to automatically segment abdominal CT images for body composition measures. We hypothesized that a deep CNN would achieve high accuracy using a limited training dataset and data augmentation.
METHOD AND MATERIALS

We manually segmented single-slice CT images obtained at the level of L4 (80kV, 70mAs, 10mm slice thickness, 50cm field of view) in 160 subjects for determination of body composition. Manual segmentation was performed on 512x512 pixel images to label 6 classes: background, muscle, bone, bowel/solid organs, visceral and subcutaneous fat. Twenty cases were segregated for a test dataset. The remaining 140 underwent a processing pipeline of histogram equalization followed by data augmentation (N=2,000), which included random modifications, horizontal mirroring, Poisson noise, cropping and magnification. We trained our model from scratch on Keras/Tensorflow using an 80/20 training/validation split and a U-Net architecture (8 batch size, 50 epochs, dropout 0.3, initial learning rate 0.0001, softmax). Testing was performed to obtain the Dice (F1) score as a parameter to compare the similarity between manual vs. CNN-based multi-class segmentation.

RESULTS

The overall mean Dice score was 96% (median 97%, range, 94-98). Mean Dice scores for each class were: background 98% (median 98%, range, 96-99), bone 87% (86%, 83-92), subcutaneous fat 94% (96%, 87-98), muscle 91% (91%, 84-97), bowel/solid organs 99% (90%, 83-94), and visceral fat 81% (88%, 45-93). Visceral fat demonstrated the broadest accuracy range, which may derive from its more variable quantity and morphology, representing an important focus to improve algorithm performance.

CONCLUSION

Our results show overall accurate automated abdominal CT segmentation for body composition using a deep CNN algorithm, trained on a limited dataset with data augmentation. While segmentation accuracy was generally high for most classes (>81%), improvement of algorithm performance will focus on strategies to increase visceral fat segmentation accuracy. This workflow may serve as a basis for future models aimed at automated segmentation of entire abdominal CT studies for body composition.

CLINICAL RELEVANCE/APPLICATION

Deep CNN algorithms for tissue segmentation are promising methods to obtain body composition measurements, and may allow efficient and automatic data extraction in opportunistic and population studies.

SSG08-06  End to End Solution for Complete Thigh Muscle Semantic Segmentation from Musculoskeletal CT using Deep Learning

Tuesday, Nov. 27 11:20AM - 11:30AM Room: S102CD

Participants
Hasnine A. Haque, DSc, PhD, Hino, Japan (Presenter) Employee, General Electric Company; Researcher, Keio University School of Medicine Science
Masahiro Hashimoto, Shinjuku-Ku, Japan (Abstract Co-Author) Nothing to Disclose
Nozomu Uetake, Hino, Japan (Abstract Co-Author) Nothing to Disclose
Masahiro Jinzaki, MD, Tokyo, Japan (Abstract Co-Author) Support, Canon Medical Systems Corporation;

For information about this presentation, contact:
N/A

PURPOSE

The goal is to develop and validate a 2.5D deep learning neural network (DLNN) to automatically classify thigh muscle into 10 classes and evaluate its classification accuracy over 2D DLNN.

METHOD AND MATERIALS

The clinical dataset consists of 48 thigh volume(TV) cropped from 24 anonymized non-contrast CT DICOM of lower extremities. Cropped volumes were aligned with femur axis and resample in 2mm voxel spacing. To reduce the annotation workload, final expert ground truth annotation was created by editing the predicted labels of muscle by a newly developed stacked U-Net DLNN. Stacked U-Net produces relatively higher segmentation accuracy on smaller muscles even when it is trained with small number annotated datasets. Proposed 2.5D DLNN consists of three 2D U-Net(optimizer: Adam, lr=1e-4,decay=1e-3) trained with axial, coronal and sagittal muscle slices respectively. A voting algorithm was used to combine the output of 2D U-Nets to create final segmentation. 2.5D U-Net was trained on PC(Intel Xeon 2.20GHz 128GB, NVIDIA Tesla P100-SXM2-16GB) with 38 TV(Epoch:100, Batch:32) and the remaining 10 TV were used to evaluate segmentation accuracy of 10 classes within Thigh. The result segmentation of both left and right thigh were de-cropped to original CT volume space. Finally, segmentation accuracies were compared between proposed DLNN and 2D U-Net(axial).

RESULTS

Average segmentation DSC score accuracy of all classes with 2.5D U-Net as 91.18% and Housdorff distance(HD) as 17mm. We found DSC score for 2D U-Net was 2.9% lower and HD was more than four times higher than the that of 2.5D U-Net.

CONCLUSION

Successfully implemented end-to-end solution for complete automatic classification with reasonable accuracy of thigh muscle into 10 classes . The same could be easily extend to muscle segmentation of any other body parts (lower limb, arm, shoulder etc. ). To date, there is no other study of deep machine learning algorithm used except our study for CT based semantic muscle segmentation.

CLINICAL RELEVANCE/APPLICATION

Muscle segmentation functionality on PACS may improve visibility and can enable automatic quantitative evaluation of muscle atrophy with the disease progression. Change in volume or shapes of muscles will enable therapeutic interventions to be targeted to the affected regions only.

SSG08-07  A Deep-Learning System for Fully-Automated Muscle Assessment on Abdominal CT for Opportunistic Detection of Sarcopenia

Tuesday, Nov. 27 11:30AM - 11:40AM Room: S102CD
Of the 1,573 radiographs tested, the algorithm predicted sex correctly with 95.4% accuracy (95.2% in female and 95.7% in male).

RESULTS

We compiled a dataset of 10,607 (5,148 male and 5,459 female) radiographs of hand and wrist from a cohort of patients, ranging from 5 years to 80 years of age. A total of 7,461 radiographs were used for training, and 1,573 images separate from the training data were randomly selected for validation. Images from the remaining 1,573 cases were reserved for testing. The images were labeled solely with the sex of the subject. We fine-tuned an ImageNet-pretrained VGG16 convolutional neural network (CNN) on our data were randomly selected for validation. Images from the remaining 1,573 cases were reserved for testing. The images were labeled solely with the sex of the subject. We fine-tuned an ImageNet-pretrained VGG16 convolutional neural network (CNN) on our data.

METHOD AND MATERIALS

First, individual lumbar vertebral bodies are segmented to separate bone from soft tissue, and create reference anatomic levels for muscle analysis, via thresholding, morphologic operations, and aggregated intensity profiles. Next, muscle groups at reference vertebral levels are segmented on axial images by a holistically nested neural network through image-to-image training and classification. There are varying reference level and muscle group standards for sarcopenia determination in different medical and surgical specialties. To accommodate this, the system performs analysis for multiple muscle groups and vertebral levels. Segmentation accuracy was assessed via Dice Similarity Coefficient, a measure of overlap between manual and automated segmentations. The system was trained on contrast enhanced portal venous phase CTs of 51 patients and tested on 51 cases (average age 67 (range 59-81), 53 F, 49 M). For demonstration here, the system was designed to calculate sarcopenia via the standard cutoff value for L3 SMI (skeletal muscle index: L3 axial muscle area cm²/patient ht m²) of < 3.62cm²/m² for women and <4.93 cm²/m² for men, as proposed by international consensus of cancer cachexia.

RESULTS

The Dice coefficients for the psoas, paraspinous, and total abdominal muscle groups in the training and testing sets were 0.953 +/- 0.015 and 0.938 +/- 0.028, respectively at the level of the third lumbar vertebra. The mean normalized L3 SMI was 5.02 +/- 1.45 cm²/m² for women and 6.18 +/- 1.83 cm²/m² for men. Sarcopenia was present in 15.4% (8/52) of women and 13.3% (6/45) of men.

CONCLUSION

This fully-automated system can robustly detect, accurately segment, and generate quantitative statistics for multiple abdominal wall muscle groups at multiple lumbar vertebral levels on CT scans.

CLINICAL RELEVANCE/APPLICATION

Automated quantification of sarcopenia may guide patient management in pre-treatment risk assessment and surgical planning, and act as a platform to facilitate large scale clinical trials.

SSG08-08 Machine-Learning-Based Discovery of Sexual Dimorphism of Hand and Wrist Radiographs

Tuesday, Nov. 27 11:40AM - 11:50AM Room: S102CD

Participants

Sehyo Yune, MD,MPH, Boston, MA (Presenter) Nothing to Disclose
Hyunkwang Lee, Boston, MA (Abstract Co-Author) Nothing to Disclose
Shahein H. Tajmir, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Michael S. Gee, MD, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Synho Do, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
sehyo.yune@mgh.harvard.edu

PURPOSE

Skeletal sexual dimorphism develops mostly in the pelvis during puberty. Although prior work has shown higher second-to-fourth digit ratio and smaller carpal bones in women compared to men, the distributions of these measures substantially overlap for women and men. We aim to create a machine-learning algorithm to distinguish sex from hand and wrist radiographs and evaluate its performance by comparing it to radiologists'.

METHOD AND MATERIALS

We compiled a dataset of 10,607 (5,148 male and 5,459 female) radiographs of hand and wrist from a cohort of patients, ranging from 5 years to 80 years of age. A total of 7,461 radiographs were used for training, and 1,573 images separate from the training data were randomly selected for validation. Images from the remaining 1,573 cases were reserved for testing. The images were labeled solely with the sex of the subject. We fine-tuned an ImageNet-pretrained VGG16 convolutional neural network (CNN) on our training dataset. The best CNN, selected based on the validation loss, then provided automated prediction of sex, which was compared to the sex in the medical record. To compare the performance with human radiologists, we randomly selected 50 cases for which the CNN correctly predicted sex. Two radiologists independently read the hand and wrist radiographs and predicted sex for these 50 cases. The radiologists were blinded to clinical information of the patients but were allowed to use reference such as the Greulich and Pyle atlas while reading the radiographs.

RESULTS

Of the 1,573 radiographs tested, the algorithm predicted sex correctly with 95.4% accuracy (95.2% in female and 95.7% in male).
The two radiologists showed 58% (45.8% in female and 69.2% in male) and 46% (50% in female and 57.7% in male) accuracy. The class activation maps (CAM) showed that the CNN mostly focused on 2nd and 3rd metacarpal base or 4th and 5th metacarpal head in women, and radioulnar/radiocarpal joint or 2nd, 3rd, and 4th metacarpophalangeal joints in men.

CONCLUSION
We developed an algorithm that accurately distinguishes men and women from hand and wrist radiographs in children as well as in adults.

CLINICAL RELEVANCE/APPLICATION
The current study shows the discovery of previously unrecognized radiologic features using machine learning. It could be used in screening of disorders affecting sexual development.

SSG08-09  Automated Radiograph Based Preoperative Measurements in FAI Patients Utilizing Deep Learning

Tuesday, Nov. 27 11:50AM - 12:00PM Room: S102CD

Participants
Simukayi Mutasa, MD, New York, NY (Presenter) Nothing to Disclose
Zenas Igbinoba, New York, NY (Abstract Co-Author) Nothing to Disclose
Michael J. Rasiej, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Tony T. Wong, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
s.mutasa@columbia.edu

PURPOSE
Utilize deep learning to obtain preoperative measurements from radiographs in patients with femoroacetabular impingement.

METHOD AND MATERIALS
A retrospective study of patients with femoroacetabular impingement was performed. 181 unique patients who underwent CT scan of the hip for preoperative measurement of alpha angle (AA), acetabular version (AV), femoral version (FV) and lateral center edge (LCE) were identified. The training set consisted of 1084 radiographs. This was made up of available preoperative false profile, Dunn, frog leg and AP radiographs (n=419) and augmented with digitally reconstructed radiographs (DRRs) generated from the CT scans at different views (n=665). A novel convolutional neural network (CNN) based on a DenseNet architecture with 54 hidden layers and a regression head was trained on 256x256 input images to predict LCE measurement. For testing AA, AV, and FV measurements, both a regression output and a binary classifier for normal and abnormal ranges were tested. Parameters were tuned based on a 20% validation group generated from the training set. The sequestered testing set consisted of 95 preoperative radiographs at various views and corresponding measurements from accompanying CT scans.

RESULTS
Overall mean absolute error (MAE) and standard deviation of the error for LCE measurement was 3.2° ± 2.3°. Performance of the network was best on false profile views of the hip (3.0° ± 2.2°) but this difference was not statistically significant. AA, AV and FV prediction performance was evaluated, however the performance of the network was not predictive in the current implementation.

CONCLUSION
Deep learning techniques applied to radiographs can be used for quantitative measurement of LCE. With further modification and additional examples, quantitative measurement of AA, AV and FV may be possible.

CLINICAL RELEVANCE/APPLICATION
An accurate, automated system designed to obtain FAI measurements from radiographs can obviate the need for CT and has the potential to decrease healthcare costs, decrease patient exposure to radiation and increase radiologist efficiency.
Automatic Femoral Neck Fracture Detection and Classification Utilizing Advanced Deep Learning Techniques

Station #1

Awards
Student Travel Stipend Award

PURPOSE
To use an algorithm augmented by recent advances in deep learning to accurately diagnose femoral neck fractures.

METHOD AND MATERIALS
An IRB approved retrospective case-control study of patients with femoral neck fractures was performed. 1063 unique AP hip radiographs without hardware were obtained from 550 patients. Ground truth labels of Garden fracture classification were applied by a fellowship trained MSK radiologist. Group A consisted of 127 Garden I and II fractures, Group B consisted of 610 Garden III and IV fractures and the third group consisted of 326 normals. An initial convolutional neural network (CNN) was trained to localize the femoral neck and produce an 850x850 pixel crop. These crops were used as inputs into a second CNN which predicted the presence of Garden I/II versus III/IV fracture or absence of a fracture. Advanced data augmentation techniques were used to expand the training set including using images produced by a generative adversarial network (GAN). Additionally, the training set was augmented by digitally reconstructed radiographs (DRRs) from affine warped hip CT scans representing 31 patients in the training data set who had a pre operative hip CT for concern of fracture. In all, 6000 total examples, real and generated were available for training. 256x256 pixel images were input into the final network. A baseline deep neural network with a wide-residual architecture and a spatial transformer layer was utilized. Parameters were tuned based on a 20% validation group. A class balanced holdout set of 105 patients was utilized as the testing set with 35 patients of each class.

RESULTS
Two class prediction of fracture vs no fracture (AUC 0.92): Accuracy 91.4%, sensitivity 0.90, specificity 0.94, PPV 0.97, NPV 0.83.
Three class prediction of normal, Garden I/II and Garden III/IV (macro AUC 0.96): Accuracy 86.0%, sensitivity 0.79, specificity 0.94, PPV 0.80, NPV 0.90.

CONCLUSION
Advanced data augmentation and deep learning techniques can be used for accurate diagnosis of femoral neck fractures with a relatively small data set.

CLINICAL RELEVANCE/APPLICATION
This may improve radiologist workflow and allow for faster patient triage in the emergency setting.

CT-Guided Percutaneous Cryoablation of Musculoskeletal Lesions: Success and Fail

PURPOSE
-Evaluation of image criteria of favorable response to treatment of musculoskeletal lesions by percutaneous cryoablation. -To identify the basis for treating musculoskeletal lesions with cryoablation and to explain the expected outcomes and how to minimize procedure-related complications.

**METHOD AND MATERIALS**

Observational retrospective study of heterogeneous sample of patients (n=11, 7 females, 4 males) with musculoskeletal lesions. We analyze of imaging outcomes of 13 CT-guided cryoablations performed in our center since 2016. Histological diagnosis included 4 bones and 9 soft tissue lesions: metastasis (n=2), angioendothelioma (n=1), chondroblastoma (n=1), chondrosarcoma (n=2), deep fibromatosis (n=4), pleomorphic sarcoma (n=1); saphenous neuropathy (n = 1); endometriosis in the abdominal wall (n=1). Cryoablation methods, clinical outcomes, complications and oncological outcomes were analyzed. 17 G and 15 G probes were used.

**RESULTS**

The patients’ average age was 51 years (17-68). The average length of the procedure was 140 min, and the number of probes was 2.7 (range 1-7). The average size of tumor after 3-6 months changed from 45 mm to 39 mm (0-115) for soft tissue lesions, and from 32.5 mm to 10mm (0-25) for bone lesions. During follow-up, three fibromatosis cases (3m, 9m, 24m), endometriosis (3m), mandibular (9m) and chordoma metastasis (18m) showed favorable response with no evidence of local recurrence. A fibromatosis case was incompletely ablated because nerve involvement with enrollment of the non-ablated component. Chondrosarcoma cases, bone angioendothelioma (6m), and chondroblastoma (6m) have shown initial positive response with local progression afterwards. Saphenous nerve neurolysis got 5 months of absolute pain relieve. Complications included 1st grade skin burns, three transient palsy of adjacent nerves, and intraarticular dissemination of knee chondroblastoma, from a previous pathological fracture.

**CONCLUSION**

Percutaneous cryoablation is effective achieving local control for <5 cm lesions and alleviating pain in larger size tumors and could be used as a minimal invasive therapeutic option in selected patients.

**CLINICAL RELEVANCE/APPLICATION**

Current advances in the field of cryoablation have improved the capabilities for this technique, and provides a complementary treatment option for many patients with musculoskeletal lesions. According to our results, we propose several indications and practice patterns.

**MK372-SD-TUA3 Proton Density Fat Fraction (PDFF) MR Imaging for Differentiation of Acute Benign and Malignant Vertebral Body Fractures**

Station #3

Participants
Frederic Carsten Schmeel, Bonn, Germany (Abstract Co-Author) Nothing to Disclose
Julian A. Luetkens, MD, Bonn, Germany (Presenter) Nothing to Disclose
Frank Traeber, Bonn, Germany (Abstract Co-Author) Nothing to Disclose
Simon J. Enkirch, Bonn, Germany (Abstract Co-Author) Nothing to Disclose
Andreas Feisst, MD, Bonn, Germany (Abstract Co-Author) Nothing to Disclose
Christoph H. Endler, MD, Bonn, Germany (Abstract Co-Author) Nothing to Disclose
Leonard C. Schmeel, Bonn, Germany (Abstract Co-Author) Nothing to Disclose
Hans H. Schild, MD, Bonn, Germany (Abstract Co-Author) Nothing to Disclose
Guido M. Kukuk, MD, Bonn, Germany (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
carsten.schmeel@ukb.uni-bonn.de

**PURPOSE**

The aim of this prospective study was to evaluate the diagnostic performance of quantitative proton density fat fraction (PDFF) magnetic resonance imaging (MRI) to differentiate between acute benign and malignant vertebral compression fractures.

**METHOD AND MATERIALS**

Fifty-seven consecutive patients with a total of 87 vertebral compression fractures were prospectively enrolled in this institutional review board approved study. All patients underwent routine clinical MRI with an additional six-echo modified Dixon sequence of the spine at a clinical 3.0-Tesla scanner. Intravertebral PDFF and PDFF-ratio (fracture PDFF / normal vertebrae PDFF) for benign and malignant vertebral compression fractures were calculated using region-of-interest (ROI) analysis and compared between both groups. Additional receiver operating characteristic (ROC) and binary logistic regression analyses were performed. All fractures were categorized as benign or malignant according to either direct bone biopsy or 6-month follow-up MRI.

**RESULTS**

There were 46 acute benign and 41 malignant vertebral compression fractures. Both PDFF and PDFF-ratio of malignant vertebral compression fractures were significantly lower compared to acute benign VCFs (PDFF, 3.48±4.30% vs. 23.99±11.86% [p<0.001]; PDFF-ratio, 0.09±0.09 vs. 0.49±0.24 [p<0.001]). The areas under the ROC-curves were 0.98 for PDFF and 0.97 for PDFFratio, yielding an accuracy of 96% and 95% for the differentiation of acute benign from malignant vertebral compression fractures. On multivariate analysis, intravertebral PDFF remained as the only imaging-based variable to independently differentiate between acute benign and malignant vertebral compression fractures (odds ratio, 0.454; p=0.005).

**CONCLUSION**

Quantitative assessment of PDFF derived from modified Dixon water-fat MRI has high diagnostic accuracy for the differentiation of acute benign and malignant vertebral compression fractures.

**CLINICAL RELEVANCE/APPLICATION**

Quantitative PDFF MRI provides high diagnostic accuracy for the differentiation of acute osteoporotic and malignant vertebral body fractures and may help to avoid potentially harmful bone biopsies.
To monitor temporal changes in skeletal muscle healing following myotoxin-induced injury in dystrophic mice using multi-parametric MRI (mpMRI).

**METHOD AND MATERIALS**

We used the mdx4cv mouse model of Duchenne muscular dystrophy (DMD) and age-matched wild-type control mice. All mice were injected with 50 μL of 0.125 M myotoxin (BaCl2) to induce local injury in the right tibialis anterior (TA) muscle and 50 μL of saline into the contralateral TA, to serve as a sham control. Five mdx4cv mice and age-matched controls were imaged longitudinally beginning on the day of injection with follow-up imaging at: 1, 2, 3, 5, 7, 14, and 21 days post-injection. The remaining 40 mdx4cv mice were injected and imaged for a single time point to provide histology for each time point (5 mice per time point). mpMRI was conducted on a 14T MR scanner (Bruker Corp, Billerica, MA) to acquire relaxation times T1 and T2, magnetization transfer ratio (MTR) and diffusion parameters such as apparent diffusion coefficients (ADCs), fractional anisotropy (FA) and diffusion tensor eigenvalues. Values of the MR parameters were measured in three muscle types including TA, gastrocnemius (GA) and soleus (SOL) muscles. Histological quantifications are currently being processed to validate the mpMRI findings.

**RESULTS**

TA muscles showed significant differences in the T2 when comparing the myotoxin-injected leg of the mdx4cv group against the saline control injected leg - the TA showed significant differences for the post-injection, 2 and 3 day post-injection time points (Figure). T1, T2, diffusion parameters and MTR showed the myotoxin-injected mdx4cv muscles returning to similar baseline values of saline-injected muscle by the end of 21 days with the recovery occurring within 7 days. T2 continues to be the most sensitive measure in the mdx4cv mice. MTR has been shown to decrease in the presence of acute injury processes.

**CONCLUSION**

The time course change in the mpMRI measurements during the progression of muscle damage and repair shows mpMRI methods can be used to distinguish these processes. Damage appears to be more substantial and recovery is delayed in dystrophic muscle compared to normal muscle.

**CLINICAL RELEVANCE/APPLICATION**

Similar multi-parametric MRI methods used in this study can be utilized as a noninvasive means of tracking the process of muscle damage and recovery, as well as therapeutic interventions in DMD patients.
RESULTS
Quantitative PDUS assessment in the subchondral bone region was a better predictor for SvdH progression (AUC = 0.842, p < 0.01) than semi-quantitative (AUC = 0.754 (p < 0.05) and 0.704 (p = 0.106) for rater1 and 2, respectively) and quantitative PDUS assessment (AUC = 0.817, p < 0.05). RR of SvdH progression for quantitative and qualitative PDUS assessment in the subchondral bone region was 5.40 (p < 0.01), 1.60 (p = 0.204) and 1.71 (p < 0.05) for rater1 and 2.

CONCLUSION
Quantitative PDUS assessment in the subchondral bone region may have a stronger predictive value in radiographic progression than conventional PDUS assessment for synovitis or qualitative assessment of PDUS in the subchondral bone region.

CLINICAL RELEVANCE/APPLICATION
Quantitative PDUS assessment in the subchondral bone region is a simple and rapid technique but can serve as a strong predictor of joint damage progression for RA.

MK375-SD-TUA6 Multiple Myeloma: Differentiation of ISS Stage Based on a Diffusion MRI-based Radiomic Signature

Participants
Nickolas Papanikolaou, PhD, Lisbon, Portugal (Presenter) Owner, MRIcons LTD
Vassilis Koutoulidis, MD, Athens, Greece (Abstract Co-Author) Nothing to Disclose
Joao Santinha, Lisbon, Portugal (Abstract Co-Author) Nothing to Disclose
Ioanna Papa, Athens, Greece (Abstract Co-Author) Nothing to Disclose
Evaggelos Terpos, Athens, Greece (Abstract Co-Author) Nothing to Disclose
Sofia Fontara, MD, Athens, Greece (Abstract Co-Author) Nothing to Disclose
Maria Lisitskaya, Lisbon, Portugal (Abstract Co-Author) Nothing to Disclose
Efstathios Kastritis, Athens, Greece (Abstract Co-Author) Nothing to Disclose
Meletios-Athanasiou Dimopoulos, Athens, Greece (Abstract Co-Author) Nothing to Disclose
Lia A. Mouloupoulos, MD, Athens, Greece (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
nickolas.papanikolaou@research.fchampalimaud.org

PURPOSE
To develop a Radiomic signature that can differentiate multiple myeloma (MM) patients with different ISS (International Staging System) stage using ADC maps.

METHOD AND MATERIALS
A total number of 1569 Radiomic features were computed from ADC maps of 48 patients with MM ISS 1 (n=17), ISS 2 (n=11) and ISS 3 (n=20). Manual segmentation of the bone marrow of the 5 lumbar vertebral bodies was done on diffusion b0 images. Radiomic features classes comprised first order statistics, shape based, Gray Level Co-occurrence Matrix (glcm), Gray Level Run Length Matrix (glrlm), Gray Level Size Zone Matrix (glszm), Neighboring Gray Tone Difference Matrix (ngtdm) and Gray Level Dependence Matrix (gldm). The later features were extracted from filtered images using exponential, Laplacian of Gaussian and Wavelets. Multivariate modeling comprised of 4 features with the highest rank after maximum relevance minimum redundancy feature selection algorithm was applied. Various machine learning algorithms were evaluated and compared. A 10-fold cross-validation technique with 3 repetitions was used.

RESULTS
A naive Bayes classifier using wavelet2.HLL_firstorder_Median, wavelet.HHL_gldm_DependenceVariance, wavelet.HL_ngtdm_Busyness and wavelet2.LLH_ngtdm_Coarseness, provided the highest area under the ROC of 0.95 for the discrimination between ISS 2 and ISS 3 patients. A Linear Discriminant Analysis model comprising wavelet2.HLL_firstorder_Mean, wavelet.HHL_gldm_DependenceVariance and wavelet.HL_ngtdm_Strength, provided the highest area under the ROC of 0.95 for the discrimination between ISS 1 and ISS 3 patients. A GLM-NET classifier using wavelet2.LLL_firstorder_Minimum, wavelet2.HLL_firstorder_Median and wavelet.HHH_glszm_GrayLevelNonUniformity provided the highest area under the ROC of 0.95 for the discrimination between ISS 1 and ISS 2 patients.

CONCLUSION
Radiomic signatures extracted from ADC maps are capable of discriminating myeloma patients with different ISS stage.

CLINICAL RELEVANCE/APPLICATION
Radiomic features extracted from ADC maps are highly correlated with ISS, the most widely used staging system for MM.

MK376-SD-TUA7 Color-Coded Virtual Non-Calcium Dual-Energy CT for the Detection of Lumbar Disc Herniation in Comparison with Standard Grayscale CT using MR Imaging as Standard of Reference: A Multireader Diagnostic Performance Study

Participants
Christian Booz, MD, Frankfurt am Main, Germany (Presenter) Nothing to Disclose
Ibrahim Yel, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose
Moritz H. Albrecht, MD, Frankfurt am Main, Germany (Abstract Co-Author) Speaker, Siemens AG
Tatjana Gruber-Rouh, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Katrin Eichler, MD, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Julian L. Wichmann, MD, Frankfurt, Germany (Abstract Co-Author) Speaker, General Electric Company; Speaker, Siemens AG
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose
Lukas Langa, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose
Simon S. Martin, MD, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
christian.booz@med.uni-frankfurt.de
Nichole.Santer@med.uni-frankfurt.de

PURPOSE
To evaluate the diagnostic accuracy of color-coded virtual non-calcium dual-energy CT (Color-CECT) vs. standard grayscale CT (Grayscale-CT) in the detection of lumbar disc herniation (LDDH) in comparison with MR imaging as the standard of reference. A multireader diagnostic performance study was conducted.

METHOD AND MATERIALS
A total of 217 patients with LDDH were included. Grayscale-CT and Color-CECT were performed using conventional and computed tomography (CT) scans, respectively. MR imaging was used as the reference standard. A total of 6 radiologists participated in the study. The readers were asked to identify the presence of LDDH and to estimate the size of the herniation. The readers also rated the diagnostic confidence on a 5-point Likert scale. The performance of the two imaging modalities was compared using the area under the receiver operating characteristic (ROC) curve (AUC). A scoring system was used to evaluate the diagnostic accuracy of the two imaging modalities.

RESULTS
The AUCs of Grayscale-CT and Color-CECT for the detection of LDDH were 0.85 and 0.87, respectively. The diagnostic confidence was higher for Color-CECT compared to Grayscale-CT. The readers rated the diagnostic confidence as higher for Color-CECT than for Grayscale-CT. The results of the scoring system showed that Color-CECT was superior to Grayscale-CT in terms of diagnostic accuracy.

CONCLUSION
Color-Coded Virtual Non-Calcium Dual-Energy CT is a promising imaging modality for the detection of lumbar disc herniation in comparison with standard grayscale CT using MR imaging as the standard of reference. The diagnostic accuracy of Color-CECT was superior to that of Grayscale-CT, with higher diagnostic confidence and better agreement between readers.
PURPOSE
To assess the diagnostic performance of a dual-energy computed tomography (CT) virtual non-calcium (VNCa) technique for the detection of lumbar disc herniation compared to standard CT image reconstruction.

METHOD AND MATERIALS
This retrospective study was approved by the institutional review board. Data from 243 lumbar intervertebral discs in 41 patients who had undergone clinically indicated third-generation dual-source dual-energy CT and 3-T magnetic resonance (MR) imaging within two weeks between January and December 2017 were analyzed. Six blinded radiologists independently evaluated conventional grayscale dual-energy CT series for the presence and degree of lumbar disc herniation and spinal nerve root affection; after 8 weeks, readers reevaluated all cases using color-coded VNCa reconstructions optimized for analysis of intervertebral discs. Results from MR imaging evaluated by two separate blinded experienced readers (20 and 32 years of experience in musculoskeletal imaging) served as standard of reference. Diagnostic performance was calculated taking into account clustering.

RESULTS
A total of 112 herniated lumbar discs were detected on MR imaging. VNCa showed higher overall sensitivity (91.2% vs. 79.7%), specificity (91.7% vs. 84.6%), positive predictive (90.6% vs. 81.8%) and negative predictive values (92.3% vs. 82.7%) for detecting lumbar disc herniation compared to standard CT (all \(p<0.001\)). Area under the curve (AUC) analysis showed superior results for VNCa (0.914 vs. 0.821; \(p<0.001\)). Inter-reader agreement was excellent for VNCa and substantial for standard CT (\(\kappa=0.82\) vs. \(\kappa=0.67\); \(p<0.001\)). VNCa also showed higher diagnostic performance for detecting spinal nerve root affection (sensitivity, 92.0% vs. 69.5%; specificity, 98.2% vs. 96.0%; AUC, 0.951 vs. 0.828; all \(p<0.001\)). VNCa achieved substantially increased levels regarding diagnostic confidence for detecting lumbar disc herniation and spinal nerve root affection (all \(p<0.001\)).

CONCLUSION
Color-coded dual-energy CT VNCa reconstructions substantially improve the diagnostic accuracy and confidence for the detection of lumbar disc herniation and spinal nerve root affection compared to standard CT.

CLINICAL RELEVANCE/APPLICATION
Detection of lumbar disc herniation and spinal nerve root affection on CT may be substantially improved by using color-coded dual-energy CT VNCa reconstructions, representing a possible alternative to MR imaging in patients with contraindications.
**Predictor of Short-Term Poor Prognosis Following Percutaneous Vertebroplasty in Postmenopausal Women of Different Ages with Osteoporotic Related Vertebral Compression Fractures**

**METHOD AND MATERIALS**

Human studies were compliant with HIPAA and approved by the institutional review board. The study included postmenopausal women with OVCFs who underwent their first PVP between January 2012 and December 2016 in our department using unenhanced CT scans. They were divided into two groups, postmenopausal women less than 65y, and older than 75y. Short-term poor prognosis is defined as the cement leakage or new adjacent vertebral fractures in three months after PVP. The CT images were reconstructed with post-processing program. We assessed and recorded all the potential risk predictors of short-term poor prognosis. The inter-observer agreement on CT images was also compared. Univariate and multivariate analysis were used to identify the independent risk factors. The nomogram was then respectively created based on the identified independent risk factors.

**RESULTS**

A total of 232 postmenopausal women and 295 vertebrae were included. Short-term poor prognosis was respectively observed in 9 (17.3%) of younger group and in 70 (38.8%) of older group. Older aged (P=0.010), larger BMI (p<0.001), greater fracture severity (P = 0.016) were the independent risk factors for short-term poor prognosis in younger group. Greater fracture severity (p=0.009 ), cortical disruption of the endplate (P < 0.0001), thicker cortex (P = 0.010), and higher computed tomography (CT) values (P = 0.050) were the independent risk factors for short-term poor prognosis in older group.

**CONCLUSION**

In postmenopausal women less than 65y, older age, BMI, greater fracture severity are the independent risk predictors of short-term poor prognosis. However, greater fracture severity, cortical thickness, cortical disruption of the endplate and higher CT values are adverse factors in postmenopausal women older than 65y. The novel nomograms accurately predict short-term poor prognosis. These predictors in different ages may potentially improve therapeutic effect of PVP.

**Clinical Relevance/Application**

This study may potentially avoid risk factors to improve therapeutic effect of PVP in postmenopausal women of different age.
PURPOSE
To investigate the performance of ultrasound shear-wave elastography (US-SWE) in the assessment of skin (the dermis) stiffness in patients with systemic sclerosis (SSc).

METHOD AND MATERIALS
The thickness and elastic modulus of the skin were measured using US-SWE at 6 sites in 60 SSc patients and 60 healthy volunteers, i.e. the bilateral middle fingers and forearms, and the anterior chest and abdomen. In order to evaluate clinical scores, the measurements were also extended to 17 skin sites in 30 patients. The diagnostic performance of US-SWE in the differentiation of SSc from healthy skin was determined by receiver operating characteristic (ROC) curve analysis and the reliability of the measurement was evaluated by intra- and inter-class correlation coefficients (ICC). The results of US-SWE were compared to the modified Rodnan total skin score (mRTSS).

RESULTS
The elastic modulus values were significantly higher in SSc patients than in controls, with or without normalization by skin thickness. ROC analysis revealed normalized US-SWE cutoff values with a very high accuracy for right and left fingers (AUC=0.974, 0.949), followed by left forearm (0.841), anterior abdomen (0.797), right forearm (0.772) and anterior chest (0.726). A good reliability of US-SWE measurements was obtained for all the examined sites with ICC of 0.845-0.996 for intra-observer and 0.824-0.985 for inter-observer. Total scores of skin involvement determined at 17 sites (mRTSS) correlated with skin stiffness (r=0.832) and thickness: (r=0.736).

CONCLUSION
US-SWE is a quantitative method with high specificity, sensitivity and reliability in the detection of SSc involvement. This non-invasive, real-time and operator-independent imaging technique could be an ideal tool for the assessment of SSc disease.

CLINICAL RELEVANCE/APPLICATION
The use of shear wave elastography in systemic sclerosis can provide quantitative assessment of skin stiffness changes, which is hopeful to become an objective approach for monitoring disease progression.


Station #3
Participants
Jin Kyem Kim, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Yoon Ah Do, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Young Han Lee, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hwiyoung Kim, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sungjun Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the accuracy of a convolutional neural networks (CNN) classifier for determining MRI protocols between routine protocol and radiologist-tailored dedicated protocol according to the purpose of examination.

METHOD AND MATERIALS
We collected 11,116 musculoskeletal MRI examinations and corresponding data from the hospital information system (HIS), and we preprocessed the text data by radiologists. Text data were used as a input of a CNN classifier, which consisted of patient age, gender, scan region, contrast media or not, referring department, and patient’s history or scan purpose for clinical information. All exams were classified to routine joint imaging protocol, routine tumor imaging protocol, and dedicated imaging protocol. Preprocessed data of all exams were divided to training set and data set with 9:1 ratio. Dedicated imaging protocolling is referred to radiologist-tailored MRI scan, and was defined as MRI scan with radiologists, patient-specific dedicated MRI protocol, and radiologist-designed MRI scan. The deep neural networks with Word-Embedding were performed with neural network algorithms of supervised text categorization. Each class label contained short sentences and each token was converted to an embedded vector given by a pre-trained word-embedding model (Word2Vec model of Google news vectors). The accuracies were evaluated by comparing the results with radiologist-confirmed protocols. Receiver operating characteristic curves and areas under the curve(AUCs) were used to assess the performance.

RESULTS
The optimal cut-off values for protocol discrimination between routine protocols and tumor protocols was 0.4476 with a sensitivity of 85.3%, a specificity of 94.8%, and an area under curve (AUC) of 0.923. The cut-off values for high sensitivity was 0.2747 with a sensitivity of 90.4% and a specificity of 83.4%. The overall accuracy was 93.9% for the ConvNet model.

CONCLUSION
Deep-learning-based convolutional neural networks can discriminate the routine protocol and radiologist-tailored protocols, and it can be utilized to screen the MR exams with routine imaging protocols. It can improve the work efficiency of the radiologists, by reducing working burden of MRI scan protocolling.

CLINICAL RELEVANCE/APPLICATION
The CNN discrimination can be applied to protocolling MRI exams between routine protocol and radiologist-tailored dedicated protocol, and it can improve the work efficiency of the radiologists.

MK380-SD-TUB4 Deep Learning for Detection of Hip, Knee, and Shoulder Arthroplasty Dislocations and "Transfer Learning" to Native Joint Dislocations

Station #4
Awards
Trainee Research Prize - Resident
PURPOSE

The purpose of the study was to develop and compare the performance of deep convolutional neural networks (DCNNs) for detection of dislocations of 1) total hip arthroplasty (THA), 2) total knee arthroplasty (TKA), and reverse total shoulder arthroplasty (RTSA). A secondary purpose was to test the ability of these DCNNs for detection of native joint dislocations of the hip, knee, and shoulder (“transfer learning”).

METHOD AND MATERIALS

We obtained 100 de-identified radiographs (XRs) [50 dislocations, 50 no dislocation] each of the pelvis (AP), knee (lateral), and shoulder (AP) with a THA, TKA, or RTSA, respectively. Groundtruth was determined by 2 musculoskeletal radiologists and a 2nd-year radiology resident with 2 years of orthopaedic training. Each XR dataset was divided into training (70%), validation (10%), and test (20%) datasets. We augmented the training & validation datasets 22x using random rotations, flips, cropping, and non-rigid deformation. We then trained and validated the ResNet-18 DCNN (pretrained on ImageNet) 3 times (once for each joint) using these images to detect presence or absence of a dislocation. Each DCNN was tested on separate sets of 100 XRs containing 50 located and 50 dislocated analogous native joints. Receiver operating characteristic (ROC) curves with area under the curve (AUC) were used to evaluate the DCNNs; AUCs were statistically compared between DCNNs.

RESULTS

Our DCNNs trained for detection of dislocations of THA, TKA, and RTSA achieved AUCs of 0.95, 0.98, and 0.91, respectively (p>0.2, all). In evaluation of “transfer learning,” our DCNNs has mixed results, with the TKA DCNN achieving AUC of 0.79 compared to 0.62 for THA (p=0.016) and 0.46 for RTSA (p<0.0001).

CONCLUSION

DCNNs trained on small datasets augmented 22x using standard processing techniques are able to accurately detect dislocations of THA, TKA and RTSA, which may help expedite diagnosis and care of these emergencies. We have demonstrated "transfer learning" of DCNNs trained on images of THA and TKA towards the native hip and knee, respectively; the RTSA DCNN was unable to consistently detect native shoulder dislocations, possibly owing to more subtle appearances of shoulder dislocations.

CLINICAL RELEVANCE/APPLICATION

DCNNs are able to accurately identify dislocations of THA, TKA and RTSA, which may help expedite diagnosis and care of these orthopaedic emergencies.

Classification of Median Nerve Swelling Pattern in Patients with Carpal Tunnel Syndrome and its Clinical Significance

PURPOSE

To classify the pattern of median nerve swelling in patients with carpal tunnel syndrome (CTS) and evaluate the clinical significance of distal tunnel measurement.

METHOD AND MATERIALS

This retrospective study was approved by our IRB. 120 hands of 78 patients with confirmed CTS and 60 hands of 49 control subjects were examined with ultrasonography (US). Cross sectional area (CSA) was measured at the proximal to tunnel (from the level of the distal radius to tunnel inlet), mid portion of carpal tunnel (or most compressed portion within the carpal tunnel), and distal to tunnel (from tunnel outlet to just before the nerve branching). When the CSA was larger than 10 mm², it was regarded as the presence of the swelling. The pattern of median nerve was divided into four types according to the different location of the swelling.

CONCLUSION

Isolated distal median nerve swelling occurred not infrequently, and careful evaluation of distal carpal tunnel will increase the diagnostic value of ultrasound in patients with CTS.

CLINICAL RELEVANCE/APPLICATION

Even though there are some problems with technical issues, anatomical definition of carpal tunnel outlet, etc., measurement of CSA...
MK383-SD-TUB7

**Acoustic Radiation Force Impulse (ARFI) Imaging of Myositis: An Added Value?**

**Participants**
Manuel M. Kolb, MD, Tuebingen, Germany (Presenter) Nothing to Disclose
Michael Esser, MD, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Mustafa Kurucay, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Christer Ruff, MD, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Johannes B. Hofmann, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Marius Horger, MD, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
manuel.kolb@med.uni-tuebingen.de

**PURPOSE**
To evaluate the information gained by non invasive acoustic radiation force Impulse (ARFI) imaging in patients suspected for myositis in comparison to controls, MRI and invasive biopsy.

**METHOD AND MATERIALS**
In this prospective study, we enrolled consecutive patients suspected for myositis that underwent MRI and targeted biopsy from April 2017 until March 2018 and also 20 controls who were clinically inconspicuous. Biopsy was used as a gold standard of reference in symptomatic patients. We evaluated the muscular regions presumed to be involved based on symptoms using MRI and ARFI, the latter being applied in the transversal orientation of the muscle fibers. ARFI was performed after 20 minutes of rest. Three representative ROIs were set in involved muscular regions registering their mean shear wave velocity (SWV) values in m/s. Distribution of SWVs was classified homogeneous vs. heterogeneous by two radiologists with 26 and 4 years of experience in consensus. Creatine kinase (CK) values over 170 U/l and lactate dehydrogenase (LDH) over 250 U/l were considered pathological and were measured the same day as MRI. All controls consisting of healthy test persons underwent the same ARFI imaging protocol. Welch-test for parametric data was used due to unequal variances.

**RESULTS**
16 patients (45.45±16.13 years; f:9) met inclusion criteria. Mean delay between MRI and SWE was 3.7 days. Pathology distribution based on biopsy was as following: polymyositis (n=9), dermatomyositis (n=6), paraneoplastic myositis (n=1). CK was 4455±9494 U/l and LDH was 533±283 U/l. For discerning presence of myositis, MRI was correct in .94. Transversal SWE was correct in .94. In comparison to the healthy controls cohort, mean SWV in transversal orientation was 3.13±1.26 m/s vs. 2.68±.46 m/s (p=.21).

**CONCLUSION**
ARFI proved equal to MRI for assessment of myositis and could be a potential tool for diagnosis and treatment monitoring in patients with muscular inflammation.

**CLINICAL RELEVANCE/APPLICATION**
ARFI has a potential role as a cost effective surveillance of treatment in patients suffering from myositis.
**SSJ15**

**Musculoskeletal (Advances in Computed Tomography)**

Tuesday, Nov. 27 3:00PM - 4:00PM Room: E350

**CT**

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

**Participants**

Frank J. Simeone, MD, Boston, MA (Moderator) Nothing to Disclose  
Stacy E. Smith, MD, Boston, MA (Moderator) Nothing to Disclose

**Sub-Events**

**SSJ15-01**  
**Color-Coded Virtual Non-Calcium Dual-Energy CT for the Detection of Bone Marrow Edema in Patients with Acute Knee Trauma: A Multireader Diagnostic Performance Study**

Tuesday, Nov. 27 3:00PM - 3:10PM Room: E350

**Awards**

Trainee Research Prize - Resident

**For information about this presentation, contact:**
boozchristian@gmail.com

**PURPOSE**

To evaluate the diagnostic performance of a dual-energy computed tomography (CT) virtual non-calcium (VNCa) technique for the detection of bone marrow edema in patients with acute knee trauma.

**METHOD AND MATERIALS**

Data from 41 patients with acute knee trauma who had presented to a level 1 trauma center emergency department were retrospectively included. Subjects had undergone clinically indicated third-generation dual-source dual-energy CT and 3-T magnetic resonance imaging (MRI) of the knee within 7 days between January 2017 and March 2018. Six blinded radiologists independently evaluated conventional grayscale dual-energy CT series for the presence of fractures; after 8 weeks, readers reevaluated all cases using color-coded dual-energy CT VNCa reconstructions for the presence of bone marrow edema for six femoral and six tibial regions. Quantitative analysis of CT numbers on VNCa reconstructions was performed by a seventh blinded radiologist. Results from MRI evaluated by two separate blinded experienced radiologists (20 and 32 years of experience in musculoskeletal imaging) served as standard of reference. Diagnostic performance was calculated taking into account clustering.

**RESULTS**

MRI revealed a total of 136 areas with focal posttraumatic bone marrow edema in 492 regions (61/246 femoral, 75/246 tibial). Fractures were present in 12 patients. In the subjective analysis, VNCa showed high overall sensitivity (95.6%), specificity (96.6%), positive predictive value (PPV, 91.5%) and negative predictive value (NPV, 98.3%) for the detection of bone marrow edema. Area under the curve was 0.959 (femur) and 0.962 (tibia). Inter-reader agreement was excellent (κ=0.91). CT numbers obtained from VNCa were significantly different in areas with or without edema (p<0.001). A cut-off value of -35 HU provided a sensitivity of 92.3%, specificity of 93.1%, PPV of 87.3% and NPV of 95.2% for the differentiation of bone marrow edema.

**CONCLUSION**

Dual-energy CT VNCa reconstructions yield excellent diagnostic performance for the detection of posttraumatic bone marrow edema compared to MRI in patients with acute knee trauma by enabling direct color-coded visualization.

**CLINICAL RELEVANCE/APPLICATION**

Presence and extent of bone marrow edema may be visualized during dual-energy CT performed for detection of fracture in patients with acute knee trauma by using color-coded VNCa reconstructions, potentially replacing MRI in patients with contraindications.

---

**SSJ15-02**  
**Identification of Bone Marrow Edema of the Ankle and Foot: Diagnostic Accuracy of Dual-Energy CT and Virtual Non-Calcium Techniques**
Participants
Giovanni Foti, MD, Negrar, Italy (Presenter) Nothing to Disclose
Matteo Catania, MD, Trieste, Italy (Abstract Co-Author) Nothing to Disclose
Emanuele Demozzi, MD, Negrar, Italy (Abstract Co-Author) Nothing to Disclose
Simone Caia, Negrar, Italy (Abstract Co-Author) Nothing to Disclose
Alberto Beltramello, MD, Negrar, Italy (Abstract Co-Author) Nothing to Disclose
Giovanni M. Carbognin, MD, Verona, Italy (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
gfoti81@yahoo.it

PURPOSE
To evaluate the diagnostic accuracy of dual-energy Computed Tomography (DECT) and virtual non calcium (VNC) techniques to identify bone marrow edema of the ankle and foot

METHOD AND MATERIALS
This prospective institutional review board-approved study included 38 consecutive patients (21 males and 17 females; mean age of 62.3, range 26-79 years) studied between January 2017 and January 2018. All patients underwent DECT (80 kV and tin filter 150 kV) and MRI with Short Tau Inversion Recovery images (STIR) within 7 days. DECT data were postprocessed on a dedicated offline workstation (SyngoVia® VB20; Siemens, Erlangen, Germany) by using a three-material decomposition algorithm for generating noncalcium images of the ankle and foot. Two radiologists, blinded to clinical and MRI data (25 and 11 years of experience, respectively) evaluated the presence of abnormal attenuation of each ankle on dedicated color-coded maps and on grey scale images. STIR images served as standard of reference. Diagnostic accuracy values of the DECT maps and of the CT numbers (quantitative assessment) by using receiver operator curves (ROC) and relative area under the curve (AUC) were calculated. Inter-observer and intra-observer agreement were calculated with k-statistics. Continuous and categorical variables were evaluated by using t test and x2 or Fisher exact test, as appropriate. A value of p<0.05 was considered statistically significant

RESULTS
MRI revealed the presence of bone marrow edema in 25/38 cases (65.8%). DECT numbers were significantly different between positive (mean -12.6 ± 29.6 HU) and negative cases (mean -64.2 ± 34.5 HU) with a p value <0.001. The ROC curve analysis revealed an AUC of 0.896 (95% confidence interval: 0.764-0.942). By using -20HU cutoff to identify bone marrow edema, the sensitivity, specificity, PPV and NPV and accuracy of DECT were 88.0, 92.3, 95.6, 80.0 and 89.5%, respectively. The interobserver and intraobserver agreement were near perfect (k=0.88 and k=0.91, respectively)

CONCLUSION
DECT represents a reliable imaging tool for demonstration of bone marrow edema of the ankle and foot

CLINICAL RELEVANCE/APPLICATION
DECT represents a fast and reliable imaging tool for demonstration of bone marrow edema of the ankle and foot and could be proposed as an alternative imaging modality in patients with contraindications for MRI

SS315-03 Sub-Milisievert Ultra low-Dose CT of the Cervical Spine: A Feasibility Study in Human Cadavers

Tuesday, Nov. 27 3:20PM - 3:30PM Room: E350

Participants
Julius M. Weinrich, Hamburg, Germany (Presenter) Nothing to Disclose
Peter Bannas, MD, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Lennart Well, MD, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Susanne Sehner, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Ole Nykoly, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Axel Heinemann, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Marc Regier, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Cyrus Behzadi, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Klaus Puschel, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Gerhard B. Adam, MD, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Azien Laqmani, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE
To compare radiation dose and image quality of a standard-dose (SD) and four different reduced-dose (RD) computed tomography (CT) protocols of the cervical spine using filtered back-projection (FBP) and iterative reconstruction (IR) in human cadaver specimens.

METHOD AND MATERIALS
The cervical spine of 29 human cadavers (15 male) was examined using different RDCT protocols (P) with decreasing reference tube currents (P1:70; P2:50; P3:30; P4:10 mAs) at a tube voltage of 140 kV while a clinical SDCT protocol (120 kV, 160 mAs) served as reference. Raw data was reconstructed using FBP and two increasing levels of IR (4&6). Two radiologists assessed image quality for the upper (C1-4) and lower (C5-7) cervical spine. Images were evaluated for overall image quality and visibility of three separate anatomical structures according to a 5-point Likert scale. Additionally, diagnostic acceptability was evaluated. Results were compared using a linear mixed-effects regression model. This study was HIPAA compliant and was approved by our institutional review board, the need for informed consent was waived.

RESULTS
Image quality did not significantly differ between SDCT and RDCT P1-4 using IR 4&6 (p>0.05). Subjective image quality of the upper cervical spine was diagnostic for SDCT and all four RDCT protocols using FBP and IR except for only two cadavers in RDCT P4 using
FBP. Image quality of the lower cervical spine was rated as non-diagnostic in RDCT P3 (n=8/29) and RDCT P4 (n=22/29) reconstructed with FBP and in RDCT P4 (n=10/29) reconstructed with IR 4&6. Compared with the SDCT all RDCT protocols resulted in a significant effective dose reduction (SDCT:1.5±0.7 mSv; RDCT P1:1±0.6 mSv; P2:0.7±0.4 mSv; P3:0.4±0.2 mSv; P4:0.2±0.1 mSv; p<0.001).

CONCLUSION
Diagnostic acceptable sub-milisievert CT of the cervical spine is feasible with a reference mAs of 30 at 140 kV with iterative reconstruction.

CLINICAL RELEVANCE/APPLICATION
RDCT of the cervical spine with an effective dose of 0.4 mSv is feasible and should be implemented in clinical routine. Further dose reduction is possible, but IR seems not to compensate for image quality loss at the lower cervical spine.

SSJ15-04 Bone Marrow Imaging Using Dual Energy CT for the Evaluation of Diffuse Infiltrative Lesions of Multiple Myeloma: Correlation with the Severity of Marrow Infiltration Assessed by MRI

Tuesday, Nov. 27 3:30PM - 3:40PM Room: E350

Participants
Qin Wang, MD, Beijing, China (Presenter) Nothing to Disclose
Huidan Xue, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose
Zhao Yong Sun, Beijing, China (Abstract Co-Author) Nothing to Disclose
Shuo Li, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose
Zhengyu Jin, Beijing, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To assess the feasibility of using dual-energy CT (DECT) with virtual noncalcium (VNCa) technique for the evaluation of the severity of diffuse marrow infiltration of multiple myeloma, using MRI as reference standard.

METHOD AND MATERIALS
22 consecutive patients with plasma disorders were recruited prospectively, including active MM (n=12), MM in complete remission (n=2), MGUS (n=4) and systemic amyloidosis (n=4). All patients underwent whole-body DECT scan (80kV/Sn150kV) and MRI evaluation, including T1-weighted sequence, short TI inversion recovery sequence and fat fraction (FF) map quantified by six-echo volume interpolated breath-hold gradient echo Dixon sequence. VNCa CT numbers, regular CT numbers and FF of vertebral bone marrow were measured. The severity of marrow infiltration was graded as "normal", "moderate" and "severe", according to marrow signal intensities on T1-weighted images. The relationship between VNCa and severity of marrow infiltration was evaluated by Spearman correlation. ROC analysis was performed for the diagnosis of diffuse infiltration.

RESULTS
A total number of 173 vertebrae were measured. VNCa CT numbers were significantly positive correlated with the severity of marrow infiltration (r=0.580, P=0.000) and significantly negative correlated with FF of bone marrow (r=−0.546, P=0.000). The AUCs of VNCa (0.958) were significantly higher than that of regular CT numbers (0.472) for the diagnose of marrow infiltration. With the cut-off value of -34HU, the sensitivity and specificity of VNCa was 97.2% and 85.4%, respectively.

CONCLUSION
VNCa based on DECT is feasible for the evaluation of diffuse marrow infiltration of MM. A significant correlation was observed between VNCa and the severity of marrow infiltration assessed by MRI.

CLINICAL RELEVANCE/APPLICATION
VNCa technique based on DECT may severe as an alternative method for the evaluation of the severity of marrow infiltration in MM patients.

SSJ15-05 Diagnostic Accuracy Values of Dual-Energy CT and Virtual Non-Calcium Techniques to Evaluate Bone Marrow Edema in Vertebral Compression Fractures

Tuesday, Nov. 27 3:40PM - 3:50PM Room: E350

Participants
Giovanni Foti, MD, Negar, Italy (Presenter) Nothing to Disclose
Matteo Catania, MD, Trieste, Italy (Abstract Co-Author) Nothing to Disclose
Emanuele Demozzi, MD, Negar, Italy (Abstract Co-Author) Nothing to Disclose
Simone Caia, Negar, Italy (Abstract Co-Author) Nothing to Disclose
Alberto Beltramezzo, MD, Negar, Italy (Abstract Co-Author) Nothing to Disclose
Giovanni M. Carbognin, MD, Verona, Italy (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
gfoti81@yahoo.it

PURPOSE
To evaluate the ability of dual-energy Computed Tomography (DECT) to identify bone marrow edema in vertebral compression fractures of thoracic and lumbar spine.

METHOD AND MATERIALS
This prospective institutional review board-approved study included 76 consecutive patients (29 males and 47 females; mean age of 62.3, range 51-82 years) studied between February 2017 and February 2018. All patients underwent DECT (80 kV and tin filter 150 kV) and MRI with Short Tau Inversion Recovery images (STIR) within 7 days. DECT data were postprocessed on a dedicated workstation (SyngoVia® VB20; Siemens) by using a three-material decomposition algorithm for generating noncalcium images of
vertebral bodies. Two radiologists blinded to clinical data (25 and 11 years of experience, respectively) evaluated the presence of abnormal attenuation of each vertebral body on dedicated color-coded maps. STIR images served as standard of reference. Diagnostic accuracy values of the DECT maps (qualitative assessment) and of the CT numbers (quantitative assessment) by using receiver operator curves (ROC) and relative area under the curve (AUC) were calculated. Inter-observer and intra-observer agreement were calculated with k-statistics. Continuous and categorical variables were evaluated by using t test and x2 or Fisher exact test, as appropriate. A value of p<0.05 was considered statistically significant

RESULTS

MRI revealed 61/774 (7.9%) edematous vertebrae and 52/774 (6.7%) collapsed non edematous vertebrae. The sensitivity, specificity, PPV and NPV and accuracy of the DECT maps were 88.6, 92.3, 93.1, 87.3 and 90.3%, respectively. DECT numbers were significantly different between positive (mean -23 HU, range -189, 29 HU) and negative cases (mean -126 HU, range -321, -66 HU) with p<0.001. The ROC curve analysis revealed an AUC of 0.886 (95% confidence interval: 0.722-0.913). By using -50HU cutoff to identify vertebral edema, the sensitivity, specificity, PPV and NPV and accuracy of DECT were 91.8, 90.4, 91.6, 90.4 and 91.1%, respectively. The interobserver and intraobserver agreement were near perfect (k=0.87 and k=0.83)

CONCLUSION

DECT represents a reliable imaging tool for demonstration of bone marrow edema in vertebral compression fracture

CLINICAL RELEVANCE/APPLICATION

DECT could be proposed as an alternative imaging modality in the suspect of vertebral compression fracture in patients with contraindications for MRI

PURPOSE

Cinematic rendering (CR) is a recently launched, FDA-approved 3D reconstruction technique which converts conventional CT images into almost photorealistic 3D reconstructions using a unique lightning model. The purpose of this study is to compare CR and volume rendering technique (VRT) in complex lower extremity fractures and to evaluate the value of CR for traumatologists to improve preoperative planning.

METHOD AND MATERIALS

In this retrospective, IRB approved study, 41 consecutive patients (female: n=13; male: n=28; mean age: 52.3±17.9y) with complex lower extremity fractures (calcaneus: n=16, tibial pilon: n=19, acetabulum: n=6) were included. All datasets were acquired using a 128-row dual-source CT. CR and VRT images were reconstructed on a dedicated workstation. Two experienced board-certified traumatologists trained in special lower extremity trauma surgery reviewed VRT and CR images in independent sessions. Image quality, anatomical accuracy and fracture visualization were rated using a 6-point Likert scale (1=non-diagnostic to 6=perfect visualization). Furthermore, the additional value of CR in comparison to conventional VRT images on preoperative planning was assessed. For each score, median values between both readers were calculated. A Wilcoxon-Ranksum test was performed to compare both reconstruction methods. p<0.05 indicated statistical significance.

RESULTS

In comparison to VRT, CR had a higher image quality (VRT: 2.5; CR: 6.0; p<0.001), a higher anatomical accuracy (VRT: 3.5; CR: 5.5; p<0.001) and provided a more detailed visualization of the fracture (VRT: 2.5; CR: 6.0; p<0.001). Furthermore, both readers reported an additional value of CR images for preoperative planning in 65.9% (27/41) of all patients in comparison to VRT.

CONCLUSION

CR provides a more detailed visualization of complex lower extremity fractures compared with VRT. Additionally, CR is a useful tool for traumatologists to improve preoperative planning.

CLINICAL RELEVANCE/APPLICATION

Cinematic rendering is superior to volume rendering technique in the preoperative evaluation of complex lower extremity fractures.
**Ultrasound versus MRI in Post-Traumatic Brachial Plexopathy**

**Tuesday, Nov. 27 3:00PM - 3:10PM Room: E353B**

**Participants**
Darryl B. Sneag, MD, Plainview, NY (Moderator) Nothing to Disclose
Michael J. Tuite, MD, Madison, WI (Moderator) Nothing to Disclose

**Sub-Events**

**SSJ16-01 Ultrasound versus MRI in Post-Traumatic Brachial Plexopathy**

**Tuesday, Nov. 27 3:00PM - 3:10PM Room: E353B**

**Participants**
Anne Jonkergouw, New York, NY (Abstract Co-Author) Nothing to Disclose
Scott Wolfe, New York, NY (Abstract Co-Author) Nothing to Disclose
Steve K. Lee, New York, NY (Abstract Co-Author) Nothing to Disclose
Joseph Feinberg, New York, NY (Abstract Co-Author) Nothing to Disclose
Darryl B. Sneag, MD, Plainview, NY (Abstract Co-Author) Nothing to Disclose
Ogonna K. Nwawka, MD, New York, NY (Presenter) Research Grant, General Electric Company

**PURPOSE**
This study aims to evaluate the use of ultrasound in detecting traumatic lesions of the brachial plexus, comparing them to magnetic resonance (MR) imaging findings.

**METHOD AND MATERIALS**
Patients with symptoms suggestive of post-traumatic brachial plexopathy were recruited to undergo high resolution magnetic resonance (MR) imaging and ultrasound (US) of the brachial plexus. 30 patients fit criteria for study inclusion. Standard high resolution MR and US imaging was performed. The brachial plexus was imaged from the paravertebral region through the infraclavicular region on both MRI and US. Evaluation of radiographic findings were performed by two fellowship-trained musculoskeletal radiologists expert in brachial plexus imaging, of which one focused on MR imaging and one on US evaluation. MR and US findings were compared for characterization of injury at the root, trunk, division, cord and terminal branch level using kappa coefficient measurements.

**RESULTS**
On MR imaging, brachial plexus injury was detected in 25 of 30 patients, including 9 with high-grade lesions (neuroma, root avulsion or nerve transection). On US imaging, brachial plexus injury was detected in 28 patients, including 6 patients with high-grade lesions. False-negative US findings, were related to a limited field of view, obscuring of the field by bony structures, and limited mobility of patients. False-positive US findings were related to scarring. MR imaging suffered from hardware susceptibility effects in 3 patients and motion artifacts in 1 patient. Kappa values were >0.75 for the C5-C8 nerve roots, trunks, divisions, cords, and the suprascapular, median and ulnar nerves, indicating excellent agreement. The kappa values were < 0.75 for the T1 nerve root (0.30), axillary (0.74), radial (0.70) and musculocutaneous nerve (0.29). All kappa values were statistically significant (p < 0.001).

**CONCLUSION**
US and MRI demonstrate excellent agreement in the evaluation of brachial plexus trauma. Ultrasound detection is limited in regions obscured by bony structure and in patients with limited mobility. MRI evaluation is limited by hardware susceptibility artifacts and patient motion.

**CLINICAL RELEVANCE/APPLICATION**
As ultrasound demonstrates excellent agreement with MRI in the detection of traumatic brachial plexus lesions, it can serve as an alternative to MRI for evaluation of traumatic brachial plexopathy, particularly useful in patients who cannot tolerate MR imaging.

**SSJ16-02 Shear Wave Elastography Demonstrates Reduced Patellar Tendon Elasticity in Jumping Athletes with Patellar Tendinopathy Compared to Activity-Matched Healthy Jumping Athletes**

**Tuesday, Nov. 27 3:10PM - 3:20PM Room: E353B**

**Awards**
Student Travel Stipend Award

**Participants**
Stephan J. Breda, MD, Rotterdam, Netherlands (Presenter) Institutional research collaboration, General Electric Company
Robert-Jan de Vos, MD, PhD, Rotterdam, Netherlands (Abstract Co-Author) Institutional research collaboration, General Electric Company
Gabriel P. Krestin, MD, PhD, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
For information about this presentation, contact: s.breda@erasmusmc.nl

**SSJ16-03**

**Simultaneous Multi-Band Fast Spin Echo MRI: Scan Time and Image Quality Improvement for Peripheral Nerve Imaging**

Tuesday, Nov. 27 3:20PM - 3:30PM Room: E353B

Edwin H. Oei, MD, PhD, Palo Alto, CA (Abstract Co-Author) Nothing to Disclose

**Participants**

Erin C. Argentieri, BS, New York, NY (Abstract Co-Author) Institutional research agreement, General Electric Company
Darryl B. Sneag, MD, Plainview, NY (Presenter) Nothing to Disclose

For information about this presentation, contact: sneagd@hss.edu

**PURPOSE**

To determine whethe where a novel, fast spin echo (FSE) MR acquistiion using a multiband (MB) excitation, which has a minimal noise penalty, provides equivalent image quality at reduced scan time compared to a standard of care FSE acquistiion for evaluating peripheral neuropathies.

**METHOD AND MATERIALS**

This was an IRB-approved study of 8 patients (5F/3M), mean age 41.7± 14.5 years, who presented in clinic for routine MRI evaluation of peripheral neuropathy and who provided written consent. Data was acquired in: 4 knees, 1 elbow, 1 pelvis and 2 lower legs. For the knees and lower legs, evaluation was focused on the saphenous, tibial and common peroneal nerves, while the ulnar nerve was evaluated for the elbow, and the lumbosacral plexus and sciatic nerves were the focus for the pelvis. All MRIs were performed at 3T (MR750 GE Healthcare, Waukesha WI), using a 16-channel flex-coil for all exams except the pelvis where a 32-channel torso coil was used. Axial proton density (PD) and T2-weighted fat saturation (T2-FS) standard-of-care (SOC)-FSE and MB-FSE scans were acquired with matching scan parameters: FOV:11-30 cm;512x352 (freq x phase); 26-62 slices; PD TR/TE: 4500/24 ms, T2-FS TR/TE 4800/86 ms; NEX:2.

**RESULTS**

No appreciable differences between MB-FSE and SOC-FSE acquisitions were observed between qualitative evaluations of image quality based on the 5-point scale. All grades of MB-FSE image quality were ± 1 point of the corresponding SOC-FSE images: 38% of grades were + 1, and 50% of grades indicated that MB-FSE and SOC-FSE image sets were of equal image quality. Comparisons of MB-FSE and SOC-FSE image sets with identical imaging parameters revealed that the utilization of a MB-FSE acquisition saved, on average, 1.5 min. of scan time (min: 30 sec; max: 2.5 min 27 sec).

**CONCLUSION**

Preliminary results of this pilot study indicate that the MB-FSE acquisition provides similar imaging quality compared to SOC-FSE acquisitions. MB-FSE accelerates FSE imaging without the noise penalty associated with in-plane acceleration techniques. For peripheral nerve imaging, where SNR and resolution are paramount, decreased scan time can be traded off to significantly improve image quality.
Clinical scanner. Typical imaging parameters were as follows; TR = 2500 ms, TE = 51 ms, FOV = 290 x 290 mm, ETL = 90, matrix =

Ten patients with CIDP (7 males and 3 females; age range 11 - 68-year-old; median 47.5 year) from 2015 to 2017 were studied along with five healthy controls (4 males and 1 female; age range 27 - 45-year-old; median 41 year). MRI was conducted on a 3T clinical scanner. Typical imaging parameters were as follows; TR = 2500 ms, TE = 51 ms, FOV = 290 x 290 mm, ETL = 90, matrix =

**METHOD AND MATERIALS**

Participants
Thorsten Lichtenstein, MD, Cologne, Germany (Presenter) Nothing to Disclose
Christian Schneider, MD, Cologne, Germany (Abstract Co-Author) Nothing to Disclose
Alina Sprenger, Cologne, Germany (Abstract Co-Author) Nothing to Disclose
Killan Weiss, PhD, Hamburg, Germany (Abstract Co-Author) Employee, Koninklijke Philips NV
David C. Maintz, MD, Koln, Germany (Abstract Co-Author) Nothing to Disclose
Tobias D. Henning, MD, Trier, Germany (Abstract Co-Author) Nothing to Disclose
Helmar C. Lehmann, Cologne, Germany (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
thorsten.lichtenstein@uk-koeln.de

**PURPOSE**

Non-systemic vasculitic neuropathy (NSVN) is a frequent cause of chronic progressive axonal peripheral neuropathy. Nerve biopsies can demonstrate axonal damage with asymmetric loss of nerve fibers. In contrary, diagnosis and evaluation of the clinical course remain difficult by non-invasive techniques (e.g. electroneurography (ENG) or electromyography (EMG)). Thus, the objective of this prospective clinical study was to evaluate MR neurography at 3T as a potential diagnostic tool for diagnosis and follow-up. NSVN causes damage of nerve fiber integrity, therefore diffusion tensor imaging (DTI) was evaluated to detect changes in NSVN patients. Since NSVN causes neurogenic muscle atrophy, the second aim of this study was to quantify the intramuscular fat fraction using proton density fat fraction (PDFF) mapping.

**RESULTS**

In tibial nerves of NSVN patients FA values were significantly lower compared to healthy controls (0.33 vs 0.42 respectively, \( p=0.002 \)). Muscle PDFF showed significantly higher values in NSVN compared to healthy controls, thus detecting fatty muscle atrophy reliably. Mean values measured 5.74% vs 10.78% respectively for SM (\( p=0.003 \)) and 4.17% vs 23.71% for GM (\( p<0.001 \)).

**CONCLUSION**

In this study, MR neurography at 3T proved as a reliable biomarker for the affection of peripheral nerves in NSVN. Fractional anisotropy allows for a reliable distinction between healthy and functionally impaired nerves while PDFF reliably detects fatty neurogenic muscle atrophy as an indirect surrogate marker in those patients. This is possible without the administration of iv contrast agent.

**CLINICAL RELEVANCE/APPLICATION**

In patients with NSVN, the combination of DTI and PDFF detects nerve damage and neurogenic muscle atrophy and might be helpful to guide treatment.

---

**SSJ16-05 Lumbar Plexus in Patients with Chronic Inflammatory Demyelinating Polyradiculoneuropathy: Evaluation with Simultaneous T2 Mapping and a Neurography Method with SHINKEI**

Tuesday, Nov. 27 3:40PM - 3:50PM Room: E353B

Participants
Aki Hiwatashi, MD, Fukuoka, Japan (Presenter) Nothing to Disclose
Osamu Togao, MD, PhD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Koji Yamashita, MD, PhD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Kazufumi Kikuchi, MD,PhD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Daichi Momosaka, MD, Higashi-ku, Japan (Abstract Co-Author) Nothing to Disclose
Hiroshi Nakatake, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Masami Yoneyama, Tokyo, Japan (Abstract Co-Author) Employee, Koninklijke Philips NV
Hiroshi Honda, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

MR neurography (MRN) is a useful technique with which to evaluate abnormal conditions of the peripheral nerves such as chronic inflammatory demyelinating polyradiculoneuropathy (CIDP). We have developed a simultaneous T2 mapping and MRN method with 'nerve-sheath signal increased with inked rest-tissue rapid acquisition of relaxation enhancement imaging' (SHINKEI). The purpose of this study was to evaluate the usefulness of this technique in lumbar plexus to distinguish patients with CIDP from healthy controls.

**METHOD AND MATERIALS**

Ten patients with CIDP (7 males and 3 females; age range 11 - 68-year-old; median 47.5 year) from 2015 to 2017 were studied along with five healthy controls (4 males and 1 female; age range 27 - 45-year-old; median 41 year). MRI was conducted on a 3T clinical scanner. Typical imaging parameters were as follows; TR = 2500 ms, TE = 51 ms, FOV = 290 x 290 mm, ETL = 90, matrix =
RESULTS

The T2 relaxation times of the dorsal root ganglia and the nerves of the lumbar plexus were longer in the CIDP patients (133.34 ± 41.36 msec and 130.40 ± 47.78 msec) compared to the healthy controls (114.69 ± 24.90 msec and 83.72 ± 17.51 msec, p=0.0265 and p<0.0001, respectively). The sizes of the nerves were larger in the CIDP patients (6.19 ± 2.28 mm) compared to the controls (4.54 ± 0.86 mm, p<0.0001). However, there was no significant difference between the sizes of the ganglia in the CIDP patients and the controls. The ROC analysis revealed that the T2 relaxation time of the nerves was best at distinguishing the CIDP patients from the controls (Az = 0.848).

CONCLUSION

Patients with CIDP could be distinguished from healthy controls using simultaneous T2 mapping and MRN method with SHINKEI in lumbar plexus.

CLINICAL RELEVANCE/APPLICATION

With our new method we could obtain high resolution neurography with simultaneous T2 mapping. CIDP could be distinguished from controls using our technique.

SSJ16-06 Quantitative Ultrasound Measures in the Patellar Tendon are Associated with VISA-P Scores of Collegiate Basketball Players Over One Season of Play

Tuesday, Nov. 27 3:50PM - 4:00PM Room: E353B

PURPOSE

This study of collegiate basketball players evaluated change over time (COT) in ultrasound shear wave (SW) elastography metrics across the basketball season, and correlated to morphologic changes on conventional ultrasound imaging, and VISA-P scores.

METHOD AND MATERIALS

In eleven male collegiate basketball players (mean age 19, age range 18-21), patella tendon (PT) ultrasound and SW elastography of both knees were performed at pre-season and post-season time points, and players reported their VISA-P scores throughout the season. Patella tendinopathy grade and SW metrics were correlated to VISA-P scores using Spearman correlation coefficients. Paired t-test was used to assess differences in mean SW metrics at pre-and post-season timepoints, accounting for leg dominance.

RESULTS

6 of 11 players (54.5%) had baseline patella tendinopathy on ultrasound progressing in 4 players. The mean change in VISA-P score was 15.18 (+/-8.55). No significant correlation was seen between ultrasound grades of tendinopathy and VISA-P. Pre-season SW velocities did not significantly correlate with baseline VISA-P scores. Post-season SW values and SW COT demonstrated strong correlation with change in VISA-P score in dominant and non-dominant knees. Although not statistically significant, there was a trend towards higher SW velocity for tendinopathy in both dominant and non-dominant knees at both study visits.

CONCLUSION

SW metrics of the PT correlated to change in VISA-P scores in the dominant and non-dominant knees, whereas conventional ultrasound grades of patella tendinopathy did not. There was a trend towards higher SW velocities in patella tendinopathy which may indicate detection of change in intrinsic tissue stiffness.

CLINICAL RELEVANCE/APPLICATION

These results showed significant correlation between SW values and patella tendinopathy symptom scores, demonstrating the benefit of this quantitative imaging technique over conventional ultrasound imaging in the characterization of clinically symptomatic patella tendinopathy.
**Vascular Interventional (Spine and Bone Intervention)**

Tuesday, Nov. 27 3:00PM - 4:00PM Room: S502AB

*IR*  *MR*  *MK*  *VA*

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

FDADiscussions may include off-label uses.

**Participants**
Alexios Kelekis, MD, PhD, Athens, Greece (Moderator) Medical Advisory Board, BTG International Ltd; Medical Advisory Board, Merit Medical Systems, Inc; Research Grant, Mindray Medical

**Sub-Events**

**SSJ26-01**  CT Guided Pulsed Radiofrequency in Patients with Acute Low Back Pain and Sciatica: 1 Year Follow-Up versus Image-Guided Injection Only as Control Group

Tuesday, Nov. 27 3:00PM - 3:10PM Room: S502AB

**Participants**
Alessandro Napoli, MD, Rome, Italy (Presenter) Nothing to Disclose
Roberto Scipione, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Fabrizio Andrani, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Susan Dababou, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Cristina Marrocchio, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Michele Anzidei, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
alessandro.napoli@uniroma1.it

**PURPOSE**
To determine the clinical impact of CT-guided Pulsed Radiofrequency in the management of patients with acute or sub-acute neuro-radiculic pain from lumbar disc herniation, refractory to pro-longed conservative treatment.

**METHOD AND MATERIALS**
We conducted a single center, prospective, randomized trial (1:1) in patients with acute or sub-acute neuro-radiculic low back pain (EMG confirmed), refractory to usual care (conservative). Pulsed radiofrequency (pRF) treatment was performed using a 22-20 G needle-electrode with probe tip directed to the symptomatic dorsal root ganglion under CT guidance; E-pulsed radiofrequency (Cosman G4) was administered for 10 min at 45V with constant local temperature of 42°C. Masking group received 1 to 3 sessions of CT-guided steroid injection on the same anatomi-cal target. Primary outcome was clinical efficacy measured with Visual Analogue Scale (VAS), Oswestry Disability Index (ODI) and Roland-Morris (RM) score for quality of life assessment; all questionnaires were obtained at baseline and at 1-week, 1-3-6 and 12-month follow-up. Analyses were performed on a per-protocol basis.

**RESULTS**
Of 260 patients enrolled, 128 patients received Pulsed Radiofrequency, 120 were treated with injection only strategy treatment. Median VAS scores decreased linearly in both groups; patients that received radiofrequency obtained greater significant overall improvement in pain and disabil-ity scores during the first year (P<0.001). Relief of leg pain was faster for patients assigned to pRF (P<0.001). Patients assigned to pRF also reported a faster rate of perceived recovery (hazard ratio, 1.97; 95% confidence interval, 1.72 to 2.22; P<0.001). The probability of perceived recovery after 1 year of follow-up was 95% in the pRF group and 61% in the injection only group. There were 6 patients considered partial responders that required a second PRF session. Eight pa-tients required further surgical management.

**CONCLUSION**
The 1-year outcomes demonstrated CT-guided Pulsed Radiofrequency superior to injection only strategy. pRF is an effective and repeatable percutaneous treatment option for patients with acute or sub-acute neuro-radiculic low back pain.

**CLINICAL RELEVANCE/APPLICATION**
The results of this study are superior to those reported from literature for usual care strategies and injections and may avoid surgery for a substantial number of patients with sciatic disc com-pression.
Treatment of Osteoid Osteomas with Magnetic Resonance Guided Focused Ultrasound: Evaluation of the Prognostic Value of Post-Treatment Perfusion Differences for Pain Reduction and Bone Remodeling

Participants
Hans Peter Erasmus, Rome, Italy (Presenter) Nothing to Disclose
Alessandro Napoli, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Cristina Marrocchio, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Susan Dababou, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Roberto Scipione, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Andrea Leonardi, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Palumbopierpaolo89@gmail.com

For information about this presentation, contact:

Purspose
Magnetic Resonance guided focused ultrasound (MRgFUS) has proven a safe, feasible and effective treatment modality for osteoid osteoma (OO). To date, however, there are no proven factors to evaluate the patient’s prognosis during / immediately after treatment. To address this question, this study evaluated the role of perfusion scans and the gained data to assess the likelihood of pain reduction and bone remodeling after treatment.

Method and Materials
A total of 42 consecutive patients with symptomatic osteoid osteomas were treated with MRgFUS from 2011 to 2018. MR (inc. perfusion scan) and CT scans of the lesion were acquired before and immediately after the treatment; follow-up MR and CT scans were acquired at 3, 6, 12, 24 and 36 months and 12 months, respectively. Visual Analog Scale (VAS) score was used to assess pain and was evaluated over the same time periods and, additionally, at 1 week post-treatment. 3 patients were lost during follow-up. Statistical analysis of the correlation with the perfusion data (namely, KTrans) was performed using Spearman’s rho.

Results
In the overall study, the mean age was 25 ± 13.5 years, and 77% of patients were male. 4 patients were retreated with MRgFUS. Mean pre-treatment VAS score was 8.4 ± 1.0 months and 0.6±1.4, 0.1±0.3, 0.1±0.3 0.1±0.2 and 0.1±0.2 at 3, 6, 12, 24 and 36 months, respectively. The median VAS dropped to 0 at 1 week from 8 before treatment and stayed there during the entire follow-up. Mean KTrans was 0.69±0.7 pre-treatment and 0.15±0.13, 0.20±.25, 0.12±0.01, 0.07±0.05, 0.13±0.08 and 0.1±0.08 immediately after treatment and at 3, 6, 12, 24 and 36 month follow-up. Spearman’s rho showed a positive correlation for a >50% KTrans reduction and significant pain reduction as well as for a >90% KTrans reduction and both pain reduction and bone remodeling. Age appeared to be an additional factor with an inverse correlation to bone remodeling. No adverse events were recorded.

Conclusion
The current study demonstrated that KTrans could be a good prognostic tool to evaluate the patient’s likelihood of pain remission and bone remodeling.

Clinical Relevance/Application
In the future, evaluation of KTrans could allow for more reliable treatment efficacy and patient satisfaction after treatment of OO with MRgFUS.

O2-O3 Chemiodiscolysis: Any Issues for Spine Biomechanics? 5 Years MRI Imaging Follow Up

Participants
Pierpaolo Palumbo, MD, L’Aquila, Italy (Presenter) Nothing to Disclose
Federico Bruno, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Simone Quarchioni, Laquila, Italy (Abstract Co-Author) Nothing to Disclose
Maria Valeria Marcella Micelli, Laquila, Italy (Abstract Co-Author) Nothing to Disclose
Marco Varrassi, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Sergio Carducci, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Francesco Amogni, Coppito, Italy (Abstract Co-Author) Nothing to Disclose
Luigi Zugaro, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Aldo Victor Giordano, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Alessandra Splendiani, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Masciocchi, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Palumbopierpaolo89@gmail.com

For information about this presentation, contact:

Purpose
O2-O3 dyscolysis is a well-validated technique for the treatment of symptomatic lumbar disc herniation. Although it is a highly effective procedure, up to now there are only a few evidences about long-term changes on disc treated and on biomechanical changes of the lumbar spine “in toto” after O2-O3 dyscolysis treatment. Indeed, dehydration of a lumbar disc with subsequent volume loss could lead to the same alteration of a degenerative pathology. The purpose of our study was to compare long-term follow-up MR images of patients treated by O2-O3 dyscolysis and long-term follow-up MR images of patients affected by lumbar disc herniation treated without intradiscal administration of O2-O3.

Method and Materials
We recalled 80 patients for an MRI follow-up treated in our department with O2-O3 mixture 5 years earlier: 40 patients treated...
RESULTS
Our analysis showed a significant decrease in disc height and protrusion (respectively mean of 15% and 37.42%) in patients treated with intradiscal O2-O3, despite a decrease of circumferences of 4.72%, differently from control group findings. There was no significant difference in the degree of disc degeneration between the two groups (even more pronounced in patients not treated by dyscolysis), as in both groups we found the same endplate changes (Modic) in about 20% of cases. Analysis of facet joint degeneration shows significant alteration according to Weishaupt classification in both groups, and no significant differences in comparison.

CONCLUSION
Compared with control group, patient treated by O2-O3 dyscolysis didn't show significant difference in lumbar disc degeneration, despite a stable shrinkage of the disc herniation.

CLINICAL RELEVANCE/APPLICATION
Our findings reveal that O2-O3 dyscolysis don't determine significant differences in biomechanical changes compared with the natural course.

Awards
Student Travel Stipend Award
Participants
Roberto Scipione, MD, Rome, Italy (Presenter) Nothing to Disclose
Alessandro Napoli, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Andrea Leonardi, MD, Roma, Italy (Abstract Co-Author) Nothing to Disclose
Fabrizio Andrani, MD, Roma, Italy (Abstract Co-Author) Nothing to Disclose
Hans Peter Erasmus, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Cristina Marrocchio, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Francesca Arrigoni, Coppito, Italy (Abstract Co-Author) Nothing to Disclose
Alberto Bazzocchi, MD, Bologna, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
roberto.scipione@uniroma1.it

PURPOSE
To examine and compare the clinical outcome of MR-guided focused ultrasound (MRgFUS) and CT-guided Radiofrequency Ablation (RFA) in patients with painful non-spinal osteoid osteoma (OO).

METHOD AND MATERIALS
Patients with clinical and radiological findings suggestive for OO were included in this multicenter study; eligible patients had pain scores >=4 (assessed with Visual Analogue Scale, VAS) and could safely undergo both MRgFUS and RFA. Vertebral locations were excluded as considered inaccessable by MRgFUS. Selected participants were assigned to receive either MRgFUS or RFA according to a matched case-control protocol; the two groups were homogeneous in terms of age, gender distribution, pain onset and pain level. Patients underwent periodical three-month follow-ups over a period of 1 year. Safety (rate of complications), clinical effectiveness (Visual Analogue Scale [VAS] pain score reduction) and durability (stability of results over time) of MRgFUS were assessed and compared between the two arms.

RESULTS
112 patients (M: 61; F: 51) were enrolled and assigned to MRgFUS or RFA. In the RFA arms, 2 complications were recorded (1 skin burn, 1 infection at the skin entry site); no treatment-related complications were observed in the MRgFUS arm. No statistically significant difference was recorded between the two arms in terms of efficacy: a complete clinical response (VAS 0) was obtained in 50 patients treated with MRgFUS (89.3%) and in 52 patients treated with RFA (92.9%) at 3-month follow-up (p>0.05). Clinical results were stable over the whole period of follow-up, and no pain recurrence was recorded in both groups.

CONCLUSION
MRgFUS has shown similar clinical results compared to RFA in the management of OO, with the advantage of complete safety. MRgFUS is limited to non-spinal locations.

CLINICAL RELEVANCE/APPLICATION
MRgFUS non-invasiveness provides relevant advantages in the treatment of this impairing disease affecting mostly young population: no ionizing radiation, no incisions or needles, and no complications.
**SSJ26-05 The Role of Multi-Modal Analgesic Cocktail for Pain Control in Patients Undergoing Microwave Ablation**

**Tuesday, Nov. 27 3:40PM - 3:50PM Room: S502AB**

**Awards**
Student Travel Stipend Award

**Participants**
Melvin Omodon, MD, Boston, MA (Presenter) Nothing to Disclose
Rafael Vazquez, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Raul N. Uppot, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact: momodon@mgh.harvard.edu

**PURPOSE**
There has been significant advancement in techniques and outcomes in various aspects of interventional radiology with much emphasis on radiological procedural advances and innovations. However, research in pain management of these patients has taken a back seat. Procedures such as microwave ablation may result in significant post-procedural pain and increased opioid use. There have been significant advances in the treatment of pain and enhancing recovery which may be applicable to interventional radiology patients. The goal of this study is to compare post-procedural pain in patients who received regular monitored anesthesia care during microwave ablation to those who received a multimodal analgesic cocktail (consisting of Gabapentin, Toradol and Dexamethasome) prior to microwave ablation. A secondary goal is to familiarize the audience with the Enhanced Recovery After Surgery protocols offered by anesthesia.

**METHOD AND MATERIALS**
A retrospective analysis was performed on 34 patients who underwent microwave ablation for liver and renal cancer with anesthesia services. The patients were in either of 3 groups: (1) standard monitored anesthesia care, (2) multimodal analgesic cocktail only (with Toradol, Gabapentin and Dexamethasome) and (3) combination of regional block and multimodal analgesics. Post-procedure pain scores and opioid consumption (dilaudid and oxycodone) were recorded.

**RESULTS**
Multimodal pre-procedural cocktail consisting of Gabapentin, Toradol and Dexamethasome is associated with decreased pain and opioid consumption in the immediate post-procedure recovery.

**CONCLUSION**
Patients undergoing liver and renal microwave ablation receiving the multimodal analgesic cocktail generally have less pain scores using the visual analogue scale. They also required less immediate post-procedural anesthesia.

**CLINICAL RELEVANCE/APPLICATION**
This multimodal cocktail consisting of Gabapentin, Toradol and Dexamethasome is associated with decreased pain and opioid consumption post microwave ablation.

---

**SSJ26-06 Histologic Diagnosis of Incidentally Discovered Parotid Lesions: Should Biopsy Be Pursued?**

**Tuesday, Nov. 27 3:50PM - 4:00PM Room: S502AB**

**Participants**
Sarah N. Eberson, MD, Houston, TX (Presenter) Nothing to Disclose
Hassan Al-Balas, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Zeyad A. Metwalli, MD, Bellaire, TX (Abstract Co-Author) Nothing to Disclose
David Sada, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
Purpose: With increased utilization of imaging in evaluation of head and neck conditions, there has been an increase in the detection of incidental parotid lesions. This study compares the pathology of incidentally discovered parotid lesions to a cohort of symptomatic parotid lesions.

**METHOD AND MATERIALS**
Materials and Methods: A single institution retrospective review of all patients who underwent percutaneous biopsy of parotid lesions between January 2010 and December 2017 was performed. 143 patients were identified and divided into two groups: patients with symptomatic parotid lesions and patients with incidentally detected parotid lesions. Patient demographics, lesions characteristics and final histologic diagnosis were recorded and compared between the two groups. Histologic diagnosis in resected lesions was considered the final diagnosis in patients who underwent parotidectomy.

**RESULTS**
Results: Of the 143 study patients, 64 (44.8%) had symptomatic parotid lesions and 79 (53.2%) had incidentally discovered parotid lesions. Histologic diagnosis in the symptomatic group included 27 Warthin tumors (42%), 7 pleomorphic adenomas (11%), 3 intra-parotid lymph nodes (5%) and 27 (42%) with miscellaneous pathology (mucoid pseudomalignant carcinoid, salivary cystadenoma, lymphoepithelial lesion, oncocytoma and lymphoepithelial lesion). Histologic diagnosis in the incidental group included 34 Warthin tumors (43%), 14 pleomorphic adenomas (18%), 5 intra-parotid lymph nodes (6%) and 26 (33%) with miscellaneous pathology. There was no significant difference in final histologic diagnosis between the two groups ($p = 0.34$).

**CONCLUSION**
Conclusion: Incidentally detected asymptomatic parotid lesions have a similar histologic profile to symptomatic lesions and tissue diagnosis is warranted.
Clinical Relevance: The distribution of histologic diagnoses of incidentally discovered parotid lesions is similar to that of symptomatic lesions and tissue diagnosis should be pursued.
**MSES34**

**Essentials of Musculoskeletal**

**Tuesday, Nov. 27 3:30PM - 5:00PM Room: S100AB**

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

Sub-Events

**MSES34A  Identifying Lyme and Scurvy**

Participants
Bethany U. Casagranda, DO, Pittsburgh, PA (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe the history of Lyme disease and scurvy. 2) Identify MSK manifestations of Lyme disease and scurvy utilizing multiple modalities. 3) Explain the appropriate clinical scenarios for adding Lyme disease and scurvy to the differential diagnosis.

**ABSTRACT**

as above

**MSES34B  Commonly Missed Fractures**

Participants
Leon Lenchik, MD, Winston-Salem, NC (Presenter) Nothing to Disclose

For information about this presentation, contact:
llenchik@wakehealth.edu

**LEARNING OBJECTIVES**

1) Develop an approach for detecting commonly missed fractures.

**MSES34C  Imaging of the Diabetic Foot**

Participants
William B. Morrison, MD, Philadelphia, PA (Presenter) Consultant, AprioMed AB; Patent agreement, AprioMed AB; Consultant, Zimmer Biomet Holdings, Inc; Consultant, Samsung Electronics Co, Ltd; Consultant, Medical Metrics, Inc

For information about this presentation, contact:
william.morrison@jefferson.edu and Twitter:@morrisonMSK

**LEARNING OBJECTIVES**

1) Understand the pathoetiology of diabetic foot ulceration and infection. 2) Know the imaging findings associated with diabetic pedal infection. 3) Be aware of imaging pitfalls and the mimickers of infection in the diabetic foot.

**ABSTRACT**

Imaging of the foot in patients with diabetes can be challenging. Modalities and imaging protocol will be discussed in addition to use of MRI contrast agents. Imaging findings will be reviewed, particularly geared toward diagnosis of osteomyelitis in patients with ulceration. Imaging pitfalls and mimickers of infection will also be discussed. Differentiation from Charcot arthropathy will be reviewed. New research will be presented with suggested guidelines and tips for accurate diagnosis.
Interpretation of Musculoskeletal Radiographs: A Forgotten Art

Tuesday, Nov. 27 4:30PM - 6:00PM Room: E353C

LEARNING OBJECTIVES

1) Obtain appropriate radiographs, AP, lateral and obliques. Oblique views are essential as certain fractures may be visible only on this projection. 2) Certain fractures and dislocations are notorious for being overlooked. Know these injuries and be certain to identify or exclude them. 3) Be aware of the potential for satisfaction of search and the potential of diagnostic oversights in certain injuries. Once such an injury is noted look closely for the commonly associated injury. 4) When the clinical diagnosis is not apparent or uncertain on the initial radiographs, do not hesitate to obtain CT or MRI to confirm or exclude an injury. 5) Understand that the location and pattern of pelvic injury varies with patient demographics and injury mechanism. 6) Recognize subtle radiographic findings indicating pelvic injuries that are easily overlooked. 7) Understand the role of advanced cross-sectional imaging in occult fractures, complex bony injury, and soft tissue trauma. 8) Familiarize the radiologist with radiographic imaging pitfalls in the lower extremity and subtle radiographic findings indicating disease. 9) Provide advanced cross-sectional imaging correlation of the radiographic findings. 10) Provide a logical framework in radiologic evaluation of bone tumors. 11) To recognize the importance and use of radiographs in evaluation of bone tumors in differential diagnosis. 12) To recognize various pattern of bone destruction and matrix mineralization.

Sub-Events

RC404A Upper Extremity

Participants
Mini N. Pathria, MD, San Diego, CA (Director) Nothing to Disclose

For information about this presentation, contact:
llenchik@wakehealth.edu

Active Handout: Lee Frank Rogers

RC404B Pelvis and Hip

Participants
Mini N. Pathria, MD, San Diego, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand that the location and pattern of pelvic injury varies with patient demographics and injury mechanism. 2) Recognize subtle radiographic findings indicating pelvic injuries that are easily overlooked. 3) Understand the role of advanced cross-sectional imaging in occult fractures, complex bony injury, and soft tissue trauma.

Active Handout: Mini Nutan Pathria

RC404C Lower Extremity

Participants
Zehava S. Rosenberg, MD, New York, NY (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Familiarize the radiologist with radiographic imaging pitfalls in the lower extremity and subtle radiographic findings indicating disease. 2) Provide advanced cross-sectional imaging correlation of the radiographic findings.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying...
Participants
Mark D. Murphey, MD, Silver Spring, MD (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Provide a logical framework in radiologic evaluation of bone tumors. 2) To recognize the importance and use of radiographs in evaluation of bone tumors in differential diagnosis. 3) To recognize various pattern of bone destruction and matrix mineralization.

ABSTRACT
This discussion focuses on the radiologic assessment of solitary and polyostotic lesions of bone with pathologic correlation. Recognition of the patterns of bone destruction on radiographs and their implication on differential diagnosis is emphasized. Identifying the patterns of matrix mineralization either chondroid or osteoid and the impact on diagnostic considerations is also discussed. Take Home Message 1. The radiographic appearance of bone lesions allows an appropriate differential diagnosis by reflecting the biologic activity of the underlying pathologic process. 2. Radiographic assessment of the solitary bone lesion is imperative to direct appropriate patient management. 3. Recognition of ‘don’t touch’ lesions is an important role for the radiologist.

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/ Mark D. Murphey, MD - 2015 Honored Educator
Emerging Technology: 3D Joint Imaging

Tuesday, Nov. 27 4:30PM - 6:00PM Room: S505AB

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

Discussions may include off-label uses.

Participants
Avneesh Chhabra, MD, Dallas, TX (Moderator) Consultant, ICON plc; Author with royalties, Wolters Kluwer nv; Author with royalties, Jaypee Brothers Medical Publishers Ltd

For information about this presentation, contact:
avneesh.chhabra@utsouthwestern.edu

LEARNING OBJECTIVES
1) Gain knowledge of 3D techniques and segmentation approaches in the domain of musculoskeletal MRI. 2) Assess the current role of 3D imaging in musculoskeletal pathologies. 3) Gain knowledge of emerging roles of 3D isotropic imaging in bone modeling and multiplanar evaluation of internal derangements.

Sub-Events

RC417A 3D MRI of Rotator Cuff and Shoulder Joint

Participants
Soterios Gyftopoulos, MD, Scarsdale, NY (Presenter) Nothing to Disclose

For information about this presentation, contact:
Soterios.Gyftopoulos@nyumc.org

LEARNING OBJECTIVES
1) To describe how 3D imaging technology can better characterize and quantify anterior shoulder instability bone injuries and rotator cuff pathology.

RC417B 3D MRI of Knee Menisci and Bone Modeling

Participants
Avneesh Chhabra, MD, Dallas, TX (Presenter) Consultant, ICON plc; Author with royalties, Wolters Kluwer nv; Author with royalties, Jaypee Brothers Medical Publishers Ltd

For information about this presentation, contact:
avneesh.chhabra@utsouthwestern.edu

LEARNING OBJECTIVES
1) Gain knowledge of optimal 3D isotropic MRI technique for knee meniscus and bone evaluation. 2) Learn how to create meniscus and cruciate specific reconstructions using 3D MRI. 3) Learn how to evaluate meniscus tears and describe their longitudinal extent with arthroscopy correlations.

RC417C 3D MRI of Ankle and Foot

Participants
Jan Fritz, MD, Baltimore, MD (Presenter) Research Grant, Siemens AG; Scientific Advisor, Siemens AG; Scientific Advisor, Alexion Pharmaceuticals, Inc; Speaker, Siemens AG

For information about this presentation, contact:
jfritz9@jhmi.edu

LEARNING OBJECTIVES
1) To apply current techniques and acquisition strategies for isotropic 3D MRI of the ankle and foot. 2) To review the diagnostic performance and comparative accuracy of 3D MRI of the ankle and foot. 3) To illustrate strengths and limitations of 3D MRI of the ankle and foot.

RC417D 3D MRI of Hyaline Cartilage

Participants
Richard Kijowski, MD, Madison, WI (Presenter) Research support, General Electric Company; Consultant, Boston Imaging Core Lab,
LEARNING OBJECTIVES

1) To classify the different types of three-dimensional sequences currently available to evaluate articular cartilage. 2) To compare the advantages and disadvantages of two-dimensional and three-dimensional sequences for evaluating articular cartilage. 3) To discuss the literature comparing the diagnostic performance of two-dimensional and three-dimensional sequences for evaluating articular cartilage. 4) To discuss the literature comparing the diagnostic performance of different three-dimensional sequences for evaluating articular cartilage.

RC417E 3D Rheumatology MRI

Participants
Parham Pezeshk, MD, Dallas, TX (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Review spondyloarthropathies, the burden of disease and the importance of early diagnosis to initiate treatment to avoid irreversible complications. 2) Discuss the challenges of diagnosis and approach to interpret the MR imaging to narrow the differential diagnosis. 3) Review imaging findings of SpA such as enthesis, sacroiliitis, Romanus lesion, Anderson lesion, fatty metaplasia lesions, sacroiliitis, and ankyloses. 4) Discuss the utilization of specific MRI sequences and 3D imaging to improve the diagnostic yield of MR imaging in the diagnosis of SpA. 5) Case presentation of selected examples of pathologies showing incremental value of MR imaging over conventional imaging techniques.
**RC452**

**Dynamic Musculoskeletal US: Clicks and Clunks of the Upper Extremity (Hands-on)**

Tuesday, Nov. 27 4:30PM - 6:00PM Room: E264

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

**Participants**

Viviane Khoury, MD, Philadelphia, PA (Presenter) Nothing to Disclose
Jon A. Jacobson, MD, Ann Arbor, MI (Presenter) Research Consultant, BioClinica, Inc; Advisory Board, General Electric Company; Advisory Board, Koninklijke Philips NV; Royalties, Reed Elsevier
David P. Fessell, MD, Ann Arbor, MI (Presenter) Nothing to Disclose
Ghyathy Habra, MD, Troy, MI (Presenter) Nothing to Disclose
Joseph S. Lee, MD, Madison, WI (Presenter) Grant, General Electric Company Research support, SuperSonic Imagine Research support, Johnson & Johnson Consultant, Echometrix, LLC Royalties, Reed Elsevier
Humberto G. Rosas, MD, Madison, WI (Presenter) Nothing to Disclose
Marnix T. van Holsbeeck, MD, Detroit, MI (Presenter) Minor stockholder, Koninklijke Philips NV; Minor stockholder, General Electric Company; Stockholder, MedEd3D; Grant, Siemens AG; Grant, General Electric Company;
Kambiz Motamedi, MD, Los Angeles, CA (Presenter) Nothing to Disclose
Mark Cresswell, MBCh, Vancouver, BC (Presenter) Research Consultant, RepliCel Life Sciences Inc; Investigator, RepliCel Life Sciences Inc; Consultant, Koninklijke Philips NV
J. Antonio Bouffard, MD, Detroit, MI (Presenter) Nothing to Disclose
Joseph G. Craig, MD, Detroit, MI (Presenter) Nothing to Disclose
Robert R. Lopez, MD, Cornelius, NC (Presenter) Nothing to Disclose
Girish Gandikota, MBBS, Ann Arbor, MI (Presenter) Nothing to Disclose
Marcos L. Sampaio, MD, Ottawa, ON (Presenter) Nothing to Disclose
Andrew J. Grainger, MRCP, FRCR, Leeds, United Kingdom (Presenter) Consultant, Levicept Ltd; Director, The LivingCare Group;
Philippe A. Peetrons, MD, Brussels, Belgium (Presenter) Research Consultant, Canon Medical Systems Corporation

**For information about this presentation, contact:**

andrewgrainger@nhs.net
kmotamedi@mednet.ucla.edu
viviane.khoury@uphs.upenn.edu
jacobsn@umich.edu
klee2@uwhealth.org

**LEARNING OBJECTIVES**

1) Identify anatomic structures which can impinge or move abnormally in the upper extremity causing pain during normal range of motion.
2) Describe the ultrasound anatomy and scanning technique for a dynamic examination of these lesions.
3) Position patients optimally for the dynamic evaluation of the upper extremity respecting ergonomics.

**ABSTRACT**

This course will demonstrate standardized techniques of performing the dynamic examination of upper extremity conditions that are only or best demonstrated dynamically. These include shoulder impingement syndrome, acromioclavicular joint instability, long head of biceps dislocation, medial elbow joint instability, extensor carpi ulnaris dislocation, median nerve movement, and trigger finger. In the first portion of the course, probe positioning will be demonstrated on a model patient with overhead projection during live scanning. In the second portion of the course, an international group of expert radiologists will assist participants in learning positioning and scanning of the shoulder, elbow, and wrist/ finger lesions described. An emphasis on dynamic maneuvers and ergonomic documentation of tissue dynamics will be taught. Participants will be encouraged to directly scan model patients.

**Honored Educators**

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Jon A. Jacobson, MD - 2012 Honored EducatorJon A. Jacobson, MD - 2017 Honored Educator
Muscloskeletal Wednesday Case of the Day

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

AMa PRA Category 1 Credit ™: .50

Participants
Daniel E. Wessell, MD, PhD, Jacksonville, FL (Presenter) Nothing to Disclose
Jonathan A. Flug, MD, MBA, Phoenix, AZ (Abstract Co-Author) Nothing to Disclose
Jeremiah R. Long, MD, Ft Belvoir, VA (Abstract Co-Author) Nothing to Disclose
Joseph M. Bestic, MD, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose
Hillary W. Garner, MD, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose
Andrew Z. Chow, MD, Jacksonville, FL (Abstract Co-Author) Nothing to Disclose
Sara Eckloff, MD, Eau Claire, WI (Abstract Co-Author) Nothing to Disclose
Matthew A. Frick, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Nicholas G. Rhodes, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Sujan C. Fernando, MD, Milwaukee, WI (Abstract Co-Author) Nothing to Disclose
John S. Symanski, MD, Milwaukee, WI (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) Participants will test their diagnostic skills and become familiar with the imaging findings of a variety of challenging and interesting musculoskeletal cases.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Daniel E. Wessell, MD, PhD - 2013 Honored Educator
Keeping Radiology Weird: Spot Diagnoses from the Pacific Northwest (Case-based Competition)

Wednesday, Nov. 28 7:15AM - 8:15AM Room: E451B

GI MK

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

FDA Discussions may include off-label uses.

Participents
Barry G. Hansford, MD, Chicago, IL (Presenter) Nothing to Disclose
Kyle K. Jensen, MD, Portland, OR (Presenter) Nothing to Disclose
Alice W. Fung, MD, Portland, OR (Presenter) Nothing to Disclose

For information about this presentation, contact:
funga@ohsu.edu

LEARNING OBJECTIVES

1) The participant will be introduced to a series of musculoskeletal and abdominal radiology case studies via an interactive game approach designed to encourage 'active' consumption of education material. 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 wireless device (phone, tablet, laptop) to participate.
LEARNING OBJECTIVES

1) Describe the evolution of MRI and the reasons for and against the implementation of fast MR imaging. 2) Describe the advantages and disadvantages of current and emerging techniques for fast MR imaging. 3) Describe how machine learning can be used to accelerate MR imaging.

For information about this presentation, contact:
Soterios.Gyftopoulos@nyumc.org

LEARNING OBJECTIVES

1) Review the evolution of MR imaging from its inception to its current state. 2) Discuss the reasons for and against fast MR imaging.

For information about this presentation, contact:
Soterios.Gyftopoulos@nyumc.org

LEARNING OBJECTIVES

1) Review current techniques that are available to obtain faster MRI scans including abbreviated MRI, single sequence 3D MRI and parallel imaging. 2) Discuss advantages and limitations of these techniques.

For information about this presentation, contact:
jfritz9@jhmi.edu

LEARNING OBJECTIVES

1) To review new and emerging acceleration techniques for 2D and 3D MRI. 2) To identify advantages and limitations of the different acceleration techniques. 3) To apply the most appropriate acceleration techniques for various clinical scenarios of musculoskeletal MRI.

For information about this presentation, contact:
michael.recht@nyumc.org

LEARNING OBJECTIVES

1) Explain the basic concepts behind using machine learning for MR image reconstruction. 2) Understand the advantages provided
by machine learning image reconstruction.
**MSSR41A**  
Shoulder Injuries in the Throwing Athlete

Participants  
Laura W. Bancroft, MD, Orlando, FL (Moderator) Author with royalties, Wolters Kluwer nv; Speaker, World Class CME; Editor, Thieme Medical Publishers, Inc; Travel support, Thieme Medical Publishers, Inc ; ;  
Andrew J. Grainger, MRCP, FRCR, Leeds, United Kingdom (Moderator) Consultant, Levicept Ltd; Director, The LivingCare Group;  

For information about this presentation, contact:  
andrewgrainger@nhs.net

Learning Objectives  
1) To understand the biomechanics of throwing forces as they relate to the shoulder. 2) To become familiar with rotator cuff, labroligamentous, and osseous abnormalities caused by overhead sports.

Abstract  
Overhead throwing athletes develop significant abnormalities as a result of acquired adaptations to the extremes of motion in the dominant shoulder. These abnormalities may eventually result in an inability to throw with the same velocity, the so-called "dead arm" syndrome. These abnormalities involve tendons, ligaments, labrum, muscles, nerves, vessels, and bones. This presentation will review the biomechanics of throwing forces as they relate to the shoulder. The MR imaging characteristics of the resultant abnormalities in the labroligamentous structures and the rotator cuff will also be highlighted. As a prototype, the throwing motion in baseball occurs over a period of approximately 2 seconds and is divided into six stages: wind up, cocking, early and late acceleration, deceleration, and follow through. The late cocking, acceleration, and deceleration phases produce the greatest stress on the glenohumeral joint structures. As with other throwing sports, the superior labrum and rotator cuff are often affected by these extreme forces.

**MSSR41B**  
Soft Tissue Wrist Injury in the Athlete

Participants  
Christian W. Pfirrmann, MD, MBA, Forch, Switzerland (Presenter) Nothing to Disclose

Learning Objectives  
1) To learn about the patterns of injury seen at the wrist in athletes. 2) To understand the advantages and disadvantages of different modalities for imaging the athlete's wrist. 3) To recognize the imaging appearances of cartilage and ligamentous injury at the wrist.

Abstract  
The first part of this interactive session will show some cases of pathologic and normal developmental changes around the physis of shoulders of skeletally immature throwing athletes. The second part of this interactive sessions will show and diusscuss cases with athletic injurys about the wrist.

**MSSR41C**  
Interactive Case Discussion

Participants  
Lynne S. Steinbach, MD, Tiburon, CA (Presenter) Nothing to Disclose  
Christian W. Pfirrmann, MD, MBA, Forch, Switzerland (Presenter) Nothing to Disclose

Learning Objectives  
1) To appreciate pathologic and normal developmental changes in skeletally immature throwing athletes, especially around the physis. 2) To consolidate the knowledge gained from the session with interactive cases of upper limb athletic injury as it relates to the skeletally immature throwing athlete.

Abstract  
The first part of this interactive session will show some cases of pathologic and normal developmental changes around the physis of shoulders of skeletally immature throwing athletes. The second part of this interactive sessions will show and diusscuss cases with athletic injurys about the wrist.
**RC504**

**Musculoskeletal Series: Shoulder MRI**

Wednesday, Nov. 28 8:30AM - 12:00PM Room: S406A

[Image 33x760 to 561x814]

[Image 33x476 to 561x527]

**Participants**

Adam C. Zoga, MD, Philadelphia, PA (Moderator) Nothing to Disclose
Lawrence M. White, MD, FRCP, Toronto, ON (Moderator) Nothing to Disclose
Erin F. Alaia, MD, New York, NY (Moderator) Nothing to Disclose
Lynne S. Steinbach, MD, Tiburon, CA (Moderator) Nothing to Disclose

For information about this presentation, contact:

lawrence.white@uhn.ca
lnenchik@wakehealth.edu
Erin.Fitzgerald@nyumc.org

**Sub-Events**

**RC504-01  Rotator Cuff**

Wednesday, Nov. 28 8:30AM - 8:55AM Room: S406A

Participants
Douglas W. Goodwin, MD, Lebanon, NH (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) To describe the spectrum of normal and pathologic imaging features of the rotator cuff.

**RC504-02  Labrum/Cartilage**

Wednesday, Nov. 28 8:55AM - 9:20AM Room: S406A

Participants
Lawrence M. White, MD, FRCP, Toronto, ON (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe the normal anatomy and function of the labrum and articular cartilage of the glenohumeral joint. 2) Identify appropriate imaging techniques and protocols for assessment of the labrum and articular cartilage of the glenohumeral joint 3) Describe the spectrum of normal and pathologic MR imaging features of the labrum and articular cartilage of the glenohumeral joint.

**RC504-03  Isolated Teres Minor Oedema and/or Atrophy: A Manifestation of Adhesive Capsulitis with Involvement of the Primary Motor Branch of the Teres Minor Muscle at the Stout Fascial Sling**

Wednesday, Nov. 28 9:20AM - 9:30AM Room: S406A

Participants
Aamer F. Iqbal, MBChB, Newport, United Kingdom (Presenter) Nothing to Disclose
Suresh Dalavaye, FRCP, MBBS, Swansea, United Kingdom (Abstract Co-Author) Nothing to Disclose
Ayesha Z. Khatib, MBBS, Cardiff, United Kingdom (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
a15720@doctors.net.uk

**PURPOSE**

Isolated teres minor denervation in the absence of a structural lesion involving the axillary nerve is not an uncommon finding on shoulder MRI. Pathologies such as rotator cuff injuries and axillary nerve traction injury have been mentioned. In our centre, we have identified a number of cases of teres minor oedema in patients with adhesive capsulitis. A study by Chafik et al (2013) described the complex anatomy of the teres minor muscle and found a combined fascia of the infraspinatus, teres minor, long head of triceps and deltoid muscle which forms a stout fascial sling attaching just medial to the inferior glenoid articular cartilage. They discovered that the primary motor branch of the teres minor runs inferior to this prior to entering the muscle. We believe that
posterior inferior joint capsule involvement in adhesive capsulitis results in teres minor oedema and/or atrophy secondary to denervation of this primary motor branch.

METHOD AND MATERIALS

This retrospective study analysed all MRI shoulders with a radiological diagnosis of adhesive capsulitis between 2014-17. Each study was re-reviewed to assess the posterior joint capsule for thickening and its proximity to the described location of the stout fascial sling, the axillary neurovascular bundle and the teres muscle for oedema and/or atrophy.

RESULTS

There were a total of 59 cases with 'adhesive capsulitis' between 2014-2017. There were 38 males and 21 females. The age range was 23-74yrs with a mean age of 47.7yrs. 48(81%) patients had thickening of the posterior inferior joint capsule in close proximity to the described location of the fascial sling. Of these, 36(75%) patients had oedema and/or atrophy. 24(50%) patients had isolated teres minor oedema and 14(29%) patients had isolated muscle atrophy. No axillary bundle lesion were identified.

CONCLUSION

The primary motor branch of the teres minor muscle courses just inferior to the stout fascial sling insertion onto the glenoid neck before it becomes sub-fascial. Adhesive capsulitis with thickening of the posterior inferior joint capsule in close proximity to the stout fascial sling may result in denervation of the primary motor branch of the teres minor resulting in isolated oedema and/or atrophy.

CLINICAL RELEVANCE/APPLICATION

Adhesive capsulitis should be excluded in symptomatic patients thought to have idiopathic isolated muscle oedema/atrophy undergoing surgical decompression of the Teres minor nerve.

RC504-04 Magnetic Resonance Arthrogram Features That Can Be Used to Distinguish Between Iatrogenic Extravasation and True Inferior Glenohumeral Ligament Complex Tears

Participants
Lidi Wan, MD, MD, San Diego, CA (Presenter) Nothing to Disclose
Wilbur Wang, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Brady K. Huang, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Matthew Sharp, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Niloofar Shojaeeadib, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Eric Y. Chang, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
liw142@ucsd.edu

PURPOSE

To identify MR imaging features on shoulder arthrography which can distinguish between iatrogenic-induced extravasation and real IGHL complex lesions and to determine the diagnostic performance of these imaging features.

METHOD AND MATERIALS

This was an IRB-approved, retrospective multi-institution study. 1,740 MR arthrograms were screened for extravasation through the IGHL complex. Exams were independently scored by 3 MSK fellowship-trained radiologists. The IGHL complex was assessed along the anterior-posterior and medial-lateral locations. Morphology of the disrupted margin was evaluated: maximum thickness of the portion floating in contrast (thin, <1mm; medium, 1-3mm; thick, >3mm), caliber change at the torn margin (tapering or reverse tapering), and regularity of the torn margin (single thin fascicle, mop-head, scarred). T-tests, chi-squared tests, and sensitivity/specificity were calculated.

RESULTS

35 exams fulfilled the strict inclusion criteria. Of those with true tears, 8/16 (50%) had a torn anterior band whereas 0/19 cases of iatrogenic induced extravasation demonstrated anterior band disruption (p<0.001). In those with iatrogenic induced extravasation, 12/19 (63.2%) had solitary extravasation through the posterior half of the axillary pouch, compared to none in true IGHL complex lesions (p<0.001). Thick ends were present in 10/16 (62.5%) of the true IGHL complex lesion group whereas 0/19 (0%) demonstrated this finding in the iatrogenic induced extravasation group (p < 0.001). Scarred margins were seen in 8/16 (50%) with true IGHL complex lesions and none of the iatrogenic induced extravasation cases (p<0.001). Presence of a torn anterior band, thick ligament, reverse tapered caliber, and scarred appearance of the torn margin were shown to be 100% specific and a torn posterior band demonstrated 84.2% specificity for true IGHL complex tears. The presence of solitary involvement of the posterior portion of axillary pouch demonstrated 63.2% sensitivity for iatrogenic induced contrast extravasation, but was 100% specific.

CONCLUSION

We have identified MR arthrogram features that can aid the radiologist in distinguishing between iatrogenic-induced extravasation and real IGHL complex lesions.

CLINICAL RELEVANCE/APPLICATION

Discriminating between a true IGHL complex tear from iatrogenic extravasation can be difficult on shoulder MR arthrography, however we have identified features that may aid the radiologist.

RC504-05 Cost-Effectiveness of MR Arthrography versus MRI for Slap Tears

Participants
Naveen Subhas, MD, Shaker Heights, OH (Presenter) Research support, Siemens AG

PURPOSE

To identify MR imaging features on shoulder arthrography which can distinguish between iatrogenic-induced extravasation and real IGHL complex lesions and to determine the diagnostic performance of these imaging features.
Jordan Conroy, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
James Koo, New York, NY (Abstract Co-Author) Nothing to Disclose
Morgan Jones, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Anthony Miniaci, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Soterios Gyftopoulos, MD, Scarsdale, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE

To determine if direct magnetic resonance arthrography (MRA) is more cost-effective than a non-contrast magnetic resonance imaging (MRI) in the diagnosis and management of superior labral anterior to posterior (SLAP) tears.

METHOD AND MATERIALS

Our base case was a 25-year-old with clinical findings of a SLAP tear in whom an imaging test is being ordered for further management. Decision analysis software (TreeAge Pro) was used to create a model from the healthcare perspective to evaluate the cost-effectiveness of 4 imaging strategies: 3-Tesla (T) MRA, 3T MRI, 1.5T MRA and 1.5T MRI. Probability and utility estimates were obtained from published literature. Commercial insurance and Medicaid reimbursements were derived from 2017 Medicare rates. Effectiveness was measured in quality-adjusted life years (QALY) over a 2-year period and costs were calculated in 2017 U.S. dollars.

RESULTS

3T MRI is the least expensive ($6126) and most effective (1.62165 QALY) strategy for our base case and is dominant to 3T MRA ($6799, 1.6165 QALY), 1.5T MRA ($7036, 1.60407 QALY) and 1.5T MRI ($6965, 1.58446 QALY). 3T MRA becomes the most cost-effective option if the specificity of 3T MRI drops below 90.4% with a willingness-to-pay (WTP) threshold of $100,000. If 3T is excluded from the analysis, 1.5T MRA is dominant for our base case but 1.5T MRI becomes the most cost effective option if its specificity is higher than 80.3%. The results remained robust and did not change over a reasonable range of costs, utilities, probabilities and WTP thresholds in 1-way, 2-way and probabilistic sensitivity analyses.

CONCLUSION

3T MRI is the most cost-effective option for management of SLAP tears. If a 3T magnet is not available, 1.5T MRA is the most cost effective option. In both circumstances, the most cost effective option is the test with highest specificity.

CLINICAL RELEVANCE/APPLICATION

MRA has been traditionally considered the test of choice when evaluating labral tears, including SLAP tears. This study, however, shows that if imaging is performed at 3T, MRI is the most cost effective option and may obviate the need for patients to undergo a more invasive test.

RC504-06  Post-arthroscopy Shoulder

Participants
Adam C. Zoga, MD, Philadelphia, PA (Presenter) Nothing to Disclose

For information about this presentation, contact:
adam.zoga@jefferson.edu

Active Handout: Adam C. Zoga


LEARNING OBJECTIVES

1) To be comfortable evaluating radiographs of the shoulder after arthroscopic intervention. 2) To be prepared to select and prescribe an optimal MRI protocol. 3) To be able to identify common glenoid labrum repairs and glenoid augmentations.

RC504-07  Acromioclavicular and Sternoclavicular Joints

Participants
Bruce B. Forster, MD, Vancouver, BC (Presenter) Stockholder, Canada Diagnostic Centres

For information about this presentation, contact:
bruce.forster@vch.ca

LEARNING OBJECTIVES

1) Identify imaging findings in AC and SC joint trauma and be able to indicate how imaging changes management.

RC504-08  Multilevel Glenoid Morphology and Retroversion Assessment in Walch B2 and B3 Types

Participants
Kamran Munawar, MD, New York, NY (Presenter) Nothing to Disclose
Soterios Gyftopoulos, MD, Scarsdale, NY (Abstract Co-Author) Nothing to Disclose
Joseph D. Zuckerman, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Mandeep S. Virk, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

Awards
Student Travel Stipend Award
PURPOSE
A major factor that impacts the long-term outcome and complication rates of total shoulder arthroplasty (TSA) is the preoperative posterior glenoid bone loss quantified by glenoid retroversion. The purpose of this study was to assess if glenoid retroversion angles vary significantly at different glenoid heights in patients with Walch B2 and B3 glenoid types. Glenoid version measurements were also compared between ‘conventional’ CT slices and ‘true’ axial slices.

METHOD AND MATERIALS
386 consecutive CT shoulder studies performed for shoulder arthroplasty preoperative planning were retrospectively reviewed. Patients with B2 and B3 glenoid types were included. ‘True axial’ CT reconstructions were created using a validated technique. Two readers independently measured glenoid retroversion angles according to the Friedman method on true axial CT images using the ‘intermediate’ glenoid line at three glenoid heights: 75% (upper), 50% (equator) and 25% (lower). The ‘clinical’ glenoid version was measured on the conventional axial images and compared with the version measurement on the true axial images.

RESULTS
29 B2 and 8 B3 glenoid types were included. There was no statistically significant difference between the retroversion measurements performed by each reader at the three glenoid levels on the B2 or B3 glenoid types. Inter-reader correlation was substantial. There was a statistically significant difference in the mean glenoid retroversion measured on conventional versus true axial images for both B2 and B3 glenoid types, with 2° overestimation on conventional compared to true axial images (p=0.01).

CONCLUSION
We demonstrated that glenoid version can accurately be measured at any level between 25% to 75% of the glenoid height for Walch B2 and B3 types and that the conventional axial CT overestimates the degree of retroversion when compared with the true axial.

CLINICAL RELEVANCE/APPLICATION
Glenoid retroversion measurement is a crucial component of the pre-operative evaluation of patients with advanced glenohumeral osteoarthritis and can be measured accurately on true axial images at the glenoid equator.

PURPOSE
The purpose of this study was to correlate the MR findings of adhesive capsulitis with clinical stages and thereby propose a MR staging system.

METHOD AND MATERIALS
This study consisted of 74 patients with clinically diagnosed adhesive capsulitis. The edema of the inferior glenohumeral ligament, pericapsular edema, thickness of anterior band of IGHL and axillary pouch, thickness of coracohumeral ligament, obliteration of fat in the subcoracoid triangle were evaluated by MRI.

RESULTS
Thickening of the anterior band of IGHL showed most significant correlation with the clinical stages. The distribution of edema of IGHL and pericapsular edema also showed significant correlation with the clinical stages of adhesive capsulitis. Pericapsular edema and IGHL edema was not observed in stage IV. Based on the correlation between MR findings and clinical staging, we propose a MR staging of adhesive capsulitis. The thickness of anterior band of IGHL on humeral side in range of 4.5 ± 0.9 mm with no obliteration of fat in the subcoracoid triangle were evaluated by MRI.

CONCLUSION
MR is an useful tool for evaluation and prediction of clinical stage of adhesive capsulitis.

CLINICAL RELEVANCE/APPLICATION
Imaging based grading system of adhesive capsulitis can aid in the identification of the stage of the disease even when the clinical manifestations are subtle. This helps in initiation of appropriate treatment to halt the disease progression, prevent the complications and avoid invasive treatment procedures.
Participants
Federico Bruno, MD, L’Aquila, Italy (Presenter) Nothing to Disclose
Simone Quarchioni, Laquila, Italy (Abstract Co-Author) Nothing to Disclose
Pierpaolo Palumbo, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Ester Cannizzaro, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Camilla Ganneramo, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Silvia Mariani, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Antonio Barile, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Masciocchi, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
federico.bruno.1988@gmail.com

PURPOSE
To assess the ability of shoulder 3D MRA and additional ABER scans to quantify bipolar bone loss and detect on-track/off-track lesions in traumatic shoulder instability, using MPR CT images as a reference standard

METHOD AND MATERIALS
We evaluated 23 consecutive patients (15 men, 8 women, mean age 27.6 years, range 19-46) with anterior shoulder instability. All patients were submitted to 3D-CT of the shoulder and direct shoulder MR Arthrography using three-dimensional (3D) isotropic PD sequences in standard and ABER position. Two observers evaluated the images twice in a randomized and blinded way to calculate the glenoid track, the Hill-Sachs interval and to predict engagement using the ‘on-track/off-track’ method. The intra- and inter-observer agreement were calculated

RESULTS
Of the 23 defect combinations, 14 were classified as non-engaging and 9 as engaging, using the ‘on-track/off-track’ method. The intra-observer reliability was 0.921 for 3D-CT and 0.786 for MR Arthrography. The inter-observer agreement ranged from ‘substantial’ to ‘almost perfect’ for both glenoid track and Hill-Sachs interval measurement (p<0.005). ABER MR Arthrography predicted engagement accurately in 21 cases (91.3%).

CONCLUSION
MR Arthrography using 3D isotropic PD sequences is a feasible approach for measuring bony defects in patients with anterior shoulder instability and bipolar bone loss using the ‘on-track/off-track’ method. The same sequence in ABER position showed and added value in direct prediction of the presence of engaging lesions

CLINICAL RELEVANCE/APPLICATION
Prediction of engaging lesions using the glenoid track method represents a valuable tool for the surgeon, that can be used preoperatively to plan the type of stabilization procedure to be performed in patients with anterior shoulder instability

RCS04-11 Extra-articular Shoulder

Participants
Erin F. Alaia, MD, New York, NY (Presenter) Nothing to Disclose

For information about this presentation, contact:
Erin.Fitzgerald@nyumc.org

LEARNING OBJECTIVES
1) Apply a systematic approach to evaluating extra-articular pathology about the shoulder. 2) Review commonly encountered osseous and soft tissue extra-articular shoulder pathology.

RCS04-12 Biceps

Participants
Lynne S. Steinbach, MD, Tiburon, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Review the MR imaging characteristics of normal anatomy, congenital variants and abnormalities of the long head of the biceps at the shoulder.

ABSTRACT
The long head of the biceps tendon originates at the supraglenoid tubercle and attaches to the superior labrum at the anchor. It courses through the glenohumeral joint where it is anchored by a pulley comprised of the superior glenohumeral ligament and coracohumeral ligament before it extends into the bicipital groove and down to the corresponding muscle of the upper arm. There can be anomalies of the biceps tendon ranging from absence to origin from the supraspinatus tendon. The supraspinatus aponeurosis is present in some individuals and lies in front of the biceps in the groove. This should not be mistaken for a tear. The tendon can become degenerated with tendinosis and can tear in the glenohumeral joint at any location. It often tears near the labral attachment and in younger patients this is associated with a SLAP lesion. In the region of the pulley proximal to the groove it can undergo tendinosis and the enlargement of the tendon prevents its excursion into the groove, producing pain upon motion of the biceps for everyday tasks. This is called the hourglass biceps. The biceps pulley may tear. The biceps is intimately associated
with the subscapularis and supraspinatus tendons when it enters the bicipital groove. Tears of these tendons can be associated with biceps subluxation or dislocation. This has been classified by Habermayer. The biceps sheath is continuous with the glenohumeral joint, so fluid surrounding the biceps can be normal. Fluid in the sheath can also be associated with tenosynovitis in the groove. The tendon may tear at any location along its length. Treatment for biceps problems is usually resection of the proximal biceps (tenotomy) or resection of the proximal biceps with anchoring of the proximal portion in the humerus (tenodesis).
Participants
A. Orlando Ortiz, MD, MBA, Mineola, NY (Presenter) Nothing to Disclose
Bassem A. Georgy, MD, MSc, San Diego, CA (Presenter) Consultant, Johnson & Johnson; Consultant, Merit Medical Systems, Inc; Consultant, Medtronic plc; Stockholder, Spine Solutions, Inc;
Allan L. Brook, MD, Bronx, NY (Presenter) Nothing to Disclose
Todd S. Miller, MD, Bronx, NY (Presenter) Nothing to Disclose
Afshin Gangi, MD, PhD, Strasbourg, France (Presenter) Proctor, BTG International Ltd; Proctor, Galil Medical Ltd

For information about this presentation, contact:
gangi@unistra.fr
tmiller@montefiore.org

LEARNING OBJECTIVES
1) Discuss appropriate algorithms for patient selection. 2) Review anatomic and technical considerations for vertebral augmentation. 3) Present an update of the recent advances in vertebral augmentation including sacroplasty. 4) Emphasize safety issues and how to avoid complications. 5) Understand the applications of vertebral augmentation in osteoporotic and neoplastic spine pathology. 6) Update participants with respect to advances in equipment and biomaterials.

ABSTRACT
1. Patient selection for vertebral augmentation. Indications and Contraindications. 2. New devices and techniques in vertebral augmentation. 3. Vertebral augmentation for osteoporotic and pathologic vertebral compression fractures. 4. Sacroplasty (sacral augmentation). 5. Complications avoidance. 6. Efficacy Vertebral augmentation is an image-guided (fluoroscopy or CT) percutaneous procedure in which a bone needle is inserted into a painful osteoporotic or pathologic fracture within the spinal axis. Biopsy, cavity creation, or lesion ablation may then be performed under imaging guidance depending on the nature of the pathology that is being treated. Subsequently, a radioopaque implant, usually an acrylic bone cement, is carefully injected into the vertebra or sacral ala under imaging guidance. These procedures have been shown to provide pain relief by stabilizing the fractured vertebra or sacrum. As with any other invasive procedure, they carry a small risk (<1%) of complication including bleeding, infection, neurovascular injury, or cement embolus. Appropriate patient selection and a detailed understanding of the technical aspects of the procedure along with active clinical patient follow-up are paramount to a successful outcome. This workshop will utilize short lectures, case examples, and interactive audience participation in order to further explore critical topics in vertebral augmentation.
LEARNING OBJECTIVES

1) Review the unique biomechanical and imaging presentation of the developing pediatric spine. 2) Review key features of pediatric spine trauma. 3) Present a brief introduction into congenital versus acquired spine disorders.

ABSTRACT
The normal development and variations of the pediatric spinal column will be discussed, age specific biomechanical properties and resultant variable patterns of accidental and non-accidental injury will be reviewed. In addition, a brief introduction will be given on differentiating acquired from congenital spine and spinal cord pathologies using a case based approach.

Participants
Mark C. Liszewski, MD, Bronx, NY (Presenter) Grant, Carestream Health, Inc; Advisory Board, Carestream Health, Inc
For information about this presentation, contact:
mliszews@montefiore.org

LEARNING OBJECTIVES

1) Describe the imaging findings of several pediatric pulmonary disorders. 2) Differentiate between disorders with similar findings. 3) Recommend appropriate management based on the imaging features.

ABSTRACT
Congenital and acquired pediatric pulmonary cases will be presented. Discussion will include: 1) description of the imaging features for each condition, 2) tips for differentiating between conditions with similar imaging findings, 3) up-to-date recommendations for management and follow-up for each condition.

Participants
Amy F. Juliano, MD, BOSTON, MA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize normal variants in the pediatric musculoskeletal system and distinguish them from disease processes. 2) Be familiar with MR imaging findings in patients with chronic non bacterial osteomyelitis. 3) Differentiate musculoskeletal neoplasms from infections.

ABSTRACT
A series of pediatric musculoskeletal cases will be presented to illustrate: 1- normal variants that can be confused with pathology 2- MR imaging spectrum of chronic non bacterial osteomyelitis (CNO) 3- Neoplasms that can mimic infections and vice versa.
MSSR42

RSNA/ESR Sports Imaging Symposium: Lower Extremity Sports Injuries (Interactive Session)

Wednesday, Nov. 28 10:30AM - 12:00PM Room: E352

Participants
Laura W. Bancroft, MD, Orlando, FL (Moderator) Author with royalties, Wolters Kluwer nv; Speaker, World Class CME; Editor, Thieme Medical Publishers, Inc; Travel support, Thieme Medical Publishers, Inc; Andrew J. Grainger, MRCP, FRCR, Leeds, United Kingdom (Moderator) Consultant, Levicept Ltd; Director, The LivingCare Group;

Sub-Events

MSSR42A  Sports-related Injuries of the Knee: What Does the Orthopedic Surgeon Need to Know?

Participants
Theodore T. Miller, MD, New York, NY (Presenter) Nothing to Disclose

For information about this presentation, contact:
millertt@hss.edu

LEARNING OBJECTIVES

1) To be able to describe features of meniscal tears, ACL tears, and cartilage abnormalities that should be included in the MRI report. 2) To be able to recognize common sports-related injury patterns of the knee.

MSSR42B  Multimodality Imaging of the Foot and Ankle Injuries in the Athlete

Participants
Andrew J. Grainger, MRCP, FRCR, Leeds, United Kingdom (Presenter) Consultant, Levicept Ltd; Director, The LivingCare Group;

For information about this presentation, contact:
andrewgrainger@nhs.net

LEARNING OBJECTIVES

1) To appreciate the different and often contributory roles that imaging modalities have in the foot and ankle. 2) To recognize the most common ligamentous and tendon injuries in the ankle. 3) To understand how common patterns of injury relate to the mechanisms involved.

ABSTRACT

Abstract: Ankle injuries are common in many sports and the complicated anatomy of the ankle joint can be challenging the reporting radiologist. The ankle joint itself is a synovial hinge joint, but important movement for ankle function also occurs at the joints of the hind and midfoot which are also susceptible to injury. In addition to conventional radiographs, CT, MRI and ultrasound all have important roles to play in the diagnosis of foot and ankle injuries in the athlete. The ligamentous and tendon structures about the ankle are generally superficial in nature and readily amenable to assessment with ultrasound where assessment can be enhanced due to the dynamic capabilities of the technique. While MRI also demonstrates these structures, it has advantages for assessing deeper joint structures such as the chondral surfaces and bones. The complex 3d anatomy of the foot and ankle means that conventional radiographs can struggle to demonstrate bone injury which means CT also has an important role to play. This lecture will focus on the use of these imaging modalities for the assessment of acute and chronic ligamentous and tendon injury. Emphasis will be put on the mechanisms of injury and how they determine the resultant patterns of injury and the imaging appearances.

Active Handout:Andrew J. Grainger

MSSR42C  Interactive Case Discussion

Participants
Theodore T. Miller, MD, New York, NY (Presenter) Nothing to Disclose
Andrew J. Grainger, MRCP, FRCR, Leeds, United Kingdom (Presenter) Consultant, Levicept Ltd; Director, The LivingCare Group;

For information about this presentation, contact:
andrewgrainger@nhs.net

LEARNING OBJECTIVES

1) To appreciate common patterns of athletic injury in the knee. 2) To become familiar with the techniques available and imaging appearances of the knee, foot and ankle athletic injury. 3) To consolidate the knowledge gained from the session with interactive cases of lower limb athletic injury.
**SSK13-01 Lower Leg Muscle Activation during Walking and Running: Quantitative Muscle-specific Assessment of Microvascular Perfusion with Intravoxel Incoherent Motion (IVIM) MR Imaging**

**Participants**
Christine B. Chung, MD, La Jolla, CA (Moderator) Nothing to Disclose
Gregory Chang, MD, New York, NY (Moderator) Nothing to Disclose

**Sub-Events**

**Purpose**
Little is known about muscle activation patterns during walking and running. Blood flow to skeletal muscles depends on the metabolic activity. Aim of this study was to non-invasively assess specific muscle activation of the lower limb after walking and running by using Intravoxel Incoherent Motion (IVIM) perfusion MRI.

**Method and Materials**
3T MR IVIM diffusion-weighted images of the lower extremities of 8 healthy female volunteers (mean age 27.5±5.7 years) were acquired at rest and immediately after walking and running, respectively. For IVIM measurements, a transverse monopolar pulsed gradient fat suppressed spin echo (SE) EPI sequence was used (9 b-values from 0 to 1000s/mm², 3 orthogonal directions). In addition, anatomical transverse T1-weighted turbo SE images were acquired at rest. Entire muscles of the pelvis, thigh and lower leg were segmented. IVIM perfusion parameters f, D* and fD* and the diffusion coefficient D were obtained after standard two-steps fitting of the IVIM bi-exponential signal equation. Descriptive statistics, paired t-tests, multiple regression models and Pearson's correlations were used for statistical analyses.

**Results**
Mean heart rates were 63±3min⁻¹ at rest, 113±14min⁻¹ during walking and 166±14min⁻¹ during jogging. Microvascular blood-flow related fD* correlated significantly with heart rate while walking and running, respectively (P<0.05). Mean fD* of all muscles was significantly higher after running (2.18±0.98×10⁻³mm²/s, P<0.001) and after walking (1.99±0.80×10⁻³mm²/s, P<0.001) compared to rest (1.65±0.83×10⁻³mm²/s). Perfusion increase was gradual and most pronounced for the lower leg muscles (fD* increase of 60.8% after walking, 137.3% after running compared to rest, P<0.001) and for the feet muscles (78.4% and 181.4%, P<0.001) (Figure). Abductor muscles showed a higher microvascular perfusion than adductor muscles; quadriceps muscles showed a higher perfusion than hamstrings (P<0.05).

**Conclusion**
Non-invasive IVIM MRI is able to quantitatively measure local microvascular muscle perfusion in order to detect muscle activation patterns after walking and running.

**Clinical Relevance/Application**
IVIM is a promising modality to non-invasively assess muscle physiology. It may potentially be of use to monitor changes in physiological microvascular muscle perfusion after training and to detect pathological muscle recruitment patterns.
Asymmetric Muscle Recruitment of the Back during Exercise in Patients with Scoliosis Demonstrated with Intravoxel Incoherent Motion (IVIM) MR Perfusion Imaging: Preliminary Results

Wednesday, Nov. 28 10:50AM - 11:00AM Room: N229

Participants
Christian Federau, Basel, Switzerland (Presenter) Nothing to Disclose
Daniela Kroismayr, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Linda Dyer, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Mazda Farshad, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Christian W. Pfirrmann, MD, MBA, Forch, Switzerland (Abstract Co-Author) Nothing to Disclose

PURPOSE

To evaluate the role of qualitative DWI, qualitative CSI: quantitative DWI(ADC values) and quantitative CSI(Signal Intensity Ratio - SIR values) in the differentiation of benign and malignant vertebral lesions.

METHOD AND MATERIALS

44 patients of all age group of both sexes showing presence of vertebral fractures on MRI were included in study. We used the biopsy results or results of clinical and radiologic follow up for at least 6 months, as the gold standard to classify the vertebral fractures as benign or malignant. The presence of high SI of vertebral fractures on DWI were considered as diffusion restricting. ADC values acquired, by placing ROI in ADC maps over the areas within the vertebral fractures that were showing abnormal signal intensities on T1, T2 weighted and STIR. The SI of vertebral fractures were compared in in-phase and out-of-phase image and loss of signal on out-of-phase image was evaluated. Quantitative analysis was done by calculating SIR values of opposed-phase to in-phase, by placing ROI over the areas within the vertebral fractures on the in-phase images and corresponding areas on the out-of-phase images(that were of abnormal SI on T1, T2 weighted and STIR sequences). SIR = SI opposed-phase / SI in-phase.

RESULTS

Qualitative DWI resulted in sensitivity of 92.9%, specificity of 20%, PPV of 35.14%, NPV of 85.71% and accuracy of 43.2%. The mean ADCs for the benign (1.37 ± 0.22) compression fracture group were significantly higher than the malignant (0.94 ± 0.17) group, and ADC cutoff value of 1.085 resulted in sensitivity of 85.7%, specificity of 83.3%, PPV of 70.59%, NPV of 92.5% and accuracy of 84.1%. Qualitative CSI resulted in sensitivity of 92.9%, specificity of 53.3%, PPV of 48.15%, NPV of 94.12% and accuracy of 65.9%. The mean SIRs for the benign (0.67 ± 29) compression fracture group were significantly lower than SIR values for the malignant (1.12 ± 0.15) group and SIR cutoff value to be 0.97 was identified with sensitivity of 92.9%, specificity of 90%, PPV of 81.25%, NPV of 96.43% and accuracy of 90.9%.

CONCLUSION

Quantifying the loss of signal on out-of-phase imaging and quantifying diffusion on ADC maps, can be used in differentiation between benign and malignant vertebral compression fractures.

CLINICAL RELEVANCE/APPLICATION

Quantitative DWI and quantitative chemical shift imaging can differentiate between benign and malignant vertebral fractures and is recommended as part of a MR study.

SSK13-03 Asymmetric Muscle Recruitment of the Back during Exercise in Patients with Scoliosis Demonstrated with Intravoxel Incoherent Motion (IVIM) MR Perfusion Imaging: Preliminary Results

Participants
Christian Federau, Basel, Switzerland (Presenter) Nothing to Disclose
Daniela Kroismayr, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Linda Dyer, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Mazda Farshad, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose
Christian W. Pfirrmann, MD, MBA, Forch, Switzerland (Abstract Co-Author) Nothing to Disclose

PURPOSE

It is thought that patients with scoliosis overuse the back muscle in the convexity of their scoliosis, which might worsen their condition. Because muscle activity increases local blood flow, muscle recruitment can be mapped using MR perfusion imaging. The purpose of this work was to study the muscular recruitment of back muscle during Roman chair exercise in patients with scoliosis using Intravoxel Incoherent Motion (IVIM), an imaging technique which extracts local and quantitative perfusion information from a diffusion weighted MRI sequence, without the need for an injection of a contrast agent.

METHOD AND MATERIALS

4 patients (3/1 f/m,20±4y) with scoliosis (Cobb angle 28±2°, range [25-30°]) were scanned at 3T first after observing a period of rest of 20 min, and then immediately after performing a symmetric back muscle exercise on a Roman chair, holding a 4kg dumbbell with both hands in the middle of the thorax, until exhaustion (72±2s). The IVIM diffusion-weighted sequence consisted of a spin-echo with echo planar readout and monopolar pulsed gradients with 16 b-values ranging from 0-900s/mm2. The IVIM bi-exponential signal equation model was fitted using a C++ implementation of a standard two steps algorithms. A region of interest was drawn in the paraspinal muscles at the level of the convexity of the scoliosis on both sides. Statistical significance was assessed using paired Student t-test.

RESULTS

At rest, microvascular blood-flow related IVIM fD* was found larger in the paraspinal muscles on the side of convexity (5.8±1.1x10-3mm2/s) compared to the concavity (4.3±1.5x10-3mm2/s), but the difference was not significantly (p=0.11). After Roman chair muscle exercise, fD* increased significantly in the paraspinal muscles (p=0.001), and fD* was significantly larger in the paraspinal muscles on the side of convexity (7.7±0.8x10-3mm2/s) compared to the concavity (5.3±1.0x10-3mm2/s,p=0.001).

CONCLUSION

The preliminary data of this study demonstrates an asymmetric microvascular muscle perfusion pattern in the muscle of the back after exercise in patient with scoliosis.

CLINICAL RELEVANCE/APPLICATION

This study helps clarifying muscular recruitment of back muscle during exercise in patients with scoliosis, and could help to improve current physiotherapeutic and surgical treatment approaches.
Six healthy subjects were recruited for this IRB approved study on a Siemens Prisma 3T magnet. Stimulated-echo diffusion response in patellar tendinopathy. Achilles tendon, was applied to PT of healthy subjects. After validation, this technique can be readily adopted to assess treatment requirement. In this study, a stimulated-echo based short TE (~15ms) diffusion protocol (ste-RS-EPI), originally developed for application of conventional diffusion MRI protocols to PT is challenged by short T2/T2* values (~2ms) and the long TE (~60ms) motion (IVIM) imaging can assess the microstructure and microcirculation characteristics of biological tissue. However, the play crucial roles in the progression of tendinopathy and tendon repair. Diffusion tensor imaging (DTI) and intravoxel incoherent motion of: adults 18-100 years, no metal in the field of view, extremity MRI scans with DWI imaging, and established reference standards of biopsy, surgery, and follow-up results. Patient cases were placed into six categories of infection: soft tissue edema, soft tissue cellulitis, soft tissue abscess, osteitis, osteomyelitis, and intraosseous abscesses in the lower extremity.

METHOD AND MATERIALS
The MRIs of sixty-two patients with musculoskeletal inflammation and/or infection were retrospectively evaluated through measurement of ROIs on DWI and ADC at the site of disease. Imaging was conducted between 2014 and 2017 with inclusion criteria of: adults 18-100 years, no metal in the field of view, extremity MRI scans with DWI imaging, and established reference standards of biopsy, surgery, and follow-up results. Patient cases were placed into six categories of infection: soft tissue edema, soft tissue cellulitis, soft tissue abscess, osteitis, osteomyelitis, and intraosseous abscesses. Diagnosis was based on a combination of pathology reports and clinical correlation (lab values, patient care notes, treatment regimen, time to resolution of symptoms). ROIs were measured by three readers trained by an experience musculoskeletal radiologist at the region of interest with minimum area of 1cm2. Statistical analysis of data was performed to measure inter-reader agreement with ICC and significance of ROI measurements on ADC with ANOVA to test for differences between the six categories of infection. The Bonferroni adjustment was applied to adjust the p value for multiple comparisons.

RESULTS
The mean ADC value of osteitis is 1.58 compared to 1.41 for osteomyelitis and 0.78 for intraosseous abscess with statistically significant difference (p < 0.02). Similarly, mean ADC value of soft tissue cellulitis is 1.70 and soft tissue abscess is 0.73 with statistically significant difference (p < 0.001). Intra-reader agreement was excellent with ICC of 0.93 and 0.96 between the three readers. The mean ADC value of osteitis is 1.58 compared to 1.41 for osteomyelitis and 0.78 for intraosseous abscess with statistically significant difference (p < 0.02). Similarly, mean ADC value of soft tissue cellulitis is 1.70 and soft tissue abscess is 0.73 with statistically significant difference (p < 0.001). Intra-reader agreement was excellent with ICC of 0.93 and 0.96 between the three readers.

CONCLUSION
DWI and ROI measurements on ADC can reliably distinguish between osteitis, osteomyelitis and intraosseous abscess, as well as soft tissue abscess and soft tissue cellulitis.

CLINICAL RELEVANCE/APPLICATION
DWI and ADC measurements can distinguish between musculoskeletal infections and are recommended as part of the MRI studies and evaluation of these conditions.

SSK13-05  Diffusion MRI of Human Patellar Tendon: Initial Experience

Participants
Kenneth T. Wengler, MS, Stony Brook, NY (Abstract Co-Author) Nothing to Disclose
Takehi Fukuda, MD, Stony Brook, NY (Abstract Co-Author) Nothing to Disclose
Dharmesh Tank, MD, Stony Brook, NY (Presenter) Nothing to Disclose
Mingqian Huang, MD, Syosset, NY (Abstract Co-Author) Nothing to Disclose
David E. Komatsu, PhD, Stony Brook, NY (Abstract Co-Author) Nothing to Disclose
James M. Paci, MD, Setauket- East Setauket, NY (Abstract Co-Author) Nothing to Disclose
Eilane S. Gould, MD, Stony Brook, NY (Abstract Co-Author) Consultant, Endo International plc
Mark E. Schweitzer, MD, Stony Brook, NY (Abstract Co-Author) Consultant, MM Medical International GmbH; Data Safety Monitoring Board, Histogenics Corporation
Xiang He, PhD, Stony Brook, NY (Abstract Co-Author) Consultant, Endo International plc

PURPOSE
The patellar tendon (PT) is essential for knee extension. Patellar tendinopathy causes persistent anterior knee pain and occurs in ~14% of recreational athletes. Despite the high prevalence, no consensus treatment exists. PT microstructure and microcirculation play crucial roles in the progression of tendinopathy and tendon repair. Diffusion tensor imaging (DTI) and intravoxel incoherent motion (IVIM) imaging can assess the microstructure and microcirculation characteristics of biological tissue. However, the application of conventional diffusion MRI protocols to PT is challenged by short T2/T2* values (~2ms) and the long TE (~60ms) requirement. In this study, a stimulated-echo based short TE (~15ms) diffusion protocol (ste-RS-EPI), originally developed for Achilles tendon, was applied to PT of healthy subjects. After validation, this technique can be readily adopted to assess treatment response in patellar tendinopathy.

METHOD AND MATERIALS
Six healthy subjects were recruited for this IRB approved study on a Siemens Prisma 3T magnet. Stimulated-echo diffusion
preparation with readout-segmented EPI (ste-RS-EPI) was adopted. To further boost tendon MR signal, magic angle effect was exploited by positioning PT ~55 degrees w.r.t. B0 direction. PT fractional anisotropy (FA), radial diffusivity (RD), axial diffusivity (AD), and mean diffusivity (MD) maps were generated with DTI Studio. PT diffusion coefficient (D), pseudo-diffusion coefficient (D*), and perfusion fraction (fp) were calculated using standard bi-exponential fit to the IVIM signal. The product of D* and fp was used as an indicator of intra-tendinous blood flow.

RESULTS
Ste-RS-EPI images achieved high signal and good image quality for the PT. The measured DTI and IVIM parameters (diffusivities in units of ×10-3 mm2/s) in the PT were: AD (1.54±0.09), RD (1.01±0.06), MD (1.19±0.07), FA (0.29±0.02), fp (4.6±1.2%), and D*×fp (36.6±6.9).

CONCLUSION
This preliminary study demonstrated the feasibility of the ste-RS-EPI DTI and IVIM protocols to assess patellar tendon microstructure and microcirculation. The estimated DTI and IVIM parameters in control subjects may serve as a baseline for subsequent studies on patients with clinical and subclinical patellar tendinopathy.

CLINICAL RELEVANCE/APPLICATION
The ste-RS-EPI DTI and IVIM techniques may be used for evaluation of tendinopathy and to quantitatively assess pathophysiologic changes that occur as a result from various treatments.

SSK13-06  Diffusion Tensor Imaging With Quantitative Evaluation of Sciatic Nerve within the Pelvis in Patients with Non-Contributory Lumbar Spine Magnetic Resonance Imaging in Radiculopathy: Preliminary Results

Wednesday, Nov. 28 11:20AM - 11:30AM Room: N229

Participants
Matteo Catania, MD, Trieste, Italy (Presenter) Nothing to Disclose
Giovanni Foti, MD, Negrar, Italy (Abstract Co-Author) Nothing to Disclose
Luigi Romano, MD, Verona, Italy (Abstract Co-Author) Nothing to Disclose
Alberto Beltramello, MD, Negrar, Italy (Abstract Co-Author) Nothing to Disclose
Emanuele Demozzi, MD, Negrar, Italy (Abstract Co-Author) Nothing to Disclose
Giovanni M. Carbognin, MD, Verona, Italy (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
matteocatania89@gmail.com

PURPOSE
Diffusion tensor imaging with quantitative evaluation of sciatic nerve within the pelvis in Patients with non-contributory lumbar spine magnetic resonance imaging in radiculopathy: preliminary results.

METHOD AND MATERIALS
This prospective institutional review board-approved study included 32 consecutive patients (11 males and 21 females; mean age of 41.2, range 19-52 years) studied between October 2016 and February 2018. The study population included 32 patients suffering from sciatica pain with negative lumbar MRI. All patients underwent DTI sequence of the pelvis (TR/TE 5800/97 ms; b=1000; slice thickness 3.5 mm; directions=20) by using a 1.5T scanner (Siemens Aera). DTI data were postprocessed on a dedicated offline workstation by two radiologists (25 and 11 years of experience, respectively) blinded to clinical data. Each radiologist placed two ROI on the nerve roots at three different levels within the pelvis on both side, and the mean value was used for further analysis. Clinical findings served as standard of reference. Diagnostic accuracy values of the FA numbers by using receiver operator curves (ROC) and relative area under the curve (AUC) were calculated. Inter-observer and intra-observer agreement were calculated with k-statistics. Continuous and categorical variables were evaluated by using t test and x2 or Fisher exact test, as appropriate. A value of p<0.05 was considered statistically significant.

RESULTS
The lumbar nerve roots were visualized and FA values were calculated in all subjects. The FA values were significantly different between suffering nerve roots (178± 48; range 146-285) and spared side (296± 52; range 221-412) with a p value <0.001. The ROC curve analysis revealed an AUC of 0.816 (95% confidence interval: 0.682-0.874). By using a FA of 220 as cutoff to identify suffering nerve roots, the sensitivity, specificity, PPV and NPV and accuracy of DTI sequences were and 81.8, 95.4, 90.0, 91.3 and 90.9%, respectively. The interobserver and intraobserver agreement were near perfect (k=0.83 and k=0.81, respectively).

CONCLUSION
DTI can quantitatively demonstrate the presence of suffering sciatic nerve roots within the pelvis.

CLINICAL RELEVANCE/APPLICATION
DTI can quantitatively evaluate compressed nerve roots of sciatic nerve in patients with negative lumbar MRI. This sequences could be used to guide the identification of nerve compression site within the pelvis by means of a tailored MR study.

SSK13-07  Comparison of Proton Density Fat Fraction, Simultaneous R2*, and Diffusion Weighted Image for Assessment of Focal Vertebral Bone Marrow Lesions

Wednesday, Nov. 28 11:30AM - 11:40AM Room: N229

Participants
Seong Woo Jeon, MD, Suwon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Kyu-Sung Kwack, MD, PhD, Suwon, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sunghoon Park, MD, Suwon, Korea, Republic Of (Presenter) Nothing to Disclose
To investigate proton density fat fraction (PDFF), R2* and apparent diffusion coefficient (ADC) estimation for assessing focal vertebral bone marrow lesions.

METHOD AND MATERIALS

We retrospectively reviewed 182 spine MRIs performed in 119 patients with focal vertebral bone marrow lesions from November 2016 to February 2018. The lesions were divided into bone metastases and focal benign vertebral bone marrow lesions. The protocol consisted of routine clinical sequences followed by IDEAL-IQ and diffusion-weighted (DW) magnetic resonance (MR) imaging with 1.5T MR unit (Signa HDxt, GE Healthcare, Waukesha, WI). PDFF and R2* were performed using a quantitative chemical shift-based water-fat separation method known as IDEAL-IQ with a multi-echo gradient echo sequence. ADC (b = 0 and 800 s/mm²) was calculated with a monoexponential fitting of the DW image data. PDFF, R2*, and ADC were compared using the Mann-Whitney U test. Receiver operating characteristic (ROC) curve analysis was performed to assess the diagnostic performances for differentiating metastasis from benign vertebral bone marrow lesions.

RESULTS

In the comparison of diagnostic performance among parameters, the PDFF (AUC = 0.960; 95% confidence interval [CI], 0.921, 0.984) showed a significantly larger AUC as compared to the R2* (AUC = 0.667; 95% CI, 0.593 - 0.735) and ADC (AUC = 0.754; 95% CI, 0.685 - 0.815) value. The optimal cut-off value of fat fraction for predicting focal malignant vertebral bone marrow lesions was 9.0%; at this threshold, sensitivity was 97.30% and specificity was 91.55%. All the PDFF, R2*, and ADC values sequences were in almost perfect agreement (r values > 0.8).

CONCLUSION

Our study shows that PDFF measurement can enable in differentiating focal vertebral bone marrow lesions, and may be more useful than DW MR imaging.

CLINICAL RELEVANCE/APPLICATION

PDFF can be the excellent diagnostic performance in differentiating focal vertebral bone marrow lesions and this examination recommend in the evaluation of suspected bone metastases.
Participants
Hyungseok Jang, La Jolla, CA (Presenter) Nothing to Disclose
Yajun Ma, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Saeed Jerban, PhD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Tan Guo, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose
Wei Zhao, La Jolla, CA (Abstract Co-Author) Nothing to Disclose
Eric Y. Chang, MD, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Jiang Du, PhD, San Diego, CA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
h4jang@ucsd.edu

PURPOSE
Use of fat saturation (FS) pulses with UTE sequences can improve short T2 contrast but reduce short T2 signal, and two point Dixon (2p-Dixon) method can misestimate fat due to short T2* decay. We propose single point Dixon (1p-Dixon) method to suppress fat for high contrast UTE imaging of short T2 tissues.

METHOD AND MATERIALS
1p-Dixon technique directly decomposes fat and water from complex MR signals after correcting phase errors due to field inhomogeneity (Ma. JMRI 2008). The proposed method utilizes dual echo 3D UTE imaging, where UTE is followed by the 2nd TE (TE2), chosen flexibly. Fat is estimated by applying 1p-Dixon to the non-UTE image at TE2, and used to suppress fat in the UTE image. In-vivo experiments were performed in 3T (GE-MR750) with two healthy volunteers (left knee of male aged 36 and left ankle of male aged 26). Parameters for knee imaging were as follows: flip angle=15degree, TE1/TE2/TR=32µs/2.7ms/20ms, voxel size=0.6x0.6x3mm scan time=3min50sec. Parameters for ankle imaging were set same as above except: TE2 =2.9ms, voxel size=0.5x0.5x3mm scan time=5min30sec.

RESULTS
Since 2p-Dixon does not consider signal decay between UTE and TE2, the short T2* decay is misinterpreted as a contribution of fat signal partially nulling water signal. Therefore, in the knee imaging fat signal in tendon and bone was misestimated by 2p-Dixon method, while the 1p-Dixon method was not affected by the short T2* signal decay. Compared with FS, 1p-Dixon based approach showed strong signal intensity in the patellar and Achilles tendon with less spatial variation in the fat suppressed UTE images, while the UTE images with FS pulse exhibited lower intensity in the tendons with gradually varying signal. The pattern of signal variation in the UTE images with FS was very similar to the water images at TE2 where most of short T2 (especially bound water) signal already decayed, which implies broad-spectrum short T2 components were partially affected by the FS pulse.

CONCLUSION
We demonstrated feasibility of 1p-Dixon based fat suppression in UTE imaging, which has the advantage of flexible echo spacing and accurate fat estimation over 2p-Dixon. Moreover, the proposed method preserves short T2 (especially bound water) signal significantly better than FS method.

CLINICAL RELEVANCE/APPLICATION
The proposed method has potential to aid with various types of morphological and quantitative UTE imaging, such as T2* mapping or UTE-MT modeling.
**Diagnostic Outcome of Image-Guided Percutaneous Core Needle Biopsy of Sclerotic Bone Lesions: A Meta-Analysis**

**Station #1**

**Participants**
Ogonna K. Nwawka, MD, New York, NY (Moderator) Research Grant, General Electric Company

Sub-Events

**MK384-SD-WEA1**

**PURPOSE**
This meta-analysis aimed to evaluate the diagnostic outcome (diagnostic yield and accuracy) of image-guided percutaneous core needle biopsy (CNB) of sclerotic bone lesions.

**METHOD AND MATERIALS**
This meta-analysis followed the guidelines of the Preferred Reporting Items for a Systematic Review and Meta-analysis (PRISMA) statement. A computerized search of the PubMed and EMBASE databases was performed to identify relevant original articles on the use of image-guided percutaneous CNB of sclerotic bone lesions. The pooled proportions of the diagnostic yield and pooled accuracy estimates were assessed using random-effects modeling. We also performed subgroup analyses of the diagnostic yield according to the drill systems (battery-powered vs. manual). Heterogeneity among studies was determined using the inconsistency index (I2). Meta-regression analyses were performed to evaluate the potential sources of heterogeneity.

**RESULTS**
Fifteen eligible studies, involving 969 sclerotic bone lesions for diagnostic yield, and 242 sclerotic bone lesions for diagnostic accuracy, were included. The pooled proportion of the diagnostic yield of image-guided percutaneous CNB of sclerotic bone lesions was 74.3% (95% CI, 61.6-83.9%), and the pooled accuracy estimate for differentiation between benign and malignant lesions was 86.9% (95% CI, 77.3-92.8%). In the subgroup analysis, the pooled proportion of the diagnostic yield of the battery-powered drill system (76.7% [95% CI, 64.0-88.8%]) was higher than that of the manual drill system (65.2% [95% CI, 58.0-71.8%]). In the meta-regression analyses, no variables were significantly different (p=0.12-0.93).

**CONCLUSION**
In conclusion, we determined that image-guided percutaneous CNB of sclerotic bone lesions is an accurate diagnostic technique with good diagnostic yield, particularly when the battery-powered bone biopsy system is used.

**CLINICAL RELEVANCE/APPLICATION**
The radiologists and orthopedic surgeons can routinely use the image-guided percutaneous CNB to diagnose sclerotic bone lesions without fear of significant non-diagnostic or inaccurate results.

**Efficacy of Hybrid Compressed Sensing in Three-Dimensional Isotropic T2-Weighted Fast Spin-Echo for the Lumbar Spine**

**Station #3**

**Participants**
Takeshi Nakaura, MD, Kumamoto, Japan (Presenter) Nothing to Disclose
Yuji Iyama, MD, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose
Natsuki Maruyama, MD, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose
Seitaro Oda, MD, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose
Tomohiro Namimoto, MD, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose
Yasuyuki Yamashita, MD, Kumamoto, Japan (Abstract Co-Author) Consultant, DAIICHI SANKYO Group
Daisuke Utsumo, MD, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose
Mika Kitajima, MD, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose
Hiroyuki Uetani, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose
This study aims to assess the efficacy of a hybrid compressed sensing (hybrid-CS) technique for three-dimensional isotropic T2-weighted fast spin-echo (3D-T2FSE) magnetic resonance imaging (MRI) of the lumbar spine.

METHOD AND MATERIALS
In this study, 16 volunteers underwent 3D-T2FSE for the lumbar spine with conventional parallel imaging - SENSitivity Encoding (SENSE) and hybrid-CS at 3T MRI. We recorded the image acquisition time of SENSE (acceleration factor = 2, number of sample averaged = 1) and hybrid-CS (acceleration factor = 8, number of sample averaged = 2) and compared the signal-to-noise-ratio (SNR) of the spine, cerebrospinal fluid (CSF), lumbar disc (disc), epidural fat, and erector spinae muscle and contrast of the spine, CSF, and disc between two sequence images with paired t-test. Furthermore, two board certified radiologists performed the qualitative image analysis assessment of two sequence images with Wilcoxon signed-rank test.

RESULTS
The image acquisition time of hybrid-CS (3 min 36 sec) was 46% shorter than that of SENSE (6 min 38 sec). The contrast of CSF (76.3 ± 15.1 vs. 62.9 ± 16.3) and SNR of the spine (6.4 ± 1.4 vs. 5.6 ± 1.3) were significantly higher with hybrid-CS than with SENSE (P < 0.05). Moreover, the SNR of the disc (5.9 ± 2.0 vs. 5.1 ± 1.7) and muscle (2.4 ± 0.4 vs. 2.1 ± 0.3) were significantly higher with SENSE than with hybrid-CS (P < 0.05). No significant differences were observed in the contrast of the spine, disc, and epidural fat and SNR of CSF and fat between hybrid-CS and SENSE. Furthermore, no considerable differences were observed in the quantitative evaluation between hybrid-CS and SENSE.

CONCLUSION
The hybrid-CS for 3D-T2FSE images for the lumbar spine can shorten the image acquisition time without sacrificing the image quality compared with SENSE sequence.

CLINICAL RELEVANCE/APPLICATION
The hybrid-CS is useful to shorten the image acquisition time without sacrificing the image quality for 3D T2WI images compared with SENSE sequence.

MK387-SD- WE4A
MRI-Based Radiomic to Assess Lipomatous Soft Tissue Tumors Malignancy: A Pilot Study

Participants
Amine BOHAMAMA, Lyon, France (Presenter) Nothing to Disclose
Benjamin Leporq, MS, Villeurbanne, France (Abstract Co-Author) Nothing to Disclose
Fabrice Lame, Lyon, France (Abstract Co-Author) Nothing to Disclose
Catherine Bihan, Lyon, France (Abstract Co-Author) Nothing to Disclose
Michael Sdika, Villeurbanne, France (Abstract Co-Author) Nothing to Disclose
Jean-yves Blay, Lyon, France (Abstract Co-Author) Nothing to Disclose
Olivier Beuf, PhD, Villeurbanne, France (Abstract Co-Author) Nothing to Disclose
Frank Pilleul, MD, Lyon, France (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
amine.bouhamama@lyon.unicancer.fr

PURPOSE
The aim of this study was to develop a MRI-based radiomic method to assess lipomatous soft tissue tumors malignancy

METHOD AND MATERIALS
105 subjects with lipomatous soft tissue tumors with histology and fat-suppressed T1w contrast enhanced MR images available were retrospectively enrolled to constitute the database. According to histology, three groups have been constituted: the benign group including deep lipomas (n = 23), the intermediate group including ALT and WDL (n = 41) and the malignant group including high grade liposarcomas (myxoid, dedifferentiated, and pleomorphic) (n = 41). Radiomic features extraction: Images were automatically loaded on an in-house software developed on Matlab R2017a. First, the tumor was segmented manually by two observers blinded to histology in order to evaluate the inter-observer reproducibility. 87 radiomic features were extracted. They included size, shape, intensity distribution, image domain (based on Gabor filtering) textures features. Data mining - A 2 step decisional algorithm was built. In a first step, a multivariate model was used to classify between benign and (intermediate + malignant) groups. If result of test is 'benign' algorithm is stopped. If it is not the case, a second model was used to classify between intermediate and malignant groups.

RESULTS
55 radiomic features (63.2%) were found to be reproducible enough. To classify between benign and (intermediate + malignant) groups, the radiome was reduced to 24 features and the 12th order model gave the best performance (AUROC = 0.959 (95% CI: 0.921 - 0.996); sensitivity = 89% (95% CI: 80.2 - 94.9%) and specificity = 95.7% (95% CI: 78.1 - 99.9%). To classify between intermediate and malignant groups, the radiome was reduced to 21 features and the 17th order model gave the best diagnosis performances (AUROC = 0.907 (95% CI: 0.844 - 0.970); sensitivity = 85.4% (95% CI: 70.8 - 94.4%) and specificity = 90.2% (95% CI: 76.9 - 97.3%).

CONCLUSION
These results show that the evaluation of lipomatous tumor malignancy is feasible using a routinely used MRI acquisition in clinical practice.

CLINICAL RELEVANCE/APPLICATION
Radiomic features may be useful to determine malignancy of lipomatous tumors. Benign tumors could be operated without previous
Correlation of Quantitative MRI Measures of Rotator Cuff Muscle Fatty Infiltration to Shoulder Strength and Range of Motion: A Pilot Study of Subjects with Painful Full-Thickness Supraspinatus Tendon Tear and Asymptomatic Controls

Statement #5

Participants
Derik L. Davis, MD, Baltimore, MD (Presenter) Research Grant, Hitachi, Ltd
Ranvijyothi Almardawi, MBBS, MPH, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Jiachen Zhuo, PhD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Mohit N. Gilotra, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Michael E. Mulligan, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Charles S. Resnik, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Selwan B. Abdullah, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Hussain Al Khalifah, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Steven Roys, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Ralph F. Henn III, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Syed A. Hasan, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Rao P. Guallapalli, PhD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
davis7@umm.edu

PURPOSE
(1) To determine if supraspinatus muscle fat fraction (FF) by 6-point Dixon MRI correlates with shoulder strength and range of motion (ROM) and (2) whether FF has higher inter-rater reliability compared to Goutallier grade (GG). (3) To determine differences in supraspinatus muscle extramyocellular lipid (EMCL) by MR spectroscopy (MRS) between subjects with painful full-thickness supraspinatus tendon tear (pFT-STT) and asymptomatic controls without full-thickness tear.

METHOD AND MATERIALS
Adults (40 to 85 years) were recruited prospectively over a 1-year period and received one shoulder MRI. Cohorts: pFT-STT (N=15; age, 62.6 ± 9.0 years; 53% male) and control (N=17; age, 63.0 ± 10.2 years; 53% male). Two blinded musculoskeletal radiologists assigned a GG for each supraspinatus muscle on the same oblique sagittal T1-weighted Y-shaped view MR image. Two blinded diagnostic radiology residents calculated supraspinatus FF on each corresponding oblique sagittal Dixon MR image. A blinded MR physicist measured EMCL by MRS. All subjects were tested for shoulder strength (abduction [ABD]; adduction external rotation [AdER]) and ROM (forward flexion [Fflex]; ABD; AdER). Cohorts were stratified by gender. Descriptive, correlative and reliability analyses were performed.

RESULTS
The pFT-STT cohort had higher FF (0.073 ± 0.051 vs 0.033 ± 0.024, p=0.010) and higher GG (0.9 ± 0.7 vs 0.4 ± 0.5, p=0.022) vs controls. Male and female pFT-STT cohorts were weaker and had less ROM vs controls for all categories. For entire study population, FF exhibited strong correlation with strength (ABD: r = -0.454, p=0.013) and ROM (Fflex: r = -0.505, p=0.005; ABD: r = -0.468, p=0.009; AdER: r = -0.416, p=0.022). GG showed weak correlation and no significance for all categories. Inter-rater reliability was higher for FF (ICC: 0.901) vs GG (Kappa: 0.362). The pFT-STT sub-cohort (N=9) had higher EMCL (22.9 ± 17.5 mmol/L vs 7.5 ± 9.2 mmol/L, p=0.131) compared to controls (N=4).

CONCLUSION
Quantitative MRI Dixon fat fraction of supraspinatus muscle has higher correlation to shoulder strength and ROM, and higher inter-rater reliability, compared to qualitative MRI Goutallier grade. Supraspinatus EMCL trends higher in pFT-STT compared to controls.

CLINICAL RELEVANCE/APPLICATION
Evaluation of rotator cuff (RC) muscle fatty infiltration (FI) is key for clinical decision making in patients with RC tear. Quantitative MRI techniques offer potential for improved measurement of FI.

Contrast Extravasation after Shoulder Arthrography: Is it Avoidable?

Statement #6

Participants
Michel O. De Maeseneer, MD, PhD, Jette, Belgium (Presenter) Nothing to Disclose
Nicolas Buls, DSc, PhD, Jette, Belgium (Abstract Co-Author) Nothing to Disclose
Freddy Machiels, Brussels, Belgium (Abstract Co-Author) Nothing to Disclose
Cedric Boulet, Brussels, Belgium (Abstract Co-Author) Nothing to Disclose
Maryam Shahabpour, MD, Brussels, Belgium (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
Michel.demaeseneer@uzbrussel.be

PURPOSE
Contrast extravasation after standard anterior artrographic puncture of the shoulder is common and negatively affects image quality and interpretation. We hypothesized that strict shoulder immobilisation in the time interval between arthrography puncture and subsequent MR arthrography would limit extravasation.

METHOD AND MATERIALS
Fifty patients underwent shoulder MR arthrography using a standard shoulder puncture in the anteroinferior quadrant. Ten mL of a mixture of saline contrast, iodine contrast and gadolinium contrast were injected by one of two senior MSK radiologist using a 20 G
needle. Half of the patients were immediately immobilized with a sling, and the other half were allowed to move shoulder and arm freely in the time interval before MR. MR arthrography was performed with a 3 T system using standard T1 and PD weighted sequences. No ABER position was performed. The MR images were reviewed and leakage in the axillary region and subcoracoid region was noted. Extravasation was graded independently by two MSK radiologist. A five point scale was used (1: none; 2: less than 2 cm; 3: 2-5 cm; 4: 5-10 cm; 5: more than 10 cm). Chi square test was performed for analysis and Conen’s kappa was calculated.

RESULTS

The mean age of the patients was 47 years (18-77 years). There were 27 men and 23 women. The mean time between puncture and MR was 35 minutes, similar for both groups. Eight (36 %) (reader 1), and 10 (45 %) (reader 2) that were immobilized were graded as 3-5. Seven (32%) (reader 1) and 5 (23%) (reader 2) of the non immobilized patients were graded 3-5. There was no statistically significant difference between both groups. Interobserver agreement was substantial (kappa: 0.64).

CONCLUSION

Contrast extravasation after arthrography puncture is common, even in experienced hands. It is unavoidable and negatively affects image quality and interpretation, such as capsular rupture and the J sign. Our hypothesis that extravasation can be avoided by strict immobilisation is false.

CLINICAL RELEVANCE/APPLICATION

Contrast extravasation after arthrography puncture of the shoulder in the time interval before MR is a major and common problem. It negatively affects image quality and limits interpretation of certain signs such as the J sign and capsular rupture. It can not be avoided by strict immobilisation of the shoulder.
**Musculoskeletal Wednesday Poster Discussions**

Wednesday, Nov. 28 12:45PM - 1:15PM Room: MK Community, Learning Center

**MK390-SD-WEB1**
**Paraspinal Lean Muscle Mass Analysis using MRI in Patients with Adjacent Segment Disease after Lumbar Fusion**

Participants
Ogonna K. Nwawka, MD, New York, NY (Moderator) Research Grant, General Electric Company

Sub-Events

**PURPOSE**
To compare the paraspinal muscle mass between patients with symptomatic adjacent segment disease (ASD) and those without ASD after lumbar fusion, using pre-operative MRI.

**METHOD AND MATERIALS**
Fifty ASD patients (mean age, 61.4 years; M:F, 13:37; mean body mass index [BMI], 25.1 kg/m²), who had undergone additional operation for ASD after lumbar fusion, were age-, gender-, BMI-, and fusion segment-matched to 50 control patients. Total cross-sectional area (CSA) and functional CSA (FCSA) (i.e. area containing only lean muscle tissue), were measured for the paraspinal muscle group (multifidus and erector spinae muscles) and the psoas muscles on pre-operative MRI. Ratio of FCSA to total CSA and skeletal muscle index (SMI) [i.e. the area of muscle (in cm²)/patient height (in m)²] were calculated. Parameters were compared between the two groups, using the independent-sample t-test.

**RESULTS**
The FCSA of the paraspinal muscle group was significantly smaller in the ASD patients compared to the control patients (mean 2178.6 mm² vs. 2594.0 mm², P=0.004), as well as FCSA:total CSA (mean 45.4 % vs. 52.2 %, P=0.001) and SMIFCSA (mean 8.8 vs. 10.6; P=0.001). With the paraspinal and psoas muscles combined together, total CSA was not significantly different, however; the FCSA (mean 3680.8 mm² vs. 4268.2 mm², P=0.013), FCSA:total CSA (mean 53.3 % vs. 58.6 %, P=0.004), SMITotalCSA (mean 27.7 vs. 29.3, P=0.049), and SMIFCSA (mean 14.9 vs. 17.3, P=0.002) were significantly lower in the ASD group compared to the control group. Other variables were not statistically different between the ASD and control patients.

**CONCLUSION**
ASD patients had smaller paraspinal lean muscle mass, as indicated by the FCSA, lower ratio of FCSA to total CSA, and SMIFCSA of the paraspinal muscle group on pre-operative MRI, compared to control patients.

**CLINICAL RELEVANCE/APPLICATION**
Smaller lean muscle mass and higher fat infiltration degree of the paraspinal muscle group can be predictors of ASD following lumbar spinal fusion.

**MK391-SD-WEB2**
**High-Frequency Ultrasound Evaluation of the Nail and Terminal Extensor Tendon in Psoriasis**

Participants
Bi Hui Zhu, Chengdu, China (Presenter) Nothing to Disclose
Ren Mei Wu, Chengdu, China (Abstract Co-Author) Nothing to Disclose
Li Qiu, Chengdu, China (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
wsqili@126.com

**PURPOSE**
To compare the ultrasonic manifestations of both nail and terminal extensor tendon between psoriasis patients and healthy subjects.

**METHOD AND MATERIALS**
A total of 37 patients with psoriasis diagnosed by experienced dermatologists and 42 healthy subjects were enrolled in this study. The patient condition and nail lesion were scored by Psoriasis Area and Severity Index (PASI) and modified Nail Psoriasis Severity Index (mNAPSI), respectively. All patients and healthy subjects underwent high-frequency sonographic examination. The appearance and thickness of each nail plate, nail bed, nail matrix, terminal extensor tendon, as well as skin of distal interphalangeal (DIP) joint, were measured in gray mode and with power doppler to detect blood flow. Statistical analysis of clinical score and ultrasound data was performed with Wilcoxon rank test or ANOVA. Spearman correlation was used in the correlation analysis and ROC analysis calculated diagnostic accuracy of thickness.

**RESULTS**

For all patients, the common abnormal morphostructures happened to nail plate, which showed wavy appearance (90, 24.46%) and loss of definition (96, 26.09%). Psoriasis patients had higher thickness on nail units, terminal extensor tendon and skin of DIP joint compared with healthy subjects (p < 0.05), but statistical analysis did not reveal significant difference in blood flow (p > 0.05). A cutoff value of 0.72mm at nail plate, which was highest diagnosis efficiency, revealed a sensitivity of 59% and a specificity of 76%, with an area under the ROC curve of 0.749 (95%CI 0.72, 0.78). The correlation coefficients between thickness of nail plate, nail bed, nail matrix and score of PASI were 0.496, 0.514, 0.346, respectively (p < 0.05), and score of mNAPSI were 0.715, 0.541, 0.325 (p < 0.05). However, no correlation coefficient was found between terminal extensor tendon and PASI (p > 0.05).

**CONCLUSION**

High-frequency sonography can detect the common changes of nail plate. Comparing to healthy people, all examination sites became thicker in psoriasis patients, but no difference of blood flow were observed. The thickness of nail plate had the highest diagnostic value, in addition, multiple indicators of nail units were correlated with PASI and mNAPSI score.

**CLINICAL RELEVANCE/APPLICATION**

High-frequency sonography can provide a non-invasive tool useful for extension and severity of psoriasis by assessing the characteristic appearance and thickness of nail psoriasis.

**MK392-SD-WEB3**

**Adhesive Capsulitis: Are We Making the Diagnosis Before Clinicians?**

Station #3

Participants
Navid Faraji, MD, Cleveland, OH (Presenter) Nothing to Disclose
Samer L. Soussain, MD, Westlake, OH (Abstract Co-Author) Nothing to Disclose
Nicholas Z. Conley, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Christos Kosmas, MD, Cleveland, OH (Abstract Co-Author) Consultant, BioClinica, Inc

For information about this presentation, contact:
navid.faraji@uhhospitals.org

**PURPOSE**

Historically adhesive capsulitis (AC) has been a clinical diagnosis of exclusion characterized by progressive shoulder pain and decreased range of motion. We hypothesize that MRI is increasingly playing a primary role in the diagnosis and guiding management of AC.

**METHOD AND MATERIALS**

After institutional review board approval, we queried our institution's medical records for patients with an MRI diagnosis of AC who in addition had a pre-MRI and post-MRI clinical note by the ordering physician available in the medical record. 208 patients with an MRI diagnosis of AC were identified, of which 86 were excluded due to lack of complete clinical information. Patients with confounding shoulder pathologies such as septic arthritis or metastatic disease were also excluded. Ordering providers included both primary care physicians and orthopedic surgeons. Management criteria were defined as conservative (physical therapy and shoulder joint injection) and operative (capsular release). A 2-proportion t-test was used for statistical analysis.

**RESULTS**

Of the 122 patients that were included in the study, the MRI report changed the pre-MRI clinical diagnosis and influenced management of AC in 71 patients (86.6%). The MRI report changed the diagnosis and influenced the management in 74% of the cases referred by a primary care physician and in 50% of the cases referred by orthopedic surgeons. When stratified by the type of ordering provider, primary care physicians were more likely to be influenced by the MRI report as compared to the orthopedists (p<0.012). Of the MRI reports that influenced management, a conservative approach was more favored as compared to an operative approach (p<0.0001).

**CONCLUSION**

While historically AC has been a clinical diagnosis of exclusion, our data demonstrates that MRI is often the first diagnostic indicator changing the working diagnosis of the treating physician. The ability of MRI to exclude pathologies that may mimic the symptoms of adhesive capsulitis suggests that early imaging may be of benefit in aiding the rapid diagnosis and prompt treatment. We conclude that radiologists can play an integral role in making the diagnosis and influencing the management of AC.

**CLINICAL RELEVANCE/APPLICATION**

MRI is increasingly becoming a primary component in not only diagnosing, but also influencing the management strategies of adhesive capsulitis for physicians.

**MK393-SD-WEB4**

3D-MRI versus 3D-CT in the Evaluation of Osseous Anatomy in Femoroacetabular Impingement using Dixon 3D FLASH Sequence

Station #4

Participants
Mohammad M. Samim, MD, MRCS, New York, NY (Presenter) Nothing to Disclose
Thomas Youm, New York, NY (Abstract Co-Author) Nothing to Disclose
Christopher J. Burke, MBCHB, New York, NY (Abstract Co-Author) Nothing to Disclose
DECT arthrography represents a reliable imaging tool for demonstration of glenoid labrum tears and could be used as alternative to MRA. The interobserver and intraobserver agreement were near perfect (k=0.82 and k=0.86, respectively). The difference of accuracy between DECT arthrography and MRA was not significant (p=0.45). The interobserver and intraobserver agreement were 89.5, 100, 100, 77.7 and 92.3%, and 94.7, 85.7, 94.7, 85.7 and 92.3 %, respectively. By using McNemar test, the difference of labral tear and 1 tear of posterior labrum. The sensitivity, specificity, PPV and NPV and accuracy of DECT arthrography and MRA were calculated. Inter-observer and intra-observer agreement were calculated with k-statistics. A value of p<0.05 was considered statistically significant.

MRI revealed the presence of labral tear in 19/26 patients (73.1%), with 8 tears of antero-inferior labrum, 10 tears of superior labrum and 1 tear of posterior labrum. The sensitivity, specificity, PPV and NPV and accuracy of DECT arthrography and MRA were 89.5, 100, 100, 77.7 and 92.3%, and 94.7, 85.7, 94.7, 85.7 and 92.3 %, respectively. By using McNemar test, the difference of accuracy between DECT arthrography and MRA was not significant (p=0.45). The interobserver and intraobserver agreement were near perfect (k=0.82 and k=0.86, respectively).

CONCLUSION
DECT represents a reliable imaging tool for demonstration of superior, antero-inferior and posterior glenoid labrum tears.

CLINICAL RELEVANCE/APPLICATION
DECT arthrography represents a reliable imaging tool for demonstration of glenoid labrum tears and could be used as alternative to MRA.
The Meniscal Comma Sign: Characterization and Clinical Importance of a Displaced Meniscal Fragment in the Meniscotibial Recess

 PURPOSE

We describe a type of meniscal tear in which a displaced flap is wedged against the tibial plateau in the meniscotibial recess. In our experience, this entity often benefits from arthroscopic debridement, even in the face of concomitant arthritic changes.

 METHOD AND MATERIALS

Reports from knee MRI’s from 2012-2017 were searched to identify patients who may have the meniscal comma sign. Those showing medial compartment osteoarthritis, osseous contusions or evidence for recent ligamentous injury were excluded. Once potential subjects were identified by MRI findings, a cross reference search of the department of orthopaedic surgery database was performed, and those who underwent dedicated orthopaedic evaluation and treatment were placed into the subject group. Associated imaging findings were recorded, including: tear type, degree of meniscal extrusion, chondrosis, and bone marrow edema. Both pre MRI questionnaires and orthopaedic clinic notes were reviewed for symptomatology. Chart review was performed for initial exam findings, treatment, and treatment outcome.

 RESULTS

Ongoing analysis has included 70 knees in the subject group. The high majority presented with pain at or just below the joint line on the medial tibial plateau margin, with medial joint line tenderness on examination. 24 patients have undergone conservative treatment, while 46 had arthroscopy and follow-up outcome was recorded from 6 to 32 weeks. They did not differ significantly by gender, age, chondrosis degree, size of meniscal flap or extrusion, tear type, and bone marrow edema in the tibial plateau. Clinical outcome, however, at the time of submission, reported a significant higher relief of symptoms (partial or total) and level of satisfaction on the arthroscopy group than those treated conservatively.

 CONCLUSION

Orthopaedists at our institution have shown increasing interest in this phenomenon due to a cohort of patients with medial meniscus tears and meniscal fragments displaced into the meniscotibial recess responding very positively to arthroscopic meniscal debridement. Imagers should note and report displaced meniscal fragments, particularly medial meniscus fragments displaced into the meniscotibial recess, as this type of radiology report may add value to the overall diagnosis and treatment algorithm.

 CLINICAL RELEVANCE/APPLICATION

One specific type of meniscal flap displacement is described, which responds very positively to arthroscopical debridement.
Sub-Events

MSES43A  Pediatric Abdominal Radiography

Participants
Steven J. Kraus, MD, Cincinnati, OH (Presenter) Author, Reed Elsevier

For information about this presentation, contact:
steven.kraus@cchmc.org

LEARNING OBJECTIVES
1) Have an alternative, organized approach to the interpretation of the abdominal radiograph in children. 2) Detect abnormalities of the abdomen on radiographs that may not have been detected previously. 3) Have a practical differential diagnosis of abnormalities detected on abdominal radiographs in children.

ABSTRACT
Abdominal imaging in children today is very sophisticated, with advances in techniques that do not involve exposure to radiation such as Ultrasonography (US) and Magnetic Resonance Imaging (MRI), as well as techniques which do expose children to radiation, namely Computed Tomography (CT). However, with all the advances in radiologic imaging techniques today, the most commonly performed abdominal imaging exam in a large academic children's hospital is the abdominal radiograph. However, if one would poll pediatric radiologists or even general radiologists today, one would probably find that the abdominal radiograph is the least favorite exam to interpret and most radiologists would probably admit that it is the hardest exam to interpret well. Cross sectional imaging such as US, MRI, and CT are so much easier because of the detailed anatomy in 3 dimensions, 4 for US if watching real-time US clips. An organized approach to the interpretation of the abdominal radiograph with a thorough knowledge of the pathologic processes of different age groups and patient demographics is very helpful in arriving at a diagnosis or differential diagnosis in many cases and can be helpful to the referring physicians of both inpatients and outpatients alike.

MSES43B  Congenital Renal Anomalies

Participants
Katharine L. Hopkins, MD, Portland, OR (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Name ten categories of congenital renal anomaly that are likely to be encountered in general radiology practice. 2) Identify the distinguishing imaging features of up to three congenital renal anomalies in each category. 3) Develop appropriate strategies for management and follow-up of congenital renal anomalies.

MSES43C  Complications of Pediatric Fractures

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

LEARNING OBJECTIVES
1) Identify the direct and indirect imaging findings of physeal bridge formation. 2) Calculate the percentage of physeal involvement of a bridge on MRI. 3) List the indications for treatment of physeal bridges.

ABSTRACT
Fractures in skeletally immature children often involve the physis. These injuries can lead to osseous bridge formation across the physis that may cause longitudinal growth disturbances or angular deformities leading to substantial disability. Risk factors for bridge formation after an injury include: the severity of the injury, the child's growth potential, the anatomic site of the fracture and the type of fracture. Complications arising from bridge formation depend upon the location of the bridge within the physis and the anatomic location within the pediatric skeleton. Imaging of children after physeal injury is important for the diagnosis of growth arrest and for the characterization of the size and location of physeal bridges for treatment planning. There is also an important role for imaging in the evaluation of complications caused by physeal bridges and in the post treatment evaluation of these children.

MSES43D  Imaging Tumors of Pediatric Spine

Participants
Laura L. Hayes, MD, Pensacola, FL (Presenter) Nothing to Disclose

For information about this presentation, contact:
laura.hayes@nemours.org
LEARNING OBJECTIVES

1) To be able to identify and classify tumors of the pediatric spine. 2) To understand how to use and apply the knowledge gained by using advanced imaging techniques to study the pediatric spine in the setting of malignancy.

ABSTRACT

There are a wide variety of tumors involving the pediatric spine. In this session, we will review the types and imaging appearances of spinal lesions. Special attention will be given to the use of diffusion-weighted imaging of the spine in these children.
LEARNING OBJECTIVES

1) To become familiar with the most common requests and indications for sports-related injuries. 2) To learn about technical considerations for performing MSK injections. 3) To understand reasons to delay injections or avoid certain injectables.

ABSTRACT

The main pitfall is from far an mistake in the diagnosis done before sending the patient to the ultrasound guided treatment. Good examination and looking carefully to the examinations done before is mandatory. Among pearls, some innovative technique for injecting will be shown, such as Trapezo-metacarpal joint, sternoclavicular joint, Morton's neuroma, subtalar joint, hip and shoulder joints, carpal tunnel and de Quervain tenosynovitis. Treatment of nerve injuries will also be depicted and illustrated. Some tips will be given for ganglia treatment.

LEARNING OBJECTIVES

1) To be aware of the indications and benefits of available injectables used to treat sports-related injuries. 2) To learn about technical considerations for performing tendon fenestration and tenotomy. 3) To become familiar with current evidence on results of MSK procedures in the literature.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Jon A. Jacobson, MD - 2012 Honored Educator; Jon A. Jacobson, MD - 2017 Honored Educator

LEARNING OBJECTIVES

1) To learn the targeted approach to injecting joints, ligaments, tendons and tendon sheaths. 2) To appreciate pitfalls to avoid in MSK procedures for treatment of sports-related injuries. 3) To understand evidence-based data on various MSK procedures in order to give patients realistic expectations after treatment.

Honored Educators

Participants

Philippe A. Peetrons, MD, Brussels, Belgium (Presenter) Research Consultant, Canon Medical Systems Corporation

For information about this presentation, contact:
jacobson@umich.edu
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Jon A. Jacobson, MD - 2012 Honored Educator Jon A. Jacobson, MD - 2017 Honored Educator
PURPOSE
As diabetes becomes more commonplace, neuropathic arthropathy (NA) is a mushrooming problem in clinical interpretation. Although radiographic classification schema was well established, many of these patients come to MR for potential superimposed infections. Thus, it behooves us to develop MR imaging staging criteria for various temporal points of NA.

METHOD AND MATERIALS
An international expert panel of 6 musculoskeletal radiologists was formed and participated in a two-round Delphi survey. A total of 30 qualitative radiologic features associated with various NA stages were compiled after a comprehensive literature search of 9 papers. For round 1, experts were asked to rate the relevance of selected criteria for identifying NA at acute, intermediate, and chronic stages on a scale of 1-10, with 1 as not relevant at all and 10 as extremely important. For round 2, panelists resubmitted answers to the same questionnaire after distributing the group median, interquartile range, and range results from round 1. A Cronbach's a score was calculated to determine consistency of signs.

RESULTS
The median scores for each sign ranged from 2-9. The highest medians for diagnostic relevance of acute presentations were marrow edema with visible fracture, inhomogeneous marrow edema, and diffuse bone marrow edema with medians of 9, 9, and 8.5 respectively. The lowest medians were irregular bone shape on T2, ligament damage, and cartilage damage with medians of 4, 3, and 2 respectively. For chronic presentations of NA, the highest medians were subchondral sclerosis, new bone formation, and fibrosis with medians of 8.5, 8, and 6.5 respectively. The lowest medians were the ghost sign, T1 tapering of distal second and third metatarsals, and sinus tracts with medians of 4, 4, and 2.5 respectively. For intermediate presentations of NA, subchondral cysts scored a higher median of 6 than the 4.5 median for intra-articular bodies. Cronbach's a score of the first and second round of questionnaires were 0.69 and 0.79 respectively.

CONCLUSION
Results of the delphi survey suggest consensus of several qualitative MRI features of neuropathic arthropathy that are indicative of disease acuity/chronicity and show good consistency.

CLINICAL RELEVANCE/APPLICATION
Staging criteria for the acuity/chronicity of neuropathic arthropathy was established such that radiologists may interpret MR images at a similar level to current standards for radiographic images.
The Metaphyseal Flare Sign: A Secondary Sign on MRI of Subchondral Insufficiency Fracture of the Knee

Tuesday, Nov. 28 3:10PM - 3:20PM Room: E450B

Participants
Alessandro Vidoni, MD, Cardiff, United Kingdom (Presenter) Nothing to Disclose
Rachel Shah, BBBS, Birmingham, United Kingdom (Abstract Co-Author) Nothing to Disclose
Davina Mak, MBBS, BSc, Middlesex, United Kingdom (Abstract Co-Author) Nothing to Disclose
David Beale, Birmingham, United Kingdom (Abstract Co-Author) Nothing to Disclose
Rajesh Botchu, MBBS, Kettering, United Kingdom (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
alessandrovidoni@icloud.com

PURPOSE
To describe a novel secondary sign of subchondral insufficiency fracture of the knee, the metaphyseal flare sign.

METHOD AND MATERIALS
A retrospective research of 7926 knee MRI examinations was performed. 48 scans were included in the study. The diagnosis of subchondral insufficiency fracture (SIF) was confirmed in a consensus review by one fellowship trained MSK radiologist and one radiology registrar. The presence of metaphyseal flare sign (soft tissue oedema in the meta-epiphyseal region of the affected condyle) was evaluated in the cohort.

RESULTS
41 patients were included in the study (21 male, 20 female). The mean age was 61.5 years (range 41 to 80 years). The anatomical location of the SIF were the medial femoral condyle (n=28), the lateral femoral condyle (n=5) and medial tibial condyle (n=8). The metaphyseal flare sign was present in 45 of the 48 scans reviewed. The average craniocaudal length of the soft tissue oedema defined as metaphyseal flare sign was 7 cm (range 10.5 to 4.5).

CONCLUSION
The metaphyseal flare sign is an early, indirect sign of subchondral insufficiency fracture (SIF).

CLINICAL RELEVANCE/APPLICATION
The metaphyseal flare sign is an early, indirect sign of subchondral insufficiency fracture (SIF) particularly useful if the diagnosis is unclear to promptly begin the treatment and prevent the progression of the pathology.

Uncovered Medial Meniscus Sign on Knee Magnetic Resonance Imaging: Evidence of Lost Brake Stop Mechanism of Posterior Horn Medial Meniscus

Tuesday, Nov. 28 3:20PM - 3:30PM Room: E450B

Participants
Youngjune Kim, Seongnam, Korea, Republic Of (Presenter) Nothing to Disclose
Joong Mo Ahn, MD, PhD, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
Yusuhn Kang, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Eugene Lee, Seongnam Si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Joon Woo Lee, MD, PhD, Sungnamsi, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Heung Sik Kang, Gyeonggi-Do, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the association between anterior tibial translation and injuries on the posterior horn medial meniscus (PHMM) and the integrity of brake stop mechanism of the PHMM in anterior cruciate ligament (ACL) deficient knee.

METHOD AND MATERIALS
This retrospective study included 85 consecutive patients with arthroscopically confirmed complete ACL tear. Anterior tibial translation was quantitatively measured using sagittal MRI at the midpoint of the lateral femoral condyle. Uncovered medial meniscus sign was considered positive if a vertical line tangent to the posterior most margin of the medial tibial plateau intersected the PHMM at the midpoint of the medial femoral condyle on sagittal MRI. Concomitant injury on the structures of the posteromedial and posteroslateral corners of the knee, including PHMM tear and meniscal ramp lesion, was recorded. Stratified subgroup analysis and multivariable regression analysis were performed to identify factors associated with anterior tibial translation.

RESULTS
The uncovered medial meniscus sign was positive in 21.2% (18/85) of patients and was significantly associated with anterior tibial translation. In the stratified subgroup analysis and multivariable regression analysis, positive uncovered medial meniscus sign consistently demonstrated a significant association with anterior tibial translation and generated an additional 3.5 mm of anterior tibial translation. Other injuries, including PHMM tear and meniscal ramp lesion, were not associated with anterior tibial translation.

CONCLUSION
The uncovered medial meniscus sign demonstrated a statistically significant correlation with anterior tibial translation and could be...
The uncovered medial meniscus sign demonstrated a statistically significant correlation with anterior tibial translation and could be a useful marker for the lost brake stop mechanism of PHMM in the ACL deficient knee.

CLINICAL RELEVANCE/APPLICATION

1. An uncovered medial meniscus sign proved to have a statistically significant correlation with anterior translation of the tibia in patients with complete tear of the anterior cruciate ligament. 2. The uncovered medial meniscus sign could be a useful magnetic resonance imaging marker for a lost brake stop mechanism of the posterior horn medial meniscus in the knee. 3. A tear at the PHMM or meniscal ramp lesion itself should not be interpreted as an evidence of lost brake stop function of the PHMM.

SSM15-04  T2 Relaxation Times of the Anterolateral Femoral Cartilage in Patients After ACL-Repair with and Without a Deep Lateral Femoral Notch Sign

Participants
Cyrus Behzadi, Hamburg, Germany (Presenter) Nothing to Disclose
Goetz H. Welsch, MD, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Jan Philipp Petersen, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Bjoern Schoenmangel, MD, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Peter Bannas, MD, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Michael G. Kaul, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Gerhard Schon, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Josephine Berger-Groch, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Gerhard B. Adam, MD, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Marc Regier, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
C.Behzadi@uke.de

PURPOSE
To assess T2 relaxation times of the anterolateral femoral cartilage following anterior cruciate ligament (ACL)-repair with and without a positive deep lateral femoral notch sign (DLNS) at post-traumatic MRI.

METHOD AND MATERIALS
In 52 patients post-traumatic MRI as well as 12 months after ACL-rupture (ACLR) and surgical treatment were analysed. In 28 patients a positive DLNS was present at post-traumatic MRI. For quantitative analysis, T2 relaxation time measurements (7 TE: 10-70 ms) were performed at time of re-evaluation. Polygonal ROIs encompassing the full cartilage layer were placed in the anterolateral as well as adjacent femoral cartilage. Clinical assessment included Lysholm-Tegner-Activity-Score, Rasmussen's clinical score and modified Cincinnati-Rating-System-Questionnaire. Description and differences were calculations as means and confidence intervals of means, controlled for the cluster effect of person, if appropriate.

RESULTS
In patients with a positive DLNS after ACLR, relaxation times in the notch region were significantly prolonged compared to patients without a positive DLNS (Δ 7.4 ms, CI: 5.6 - 9.2; p-value <0.001) as well as to the adjacent anterior (Δ 5.7 ms, CI: 4.7 - 6.7; p-value <0.001) and central femoral cartilage (Δ 6.6 ms, CI: 5.7 - 7.6; p-value <0.001). No significant differences in the performed clinical scores between the two groups were noticed (p>0.05).

CONCLUSION
Significantly prolonged T2 relaxation times of the anterolateral femoral cartilage were found in patients with a positive DLNS following ACL-repair compared to patients without a DLNS. Based on these results, it has to be assumed that a positive DLNS is associated with higher cartilage degradation.

CLINICAL RELEVANCE/APPLICATION
The presented results implicate an impact on relaxation times in patients with a femoral notch sign after ACL-rupture. T2 analysis might help identifying patients at risk for earlier onset of Osteoarthritis, which might benefit from precocious surgical treatment.

SSM15-05  Decreased Vertebral Enhancement in Patients with Infectious Spondylitis, Presenting 'Black Vertebrae' as an Atypical Enhancement Pattern

Participants
Sungeun Park, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Hye Jin Yoo, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sung Hwan Hong, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Ja-Young Choi, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hee-Dong Chae, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To investigate the characteristics of patients with infectious spondylitis who show decreased vertebral enhancement.

METHOD AND MATERIALS
From January 2010 to November 2017, 767 patients with reports containing terms about infectious spondylitis was collected for this retrospective study. After reviewing images and medical record, we included 456 patients suspicious for infectious spondylitis with 706 post-contrast MR exams. When affected vertebra showed markedly lower degree of enhancement than that of normal bone
marrow (BM) and when the area showing decreased enhancement was greater than 50% of the area of the vertebral body, the vertebra was recognized as 'black vertebra'. Finally 10 patients (M:F=5:5, mean age=66.4 years) with 10 MRI were identified as showing 'black vertebra'. In those patients, imaging findings of MRI and CT within 2 weeks interval from MRI were evaluated. Clinical characteristics including comorbidities, causative organism and treatment course were reviewed.

RESULTS
10 patients with black vertebra showed atypical findings as for infectious spondylitis. There was little BM signal alteration on T1-weighted image (n=9), or absence of fluid-equivalent discal signal intensity (SI) on T2-weighted image (n=5). However, 6 patients showed T2 signal voids in or around the vertebral body and 8 patients showed air burbles on CT images (average interval: -1.1 days from MR), suggesting emphysematous infection. On follow-up MRI (average interval: 7.2 weeks from initial MR), available in 5 patients, those atypical findings almost disappeared but marked progression of infection was evident: increased range of affected segments (n = 3); low T1 SI of affected vertebra (n = 5); and increased contrast enhancement (n = 3). 9 patients had underlying disease such as Diabetes mellitus (n = 5) or connective tissue disease (n = 2) or etc. Causative organisms were identified as Klebsiella pneumoniae (n = 3), Staphylococcus aureus (n = 3), Escherichia coli (n = 2) and etc. Finally, 5 patients underwent surgery due to uncontrolled infection despite antibiotic treatment.

CONCLUSION
'Black vertebra' on contrast enhanced image seems to be associated with early finding of emphysematous infection.

CLINICAL RELEVANCE/APPLICATION
Recognition of decreased enhancement of affected spine, 'black vertebra', would be important to diagnose early emphysematous infection, known to have worse course than typical infectious spondylitis.

SSM15-06 Leopard Spot Edema: An Osseous Stress, Healing and Reinjury Phenomenon in Professional Ballet Dancers Seen on MR

Wednesday, Nov. 28 3:50PM - 4:00PM Room: E450B

Participants
Felix Gonzalez, MD, atlanta, GA (Presenter) Nothing to Disclose
Bethany U. Casagrande, DO, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
William B. Morrison, MD, Philadelphia, PA (Abstract Co-Author) Consultant, AprioMed AB; Patent agreement, AprioMed AB; Consultant, Zimmer Biomet Holdings, Inc; Consultant, Samsung Electronics Co, Ltd; Consultant, Medical Metrics, Inc
Samia K. Sayyid, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Adam D. Singer, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Monica B. Umpierrez, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Adam C. Zoga, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
felix.m.gonzalez@emory.edu

PURPOSE
Professional ballet dancers are subject to numerous overuse syndromes about the ankle and foot. Anecdotally, we observed a patchy bone marrow pattern on MR in the hindfeet of skeletally mature dancers, similar to the "starry night" pattern described as normal in children. We sought to describe this pattern of "leopard spot marrow edema" (LSME) at MR and explore its potential etiology and significance using clinical correlation and follow-up imaging.

METHOD AND MATERIALS
28 MR exams of the ankle/hindfoot in 19 professional ballet dancers were reviewed by 2 MSK radiologists. The presence of LSME was recorded along with age, gender, clinical indication and primary MR findings potentially related to symptoms. Follow-up MRs were reviewed and edema was graded as improved or progressive. Correlation with clinical findings was made.

RESULTS
LSME was observed in 14/18 subjects (78%) and 22/28 MRs (78.5%). 8/22 with LSME had repeat MR (interval 3-71, mean 33 months). 5/8 showed improvement of LSME including 2 with complete resolution, both of whom were not dancing at follow-up. 1 subject showed improvement at 5 months but progression at 24 months. 3/8 had progressive LSME, and all 3 were dancing in an active production at follow-up. For subjects with LSME, the age range was 22-35, mean 25 years. There was little gender difference as 9/11 females and 5/7 males had LSME. As for other MR findings, 9/18 (50%) had focal osseous stress response or stress fracture, 7/18 (39%) had findings of posterior impingement, 2 had lateral ligament injury, 2 had posterior tibial tendon injury, and 1 each had Achilles tendinopathy, Lisfranc sprain and peroneal tendinopathy. 2 subjects with LSME at 1st MR had stress fractures at follow-up.

CONCLUSION
"Leopard spot marrow edema" is a common but previously unreported finding at MR of the hindfoot in ballet dancers, and our series suggests progression with active dancing such that it may reflect a syndrome of microtrabecular injury, healing response, and re-injury distinct from the pediatric marrow pattern reported as normal.

CLINICAL RELEVANCE/APPLICATION
The observation of this bone marrow pattern in an active ballet dancer should raise concern for evolving osseous stress response and a period of limited activity should be considered. Worsening bone marrow edema suggests that a process of microtrabecular injury with a healing response and re-injury is present explaining the observed MR findings.
RSNA/ESR Sports Imaging Symposium: Postoperative Imaging of Sports Injuries (Interactive Session)

Wednesday, Nov. 28 3:30PM - 5:00PM Room: E352

AMRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Laura W. Bancroft, MD, Orlando, FL (Moderator) Author with royalties, Wolters Kluwer nv; Speaker, World Class CME; Editor, Thieme Medical Publishers, Inc; Travel support, Thieme Medical Publishers, Inc ; ;
Andrew J. Grainger, MRCP, FRCR, Leeds, United Kingdom (Moderator) Consultant, Levicept Ltd; Director, The LivingCare Group;

For information about this presentation, contact:
andrewgrainger@nhs.net

LEARNING OBJECTIVES
1) To become familiar with the expected and abnormal MR imaging findings after labral repair. 2) To learn about the postoperative imaging features after capsular shift/capsulorrhaphy. 3) To appreciate normal imaging and complications after remplissage and Laterjet/Bristow procedures.

ABSTRACT
The aim of ACL reconstruction is to stabilize the knee and prevent chondral and meniscal injuries, which are sequelae of anteroposterior translation and are associated with early osteoarthritis. The idea of the double-bundle ACL graft was to restore normal joint kinematics by anatomic reconstruction of the anteromedial and the posterolateral bundle of the original ACL. This was expected to improve clinical outcomes and restore anterior and rotational knee stability. The single-bundle technique, however, causes less osseous defects and is still a popular technique. Complications, such as ACL graft failure, impingement, cyclops lesion, arthofibrosis, and patellar inferior syndrome, are discussed. The second part of this presentation will illustrate cartilage repair techniques and imaging findings. The radiologist must be familiar with the different cartilage repair procedures and characteristics in cartilage imaging to evaluate long-term progression or failure. Abnormal postoperative findings include hypertrophic filling, incomplete integration of the transplant into the surrounding cartilage, or subchondral defects, osteophytes, cysts, and persistent bone marrow edema and joint effusion.

For information about this presentation, contact:
laura.bancroft.md@flhosp.org
claudia.schueller-weidekamm@meduniwien.ac.at

LEARNING OBJECTIVES
1) To review the common and uncommon ACL reconstruction techniques. 2) To appreciate the expected and abnormal MR imaging findings after ACL reconstruction. 3) To understand common cartilage repair techniques, and corresponding normal and abnormal postoperative MRIs.

ABSTRACT
The aim of ACL reconstruction is to stabilize the knee and prevent chondral and meniscal injuries, which are sequelae of anteroposterior translation and are associated with early osteoarthritis. The idea of the double-bundle ACL graft was to restore normal joint kinematics by anatomic reconstruction of the anteromedial and the posterolateral bundle of the original ACL. This was expected to improve clinical outcomes and restore anterior and rotational knee stability. The single-bundle technique, however, causes less osseous defects and is still a popular technique. Complications, such as ACL graft failure, impingement, cyclops lesion, arthofibrosis, and patellar inferior syndrome, are discussed. The second part of this presentation will illustrate cartilage repair techniques and imaging findings. The radiologist must be familiar with the different cartilage repair procedures and characteristics in cartilage imaging to evaluate long-term progression or failure. Abnormal postoperative findings include hypertrophic filling, incomplete integration of the transplant into the surrounding cartilage, or subchondral defects, osteophytes, cysts, and persistent bone marrow edema and joint effusion.

For information about this presentation, contact:
laura.bancroft.md@flhosp.org
claudia.schueller-weidekamm@meduniwien.ac.at

LEARNING OBJECTIVES
1) To become familiar with the diagnostic features of failed ACL reconstructions. 2) To understand the imaging features of intact...
1) To become familiar with the diagnostic features of failed ACL reconstructions. 2) To understand the imaging features of intact and failed cartilage repair.

ABSTRACT

Postoperative imaging after ACL or cartilage repair is indicated in patients with ongoing pain/instability or repetitive injury. Radiography remains the initial imaging modality; however, further assessment with CT or MRI is recommended. With a clear emphasis on MRI, we will review normal postoperative findings and complications after ACL reconstructions and cartilage repair. The case discussion will cover the most significant pathologies and pitfalls, and normal postoperative findings will be illustrated.
**SPDL41**

**Neuro and MSK (Case-based Competition)**

Wednesday, Nov. 28 4:30PM - 6:00PM Room: E451B

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

**Participants**

Paul J. Chang, MD, Chicago, IL (Presenter) Co-founder, Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Researcher, Bayer AG; Advisory Board, Bayer AG; Advisory Board, Aidoc Ltd; Advisory Board, EnvoyAI; Advisory Board, Inference Analytics

Omer A. Awan, MD, Philadelphia, PA (Presenter) Nothing to Disclose

Gregory L. Katzman, MD, Chicago, IL (Presenter) Nothing to Disclose

Neety Panu, MD, FRCPC, Ottawa, ON (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Be introduced to a series of neuroradiology and musculoskeletal radiology case studies via an interactive team game approach designed to encourage ‘active' consumption of educational content. 2) Use their mobile wireless device (tablet, phone, laptop) to electronically respond to various imaging case challenges; participants will be able to monitor their individual and team performance in real time. 3) Receive a personalized self-assessment report via email that will review the case material presented during the session, along with individual and team performance.

**ABSTRACT**

The extremely popular audience participation educational experience, Diagnosis Live!, is an expert-moderated session featuring a series of interactive case studies that will challenge radiologists’ diagnostic skills and knowledge. The session features a lively, fast-paced game format: participants will be automatically assigned to teams who will then use their personal mobile devices to test their knowledge in a fast-paced session that will be both educational and entertaining. After the session, attendees will receive a personalized self-assessment report via email that will review the case material presented during the session, along with individual and team performance.
ED008-TH

**Muscloskeletal Thursday Case of the Day**

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

**AMA PRA Category 1 Credit ™:** .50

**Participants**
- Daniel E. Wessell, MD, PhD, Jacksonville, FL *(Presenter)* Nothing to Disclose
- Jonathan A. Flug, MD, MBA, Phoenix, AZ *(Abstract Co-Author)* Nothing to Disclose
- Jeremiah R. Long, MD, Ft Belvoir, VA *(Abstract Co-Author)* Nothing to Disclose
- Joseph M. Bestic, MD, Jacksonville, FL *(Abstract Co-Author)* Nothing to Disclose
- Hillary W. Garner, MD, Jacksonville, FL *(Abstract Co-Author)* Nothing to Disclose
- Andrew Z. Chow, MD, Jacksonville, FL *(Abstract Co-Author)* Nothing to Disclose
- Sara Eckloff, MD, Eau Claire, WI *(Abstract Co-Author)* Nothing to Disclose
- Matthew A. Frick, MD, Rochester, MN *(Abstract Co-Author)* Nothing to Disclose
- Nicholas G. Rhodes, MD, Rochester, MN *(Abstract Co-Author)* Nothing to Disclose
- Sujan C. Fernando, MD, Milwaukee, WI *(Abstract Co-Author)* Nothing to Disclose
- John S. Symanski, MD, Milwaukee, WI *(Abstract Co-Author)* Nothing to Disclose

**TEACHING POINTS**

1) Participants will test their diagnostic skills and become familiar with the imaging findings of a variety of challenging and interesting musculoskeletal cases.

**Honored Educators**

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Daniel E. Wessell, MD, PhD - 2013 Honored Educator
Case-based Review of Musculoskeletal Radiology (Interactive Session)

Thursday, Nov. 29 8:30AM - 10:00AM Room: S100AB

AMERICAN MEDICAL ASSOCIATION - PRA Category 1 Credit: 1.50
ARRT Category A+ Credit: 1.75

FDA Disclosures may include off-label uses.

Participants
Stacy E. Smith, MD, Boston, MA (Director) Nothing to Disclose

Sub-Events

MSCS51A Shoulder
Participants
Laura W. Bancroft, MD, Orlando, FL (Presenter) Author with royalties, Wolters Kluwer nv; Speaker, World Class CME; Editor, Thieme Medical Publishers, Inc.; Travel support, Thieme Medical Publishers, Inc.

For information about this presentation, contact:
laura.bancroft.md@flhosp.org

LEARNING OBJECTIVES
1) Review essential imaging characteristics of post-traumatic and sports-related shoulder injuries. 2) Review salient multimodality imaging features of various shoulder pathologies in a case based format.

MSCS51B Soft Tissue Lesions
Participants
Stacy E. Smith, MD, Boston, MA (Presenter) Nothing to Disclose

MSCS51C MSK Ultrasound
Participants
Akira M. Murakami, MD, Boston, MA ( Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Describe anatomy, pathology and US appearances of MSK cases outlining use of dynamic imaging and doppler. 2) Identify potential pitfalls. 3) Describe how other imaging modalities are complimentary to MSK Ultrasound.

ABSTRACT
The presentation will be a case based approach to review ultrasound appearances of common musculoskeletal pathologies of the upper and lower extremity including the use of dynamic imaging and doppler. Potential pitfalls will be reviewed as well as the importance of other imaging modalities and how they are complimentary to ultrasound.

MSCS51D Spine Lesions
Participants
Glenn C. Gaviola, MD, Boston, MA (Presenter) Nothing to Disclose
RC604

Musculoskeletal Series: Musculoskeletal Interventions

Thursday, Nov. 29 8:30AM - 12:00PM Room: E353C

AMA PRA Category 1 Credits™: 3.50
ARRT Category A+ Credits: 4.00

Participants
Theodore T. Miller, MD, New York, NY (Moderator) Nothing to Disclose
Kenneth S. Lee, MD, Madison, WI (Moderator) Grant, General Electric Company Research support, SuperSonic Imagine Research support, Johnson & Johnson Consultant, Echometrix, LLC Royalties, Reed Elsevier
Robert S. Campbell, MBCh, Liverpool, United Kingdom (Moderator) Nothing to Disclose

For information about this presentation, contact:
klee2@uwhealth.org
llenchik@wakehealth.edu

Active Handout: Robert SD Campbell

LEARNING OBJECTIVES
1) Correlate symptoms with MRI findings. 2) Explain pain generators on MRI. 3) Describe role of corticosteroid injection.

RC604-01 Spine

Participants
William E. Palmer, MD, Boston, MA (Presenter) Nothing to Disclose

For information about this presentation, contact:
wpalmer@mgh.harvard.edu

LEARNING OBJECTIVES
1) Be able to describe the clinical uses of sonographically guided interventions of the hip and knee. 2) Be able to describe technique of sonographically guided interventions of the hip and knee.

RC604-02 Hip/Knee

Participants
Theodore T. Miller, MD, New York, NY (Presenter) Nothing to Disclose

For information about this presentation, contact:
millertt@hss.edu

RC604-03 3-Tesla MR-Guided MR Arthrography of the Shoulder: Technical Performance, Patient Experience, and Comparative Efficiency

Participants
Ethan Dyer, McDonough, GA (Presenter) Nothing to Disclose
Moustafa Abou Areda, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Bao Chau Ly, BS, MS, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Janice A. Wang, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Jan Fritz, MD, Baltimore, MD (Abstract Co-Author) Research Grant, Siemens AG; Scientific Advisor, Siemens AG; Scientific Advisor, Alexion Pharmaceuticals, Inc; Speaker, Siemens AG

For information about this presentation, contact:
fritz9@jhmi.edu

Awards
Student Travel Stipend Award
Participants
Ethan Dyer, McDonough, GA (Presenter) Nothing to Disclose
Moustafa Abou Areda, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Bao Chau Ly, BS, MS, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Janice A. Wang, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Jan Fritz, MD, Baltimore, MD (Abstract Co-Author) Research Grant, Siemens AG; Scientific Advisor, Siemens AG; Scientific Advisor, Alexion Pharmaceuticals, Inc; Speaker, Siemens AG

For information about this presentation, contact:
fritz9@jhmi.edu
DIRECT DRILLER MR arthrography typically requires image-guided joint injections before MRI. However, the coordination of rooms and teams can be time-consuming or may not be possible at outpatient sites, in which case MR-guided MR arthrography may be advantageous. Therefore, we evaluated the performance of MR-guided MR arthrography at 3-Tesla.

METHOD AND MATERIALS
Following IRB-approval and informed consent, 154 patients (average age, 36; range, 13-77) undergoing MR-guided shoulder MR arthrography with a 3T wide-bore MRI system were prospectively included. Patients underwent MRI, MR-guided glenohumeral injection, and MR arthrogram as a single session procedure. The injections were performed by fellow or attending physicians. Outcome variables included technical success, extracapsular contrast leakage, procedure times, major complications, and patient experience obtained through a postprocedural questionnaire. Efficiency was assessed by comparison with procedural times of 50 recent fluoroscopy-guided MR arthrography procedures, consisting of injection and subsequent mixed MRI and MR arthrography. We used unpaired t-test and a $p<0.05$ significance level.

RESULTS
MR-guided shoulder arthrography was technically successful in 152/154 (99%) patients, whereas in 2/154 patients the procedure was prematurely terminated due to patient discomfort and inability to achieve intra-articular puncture. 10/152 (7%) procedures had mild extra-articular contrast leakage. There were no major complications. The procedure was tolerated well with low rates of moderate nausea (3%), moderate pain (7%), severe pain (2%), and no higher-grade claustrophobia, flashes, or heat sensations. MR-guided MR arthrography required a total of 87 (53-140) min including MRI [39 (16-59) min], MR-guided injection [28 (9-77) min], and MRA [16 (4-27) min]. In comparison, fluoroscopy-guided MR arthrography required a total time of 104 (51 -158) min ($p<0.001$).

CONCLUSION
3-Tesla MR-guided MR arthrography of the shoulder is clinically feasible and affords high technical accuracy, as well as favorable safety profile and efficiency, which may supersede traditional fluoroscopy-guided MR arthrography.
CT-guided Discitis-Osteomyelitis Biopsies: Needle Gauge and Microbiology Results

Thursday, Nov. 29 9:40AM - 9:50AM Room: E353C

Participants
Jad S. Husseini, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Brooks Applewhite, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Nathaniel D. Mercaldo, Boston, MA (Abstract Co-Author) Nothing to Disclose
Joao Rafael T. Vicentini, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Sandra B. Nelson, Boston, MA (Abstract Co-Author) Nothing to Disclose
Frank J. Simeone, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Connie Y. Chang, MD, Boston, MA (Presenter) Nothing to Disclose

For information about this presentation, contact: cychang@mgh.harvard.edu

PURPOSE
To compare the microbiology results and needle gauge for CT-guided biopsies of suspected acute discitis-osteomyelitis.

METHOD AND MATERIALS
All CT-guided biopsies performed for suspected acute discitis-osteomyelitis between May 2014 and December 2017 were reviewed. Biopsy location, needle type and gauge, microbiology, pathology, and clinical and imaging follow-up were obtained through chart review. Descriptive statistics were computed for all demographic and biopsy characteristics. Logistic regression analyses were used to quantify the association between a correct test result and needle gauge. Odds ratios and 95% confidence intervals were computed using the full cohort to summarize accuracy and using those with confirmed acute discitis-osteomyelitis infection to summarize sensitivity.

RESULTS
A total of 79 (age: 55 ± 19 years; 26 (33%) F; 1 (1%) cervical, 18 (23%) thoracic, 60 (76%) lumbar) biopsies were performed. There were 37 (47%) bone/disc biopsies, 30 (38%) disc only biopsies, 9 (11%) bone only biopsies, and 3 (4%) paravertebral soft tissue biopsies. There were 14 (18%) 12 gauge (G) biopsies, 12 (15%) 13 G biopsies, 21 (27%) 14 G biopsies, and 32 (41%) 16+ G biopsies. True disease status (infection) was determined via either pathology findings (64, 82%) or clinical and imaging follow up (15, 18%). The overall accuracy and sensitivity of the CT-guided biopsies were 82% (95% CI: 73-91) and 74% (60-87), respectively. The estimates by gauge were [accuracy, sensitivity]: 12 G, [79 (49-95), 82 (48-98)]; 13 G, [58 (28-85), 56 (21-86)]; 14 G, [48 (26-70), 45 (23-68)]; 16+ G, [53(35-71), 42 (23-63)]. The odds ratios of 12 vs 13+, 12 and 13 vs 14+, and 12 to 14 vs 16+ G needle biopsies were 3.3 (0.9-15.8), 2.2 (0.8-6.1), and 1.3 (0.5-3.2), respectively. Similar estimates of obtaining positive microbiology results among disease positive patients were 5.4 (1.3-37.6), 3.0 (1.0-9.9), and 1.8 (0.7-5.1), respectively.

CONCLUSION
The odds of having an accurate microbiology result were 5.4 (1.3-37.6) times higher among disease positive patients. These results suggest that the use of a larger gauge biopsy needle may increase the likelihood of culturing the causative microorganism for CT-guided biopsies of acute discitis-osteomyelitis.

CLINICAL RELEVANCE/APPLICATION
Using a lower gauge biopsy needle needle to obtain a larger core sample may help to culture the causative organism in discitis-osteomyelitis.
participants

Giovanni Mauri, MD, Milan, Italy (Abstract Co-Author) Consultant, Esaote SpA
Domenico Albano, Palermo, Italy (Abstract Co-Author) Nothing to Disclose
Carmelo Messina, MD, Milan, Italy (Abstract Co-Author) Nothing to Disclose
Angelo Corazza, MD, Genova, Italy (Abstract Co-Author) Nothing to Disclose
Santi Rapisarda, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Luca Maria Sconfienza, MD, PhD, Milano, Italy (Presenter) Travel support, Bracco Group; Travel support, Esaote SpA; Travel support, ABIOPHARM SpA; Speakers Bureau, Fidia Pharma Group SpA

For information about this presentation, contact:
io@lucasconfienza.it

purpose

Electromagnetic fusion imaging is an established modality to perform interventional procedures around the body. However, this modality has never been tested in the spine. Our aim was to test the technical feasibility of electromagnetic fusion imaging-guided spinal bone biopsies.

method and materials

Between February and March 2018, nine patients (four males, mean age 47 ± 12 years) referred to our radiology unit of a tertiary orthopaedic center to undergo a bone biopsy of the spine. Lesions were located in the sacrum (n=3), vertebral body (n=3), intervertebral disc (n=3). Patients were placed prone on CT table (64 slice, Siemens, Germany), an external fiducial marker was placed in the relevant area and image volume was acquired. DICOM dataset was then loaded on a US system (Twice, Esaote, Italy) equipped with a GPS-based electromagnetic navigation unit and a needle-tracking system. Bone biopsy was then performed with standard procedure using CT and fusion guidance for the first six cases and fusion guidance only in the last three. For every procedure, we recorded the elapsed time between local anesthesia and specimen withdrawal, the number of CT passes, complications, specimen adequacy. We compared the elapsed times and number of CT passes with similar previous cases performed with standard CT-guided procedures.

results

Mean elapsed time for the first six cases was 455 minutes, while for cases performed using fusion imaging only was 307 minutes (P=0.061). In similar previous cases performed with standard CT-guided procedures, elapsed time was 446 minutes (P=0.809) and 454 minutes (P=0.05), respectively. Median number of CT passes for the first six cases was 7.5 (IQR 5.75-8.25) while it was 3 (3-3) for cases performed using fusion imaging only. In similar previous cases performed with standard CT-guided procedures, median number of CT passes was 6 (5-7.25) (P=0.219) and 8 (7-8) (P=0.042), respectively. No complications occurred and all specimens were adequate.

conclusion

Although on a small series and after initial testing, electromagnetic fusion imaging-guided spine biopsy seems to be feasible and may reduce the procedural time and the number of CT passes, thus also reducing radiation administration.

clinical relevance/application

Electromagnetic fusion imaging-guided spine biopsy seems to be promising in reducing procedure time and amount of radiations administered to patients.

rc604-09 clinical and patient-reported outcomes after image-guided intra-articular therapeutic hip injections in patients with osteoarthritis related hip pain: a retrospective study

Participants

William Walter, MD, New York, NY (Presenter) Nothing to Disclose
Craig Bearison, New York, NY (Abstract Co-Author) Nothing to Disclose
James Slover, New York, NY (Abstract Co-Author) Nothing to Disclose
Heather T. Gold, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose
Soterios Gyftopoulos, MD, Scarsdale, NY (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
william.walter@nyumc.org

purpose

To evaluate change in patient reported outcomes (PROs) scores for patients undergoing image-guided intraarticular therapeutic hip steroid injections for pain management and assess potential correlation of outcomes with patient- and injection-specific factors.

method and materials

We performed a retrospective medical record review of consecutive patients undergoing treatment for hip pain who completed PRO surveys from 10/2011-09/2017 at an outpatient orthopedic surgery clinic. Patients underwent steroid hip injection and completed PRO assessments: EuroQol-5 domain (EQ5D), EQ5D visual analog scale, and the hip disability and osteoarthritis outcome (HOOS), before injection and within 1-6 months post-injection. Pre- and post-injection PRO scores were compared. Time to repeat injection and hip surgery was recorded. Available imaging was reviewed for degree of osteoarthritis. Statistical methods included exact Wilcoxon signed rank test to assess score differences and Spearman correlation, and Kruskal-Wallis, and exact Mann-Whitney tests to assess correlation of PRO scores with patient and injection-specific factors.

results

In the 144 patients who met our inclusion criteria, there was no significant change from pre-injection to post-injection in the EQ5D (p=0.210), EQ5D visual analog scale (p=0.293), average HOOS (p=0.562) or total HOOS (p=0.459) scores. Forty patients (27.8%)
underwent hip arthroplasty within 1 year of the injection. Weakly positive correlation was found between number of days from injection to surgery and change in EQ-5D ($r=0.29$, $p=0.023$) and average ($r=0.36$, $p=0.008$) and total HOOS ($r=0.40$, $p=0.003$) scores. No other significant correlations between PRO score change and patient- or injection-specific factors, including radiographic degree of osteoarthritis, were detected.

CONCLUSION

We demonstrated no significant change in EQSD or HOOS scores measured before intra-articular therapeutic hip injections compared with 1-6 months after injection. While our results should temper expectations for symptom improvement, further study is required to systematize PRO collection and identify predictive factors or patient subsets most likely to benefit from these injections.

CLINICAL RELEVANCE/APPLICATION

Image-guided therapeutic injections may not significantly change quality of life among patients with osteoarthitis-related hip pain, as measured by PROs.

RC604-10 Ultrasound-Guided Aspiration of Hematomas: Safety, Efficacy and Relationship to Sonographic Appearance

Thursday, Nov. 29 11:00AM - 11:10AM Room: E353C

Awards
Student Travel Stipend Award

Participants
Edward S. Yoon, MD, New York, NY (Presenter) Nothing to Disclose
Theodore T. Miller, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Susan C. Lee, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
yoone@hss.edu

PURPOSE

To evaluate the safety and efficacy of ultrasound-guided aspiration of musculoskeletal hematomas. To determine whether the age of hematomas correlates with their sonographic appearance, and if the appearance predicts the ease of aspiration.

METHOD AND MATERIALS

With IRB approval, we searched our radiology database between 1/01/2008 - 9/28/2017, for hematoma aspirations performed by a single senior musculoskeletal radiologist specializing in musculoskeletal ultrasound. We reviewed the echogenicity of the collection (hypoechoic, heterogeneous, complex, echogenic), age of the hematoma, aspiration amount and aspirate consistency/quality, whether lavage was performed, needle gauge, location, complications, and amount of decompression categorized as minimal (<25% decompression), moderate (25-75%), and complete (>75%). Electronic medical records were reviewed to determine the clinical outcome and any complications.

RESULTS

67 patients (32 females/35 males, 16-80 years old) had US-guided hematoma aspirations. 47 patients returned for clinical follow-up with no infections and all reporting symptomatic relief. Hematoma locations included intramuscular, intrabursal, and intraarticular. Of the 67 hematomas, 34 were lavaged with saline or lidocaine which improved the aspiration. The amount of decompression ranged from: minimal (8/67), moderate (18/67), and complete (41/67). Of the completely decompressed hematomas, (6/41, 13%) were hypoechoic, (23/41, 47%) heterogeneous, (18/41, 40%) complex, and (0/41) echogenic. Of the moderately decompressed hematomas, (10/18, 56%) heterogenous, (8/18, 44%) complex, and (0/18) echogenic. Of the minimally decompressed hematomas, (1/8, 13%) were hypoechoic, (4/8, 50%) heterogeneous, (2/8, 25%) complex, and (0/8, 13%) echogenic. Age of hematomas in 45/67 patients ranged from 1-90 days with an average of 11 days. Ordinal logistic regression showed no significant correlation between echotexture ($p=0.075$) or the age of the hematoma with ease of aspiration ($p=0.085$).

CONCLUSION

Ultrasound-guided hematoma aspiration is a safe and effective treatment. There is no correlation between the echogenicity of the hematoma, age of the hematoma, and ease of aspiration/amount of decompression.

CLINICAL RELEVANCE/APPLICATION

Hematoma aspiration is a safe procedure. The age and sonographic appearance of the hematoma do not predict the ease of aspiration.

RC604-11 Shoulder

Thursday, Nov. 29 11:10AM - 11:35AM Room: E353C

Participants
Robert S. Campbell, MBBCh, Liverpool, United Kingdom (Presenter) Nothing to Disclose

Active Handout: Robert SD Campbell

LEARNING OBJECTIVES

1) The clinical Indications for undertaking shoulder intervention. 2) The techniques for performing shoulder interventions. 3) The evidence base that supports the use of shoulder interventions.

RC604-12 Ablative Techniques
Participants
Travis J. Hillen, MD, Saint Louis, MO (Presenter) Consultant, Biomedical Systems; Consultant, Medtronic plc

For information about this presentation, contact:
tjhillen@wustl.edu

LEARNING OBJECTIVES
1) Discuss the multiple different ablation modalities and common uses for each. 2) Indications and techniques for benign musculoskeletal tumor ablation. 3) Indications and techniques for malignant tumor ablation. 4) Indications and techniques for thermoprotection with ablation. 5) Contraindications and potential complications to tumor ablation.
Interactive Game: When Do Imaging Findings Make a Difference? (Interactive Session)

Thursday, Nov. 29 8:30AM - 10:00AM Room: E353B

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

Participants
David M. Panicek, MD, New York, NY (Moderator) Nothing to Disclose

For information about this presentation, contact:
panicekd@mskcc.org

LEARNING OBJECTIVES
1) To recognize and review a range of potential interpretive pitfalls in oncologic imaging of the nervous, gynecologic, and musculoskeletal systems, using an interactive audience response system.

GENERAL INFORMATION
This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

Sub-Events
RC618A Neuro
Participants
Birgit B. Ertl-Wagner, MD, Toronto, ON (Presenter) Spouse, Stockholder, Siemens AG; 

For information about this presentation, contact:
Betina.Ertl-Wagner@sickkids.ca

LEARNING OBJECTIVES
1) To comprehend the importance of signs in neuroimaging for diagnostic decision making. 2) To understand in which instances imaging findings have a direct consequence for therapeutic decision making. 3) To appreciate the therapeutic consequences of select neuroimaging findings.

RC618B Musculoskeletal
Participants
David M. Panicek, MD, New York, NY (Presenter) Nothing to Disclose

For information about this presentation, contact:
panicekd@mskcc.org

LEARNING OBJECTIVES
1) Assess imaging features that facilitate specific diagnoses of musculoskeletal lesions. 2) Describe scenarios in which various imaging features of musculoskeletal lesions lead to more accurate tumor staging and treatment response assessment. 3) Detect musculoskeletal complications of tumors and their treatment.

RC618C Pelvis
Participants
Rosemarie Forstner, MD, Salzburg, Austria (Presenter) Nothing to Disclose

For information about this presentation, contact:
panicekd@mskcc.org

LEARNING OBJECTIVES
1) Understand the role of imaging in the management of gynaecological malignancies.2) Assess imaging features that allow accurate staging of gynaecological malignancies.3) Be familiar with pitfalls that can result in staging errors using imaging.4) Understand the changes in imaging appearance post treatment.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Caroline Reinhold, MD, MSc - 2013 Honored EducatorCaroline Reinhold, MD, MSc - 2014 Honored EducatorCaroline Reinhold, MD, MSc - 2017 Honored Educator
Common Spinal Injection Procedures for Diagnosis and Treatment of Back Pain (Hands-on)

Thursday, Nov. 29 8:30AM - 10:00AM Room: E263

LEARNING OBJECTIVES
1) To introduce common spinal injection procedures that are used for the diagnosis and treatment of neck and back pain disorders.
2) To learn the indications and contraindications for these procedures. 3) To understand how imaging guidance is used to perform these procedures. 4) To introduce some of the equipment and techniques that are helpful in performing spine injection procedures in a hands on format with an opportunity for attendees to address their specific questions and concerns with the course faculty.

ABSTRACT
Image guided spine interventions can be used for the diagnosis and/or treatment of painful conditions of the spinal access. Diagnostic procedures often include specific nerve blocks that can be performed with anesthetic agents. Facet joint and sacroiliac joint pain syndromes can likewise be managed with spine interventional techniques. Epidural steroid injections can be performed using interlaminar, caudal or transforaminal techniques in the management of focal back or neck pain with an associated radicular pain component. More advanced longer lasting treatments include radiofrequency neuolysis which can also be used to manage facet or sacroiliac joint related pain that temporarily responds to diagnostic median branch blocks or specific joint injections. Spinal cord stimulator placement is another advanced technique that can be used to manage chronic pain syndromes. The workshop emphasizes patient selection, imaging evaluation, procedure indication and contraindications in order to optimize treatment outcome.
Live Ultrasound Interventional Procedures: Joint Injections, Cyst Aspiration, Abscess Drainage, Vascular Access, Core Biopsy, and Foreign Body Removal (Hands-on)

Thursday, Nov. 29 8:30AM - 10:00AM Room: E264

Participants
Veronica J. Rooks, MD, Honolulu, HI (Moderator) Nothing to Disclose
Veronica J. Rooks, MD, Honolulu, HI (Presenter) Nothing to Disclose
Stephen C. O’Connor, MD, Boston, MA (Presenter) Nothing to Disclose
James W. Murakami, MD, Columbus, OH (Presenter) Nothing to Disclose
Kal Dulaimy, MD, Springfield, MA (Presenter) Nothing to Disclose
Hisham A. Tchelepi, MD, Los Angeles, CA (Presenter) Nothing to Disclose
Christian L. Carlson, MD, MS, Jbsa Ft Sam Houston, TX (Presenter) Nothing to Disclose
Paolo Minafra, MD, Pavia, Italy (Presenter) Nothing to Disclose
Leah E. Braswell, MD, Columbus, OH (Presenter) Nothing to Disclose
Horacio M. Padua JR, MD, Boston, MA (Presenter) Nothing to Disclose
Adam S. Young, MD, MBA, Los Angeles, CA (Presenter) Nothing to Disclose
Paula B. Gordon, MD, Vancouver, BC (Presenter) Stockholder, OncoGenex Pharmaceuticals, Inc ; Stockholder, Volpara Health Technologies Limited; Scientific Advisory Board, Real Imaging Ltd; Scientific Advisory Board, DenseBreast-info, Inc; Ebonee Carter, MD, Savanna, GA (Presenter) Nothing to Disclose
Eric Royston, DO, MPH, Tripler Army Med Ctr, HI (Presenter) Nothing to Disclose
Peter L. Cooperberg, MD, Vancouver, BC (Presenter) Nothing to Disclose
Shankar Rajeswaran, MD, Chicago, IL (Presenter) Nothing to Disclose
Eva M. Smietana, MD, Kailua, HI (Presenter) Nothing to Disclose

For information about this presentation, contact:
ronirooks@gmail.com
brian.h.ching.civ@mail.mil
Ebonee.B.Carter.mil@mail.mil
paolominafra@gmail.com
James.Murakami@nationwidechildrens.org

LEARNING OBJECTIVES
1) Identify basic skills, techniques, and pitfalls of freehand invasive sonography. 2) Define and discuss technical aspects, rationale, and pitfalls involved in musculoskeletal interventional sonographic care procedures. 3) Successfully perform basic portions of hands-on US-guided MSK procedures in a tissue simulation learning module, including core biopsy, small abscess drainage, cyst aspiration, soft tissue foreign body removal, vascular access, and intraarticular steroid injection. 4) Incorporate these component skill sets into further life-long learning for expansion of competency and preparation for more advanced interventional sonographic learning opportunities.
MSCS52

Case-based Review of Musculoskeletal Radiology (Interactive Session)

Thursday, Nov. 29 10:30AM - 12:00PM Room: S100AB

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

Participants
Stacy E. Smith, MD, Boston, MA (Director) Nothing to Disclose

Sub-Events

MSCS52A  Foot and Ankle

Participants
Hilary R. Umans, MD, Ardsley, NY (Presenter) Nothing to Disclose

For information about this presentation, contact:
hilary.umans@radnet.com

LEARNING OBJECTIVES
1) Learn to identify common pathology encountered in imaging the ankle / hind-foot, mid- and forefoot; cases will be selected to encompass common osteochondral, ligamentous, myotendinous capsular and soft tissue pathology.

MSCS52B  Metabolic MSK Disorders

Participants
Giuseppe Guglielmi, MD, Foggia, Italy (Presenter) Nothing to Disclose

For information about this presentation, contact:
giuseppe.guglielmi@unifg.it

LEARNING OBJECTIVES
1) To learn about osteoporosis, osteopenia and osteomalacia in course of gastrointestinal, haematological, tumoral and metabolic diseases. 2) To understand the physiopathogenesis of these conditions and its differences from primary osteoporosis. 3) To present the role conventional and advanced techniques to evaluate bone mineral density and bone quality.

ABSTRACT

Metabolic bone diseases are widespread conditions which can be either primary or secondary to several disorders, such as gastrointestinal, haematological and tumoral ones. Conventional and advanced Imaging techniques may help the Radiologist to detect changes in bone mineral density (bone quantity) as well as in bone mineral architecture (bone quality) in order to make the proper diagnosis. In particular, in this session the role of Radiographs, bone densitometry, CT, MRI and their histology specimens will be discussed.

MSCS52C  Hip

Participants
Donna G. Blankenbaker, MD, Fitchburg, WI (Presenter) Consultant, Reed Elsevier; Royalties, Reed Elsevier

LEARNING OBJECTIVES
1) Recognize the imaging appearance for different hip conditions. 2) Improve diagnostic skill and apply principles for developing a differential diagnosis.

MSCS52D  Knee

Participants
Christine B. Chung, MD, La Jolla, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify current challenges in clinical diagnosis of commonly encountered knee pathology. 2) Apply strategies to address diagnostic challenges using a case-based format.
Participants
Laura W. Bancroft, MD, Orlando, FL (Presenter) Author with royalties, Wolters Kluwer nv; Speaker, World Class CME; Editor, Thieme Medical Publishers, Inc; Travel support, Thieme Medical Publishers, Inc;

For information about this presentation, contact:
laura.bancroft.md@flhosp.org

LEARNING OBJECTIVES

1) Discuss importance of proper radiographic positioning for upper and lower extremity musculoskeletal imaging. 2) Review radiographic pitfalls and potentially missed musculoskeletal cases in a case-based format.
Histological Validation of Chemical Exchange Saturation Transfer (CEST) imaging for the Measurement of Metabolism Status in Infarcted Myocardium

PURPOSE

The purpose of this study was to test if the distribution of creatine shown on Chemical Exchange Saturation Transfer (CEST) MRI could differentiate infarct myocardium from the normal on pigs, by referring to LGE images and pathologic results.

METHOD AND MATERIALS

We prospectively enrolled 27 Bama miniature pigs. MI model was built by applying a ligation at the remote ending of the left anterior descending artery. CMR scan was arranged at 3 days and 2 months later for the AMI and CMI group on a 3 T whole-body scanner. A single SAX slice was used for CEST scanning by using Amide proton transfer (APT) sequence before the injection of contrast. 36 samples were collected from a saturation frequency offset from -5.0 ppm to + 5.0 ppm. The scanned pigs were humanely euthanized under deep anesthesia with KCl and the heart was excised. Triphenyl tetrazolium chloride was used to manifest the infarcted region. CEST values at the frequency of ~1.8ppm, ~2.5ppm, ~2ppm and ~3ppm were recorded respectively for each pig and Color code map was plotted based on the CEST values at a frequency offset of ~1.8ppm (Matlab). Statistic analysis was performed on R project.

RESULTS

A total of 5 AMI pigs (M, 7 months, 16.6 ± 1.2 kg), and 14 CMI pigs (M, 9 months, 27.8 ± 2.1 kg), were finally included. Statistic differences were observed for Cr, ATP, and Glu between the infarct myocardium and the normal myocardium for CMI pigs, while only Cr and ATP for AMI pigs. The color code map showed a prominent larger abnormal region with a lower concentration of creatine than the MI regions recognized on the LGE sequences and the pathology images.

CONCLUSION

This study demonstrated that the metabolic conditions measured on CEST imaging could be used for infarcted myocardium recognition and the region of myocardium with a lower creatine concentration was larger than the region confirmed with infarction, which again provided proof of the existence of the injured or stunned myocardial tissue surrounding the infarction region.

CLINICAL RELEVANCE/APPLICATION

CEST MRI provided a promising invasive way to observe metabolism status of infarcted myocardium and further studies on MI patients would be needed to validate its clinical application.

Molecular Imaging (Musculoskeletal, Gastrointestinal, Cardio)

Thursday, Nov. 29 10:30AM - 12:00PM Room: S504CD

SSQ12-02 Molecular Lumbar Intervertebral Disc Alterations in Patients with Leg Length Discrepancy Before and After Therapy

Participants

Christoph Schleich, MD, Dusseldorf, Germany (Abstract Co-Author) Nothing to Disclose
Miriam Frenken, Dusseldorf, Germany (Presenter) Nothing to Disclose
Daniel B. Abrar, MD, Dusseldorf, Germany (Abstract Co-Author) Nothing to Disclose
Johannes Boos, MD, Dusseldorf, Germany (Abstract Co-Author) Nothing to Disclose
Joel Aissa, MD, Duesseldorf, Germany (Abstract Co-Author) Nothing to Disclose

Molecular Imaging (Musculoskeletal, Gastrointestinal, Cardio)

Thursday, Nov. 29 10:30AM - 12:00PM Room: S504CD

SSQ12-01 Histological Validation of Chemical Exchange Saturation Transfer (CEST) imaging for the Measurement of Metabolism Status in Infarcted Myocardium

Participants

Kaiyue Diao, Chengdu, China (Presenter) Nothing to Disclose
Zhigang Yang, MD, Chengdu, China (Abstract Co-Author) Nothing to Disclose
Yingkun Guo, Chengdu, China (Abstract Co-Author) Nothing to Disclose
Wanlin Peng, MS, Chengdu, China (Abstract Co-Author) Nothing to Disclose
Chunchao Xia, Chengdu, China (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:

kaiyuediao@qq.com
This study showed the feasibility of VAT oxygenation by BOLD MRI in ZDF rats with obesity induced by high-fat diet. The R2* values were measured in the perirenal VAT. The trygliceride, cholesterol and insulin levels were measured by blood biochemistry analysis. BOLD MRI was performed at 13 and 23 weeks of age using a multi-echo spoiled gradient-echo (gagCEST) sequence were performed. Subjects with bulged or hemiated discs were excluded.

**RESULTS**

Nucleus pulposus-gagCEST values of L5/S1 disc were significantly lower in patients with LLD compared to control group (p = 0.0008). For all other disc levels, no significant difference was found. At follow-up, no significant difference of NP-gagCEST values at baseline and 6 months after therapy could be found (p > 0.05).

**CONCLUSION**

This study supports the hypothesis that LLD greater than 10 mm could be a predisposing factor for early molecular alterations of lumbar discs of L5/S1. Remarkably, we observed lower gagCEST values of the lumbar disc of L5/S1 caused by LLD even before any morphological pathology could be found. Biochemical disc alterations of patients with LLD could be stopped under therapy.

**CLINICAL RELEVANCE/APPLICATION**

This study supports the hypothesis that LLD could be a predisposing factor for early molecular alterations of the lumbar disc of L5/S1. Furthermore, lower gagCEST values of the lumbar disc of L5/S1 caused by LLD were observed before any morphological pathologies were detectable. This molecular alterations of L5/S1 of patients with LLD could be delayed under the effect of shoe inserts and physical therapy.

**SSQ12-03 Blood Oxygen Level-Dependent MRI Can Evaluate the Oxygenation of Visceral Adipose Tissue in Zucker Diabetic Fatty Rats**

**Participants**

Matteo Figini, Chicago, IL (*Presenter*) Nothing to Disclose
Yaqi Zhang, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Su Hu, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Liang Pan, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Junjie Shangguan, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Jia Yang, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Quanhong Ma, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Yuri Velichko, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Vahid Yaghmai, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Zhuoli Zhang, MD, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

**PURPOSE**

Visceral adipose tissue (VAT) hypoxia is associated with insulin resistance and obesity-related chronic low-grade inflammation (metamflammation). Its evaluation is then of great importance for prevention and therapy, but current methods are invasive and focus on subcutaneous fat rather than VAT. The purpose of this study is to investigate the feasibility of evaluating VAT hypoxia with Blood Oxygen Level-Dependent (BOLD) MRI, which is sensitive to hemoglobin oxygenation, in Zucker Diabetic Fatty (ZDF) rats.

**METHOD AND MATERIALS**

Seven-week old ZDF rats (n=18) were provided with water and high-fat diet ad libitum; their body weight and blood glucose were monitored. At 13 weeks of age they were divided into two subgroups, receiving a daily dose of pioglitazone (ZDF-PGZ, n=9) or saline (ZDF-VE, n=9) respectively. BOLD MRI was performed at 13 and 23 weeks of age using a multi-echo spoiled gradient-echo sequence (5 echo times from 3.75 to 29.07 ms with 6.33 ms echo spacing, TR = 408 ms, voxel size = 0.47x0.38x3 mm3). R2* values were measured in the perirenal VAT. The trygliceride, cholesterol and insulin levels were measured by blood biochemistry analysis, and insulin resistance was calculated by HOMA-IR = insulin[mU/L] x glucose[mmol/L] / 22.5. Immunofluorescence was used to evaluate hypoxia by pimonidazole adduct-positive area. The proportion of Th17 and Treg cells, CD34+ and CD34++ monocytes were evaluated by flow cytometry.

**RESULTS**

The ZDF-VE group had hyperlipidemia (p < 0.01) and hyperinsulinemia (p < 0.001) and higher HOMA-IR (p < 0.001) compared to the ZDF-PGZ group. There was a significant R2* increase between the two scans for ZDF-VE (20.14 ± 0.23 vs. 21.53 ± 0.20, p = 0.012) but not for ZDF-PGZ (figure 1A). VAT R2* values showed a positive correlation with pimonidazole adduct-positive area, HOMA-IR, the percentage of Th17 cells and CD43+ monocytes, and a negative correlation with the percentage of Treg cells and CD43++ monocytes (figure 1B).

**CONCLUSION**

This study showed the feasibility of VAT oxygenation by BOLD MRI in ZDF rats with obesity induced by high-fat diet. The R2*
values obtained by BOLD MRI are also associated with insulin resistance and metaflammation.

**CLINICAL RELEVANCE/APPLICATION**

BOLD-MRI can be a non-invasive tool for the evaluation of visceral adipose tissue hypoxia and obesity-related insulin resistance and systemic inflammation.

**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/

**SSQ12-04 Baseline Pancreatic Beta Cell Imaging Post Pancreatic Transplantation Using Whole Body 68Ga-DOTA-Exendin-4 PET/CT: Our Initial Experience**

Thursday, Nov. 29 11:00AM - 11:10AM Room: S504CD

Participants

Murali K. Logudoss, MBBS, MD, Chennai, India (Presenter) Nothing to Disclose
Natesan Chidambaramathan, MD, PhD, Chennai, India (Abstract Co-Author) Nothing to Disclose
Rajasekaran Sivaprasakam, DMRD, PhD, Chennai, India (Abstract Co-Author) Nothing to Disclose
Kanimozhi Damu JR, MBBS, MD, Coimbatore, India (Abstract Co-Author) Nothing to Disclose
Anand N. Parimalai, MD, Chennai, India (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
drlmkmdrd@gmail.com

**PURPOSE**

Whole-pancreatic transplant and islet cells transplantation are currently available strategies aiming towards diabetes cure. Beta cell specific non-invasive functional imaging using novel PET radiotracers are now available. 68Ga-DOTA-Exendin-4 PET/CT is used for detecting localised Insulinomas. However this tracer can also be used for beta cell imaging and quantification. We have attempted in this study to recognise the pattern of uptake by this tracer in patients with pancreatic transplants.

**METHOD AND MATERIALS**

8 patients who had undergone pancreatic transplant for Diabetes Mellitus were included in the study. After obtaining informed consent from the patients 4-5 mCi of 68Ga-DOTA-Exendin-4 was injected intravenously. One hour after injection whole body PET CT was performed and the images were analysed.

**RESULTS**

Among the 8 patients who had pancreatic transplant, 4 patients had Type I Diabetes Mellitus and 4 patients had Type II Diabetes Mellitus. The mean age of the patients were 36 yrs. All the 8 patients were male patients. One of the patient had undergone simultaneous pancreatic and renal transplant. Anterior and lateral MIP images demonstrated diffuse heterogeneous GLP-1R expression in vertically oriented transplanted pancreas in 7 out of 8 patients. Three dimensional PET CT imaging along revealed increase tracer uptake in the transplanted pancreas. There was no uptake in the native pancreas in 6 out of the 8 patients. There was atrophy and calcification of the native pancreatic tissue in these 6 patients. Mild tracer uptake was noted in 2 out of the 8 patients. In one patient there was very low tracer uptake in the transplanted pancreas. Fat stranding was noted surrounding the transplant tissue with areas of necrosis within. This patient was later confirmed to have transplant rejection.

**CONCLUSION**

In our initial study of 8 patients we conclude Exendin-4 PET/CT is very sensitive tracer for beta cell imaging. It can be used for baseline and flow up of graft imaging. Currently biopsy is the only method to prove graft rejection. However with the use of Exendin-4 PET/CT early graft rejection can be detected non invasively. We further hypothesize the future use of Exendin-4 PET/CT for quantification of beta cell mass using volumetric analysis.

**CLINICAL RELEVANCE/APPLICATION**

68Ga-DOTA-Exendin-4 PET/CT can be used as baseline and for follow up pancreatic transplant patients for analysis of beta cell mass.

**SSQ12-05 In Vivo Bioluminescence Imaging of Transplanted Mesenchymal Stromal Cells and Their Rejection Mediated by Intrahepatic NK Cells**

Thursday, Nov. 29 11:10AM - 11:20AM Room: S504CD

Participants

Jingjing Liu, Zhengzhou, China (Presenter) Nothing to Disclose

For information about this presentation, contact:
liujingjing198631@126.com

**PURPOSE**

Mesenchymal stromal cells (MSCs) hold promise in the treatment of liver disease. However, short survival time of MSCs after intrahepatic transplantation limits their value; therefore, understanding the basis of MSCs survival and rejection may increase their utility. This study was aimed at determining the role of intrahepatic natural killer (NK) cells on MSCs survival and their retention in the liver shortly after transplant.

**METHOD AND MATERIALS**
Human MSCs were labeled with the Luc2-mKate2 dual-fusion reporter gene (MSCs-R), and the residence time and survival of MSCs-R xenografts after intrahepatic transplantation were evaluated by in vivo bioluminescence imaging (BLI). Coculture of MSCs and NK cells was performed to assess cytotoxicity. To evaluate the role of NK cells in rejection of the xenografted cells, the fates of transplanted MSCs-R were then assessed in vivo by BLI after activation of intrahepatic NK cells.

RESULTS
We observed a linear correlation between luciferase activity from live MSCs-R and cell number in vitro ($R^2 = 0.9956$). In vivo, we observed a gradual decline in bioluminescent signals from transplanted MSCs-R over a region corresponding to the liver in both the control group and the NK-activated group. However, the survival time and retention of intrahepatic MSCs decreased more rapidly in the NK-activated group of mice compared to the control group. This indicated that activated NK cells accelerate the elimination of transplanted MSCs. Also, we found that the number of hepatic NK cells and the expression of NK activation markers significantly increased after intrahepatic delivery of MSCs. This suggested that resident NK cells, in a resting state, were activated by intrahepatic transplantation of human MSCs. Taken together, the data suggests that activated hepatic NK cells mediate, in part, rejection of the MSCs xenografts. Cytotoxicity assays showed that activated NK cells may inhibit the proliferation of MSCs and, to a certain extent, induce MSCs death.

CONCLUSION
Human MSCs could be followed dynamically in vivo by BLI, and the role of murine hepatic NK cells, especially activated NK cells, could be inferred from the loss of signals from MSCs.

CLINICAL RELEVANCE/APPLICATION
This finding may have practical clinical implications in MSCs transplantation in treating liver disease.

SSQ12-06 Assessment for NASH-Related Hepatocarcinogenesis Inhibition of Shikonin in a Murine Model Using DW-MRI

Thursday, Nov. 29 11:20AM - 11:30AM Room: S504CD

Participants
Hong Young Jun, PhD, Iksan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Kwon-Ha Yoon, MD, PhD, Iksan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Chang Won Jeong, Iksan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Tae-Hoon Kim, Iksan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Si-Hyeong Noh, Iksan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Ji-Eon Kim, Iksan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Seungjin Kim, Iksan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Pan Jung Kim, Iksan-si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Koeun Lee, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose

For information about this presentation, contact:
zip80@wku.ac.kr

PURPOSE
Nonalcoholic steatohepatitis (NASH) is a major risk factor for hepatic carcinogenesis. This study was assess the effect of shikonin using diffusion-weighted magnetic resonance imaging (DW-MRI) in an NASH-related hepatocarcinogenesis murine model.

METHOD AND MATERIALS
On the second day after birth, male pups were subjected to a single subcutaneous injection of 200 μg streptozotocin (STZ) and fed high-fat (45% kcal from fat) diet from the age of 4 weeks. The mice were randomly divided into groups when the tumor area was about > 0.5 mm² as follows: STZ + high-fat diet (SH; n=6) and STZ + high-fat diet + shikonin (SHS; n=7). For the experimental group, shikonin (2.0 mg/kg) was injected intraperitoneally daily for 14 days (with diluted PBS). DW-MRI was performed to assess effects of shikonin at pre-and post-treatment. Aspartate aminotransferase (AST) and alanine aminotransferase (ALT), glucose, cholesterol, and triglyceride were determined in plasma. The liver tissues were collected at 14 day post-treatment for hematoxylin and eosin staining.

RESULTS
The mean area of tumors were 2.56 ± 2.12 mm² at the SH and SHS groups, before treatment initiation. The tumor area changes of the SH and SHS groups were 326.28 ± 320.81% and 91.58 ± 78.22% after post-treatment. The tumor area change in the SHS group significantly lower compared to the SH group ($p < 0.05$). The mean ADC changes of the SH and SHS groups were 41.97 ± 50.48% and -9.24 ± 30.46% after post-treatment. The ADC change in the SHS group significantly decreased compared to the SH group ($p < 0.01$). AST and ALT levels were significantly lower in the SHS group than in the SH group after post-treatment. Plasma glucose, total cholesterol and triglyceride levels were not significantly different between SH and SHS groups. The SH group exhibited numerous tumors on the liver surface, whereas the SHS group exhibited fewer and smaller liver tumors. The histological findings at SH and SHS groups revealed that the tumors were hepatocellular carcinoma.

CONCLUSION
In this study, we found that the cancer inhibition effects of shikonin in a NASH-related hepatocarcinogenesis murine model by using DW-MRI.

CLINICAL RELEVANCE/APPLICATION
Shinkonin might be considered a novel preventive or therapeutic approach for NASH-related hepatocarcinogenesis.
SSQ12-07  Management of Complex Regional Pain Syndrome (CRPS) with Sigma-1 Receptor Radioligand and PET/MRI

Thursday, Nov. 29 11:30AM - 11:40AM Room: S504CD

Participants
Sandip Biswal, MD, Stanford, CA (Presenter) Research Grant, General Electric Company; Peter Cipriano, BA, Stanford, CA (Abstract Co-Author) Nothing to Disclose
DaeHyun Yoon, PhD, Stanford, CA (Abstract Co-Author) Research support, General Electric Company

For information about this presentation, contact:
biswal@stanford.edu

PURPOSE
Complex regional pain syndrome (CRPS) is a severe chronic pain condition affecting millions worldwide. Unfortunately, there is no specific diagnostic test to identify the pain generators in CRPS, leading to poor pain management of this disease. Given sigma-1 receptors (S1Rs) specific association for pro-nociceptive processes, we determine the clinical impact of a more pain-specific PET/MRI approach for CRPS, adopting a novel high affinity sigma-1 receptor (S1R) PET radioligand ([18F]FTC-146; Ki = 0.0025 nM).

METHOD AND MATERIALS
IRB and FDA approval were obtained. Fifteen patients suffering from CRPS were referred directly from specialists in pain medicine. Whole-body (head-to-toe) PET/MR (time-of-flight PET; 3.0T MR bore; GE Healthcare) imaging was performed following 10 mCi IV injection of [18F]FTC-146. MR sequences included 3D axial LAVA-FLEX, high-resolution 3D axial DESS and 2D axial T2-weighted FSE scans. ROI analysis was performed (OsiriX v.6.0 64-bit). Findings from the PET/MR scans were discussed with the referring pain specialists, subsequent alterations in the pain management plan were recorded and, in a subset of cases, new treatments were applied to which outcomes were measured.

RESULTS
Fourteen out of 15 patients showed unexpected findings on [18F]FTC-146 PET/MRI, which lead to a change in the patients’ pain management plans. In one specific case, a CRPS patient had severe (8-10/10) unilateral knee pain despite 2 previous unsuccessful surgeries. [18F]FTC-146 PET/MRI showed a high, focal [18F]FTC-146 PET uptake of a lesion which co-localized to an abnormal mass-like lesion in the intercondylar notch on the MRI. Subsequent arthroscopic surgery removed the [18F]FTC-146-avid lesion, which completely relieved the knee pain (0/10 pain). A separate CRPS patient with severe bilateral foreleg pain showed increased uptake of [18F]FTC-146 in the anterior compartment of both forelegs. Botulinum toxin injection in the areas of high [18F]FTC-146 uptake resulted in significant improvement in pain score (9-10/10 down to 2/10). We continue to follow the other patients to further evaluate our image findings.

CONCLUSION
A whole-body PET/MRI approach with a novel S1R PET tracer, [18F]FTC-146, can potentially identify pain generators in CRPS and improves treatment outcomes.

CLINICAL RELEVANCE/APPLICATION
The proposed whole body PET/MRI approach could alter the pain management for CRPS patients to achieve better pain-relief outcome.

SSQ12-08  Inflammation Focus Search with 18F-FDG-PET/MRI: Comparative or Additive Value of PET and MRI

Thursday, Nov. 29 11:40AM - 11:50AM Room: S504CD

Participants
Ahmet Oernek, Essen, Germany (Presenter) Nothing to Disclose
Lale Umutlu, MD, Essen, Germany (Abstract Co-Author) Consultant, Bayer AG
Yan Li, Essen, Germany (Abstract Co-Author) Nothing to Disclose
Julian Kirchner, Dusseldorf, Germany (Abstract Co-Author) Nothing to Disclose
Ken Herrmann, Essen, Germany (Abstract Co-Author) Co-founder, SurgicEye GmbH; Stockholder, SurgicEye GmbH; Consultant, Sofie Biosciences; Consultant, Ipszon SA; Consultant, Siemens AG; Research Grant, Advanced Accelerator Applications SA; Research Grant, Ipszon SA
Verena Ruhlmann, Essen, Germany (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
ahmet.oernek@uk-essen.de

PURPOSE
To evaluate the comparative or additive value of 18F-FDG PET and MRI for identifying the etiology of inflammation of unknown origin.

METHOD AND MATERIALS
A total of 24 patients (13 m, 11 w, age 42±23 [8-82] y) with suspicion of an inflammation focus due to laboratory inflammation markers (increased CRP, leukocytes) or fever and up to now non-leading conventional imaging underwent a whole-body PET/MRI. Image analyses included the detection and localization of pathologically (focal) increased tracer uptake in PET including determination of S/0max using V0I technique and evaluation of the contrast enhancement and diffusion restriction (ADC values) of abnormal lesions in MRI. Descriptive analysis included mean values, standard deviation and range. PET/CT, clinical, and radiological follow-up as well as histopathology served as standards of reference.

RESULTS
In 17/24 patients the PET/MRI contributed to the diagnosis of a (focal) pathological etiology of the inflammatory disease (vasculitis n=5, inflammatory bowel disease n=4, pneumonia n=1, infected vascular prosthesis n=2, (active) retroperitoneal fibrosis n=1, ...
peritonitis and cholecystitis n=1, synovitis n=1, mycotic infection (hepatic candidosis) n=1, bone marrow activation n=1). In PET all pathological foci showed a moderately to significantly increased FDG uptake (SUVmax 5.3 ± 3.5, range 1.4-14.2). The MRI satisfactorily allows the localization of the findings, but only in 12/17 a corresponding contrast-enhancement and in 13/17 a corresponding diffusion restriction could be found. 3/17 patients showed neither a contrast-enhancement nor a diffusion restriction, but only an increased FDG uptake.

CONCLUSION
Integrated 18F-FDG-PET/MRI shows high potential in identifying the etiology of inflammation of unknown origin. The MRI satisfactorily allows the localization of the findings, but a significant higher detection rate could be found in PET compared to MRI. Considering the significantly lower dose of ionizing radiation, PET/MRI may serve as a powerful alternative to PET/CT.

CLINICAL RELEVANCE/APPLICATION
Inflammation focus search with 18F-FDG-PET/MRI

SSQ12-09  Early Detection and Measurement of Disease Activity in Experimental, Inflammatory Bowel Disease Using Target-Specific Molecular Imaging and Fluorescence Colonoscopy

PURPOSE
Pro-inflammatory monocytes comprise the majority of the early inflammatory infiltrate in inflammatory bowel disease (IBD). In mice, these cells are characterised by high expression of Ly6C. Purpose of this study was to evaluate Ly6C-specific imaging for visualisation and measurement of IBD activity in comparison to perfusion-type contrast agents and assess the performance in fluorescence mediated tomography (FMT) and fluorescence colonoscopy (FC) for whole body and local application respectively.

METHOD AND MATERIALS
IBD was induced in 10 female Balb/c wild type mice by application of DSS with the drinking water. The weight was monitored as a marker of disease activity. FMT was performed before and 5 and 10 days after IBD induction. Mice received a Cy5.5-labelled Ly6C antibody (2nmol dye) or an equivalently labelled, unspecific IgG to reflect perfusion effects. In parallel, all mice underwent FC for detection and scoring of local disease activity. Histology served for correlation and validation of in vivo imaging.

RESULTS
On day 5 after IBD induction, weight loss did not allow for safe identification of IBD activity and was only significantly increased at day 10 (2% vs. 15%). Perfusion was elevated on day 5 as compared to baseline already but did not increase significantly towards day 10 as reflected by the IgG-driven signal (192 vs. 328 vs. 342 pmol tracer). Ly6C-specific tracer accumulation was, in contrast, significantly elevated on day 5 already; a further increase towards day 10 reflected the growing disease activity (110 vs. 700 vs. 1166 pmol; p<0.001). In vivo colonoscopy allowed for safe identification of inflammatory foci based on the specific probe accumulation but not the unspecific control. FC-based disease scoring was clearly reflected by Ly6C-specific imaging.

CONCLUSION
Target-specific imaging of Ly6C as a marker for early infiltrating, pro-inflammatory monocytes allows for sensitive and specific measurement of IBD activity in vivo by non-invasive and endoscopic approaches. It is superior over clinical examination and perfusion type contrast.

CLINICAL RELEVANCE/APPLICATION
In IBD, monitoring of disease activity and sub-clinical inflammation e.g. under therapy is a relevant challenge. Specific imaging can aid research and potentially improve multi-modal clinical imaging.
**Purpose**

Our aim was to systematically analyze longitudinal MRI findings during the development of accelerated knee osteoarthritis (AKOA) to identify patients that may benefit from an intervention.

**Method and Materials**

Knees progressing from no radiographic osteoarthritis (OA, KL 0/1) to advanced-stage OA (KL 3/4) within 4 years (AKOA definition) at any time point within the Osteoarthritis Initiative were selected. OA risk factors including knee injury or surgery were noted. MRIs were graded using the modified Whole-Organ Magnetic Resonance Imaging Score (WORMS) at baseline, 2 and 4 years. Additional findings such as root tears and meniscal extrusion were noted. Presence or absence of features associated with KL 3/4 onset within 2 years compared to 4 years were assessed using Pearson's chi-square test for OA risk factors and multivariable logistic regression models for baseline imaging parameters.

**Results**

AKOA was present in 162 knees in 149 subjects (age 63.25±8.3 years; 103 females; BMI 29.4±3.9). Knee injury was documented in 22% (36/162), meniscal resection in 27% (43/162). Moderate to severe meniscal lesions WORMS >= grade 3 were present in 25% (41/162) at baseline, 65% (105/162) at 2 years and in 94% (152/162) at 4 years. Meniscal extrusion was the most prevalent finding associated with AKOA (18% bl; 45% 2y; 94% 4y). Root tears were the most common types of meniscal tears (9% bl; 22% 2y; 38% 4y). Risk factors associated with KL 3/4 onset within 2 years (n=116) compared to 4 years (n=46), included higher baseline maximum scores of the weight-bearing cartilage (adjusted odds ratio [OR], 1.22; 95% confidence interval [CI]: 1.02, 1.46; p=0.033), presence of root tears at baseline (adjusted OR, 2.82; 95% CI: 1.33, 6.00; p=0.007) and presence of knee injury during the observation period (42%, 49/116 vs. 24%, 11/46, p = 0.032).

**Conclusion**

Meniscal abnormalities were the most prevalent morphological feature associated with AKOA and are likely responsible for rapid cartilage loss. Knee injury and meniscal resection were frequently present in our cohort and probable risk factors for AKOA. Root tears were associated with substantial increased risk for progression of radiographic joint space loss.

**Clinical Relevance/Application**

Meniscal pathology/damage was associated with accelerated radiographic progression with joint space loss and identifies a subgroup of patients that may benefit from an intervention.
There were 41 patients; 31 females and 10 males with ages of 41+/-10 and 41+/-12 (mean+/- SD), respectively. The spine T2W

RESULTS

The sign rank test and the Fisher's exact test. P value less than 0.05 was considered statistically significant.

(PABAK) was used for reader agreement. Changes in diagnostic confidence, treatment and patient response were evaluated using

Two radiologists interpreted the studies to record the findings of SpA and its activity. Prevalence-adjusted and bias-adjusted kappa

clinical and lab findings as well as the disease activity based on a confidence scale before and after imaging results of 3T MRLI.

41 consecutive patients with suspected axial SpA referred by rheumatologists were included. Two rheumatologists recorded the

METHOD AND MATERIALS

To evaluate patients with suspected axial spondyloarthritis (SpA) to determine technical success of multiparametric rheumatology

lumbosacral MR imaging (MRLI) protocol, disease distribution, inter-reader reliability, and effect on patient management.

PURPOSE

Previous studies have suggested that meniscectomy is a significant risk factor for osteoarthritis (OA), but it is not known how the

amount of meniscal resection impacts disease burden and progression. The goal of this study was therefore to develop a MRI-based

semi-quantitative scoring technique for postoperative assessment of the amount of meniscal resection, to test its reproducibility

and to investigate how the meniscal resection scores correlate with the severity and worsening of degenerative changes.

METHOD AND MATERIALS

The right knees of 135 participants from the Osteoarthritis Initiative were selected, who underwent meniscal resection. Using a

newly developed semi-quantitative meniscal resection score (MenRS) the extent of meniscal resection was assessed on baseline

3.0T MRIs. Dividing the meniscus into radial and circumferential zones amount of meniscal resection was scored from 0 (none) to 18

(complete resection). In addition knee osteoarthritic abnormalities at baseline and 48-month were graded using a modified Whole-

Organ Magnetic Resonance Imaging Score (WORMS). Statistical analysis included linear and logistic regression to correlate MenRS

with baseline and change in WORMS grades as well as intra-class correlation coefficient (ICC) to determine reproducibility.

RESULTS

Using the new MenRS system high ICC values for both intra- and inter-observer reproducibility of 0.980 and 0.977, respectively

were found. Most importantly the amount of meniscal resection was significantly correlated with baseline WORMS grades

throughout the knee: higher MenRS were associated with higher total WORMS grades (p=0.004) as well as cartilage (p=0.004), and

ligament (p<0.001) subscores. Correlations were higher when analyzing the associations between WORMS abnormalities in the index

compartment separately (p<0.001). There were no significant correlations of MenRS and change in WORMS grades over 4 years.

CONCLUSION

Using MenRS to assess the amount of meniscal resection showed excellent reproducibility and significant correlations with the

amount of cartilage and ligamentous abnormalities, with the strongest association in the index compartment.

CLINICAL RELEVANCE/APPLICATION

The new meniscal resection score allows to analyze the amount of meniscal resection with high reproducibility and is directly

correlated with the severity of degenerative knee abnormalities.

SSQ13-03 Three Tesla Multiparametric Combined Imaging Evaluation of Axial Spondyloarthritis And Pelvic Enthesopathy

Participants
Parham Pezeshk, MD, Dallas, TX (Presenter) Nothing to Disclose
Fatemeh Ezzati, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Joel Taurog, MD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Avneesh Chhabra, MD, Dallas, TX (Abstract Co-Author) Consultant, ICON plc; Author with royalties, Wolters Kluwer nv; Author with royalties, Jaypee Brothers Medical Publishers Ltd

For information about this presentation, contact:
parham.pezeshk@utsouthwestern.edu

PURPOSE

To evaluate patients with suspected axial spondyloarthritis (SpA) to determine technical success of multiparametric rheumatology

lumbosacral MR imaging (MRLI) protocol, disease distribution, inter-reader reliability, and effect on patient management.

METHOD AND MATERIALS

41 consecutive patients with suspected axial SpA referred by rheumatologists were included. Two rheumatologists recorded the

clinical and lab findings as well as the disease activity based on a confidence scale before and after imaging results of 3T MRLI.

Two radiologists interpreted the studies to record the findings of SpA and its activity. Prevalence-adjusted and bias-adjusted kappa

(PABAK) was used for reader agreement. Changes in diagnostic confidence, treatment and patient response were evaluated using

the sign rank test and the Fisher's exact test. P value less than 0.05 was considered statistically significant.

RESULTS

There were 41 patients; 31 females and 10 males with ages of 41+/-10 and 41+/-12 (mean+/- SD), respectively. The spine T2W
imaging received highest quality scores followed by whole abdomen-pelvis 3DT2W imaging, 3DCEMR, and DWI, respectively. On T2W, acute and chronic lesions of LS spine and SIJ were seen in 4/41, 18/41, 6/41, and 27/41 of the patients, respectively. Many enthesopathy lesions were seen in abdomen and pelvis. In the abnormal area of the bones, ADC measured 0.95+-0.23 (mean+-SD) versus normal bone (0.20+-0.1). In synovial linings, there was overlap of ADC. PABAK for acute and chronic findings were 0.70-1.0 and 0.41-0.51, respectively. Clinical confidence scale after imaging changed in 20 out of 41 patients, however, with the change was not statistically significant. The changes in diagnosis occurred in 17/41 and no association existed with respect to change in treatment (p=1) or patient response (p= 0.2).

CONCLUSION
The study validates the whole abdomen and pelvis multiparametric imaging approach for axial spondyloarthritis with successful assessment of multiple regional enthesopathy sites in the same setting.

CLINICAL RELEVANCE/APPLICATION
High field multiparametric MRLI is technically successful and identifies multiple active SpA sites in the same setting. Larger scale studies can be performed using this novel protocol to evaluate the effect on patient outcomes.

SSQ13-04 Monosodium Urate Burden Assessed with Dual-Energy Computed Tomography Predicts the Risk of Flares in Gout: A 12-Month Observational Study

PURPOSE
To determine if the extent of urate burden measured with dual-energy computed tomography (DECT) and ultrasonography (US) is predictive of the risk of gout flares.

METHOD AND MATERIALS
This prospective observational study recruited gout patients to undergo monosodium urate (MSU) burden assessment with DECT (volume of deposits) and US (double contour sign) scans of knees and feet. Patients attended follow-up visits at 3, 6 and 12 months. Patients having presented with at least one flare at 6 months were compared versus those who did not flare. Odds-ratios (ORs) [95% confidence interval] were calculated on relevant data stored by the automatic selection procedure applied on the binary logistic regression model.

RESULTS
Overall, 64/78 included patients attended at least one follow-up visit. In bivariate analysis, the number of joints with the double contour sign was not associated with risk of flare (p=0.67). Multivariate analysis retained a unique variable: DECT MSU volume of the feet. For each 1cm3 increase in DECT MSU volume in feet deposits, the risk of flaring increased 2.03-fold during the first 6 months after initial assessment (OR 2.03 [1.15 - 4.38]) and 1.57-fold during the first 12 months (OR 1.57 [1.01 - 2.86]). The threshold volume best discriminating flarers from non-flarers was 0.81 cm3 (specificity 61%, sensitivity 77%).

CONCLUSION
This is the first study showing the usefulness of DECT for the management of gout patients beyond diagnosis by demonstrating that the extent of MSU burden measured with DECT but not US is predictive of the risk of flares.

CLINICAL RELEVANCE/APPLICATION
This is the first study to show the predictive value of DECT for gout flares.

SSQ13-05 Association Between Gout and Longitudinal 3T MRI-Based Knee Osteoarthritis (OA) Worsening: Initial Observation and Preliminary Analysis from the FNIH OA Biomarkers Consortium

PURPOSE
To determine whether the presence of gout is associated with increased odds of knee osteoarthritis (OA) worsening in participants
METHOD AND MATERIALS

Using a 1:3 propensity score matching method, 25 subjects with positive history of physician confirmed gout (symptomatic and/or subclinical gout in any joints) and 75 controls who were matched for OA and gout confounding variables (age, sex, BMI, and race) were included in this IRB approved HIPAA compliant study. Baseline and follow-up knee radiographic measurements and MRI Osteoarthritis Knee Score (MOAKS) variables for cartilage damage, bone marrow lesions (BMLs), osteophytes, effusion-synovitis, and Hoffa-synovitis were extracted. The association between gout and 48-months radiographic OA progression (>0.7mm reduction in medial tibiofemoral joint space width) was evaluated using conditional regression model. The relationship between gout and 24-months change in MOAKS measurements was determined using conditional regression. A mediation effect analysis was utilized to explore the variable mediating the association between gout and knee OA.

RESULTS

There was no significant association between gout and 48-months radiographic OA progression (OR 95%CI: 1.21 (0.66-2.21)). However, in comparison with matched controls, subjects with gout showed higher odds of worsening tibial cartilage damage (OR 95%CI: 2.02 (1.01-4.04)) and Hoffa-synovitis (OR 95%CI: 5.20 (0.89-30.48)), but not for osteophyte or BML worsening, over 24-months. Mediation analyses suggested a non-significant trend for the mediatory role of Hoffa-synovitis for the association between gout and tibial cartilage damage worsening (Sobel's test p-value: 0.086; indirect effect 95%CI: -0.084-2.087).

CONCLUSION

Positive medical history of gout is associated with longitudinal MRI-based OA-related structural damage worsening including tibial cartilage defect and Hoffa-synovitis.

CLINICAL RELEVANCE/APPLICATION

Presence of symptomatic or subclinical gout in any joints can be considered as a potential risk factor for future tibiofemoral OA progression.

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/

Participants

Sven S. Walter, MD, Tuebingen, Germany (Presenter) Nothing to Disclose
Elke Wintemeyer, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Roberto Lorbeer, Greifswald, Germany (Abstract Co-Author) Nothing to Disclose
Wolfgang Rathmann, Duesseldorf, Germany (Abstract Co-Author) Nothing to Disclose
Sergios Gatidis, MD, Tubingen, Germany (Abstract Co-Author) Nothing to Disclose
Fabian Bamberg, MD, Tuebingen, Germany (Abstract Co-Author) Speakers Bureau, Bayer AG ; Speakers Bureau, Siemens AG ; Research Grant, Siemens AG 
Konstantin Nikolau, MD, Tuebingen, Germany (Abstract Co-Author) Advisory Panel, Siemens AG ; Speakers Bureau, Siemens AG ; Speaker Bureau, Bayer AG 
Mike Notohamiprodjo, Munich, Germany (Abstract Co-Author) Nothing to Disclose

SSQ13-06 Does Metabolic Syndrome Increase the Risk of Osteoarthritis - Analysis of Subjects with Metabolic Syndrome and Healthy Controls from the KORA Cohort

Thursday, Nov. 29 11:20AM - 11:30AM Room: E451A

METHOD AND MATERIALS

Included were 356 patients of the KORA cohort (Cooperative Health Research in the Augsburg Region) with metabolic syndrome and a healthy control group. All subjects underwent a detailed assessment for the waist circumference as well as the presence of diabetes mellitus (fasting glucose), hypertension (systolic and diastolic), elevated triglycerides as well as an MR scan. MR measurements were performed on a 3 Tesla scanner (Magnetom Skyra, Siemens Healthcare, Erlangen, Germany) using a dual-echo Dixon and a T2 Haste sequence for anatomical structures. In order to quantify osteoarthritis of the hip, assessment was performed by two experienced radiologists for joint gap narrowing, osteophytes and subchondral sclerosis according to the Kellgren-Lawrence classification. Statistical analysis was performed using odds ratios from univariate and multivariate logistic regressions.

RESULTS

Age was found the only parameter in univariate and multivariate analysis to be significantly influencing on osteoarthritis of the hip joint. There was no correlation in univariate and multivariate analysis shown for any parameter of the metabolic syndrome as the waist circumference (OR left hip: 1.00, p= 0.933 ; OR right hip: 1.00, p= 0.833), triglyceride (OR left hip: 1.00, p= 0.952; OR right hip: 1.00, p= 0.209), HDL (OR left hip: 1.01, p= 0.084; OR right hip: 1.01, p= 0.111), systolic (OR left hip: 1.01, p= 0.469; OR right hip: 1.01, p= 0.404) or diastolic (OR left hip: 1.01, p= 0.407; OR right hip: 1.00, p= 0.736) blood pressure and fasting glucose (OR left hip: 1.00, p= 0.573; OR right hip: 1.02, p= 0.102) in comparison to osteoarthritis of the hip joint. Neither did the complex of metabolic syndrome in total show any significant correlation (OR left hip: 1.69, p= 0.104; OR right hip: 1.35, p= 0.313) to osteoarthritis of the hip joint.

CONCLUSION

Despite the strong influence of the metabolic syndrome on a wide range of inter alia cardiovascular diseases, we were able to show that metabolic syndrome does not affect osteoarthritis of the hip joint.

CLINICAL RELEVANCE/APPLICATION

Presence of symptomatic or subclinical gout in any joints can be considered as a potential risk factor for future tibiofemoral OA progression.
Since a pathological mechanism has not yet been confirmed, growing research tries to associate osteoarthritis with the metabolic syndrome. This study wants to assess which subgroup of the metabolic syndrome is associated with osteoarthritis.

**SSQ13-07**  
**Association Between Patellofemoral Cartilage Damage and Frequency of Kneeling Activity in Subjects with/without Patella Alta: An FNIH OA Biomarkers Consortium Study**

**Thursday, Nov. 29 11:30AM - 11:40AM Room: E451A**

**Participants**

Anya Haj-Mirzaian, MD, MPH, Baltimore, MD (Presenter) Nothing to Disclose  
Bahram Mohajer, Tehran, Iran (Abstract Co-Author) Nothing to Disclose  
Ali Guermazi, MD, PhD, Boston, MA (Abstract Co-Author) Shareholder, Boston Imaging Core Lab, LLC; Research Consultant, Merck KGaA; Research Consultant, sanofi-aventis Group; Research Consultant, TissueGene, Inc; Research Consultant, OrthoTrophiX, Inc; Research Consultant, AstraZeneca PLC; Research Consultant, General Electric Company; Research Consultant, Pfizer Inc  
Frank W. Roemer, MD, Erlangen, Germany (Abstract Co-Author) Officer, Boston Imaging Core Lab, LLC; Research Director, Boston Imaging Core Lab, LLC; Shareholder, Boston Imaging Core Lab, LLC  
Shadpour Demehri, MD, Baltimore, MD (Abstract Co-Author) Research support, General Electric Company; Research Grant, Carestream Health, Inc; Consultant, Toshiba Corporation  

**For information about this presentation, contact:**  
sdemehr1@jhmi.edu

**PURPOSE**

It has been suggested that kneeling in occupational/sport activities is associated with knee OA. Studies suggested the association between kneeling and tibiofemoral joint cartilage damage, but reports of patellofemoral joint (PFJ) involvement are controversial. We aimed to investigate whether kneeling activity is associated with the worsening of MRI measures of PFJ cartilage damage in subjects with/without patella alta (PA) using the Foundation for the National Institute of Health (FNIH) study participants.

**METHOD AND MATERIALS**

The study was IRB-approved and HIPAA-compliant. Baseline and 24-month follow-up semi-quantitative MRI Osteoarthritis Knee Score (MOAKS) measures of PFJ of 600 subjects from the FNIH study were extracted. At the baseline visit, subjects were asked how many days per week they participated in activities with kneeling activity >=30 minutes. Insall-Salvati ratio (ISR) (patellar tendon/patellar height) was measured by a musculoskeletal radiologist using the baseline MRIs; knees with ISR>=1.3 were considered as PA. Logistic regression adjusted for age, sex and BMI, Chi-square test and Breslow-Day Homogeneity test were used to assess the impact of kneeling on worsening of MOAKS cartilage scores over 24-months in subjects with/without PA.

**RESULTS**

Worsening in MOAKS cartilage scores was seen in subjects with >=6 days/week of kneeling activity compared to subjects with less kneeling activity (adjusted OR(95%CI): 2.95(1.08-8.07)). However, despite the trend, 2-5 days/week kneeling was not associated with worsening of PFJ cartilage damages compared to less kneeling activity (<2 days/week). Stratifying analysis showed that only PA+ subjects, not PA-, had significant association between the kneeling and worsening of PFJ cartilage damage, especially in surface cartilage score (OR: 45.01(1.40-1444.2)) and medial side (OR:44.0(4.55-425.7)). Homogeneity test demonstrated significant difference between PA+ and PA- groups (P-value: 0.005).

**CONCLUSION**

Kneeling activity in >=6 days/week is associated with the worsening of PFJ MRI cartilage scores compared to less kneeling activity, especially in subjects with underlying PA.

**CLINICAL RELEVANCE/APPLICATION**

Frequent daily kneeling activity is associated with the higher risk of PFJ cartilage damage resulting in PF OA, especially in subjects with associated patella alta.

**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/

**SSQ13-08**  
**3D T1 Mapping of Hip Cartilage: Comparison of a New Inversion-Recovery Based Method with Conventional Dual-Flip Angle Acquisition**

**Thursday, Nov. 29 11:40AM - 11:50AM Room: E451A**

**Participants**

Florian Schmaranzer, Bern, Switzerland (Presenter) Nothing to Disclose  
Till Lerch, Bern, Switzerland (Abstract Co-Author) Nothing to Disclose  
Jennifer L. Cullmann, Bern, Switzerland (Abstract Co-Author) Nothing to Disclose  
Moritz Tannast, MD, Bern, Switzerland (Abstract Co-Author) Nothing to Disclose  
Johannes T. Heverhagen, MD, PhD, Bern, Switzerland (Abstract Co-Author) Research Grant, Bracco Group; Research Grant, Guerbet SA; Research Grant, Siemens AG; Speaker, Bayer AG  
Tobias Kober, Lausanne, Switzerland (Abstract Co-Author) Employee, Siemens AG  
Markus Barthofer, Zurich, Switzerland (Abstract Co-Author) Nothing to Disclose  
Michael Ith, Bern, Switzerland (Abstract Co-Author) Nothing to Disclose  
Bernd Jung, Freiburg, Germany (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Although commonly used for quantitative imaging of hip cartilage, 3D dual flip angle techniques are highly sensitive to flip angle...
Although commonly used for quantitative imaging of hip cartilage, 3D dual flip angle techniques are highly sensitive to flip angle variation (B1 inhomogeneities) which is even more pronounced at 3 T. To compare precontrast T1 values of (1) hip cartilage and (2) periarticular musculature using a new inversion-recovery based method with conventional dual-flip angle acquisition in asymptomatic volunteers.

METHOD AND MATERIALS

IRB-approved study of 18 asymptomatic hips (9 volunteers; mean age 27 ± 2 years, 60% female). All subjects underwent non-contrast, quantitative T1 imaging of hip cartilage at 3T with two different methods: (1) 3D dual-flip angle GRE-based technique (0.9 mm³ isotropic T1 VIBE; acquisition time 8:30 min) including a prescan for B1 correction. (2) 3D dual inversion-recovery approach that has been recently introduced in brain imaging (0.9 mm³ isotropic T1 MP2RAGE; acquisition time 7:30 min) in which T1 values are calculated based on two different inversion pulses. Radial images were reformatted for both T1 techniques. Regions of interest were placed manually, based on anatomic landmarks within the (1) cartilage at each hour position of the clock face. (2) At the 3/9 o'clock position 2 quotients (%) of the peri-articular musculature were calculated as a measure for antero-posterior (T1 psoas/gluteus maximus muscle) and medio-lateral (T1 iliacus/gluteus medius muscle) flip-angle variations over the field of view.

RESULTS

(1) Mean T1 values and standard deviations of overall (1488±174 ms vs 1036±41 ms), anterior (1533±219 ms vs 1026±45 ms) and posterior (1444±157 ms vs 1047±34 ms) hip cartilage were higher for the dual-flip angle compared to the inversion-recovery based method (all p<0.001). (2) T1 psoas/gluteus maximus muscle quotient (105±11% vs 97±4%, p<0.001) and T1 iliacus/gluteus medius muscle quotient (131±16% vs 98±2%, p<0.001) were higher for the dual-flip angle compared to the inversion-recovery based method.

CONCLUSION

Despite the used B1 prescan inter-individual differences (= standard deviation) in T1 values of cartilage were greater with the dual-flip angle method compared to the inversion-recovery method due to the greater flip-angle variations at 3 T.

CLINICAL RELEVANCE/APPLICATION

A more robust method for acquisition of 3D maps of hip cartilage could help in defining thresholds to differentiate intact from biochemical cartilage degeneration at 3 T.

SSQ13-09 Evaluating Variability in Knee CartiGram MRI - A Quantitative Study

Thursday, Nov. 29 11:50AM - 12:00PM Room: E451A

Participants
Rafeek Thaha, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Sandeep P. Jogi, Gurgaon, India (Abstract Co-Author) Nothing to Disclose
Vidur Mahajan, MBBS, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Sriram Rajan, MD, New Delhi, India (Presenter) Nothing to Disclose
Amit Mehndiratta, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Anup Singh, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Vasanthakumar Venugopal, MD, New Delhi, India (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
vidur@mahajanimaging.com

PURPOSE

MRI cartilage assessment using CartiGram is a widely used T2 mapping sequence to non-invasively detect changes in cartilage. We tested the robustness of the technique by quantitatively measuring intra- and inter-scanner variability of T2 values.

METHOD AND MATERIALS

Our study had two parts. First, a phantom containing NaCl, GdCl3 and Agarose was created to mimic human meniscus, muscles, cartilage and synovium. A T2 CartiGram (test) and T1w IR-TSE (gold standard) were performed on a 3.0T (750W, GE Healthcare) and 1.5T (HDxt, GE Healthcare) MRI scanners. A phantom integrity test was performed at the end. Obtained data was evaluated by creating T2 maps and calculation of T2 mean±SD. Second, in two healthy volunteers, a T2 CartiGram was performed twice, at an interval of 10 minutes with subject lying still in the scanner, each on both the scanners on the same day. T2 maps were created and mean±SD and Relative Percentage Difference (RPD) calculated. Additional 2-D wear maps were created to check for anatomical variability.

RESULTS

Phantom: 3.0T MRI showed T2 values of 26.5±1.4 in meniscus, 61±3.5 in muscles and 56±2.9, 71.4±3.8 and 78±5.5 in three cartilage samples. The 1.5T MRI showed T2 values of 284±1.2 in meniscus, 62.3±3.4 in muscles and 52.9±2.9, 77.5±5.4 and 89±7.3 in the three cartilage samples. Healthy Volunteers: The RPDs on the same scanner for subject 1 were 3.5% (on 3.0T) and 3.8% (on 1.5T) on the medial femoral cartilage and -1.7% (on 3.0T) and -1% (on 1.5T) on the lateral, and for subject 2, they were -0.4% (on 3.0T) and 4.8% (on 1.5T) on the medial and 1.2% (on 3.0T) and 5.5% (on 1.5T) on the lateral. The 1.5T scanner reported a lower overall T2 value than the 3.0T, in contrast to the phantom results. Visual inspection of the 2D wear maps by a musculoskeletal radiologist revealed variability of T2 signal with no observable pattern.

CONCLUSION

There exists variability in T2 values of CartiGram when performed in healthy volunteers across both, different time points and different field-strengths. Further studies are needed to re-evaluate the threshold of 40 ms for cartilage pathology and define MRI machine-specific guidelines.

CLINICAL RELEVANCE/APPLICATION

Significant differences in T2 values on CartiGram can lead to difficulty in diagnoses of borderline cases in clinical practice.
Fracture Risk Assessment of Diabetes Mellitus Patients: Comparison of Trabecular Bone Analysis by Tomosynthesis with Various Established Estimations

PURPOSE

Although bone mineral density (BMD) by dual X-ray absorptiometry (DXA) has been used to predict bone strength clinically, diabetes mellitus (DM) patients have an elevated fracture risk despite normal BMD. While there are some complementary methods for estimating fracture risk, such as the trabecular bone score (TBS) and the fracture risk assessment tool (FRAX), these are still not sufficient in the case of DM. The purpose of this study is to compare trabecular bone analysis by tomosynthesis with various established estimations (BMD, TBS, and FRAX) for femoral neck fracture risk assessment of DM patients.

METHOD AND MATERIALS

Sixty DM patients were included in this study. They underwent DXA, tomosynthesis, and CT covering the vertebral body of Th10 to the hip joints within a week. We extracted the trabecular patterns of tomosynthesis images, and obtained the total strut length (TSL), the bone volume per tissue volume (BV/TV) and the textural features (HOM: homogeneity, ENT: entropy, COR: correlation, CON: contrast, VAR: variance) as the indices of tomosynthesis images. Four square ROIs (64 x 64 pixels) were located at principal tensile (PT) group and at principal compressive (PC) group to reflect the bone strength of the proximal femur. Failure load of the femoral neck, determined by the CT-based finite-element method (FEM), was used as the gold standard for bone strength. A forward stepwise multiple regression analysis for evaluating the availability of the tomosynthesis image indices was performed. A logistic model was used with BMD, TBS, FRAX, and the tomosynthesis texture indices.

RESULTS

The combination of the BMD with the CON at principal tensile group and the VAR at principal compressive group showed the highest correlation to the failure load by CT-FEM, and the correlation (r=0.772) was higher than that between the failure load and the BMD alone (r=0.709; p<0.001). The correlation between the failure load and the BMD with the tomosynthesis texture indices was higher than that between the failure load and the FRAX with hip BMD (r=0.732).

CONCLUSION

Tomosynthesis-based trabecular bone analysis in combination with BMD measurements can potentially be used in predicting bone strength in DM patients in clinical practice.

CLINICAL RELEVANCE/APPLICATION

Low-cost trabecular bone analysis using tomosynthesis images assessment of proximal femur may provide bone strength information that is not provided by dual X-ray absorptiometry.
However, until now pattern allocation was only possible with magnetic resonance imaging (MRI), based on subjective image impression. We aim to evaluate whether different infiltration patterns also result in different dual-energy computed tomography (DECT) attenuation of the bone marrow.

**METHOD AND MATERIALS**

The institutional review board approved this study. Written informed consent was obtained from all participants. 53 patients with plasma cell disorders (24 with normal imaging pattern, 24 with focal infiltration, 5 with diffuse infiltration) and 21 control subjects sequentially underwent DECT and MRI of the axial skeleton. MRI served as reference standard for imaging pattern assessment. Bone marrow dual-energy virtual noncalcium (VNCa) attenuation numbers were obtained based on imaging pattern allocation. Generalized estimating equations and a receiver operating characteristic (ROC) analysis were performed.

**RESULTS**

Mean VNCa attenuation numbers in patients with normal, focal and diffuse imaging patterns were -65.8 HU, 3.3 HU, and -13.3 HU, respectively. We found significant differences between diffuse vs. normal (P < 0.001), diffuse vs. focal (P = 0.002), and normal vs. focal (P < 0.001) patterns. A cut-off VNCa attenuation of 35.7 HU showed a sensitivity of 100% (24/24) and specificity of 97% (116/120) for the identification of a diffuse pattern vs. normal pattern, with an area under the ROC curve of 0.997.

**CONCLUSION**

We conclude that different infiltration patterns in patients with MM result in significantly different VNCa bone marrow attenuation. Thus, DECT can potentially be used to detect not only focal osteolytic and non-osteolytic lesions, but also confidently determine a diffuse infiltration pattern, which is associated with a worse prognostic outcome and until now could only be diagnosed with MRI.

**CLINICAL RELEVANCE/APPLICATION**

Our data indicate that DECT is able to discriminate infiltration patterns in patients with MM similar to MRI, which could be of prognostic and potential therapeutic relevance.

**MK398-SD-THA3**  
**A Method to Improve the Image Quality of Spine CT on Reducing Metal Artifacts Caused by Pedicle Screws in Patients**

**Participants**
Weiwei Qi, MD, Beijing, China (Presenter) Nothing to Disclose
Xia Liu, Beijing, China (Abstract Co-Author) Nothing to Disclose
Yan Jiang, MD, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Lei Chen, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose
Nan Hong, MD, Beijing, China (Abstract Co-Author) Nothing to Disclose

**For information about this presentation, contact:**
qiweiw@pkuph.edu.cn

**PURPOSE**
To improve the image quality of spine CT on reducing metal artifacts caused by pedicle screws in patients with orthopedic metal artifact reduction (O-MAR) combined with body position change.

**METHOD AND MATERIALS**

Thirty-five patients after Pedicle screw fixation surgery were enrolled and underwent spine CT scan (iCT, Philips Healthtech). The patients were separated into two groups randomly (control group, 20 patients with total 98 pedicle screws; exam group, 15 patients with total 78 pedicle screws). For control group, the angle between the long axial of screw and transversal line of each screw was also measured and assessed quality. For exam group, the tilt angle of foam plastic cushion for running up upper body was used to get better image quality. All images were reconstructed with O-MAR and HIR algorithms (iDose4). The image quality of each pedicle screw was assessed with 5-point at volume view mode by two radiologists. Image quality assessment divided into 3 groups (Group A, image with O-MAR of control group; Group B, image without O-MAR of control group; Group C, image with O-MAR of exam group). The ROI was set by side the screw to measure the noise and beam-hardening artifact objectively.

**RESULTS**

For control group, the average tilt angle of screw was 9.51±8.10 degree and the image quality of average score in group B was 3.79±2.43. Both the objective and subjective image quality were also better with the angle increasing. The average angle with 3 score and above was 6.72 degree as the tilt angle of plastic cushion. For exam group, the angle of screws at exam group was 18.54±7.80 degree which was larger than that at control group (P<0.01); the image quality score of Group C (4.36±1.93) also was better than that of Group A (1.98±1.05) and Group B (P<0.01), the image quality score of groups (Group B,C) with O-MAR all better than that of group (Group A).

**CONCLUSION**

O-MAR combined with body position changed (7degree tilted) is an effective means to improve the image quality of spine CT in reducing metal artifacts caused by pedicle screws in patients.

**CLINICAL RELEVANCE/APPLICATION**

O-MAR combined with body position changed (7degree tilted) can improve the image quality of spine CT in reducing metal artifacts caused by pedicle screws paralleling scan plane in patients.

**MK399-SD-THA4**  
**Detection of Spondylolysis: Is Replacement of CT by Ultrashort Time to Echo (UTE) MR Sequences Feasible? A Human Cadaveric Spine Study**

**Participants**
Tim Finkenstaedt, MD, San Diego, CA (Presenter) Nothing to Disclose
Palanan Sriwananangsun, MD, Bankok, Thailand (Abstract Co-Author) Nothing to Disclose
Vs. 2.3 ms, p=0.01). The presence of baseline MFTC meniscal damage or extrusion was associated with prolongation in deep layer T2 times over the first year (0.8 vs. 0.0 ms, p=0.02), and the entire 4-year period (0.9 vs. 0.5 ms, p=0.003). 50 women and 32 men were included (mean age 54.1±7.2y, BMI 24.2±3.0 kg/m²). The presence of MFTC osteophytes was associated with a prolongation of T2 times.

RESULTS

Compartment-specific analysis of factors associated with superficial or deep layer T2 change over 1 or 4 years was performed using UNIANOVA. To evaluate whether the presence of baseline MRI-defined structural damage is associated with subsequent change in laminar cartilage T2 values in the femorotibial joint of participants from the OAI healthy reference cohort over 1 and 4 years of observation.

PURPOSE

To assess the diagnostic performance of conventional vs. UTE MRI for detection of spondylolysis in comparison to the CT reference standard.

METHOD AND MATERIALS

Four human lumbar spine specimens (mean age: 54±18 yrs; 3 females, 1 male) with 41 individual pars interarticularis were randomized to be left intact (n=22) or to undergo simulated fracture (n=19) using a 1-mm oscillating microsurgical saw. To prevent air and fluid accumulation, the fractures were filled with 8% agarose gel featuring similar MR signal characteristics as scar tissue. The specimens were imaged using: 1) conventional lumbar MR protocol at 3-T (5 sequences: sagittal spin echo T1, T2 and STIR; axial T1 and T2; total scan time=13 min), and 2) a sagittal UTE MR sequence at 3-T (TR=44.3 ms, TE=0.05 ms, matrix=256x256, slice=2 mm, FOV=24 cm, scan time=3 min), and 3) a 256-MDCT scanner (120 kVp, 100 mA, slice=0.625 mm). Two blinded readers evaluated MR data using a 4-point scale (1=absent, 2=probably absent, 3=probably present, 4=certainly present). CT served as the reference standard. Inter-reader agreement (intraclass correlation, ICC) and the diagnostic performance (sensitivity and specificity, and reader confidence) of each MR technique was determined.

RESULTS

Conventional MR images (Figure 1AB) lacked contrast between cortical bone and the pars defect. In contrast, UTE images (Figure 1C) clearly depicted the bony defect, appearing near exact inverse of the CT image (Figure 1D). Diagnostic performance (Table 1) was moderate for conventional MR, with a low sensitivity and high specificity, unlike UTE MR, which has both high sensitivity and specificity. More importantly, diagnostic confidence was much greater for UTE MR (100% read correctly with certainty), compared to conventional MR (<30%). Inter-reader agreement was also lower for conventional (ICC=0.855) than UTE (ICC=1.000) MRI.

CONCLUSION

Our study showed that MR detection of simulated pars fractures is markedly better with a single sagittal UTE sequence than with a suite of conventional protocol. UTE MR exhibited a diagnostic performance and confidence similar to CT.

CLINICAL RELEVANCE/APPLICATION

If further clinical studies confirm our results, a sagittal UTE sequence could replace the CT scan in the diagnostic workup of patients with clinically suspected lumbar spondylolysis.

MK400-SD-THAS

MRI-Detected Structural Damage and Longitudinal Change in Femorotibial Cartilage T2 Values in Radiographically Normal Joints

Participants

Frank W. Roemer, MD, Erlangen, Germany (Presenter) Officer, Boston Imaging Core Lab, LLC; Research Director, Boston Imaging Core Lab, LLC; Shareholder, Boston Imaging Core Lab, LLC
Felix Eckstein, MD, Salzburg, Austria (Abstract Co-Author) Co-owner, Chondrometrics GmbH; Co-founder, Chondrometrics GmbH; CEO, Chondrometrics GmbH; Consultant, Novartis AG; Consultant, Merck KGaA; Consultant, sanofi-aventis Group
Georg Duda, Berlin, Germany (Abstract Co-Author) Nothing to Disclose
Ali Guermazi, MD, PhD, Boston, MA (Abstract Co-Author) Shareholder, Boston Imaging Core Lab, LLC; Research Consultant, Merck KGaA; Research Consultant, sanofi-aventis Group; Research Consultant, TissueGene, Inc; Research Consultant, OrthoTrophix, Inc; Research Consultant, AstraZeneca PLC; Research Consultant, General Electric Company; Research Consultant, Pfizer Inc
Susanne Masche, Aining, Germany (Abstract Co-Author) Shareholder, Chondrometrics GmbH
Wolfgang Wirth, Salzburg, Austria (Abstract Co-Author) Shareholder, Chondrometrics GmbH

For information about this presentation, contact:

froemer@bu.edu

PURPOSE

To evaluate whether the presence of baseline MRI-defined structural damage is associated with subsequent change in laminar cartilage T2 in the femorotibial joint of participants from the OAI healthy reference cohort over 1 and 4 years of observation.

METHOD AND MATERIALS

Included were the right knees of 82 participants without radiographic OA, without pain, and no risk factors of OA (Kellgren-Lawrence 0/0). Baseline effusion-synovitis, Hoffa-synovitis, bone marrow lesions (BMLs), cartilage lesions, meniscus morphology and - extrusion were assessed using the MOAKS scoring system. Cartilage T2 relaxometry was performed using multi-echo spin-echo MRIs. Deep and superficial layer cartilage T2 times were computed from manual segmentations in both the medial and lateral femorotibial compartment (MFTC/LFTC). Compartment-specific analysis of factors associated with superficial or deep layer T2 change over 1 or 4 years was performed using UNIANOVA.

RESULTS

50 women and 32 men were included (mean age 54.1±7.2y, BMI 24.2±3.0 kg/m²). The presence of MFTC osteophytes was associated with prolongation in deep layer T2 times over the first year (0.8 vs. 0.0 ms, p=0.02), and the entire 4-year period (0.9 vs. 2.3 ms, p=0.01). The presence of baseline MFTC meniscal damage or extrusion was associated with prolongation in deep layer...
T2 times at Y4 (0.7 vs. 2.1 ms, p=0.02). The number of baseline MRI pathologies did not have an effect on T2 times in the MFTC or LFTC at 1 or 4 years. Ipsi-compartmental worsening of MRI features from baseline to Y1 was neither associated with change in T2 values from Y1 to Y4 in the MFTC (superficial 0.9 ms vs. 0.2 ms, p=0.69; deep 0.2 ms vs. -0.2 ms, p=0.69) nor the LFTC (superficial 0.8 ms vs. 1.4 ms, p=0.69; deep 0.3 ms vs. 0.8 ms, p=0.69). (Table 1 shows Y1 results).

CONCLUSION
MNI structural abnormalities at baseline did generally not predict change in ipsi-compartmental longitudinal cartilage T2 over 1 or 4 years. The only associations that appeared to be seen were for presence of medial osteophytes and medial meniscal damage with subsequent T2 change in at least one (superficial or deep) layers; however, these relationships did not account for multiple statistical testing.

CLINICAL RELEVANCE/APPLICATION
In healthy knees without clinical risk factors, structural MRI pathology may not be a reliable predictor of compositional progression as defined by change in cartilage T2.

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/ Ali Guermazi, MD, PhD – 2012 Honored Educator

PURPOSE
The purpose of this study is to evaluate the risk of postoperative infection following total hip arthroplasty (THA) in patients with preoperative intraarticular steroid hip injections.

METHOD AND MATERIALS
A hospital system database was queried, identifying patients undergoing primary THA at a single academic hospital. Patients were stratified related to hip steroid injection in the preceding 12 months: Control group-THA with no injection (n=499), THA with fluoroscopy-guided injection by a musculoskeletal (MSK) radiologist (n=216), or THA with hip steroid injection by a non-radiologist (n=18). The rates of superficial and deep infections within 1 year of surgery were obtained and compared using odds ratios. Data collection included procedural techniques, injection timing relative to THA, injectate, surgery and hardware type, length of stay, and patient age, sex, and co-morbidities.

RESULTS
The incidence deep infection after THA among the MSK radiologist injection group (0.46%), among injections performed by radiologists within 3 months of surgery (1.33%), and among the fluoroscopy-guided injection group (1.32%) were each not significantly different from that of the non-injection group (1.60%) with odds ratios and P values of 0.29 and 0.239; 0.83 and 0.861; 0.82 and 0.774, respectively. The incidence of deep infection after THA among the non-radiologist injection group (16.67%) was significantly different from that of the non-injection group (1.60%) with an odds ratio and P value of 12.28 and <0.001, respectively. Comparison analysis of superficial and deep infections combined yielded comparable results.

CONCLUSION
Intraarticular hip injections performed by MSK radiologists under fluoroscopic guidance within one year prior to THA have comparable rates of postoperative infection when compared to controls. Further, current data suggest that injections performed by non-radiologists as well as those performed without fluoroscopic guidance may have increased rates of postoperative infection.

CLINICAL RELEVANCE/APPLICATION
Controversy exists regarding the increased risk of THA postoperative infection after a hip injection. This study shows the operator and technique used may be important factors in modifying this risk.
Musculoskeletal Thursday Poster Discussions

Thursday, Nov. 29 12:45PM - 1:15PM Room: MK Community, Learning Center

MK

AMA PRA Category 1 Credit ™: .50

Participants
Travis J. Hillen, MD, Saint Louis, MO (Moderator) Consultant, Biomedical Systems; Consultant, Medtronic plc

Sub-Events

MK402-SD-THB1 Correlation of the New MRI Grading System for Cervical Foraminal Stenosis Based on Axial T2-Weighted Images with Severity of Neurological Manifestations

Station #1

Participants
Bianca V. Granados Pinedo, MD, Mexico City, Mexico (Presenter) Nothing to Disclose
Maria F. Ortiz Haro y Nasar, MEd, Mexico, Mexico (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
bianca_granados@hotmail.com

PURPOSE
To evaluate the clinical correlation of the new magnetic resonance grading system for cervical foraminal stenosis using a proposed scale for evaluating severity of the neurological signs and symptoms. Currently there is no scale or method that had been capable of correlating severity of foraminal stenosis with severity of symptoms.

METHOD AND MATERIALS
We examined 102 patients who underwent MR imaging of the cervical spine in the institute. We assessed the severity of foraminal stenosis using the new grading system by Kim et al, the results were correlated with a new proposed scale that included clinical manifestations and neurologic physical examination findings and we assigned 1 point for each positive sign or symptom with a total of 6 points, and classifying patients in severe (4 or more points) or not severe symptoms (3 or less points). Proposed clinical scale:

The MRIs were independently analyzed by two radiologists. Interobserver and intraobserver agreements were analyzed using the percentage agreement and kappa statistics.

RESULTS
We made analysis of correlation coefficients (Spearman) that showed high correlation (0.8426) between grades of foraminal stenosis using the Kim system and severity of neurological manifestations using the proposed new clinical scale. The percentage of agreement among the two radiologist was of 96.47%, and the kappa values (κ = 0.940) indicating near perfect agreement.

CONCLUSION
The Kim system in conjunction with the proposed clinical scale demonstrated high correlation with severity of clinical findings. This is the first time that the severity of neurological manifestations are quantified and we hope to make further studies that validate the proposed clinical scale and its correlation with the MRI findings.

CLINICAL RELEVANCE/APPLICATION
We found that patients that were diagnosed with grade 1 and 2 of foraminal stenosis did not require surgical intervention and that only patients that had grade 3 foraminal stenosis underwent surgery, this finding demonstrated that an adequate evaluation have a great impact in the prognosis of the patients with radiculopathy resultant from foraminal cervical stenosis.

MK403-SD-THB2 Three-Dimensional Magnetic Resonance Imaging Improved Diagnostic Accuracy for Posterior Ligamentous Complex Disruption Based on an In Vitro Study

Station #2

Participants
Xuee Zhu, MD, Nanjing, China (Presenter) Nothing to Disclose
Jichen Wang, MD, PhD, Nanjing, China (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
snowy2009@126.com

PURPOSE
Posterior ligamentous complex (PLC) which composed of supraspinous ligament (SSL), interspinous ligament(ISL), ligamentum flavum(LF), and the facet joint capsules is believed to contribute significantly to the stability of thoracolumbar spine. Previous studies revealed a relatively high false-positive rate for identifying PLC disruption on routine sagittal fat-suppressed T2-weighed MRI (STIR) especially that of ISL if the ligament is surrounded by extensive hemorrhage or edema. This prospective study was...
conducted to test our hypothesis that three-dimensional MRI can detect ISL tear from the adjacent soft tissue edema and thus improve diagnostic accuracy for ISL disruption.

**METHOD AND MATERIALS**

Forty freshly harvested goat spine segments with surrounding soft tissue intact were used in this study. A total of 10ml saline was injected percutaneously at each side of ISL to create a paraspinal edema model. All the segments then underwent sagittal STIR and coronal three-dimensional proton density weighted imaging with fat suppression (3D-PDW-SPIR). After that, ISL was cut under fluoroscopic control using a metal crochet hook and the segments were scanned again in the same way as the prior. Two radiologists independently evaluated the images in a blinded fashion to determine tear of ISL on sagittal and coronal images separately. The imaging interpretations were compared with the intraoperative findings. A comparison of diagnostic accuracy between sagittal STIR and coronal 3D-PDW-SPIR was performed.

**RESULTS**

The interobserver reliability for ISL disruption on sagittal STIR and coronal 3D-PDW-SPIR is 0.705 and 1.000, respectively. The diagnostic sensitivity, specificity and accuracy of sagittal STIR and coronal 3D-PDW-SPIR in detecting ISL disruption was 45.0%, 92.5%, 68.8% and 100%, 97.5%, 98.8%, respectively. The accuracy of coronal 3D-PDW-SPIR for depicting ISL tear was significantly greater than sagittal STIR (p < 0.05).

**CONCLUSION**

This study clarified a much higher diagnostic accuracy of 3D-PDW-SPIR for ISL disruption than sagittal STIR did. In clinical setting, additional 3D-PDW-SPIR to a routine MR protocol is critical for identifying PLC disruption if there is extensive edema around the structure.

**CLINICAL RELEVANCE/APPLICATION**

Posterior Ligamentous Complex Injuries are related to fracture severity and neurological damage in patients with acute thoracic and lumbar burst fractures. Its status affects the patient’s management.

**PURPOSE**

We aimed to determine injury patterns of the medial patellofemoral ligament (MPFL) on MRI of the patients with acute anterior cruciate ligament (ACL) tear, and to find MR findings associated with MPFL injury and to determine whether MPFL injury results in the patellofemoral osteoarthritis (OA) after ACL reconstruction.

**METHOD AND MATERIALS**

We retrospectively reviewed preoperative knee MR images of 122 consecutive patients with ACL injury who had taken MRI in an average of 7 days after trauma and had underwent arthroscopic ACL reconstruction. 42 patients were excluded due to suboptimal image sequences, prior knee fracture or chronicity of ACL tear. This left 80 knees for this study (male: female = 64:16, mean age, 29.6 years). All MR images were independently assessed by two musculoskeletal radiologists for MPFL injury patterns, PCL, MCL, LCL, menisci, vastus medius obliquus (VMO), and bone contusion distribution. 60 knees with minimum 1-year follow-up X-ray (1~9 years) was assessed for progression of patellofemoral OA.

**RESULTS**

MPFL injuries were found in 66.3% (53/80 knees; periligamentous edema 32.5%, partial tear 26.3%, and complete tear 7.5%). MPFL injuries were significantly associated with MCL injury (p <0.0001), VMO strain (p < 0.0001), and bone contusion of lateral femoral condyle (p < 0.01 and 0.022, respectively). Progression of the patellofemoral OA on X-rays at mean follow-up of 3.4 years (1.0~9.6 years) was observed in 41/60 (68.3%) and was significantly associated with grade 3 MCL injury and MM tear (p = 0.027 and 0.066, respectively), but not with MPFL injury.

**CONCLUSION**

MPFL was frequently injured in patients with acute ACL injury. Mild patellofemoral OA was observed commonly after ACL reconstruction, which may be associated with grade 3 MCL injury and MM tear, but not with MPFL injury.

**CLINICAL RELEVANCE/APPLICATION**

MPFL injuries can frequently occur in the setting of acute ACL injury, but there has been little information regarding the clinical significance of MPFL injury after ACL reconstruction. We found a relatively high prevalence of the patellofemoral OA change after ACL reconstruction. This change might not be associated with MPFL injury, so MPFL injury do not need to be addressed at the time of surgery.
Hyperintensity of Vertebral Lesions in Relation to the Spinal Cord on T1-Weighted MR images: A Sign to Differentiate Multiple Myeloma from Metastasis

PURPOSE
To assess the value of the lesion-to-cord signal intensity (SI) ratio in differentiation of multiple myeloma and metastasis on T1-weighted magnetic resonance (MR) images of the spine.

METHOD AND MATERIALS
MR images of 45 patients with well-defined lesions of the spine were retrospectively evaluated including 29 patients with metastases and 16 with multiple myeloma. Signal intensity of the lesion and the spinal cord were measured on sagittal T1-weighted images. The ratio of the signal intensity of the lesion to the spinal cord was compared in the two groups. Statistical analysis has been performed by the Student’s T test.

RESULTS
On T1-weighted images, the lesion-to-cord SI ratio has been 1.31±0.38 for multiple myeloma and 0.87±0.58 for metastases. The difference between multiple myeloma and metastases has been statistically significant (p=0.01). The highest accuracy of the hyperintensity sign for the diagnosis of multiple myeloma has been 84.4% at a cut-off value of lesion-to-cord SI ratio >1 (i.e. lesion is hyperintense to the spinal cord) on T1-weighted images.

CONCLUSION
Unlike metastasis, multiple myeloma tends to be hyperintense in comparison to the spinal cord on T1-weighted images. The accuracy of the hyperintensity sign for diagnosis of multiple myeloma is 84.4%.

Ultrasound-Guided Percutaneous Needle Tenotomy Using Tenex Technique for Lateral Epicondylitis: Effectiveness and Contributing Factors

PURPOSE
Lateral epicondylitis (LE) is a common area of tendon degeneration. Most will respond to conservative treatments; however, some individuals require open surgical tenotomy. Ultrasound-guided percutaneous needle tenotomy (USPNT) has been used as an alternative treatment to surgery with shorter recovery time and lower cost. This investigation evaluates the effectiveness of USPNT using Tenex technique for refractory LE. We will also evaluate possible cofactors, which may contribute in treatment response.

METHOD AND MATERIALS
PRTEE (Patient-Rated Tennis Elbow Evaluation) and DASH (Disabilities of the Arm, Shoulder, Hand) questionnaires were completed before USPNT for all consecutive patients (n=72) over 38 months (Feb 2015-Mar 2018) using Tenex (Tenex Health Inc, CA, USA). Patients were contacted for follow-up evaluations. Paired t-test was used to evaluate changes in treatment response (p<0.05). Univariate linear regression model analysis was used to evaluate bivariate correlation of treatment response and possible confounding factors. Variables with any correlation with treatment response (p<0.1) were evaluated with stepwise multivariate regression analysis.

RESULTS
35 patients were not included due to lack of follow-up information (n=29), surgery before follow-up (n=4) or recent (<2-month) USPNT (n=2). 37 patients (age: 51+/-9 year, M/F: 15/22) with refractory LE were included (mean follow-up: 531 days, range: 65-1148 days). Tenex USPNT significantly decreased PRTEE (pain and function) and DASH scores (p<0.001). All score changes had significant correlation with post-procedure physical therapy (PT) (R2, B, and p values of 0.18, 13.05, <0.01 for PRTEE pain score, 0.21, 13.08, <0.01 for PRTEE function score, and 0.20, 28.94, <0.01 for DASH score, respectively). Age, gender, cutting time, severity of tendinopathy, and time of follow-up did not show correlation with treatment response (p >0.05).

CONCLUSION
USPNT significantly improves pain and function in individuals with LE even with long term follow up. While PT with Tenex has significant impact in improvement, cutting time and severity of tendinopathy has no significant correlation with treatment response.

CLINICAL RELEVANCE/APPLICATION
USPNT is an effective alternative to open surgical intervention for LE. Post-procedure PT contributes to this improvement response.
RC704

Imaging of the Hand and Wrist: How to Add Value

Thursday, Nov. 29 4:30PM - 6:00PM Room: S406B

MK

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

Participants
Soterios Gyftopoulos, MD, Scarsdale, NY (Director) Nothing to Disclose
For information about this presentation, contact:
Soterios.Gyftopoulos@nyumc.org
llenchk@wakehealth.edu

LEARNING OBJECTIVES
1) Review the most common bone, ligamentous, and tendon conditions found in the hand and wrist. 2) Review the imaging options for common hand and wrist pathologies. 3) Describe how to accurately diagnose common hand and wrist bone, ligamentous, and tendon conditions using imaging.

Sub-Events
RC704A Bones

Participants
Laura W. Bancroft, MD, Orlando, FL (Presenter) Author with royalties, Wolters Kluwer nv; Speaker, World Class CME; Editor, Thieme Medical Publishers, Inc; Travel support, Thieme Medical Publishers, Inc
For information about this presentation, contact:
laura.bancroft.md@flhosp.org

LEARNING OBJECTIVES
1) Review which imaging modalities can add value to the diagnostic evaluation of hand and wrist injuries. 2) Review specific osseous injury patterns in the hand and wrist.

RC704B Tendons

Participants
Scott D. Wuertzer, MD, MS, Winston-Salem, NC (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Be able to recognize the normal and abnormal MRI appearance of tendons in the hand and wrist. 2) Be familiar with the relevant anatomy associated with these tendons. 3) Be able to diagnose common pathologic conditions of tendons in the hand and wrist.

RC704C Ligaments

Participants
Christine B. Chung, MD, La Jolla, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify current challenges and gaps in clinical practice for evaluation of intrinsic and extrinsic wrist ligaments. 2) Apply diagnostic algorithms that improve diagnosis and characterization of wrist ligaments.

RC704D TFCC

Participants
Soterios Gyftopoulos, MD, Scarsdale, NY (Presenter) Nothing to Disclose
For information about this presentation, contact:
Soterios.Gyftopoulos@nyumc.org

LEARNING OBJECTIVES
1) Review the normal anatomy of the TFCC. 2) Review the most common types of acute and chronic TFCC pathology and their locations.
**RC731**

*Image-guided Biopsy of the Spine (Hands-on)*

Thursday, Nov. 29 4:30PM - 6:00PM  Room: E263

| MK | NR | IR |

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

**Participants**

John L. Go, MD, Los Angeles, CA (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Discuss and demonstrate spine biopsy techniques including CT and fluoroscopic approaches, anatomic landmarks, needle selection, special technical considerations for dealing with soft tissue masses, and fluid accumulations, lytic and blastic lesions, and hypervascular conditions. 2) Hands on exposure will be provided in order to familiarize participants with the vast number of biopsy devices that are clinically available. 3) Training models will also be used in order to teach technical skills with respect to approach and technique. 4) Advantages and disadvantages of various biopsy devices and techniques, and improve their understanding of how to maximize the reliability and safety of these spine biopsy procedures.

**Sub-Events**

**RC731A Pre- and Post Biopsy Assessment**

Participants

Richard Silbergleit, MD, Royal Oak, MI (*Presenter*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Be familiar with all required aspects of the pre-biopsy work-up, including medications, laboratory values, and review of relevant prior imaging. 2) Be familiar with solutions to address complications or other unexpected events which may arise during the course of spine biopsy. 3) Be comfortable in performing the post procedure assessment of the patient after spinal biopsy.

**RC731B Equipment Used for Image-guided Biopsies of the Spine**

Participants

Michele H. Johnson, MD, New Haven, CT (*Presenter*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Demonstrate the types of needles used for spine biopsy. 2) Selecting the proper types of needles used for spine biopsy. 3) Case demonstration of the proper use of single or coaxial needle sets for spine biopsy and the advantages or disadvantages of each.

**RC731C Thoracic and Lumbar Biopsies**

Participants

John L. Go, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review the anatomy of the thoracic and lumbar spine relevant to spine biopsy. 2) Describe the approaches used to approach various anatomical regions within the thoracic and lumbar spine. 3) Provide case examples of various approaches used to biopsy the thoracic and lumbar spine.

**RC731D Cervical Spine Biopsies**

Participants

A. Orlando Ortiz, MD, MBA, Mineola, NY (*Presenter*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Demonstrate the various approaches used to biopsy lesions of the cervical spine. 2) Determine the selection of the proper needles to use to biopsy the spine. 3) Provide case examples of cervical biopsies and the thought process used to perform these procedures.

**ABSTRACT**

Cervical spine biopsies can be challenging procedures to perform, hence they tend to be performed by a limited number of proceduralists. C-spine biopsy is often performed to evaluate potential neoplastic or infectious processes of the cervical spine. The key to performing these procedures effectively and safely is in appropriate patient selection, careful image analysis in order to properly position the patient and choose an approach, identification of critical structures (such as the carotid artery) and neck spaces that should be avoided, and use of coaxial biopsy techniques. The procedure can be safely performed with CT and/or CT fluoroscopy. Specimen sampling principles and specimen handling are also discussed they can help to optimize this procedure.

**RC731E Disc Biopsy and Aspiration**

Participants

John L. Go, MD, Los Angeles, CA Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review the anatomy of the thoracic and lumbar spine relevant to spine biopsy. 2) Describe the approaches used to approach various anatomical regions within the thoracic and lumbar spine. 3) Provide case examples of various approaches used to biopsy the thoracic and lumbar spine.
Participants
Amish H. Doshi, MD, New York, NY (Presenter) Nothing to Disclose

For information about this presentation, contact:
amish.doshi@mountsinai.org

LEARNING OBJECTIVES

1) To review the indications for spinal biopsies in the setting of discitis and osteomyelitis of the spine. 2) The various techniques and imaging modalities for these biopsies will be reviewed. 3) Sample collection and analysis as well as typical diagnostic yield will also be reviewed.

ABSTRACT

The lecture will focus on the indications for imaging guided biopsy in the setting of discitis/osteomyelitis and describe a variety of CT and Fluoroscopic guided techniques in obtaining aspirate and tissue sample. Additionally, the lecture will review of the various types of needles used in the procedures and in what setting specific needles should be used. A brief review of current literature on yield of imaging guided biopsy will also be discussed.
Ligamentous Injuries of the Knee: Mechanistic Approach with Emphasis on MR Imaging

Friday, Nov. 30 8:30AM - 10:00AM Room: E451A

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

Participants
Brady K. Huang, MD, San Diego, CA (Director) Nothing to Disclose
Tetyana A. Gorbachova, MD, Huntingdon Vy, PA (Presenter) Nothing to Disclose
Robert D. Boutin, MD, Davis, CA (Presenter) Nothing to Disclose
Brady K. Huang, MD, San Diego, CA (Presenter) Nothing to Disclose

For information about this presentation, contact:
llenchik@wakehealth.edu

LEARNING OBJECTIVES
1) To delineate the MR imaging features typical of a variety of ligamentous injuries of the knee. 2) To illustrate how MR imaging findings, including those related to abnormalities in the subchondral bone of the femur, tibia, and/or patella, provide critical clues to the specific mechanism involved in these ligamentous injuries. 3) To define the characteristic MR imaging features associated with translational, angular, and rotational mechanisms that lead to injury of the anterior and posterior cruciate ligaments and the medial and lateral supporting structures of the knee.

ABSTRACT
This course will emphasize a mechanistic approach to ligamentous injuries of the knee, emphasizing MR imaging. Individual speakers will use this approach in their discussions of such injuries with attention focused on the anterior cruciate and posterior cruciate ligaments and the medial and lateral supporting structures. The importance of the distribution and pattern of bone injury, especially that in the subchondral region of the femur, tibia, and/or patella, will be illustrated with analysis of hyperextension, hyperflexion, and translational, angular, and rotational injuries, among others.

Active Handout: Brady Kirk Huang

**LEARNING OBJECTIVES**

1) Review of Pediatric Nuclear medicine, particularly for radiologists and nuclear medicine physicians who may not specialize in pediatric patients, and for resident and fellow trainees.

**Sub-Events**

**RC811A Pediatric Gastrointestinal**

Participants
Helen R. Nadel, MD, Palo Alto, CA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:
hnadel@stanford.edu

**LEARNING OBJECTIVES**

1) Be able to list indications for GI scintigraphy in children. 2) Be able to describe scintigraphic patterns of disease on GI examinations in children.

**RC811B Pediatric Genitourinary**

Participants
Neha S. Kwatra, MBBS, MD, Boston, MA (*Presenter*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe pediatric renal diseases highlighting the complementary role of scintigraphy and other imaging modalities. 2) Explain pediatric-specific imaging considerations. 3) Identify important normal variants/pitfalls in interpretation.

**RC811C Pediatric Musculoskeletal**

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

For information about this presentation, contact:
susan.sharp@cchmc.org

**LEARNING OBJECTIVES**

1) Be able to describe the utilization and performance of nuclear medicine imaging for musculoskeletal indications in pediatric patients. 2) Be able to identify musculoskeletal findings on Tc-99m-MDP and F-18-FDG scans.

**RC811D Case Presentation/Panel Discussion**

Participants
Neha S. Kwatra, MBBS, MD, Boston, MA (*Presenter*) Nothing to Disclose
### Top Tips in MSK Radiology: MSK Techniques

**Participants**
Laura W. Bancroft, MD, Orlando, FL *(Moderator)*  
Author with royalties, Wolters Kluwer nv; Speaker, World Class CME; Editor, Thieme Medical Publishers, Inc; Travel support, Thieme Medical Publishers, Inc;

**For information about this presentation, contact:**
laura.bancroft.md@flhosp.org

**LEARNING OBJECTIVES**
1) Review the salient imaging features of some of the most commonly encountered musculoskeletal diagnoses.

### Top Tips to Reduce Artifacts in MSK MRI

**Participants**
David A. Rubin, MD, Saint Louis, MO *(Presenter)* Nothing to Disclose

**For information about this presentation, contact:**
rubinda@wustl.edu

**LEARNING OBJECTIVES**
1) Recognize the source of common artifacts on MSK MIR images. 2) Anticipate artifacts before they occur. 3) Devise simple interventions to reduce or eliminate artifacts without sacrificing time or SNR. 4) Communicate with their technologists regarding MRI techniques.

### Top Tips for Functional MRI

**Participants**
Won-Hee Jee, MD, Seoul, Korea, Republic Of *(Presenter)* Research Grant, Bayer AG;

**For information about this presentation, contact:**
whjee12@gmail.com

**LEARNING OBJECTIVES**
1) Describe the role of functional MRI in MSK imaging. 2) Apply functional MRI to MSK imaging in clinical practice. 3) List the top benefits of functional MRI in MSK imaging.

### Top Tips for MR/CT Arthrography

**Participants**
Reto Sutter, MD, Zurich, Switzerland *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**
1) Know and assess indications of MR and CT arthrography for different joints. 2) Identify the classic approaches for joint injections. 3) Compare the benefits of MR and CT arthrograms versus non-contrast MR and CT imaging. 4) Recognize diagnostic pitfalls of MR and CT arthrography.
SPIS61E  Discussion  
Friday, Nov. 30 10:15AM - 10:30AM Room: E450A

SPIS61F  Top Tips in MSK Radiology: MSK Pitfalls  
Friday, Nov. 30 10:30AM - 11:30AM Room: E450A
Participants  
Jung-Ah Choi, MD, Seoul, Korea, Republic Of (Moderator) Research Grant, Bracco Group;  
Andrew J. Grainger, MRCP, FRCR, Leeds, United Kingdom (Moderator) Consultant, Livicept Ltd; Director, The LivingCare Group;

For information about this presentation, contact:  
andrewgrainger@nhs.net

LEARNING OBJECTIVES  
1) Review the imaging characteristics of commonly encountered musculoskeletal entities with similar or overlapping features.

SPIS61G  Top Pitfalls in Fracture Diagnosis  
Friday, Nov. 30 10:30AM - 10:45AM Room: E450A
Participants  
Mini N. Pathria, MD, San Diego, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES  
1) Develop a systematic approach to evaluating radiographs in the injured patient, focusing on soft tissue indicators of injury, articular alignment, and assessment of the bone cortex. 2) Detect patient characteristics (such as advanced age etc) and imaging limitations (poor positioning etc) that lead to interpretation errors. 3) Identify radiographic imaging findings that indicate underlying musculoskeletal injury and the need for further imaging.

Active Handout:  

SPIS61H  Top Pitfalls in Groin Pain  
Friday, Nov. 30 10:45AM - 11:00AM Room: E450A
Participants  
Philip Robinson, MBChB, Leeds, United Kingdom (Presenter) Director, The LivingCare Group

For information about this presentation, contact:  
philip.robinson10@nhs.net

LEARNING OBJECTIVES  
1) Explain the biomechanics and functional anatomy of the anterior pelvis (groin) in relation to athletes. 2) Compare the theories and nomenclature for the pathogenesis of chronic groin pain in athletes. 3) Contrast the imaging findings in symptomatic and asymptomatic athletes focussing on MR imaging. 4) Critique the interpretation of these findings and what research shows they relate to in terms of diagnosis, prognosis and decision making for treatment.

ABSTRACT  
Groin pain in the athlete is a complex process with different surgical and radiological researchers focusing on different structures in the hope of identifying the primary cause for chronic groin pain. There is a resulting confusion over terminology with, for example, osteitis pubis, adductor pain and sportsman’s hernia encompassing many different potential conditions for different clinicians. In reality there is a lot of crossover with many or all of the anatomical region thought to be involved by chronic shearing forces acting through the symphysis pubis and surrounding soft tissues contributing to the development of groin pain. Research is also now increasingly showing that previous imaging findings thought to be pathognomonic for groin pain are found in asymptomatic kicking athletes. This talk will review such potential pitfalls and offer a reporting strategy.

SPIS61I  Top Pitfalls of Osteoporosis  
Friday, Nov. 30 11:00AM - 11:15AM Room: E450A
Participants  
James F. Griffith, MD, Shatin, Hong Kong (Presenter) Nothing to Disclose

SPIS61J  Discussion  
Friday, Nov. 30 11:15AM - 11:30AM Room: E450A

SPIS61K  Top Tips in MSK Radiology: MSK Research Trends  
Friday, Nov. 30 11:30AM - 12:30PM Room: E450A
Participants  
James F. Griffith, MD, Shatin, Hong Kong (Moderator) Nothing to Disclose  
Lawrence M. White, MD, FRCPC, Toronto, ON (Moderator) Nothing to Disclose

For information about this presentation, contact:
LEARNING OBJECTIVES

1) Review some of the common musculoskeletal research trends with current clinical applications in patient care.

SPIS61L  **Top Trends in Tumor Imaging**

Friday, Nov. 30 11:30AM - 11:45AM Room: E450A

Participants

Takatoshi Aoki, MD, PhD, Kitakyusyu, Japan (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the advanced techniques in musculoskeletal oncology. 2) Describe the radiomics for bone and soft tissue tumor imaging. 3) List the newly updated entities of bone and soft tissue tumors.

SPIS61M  **Top Trends in Marrow Imaging**

Friday, Nov. 30 11:45AM - 12:00PM Room: E450A

Participants

Frederic E. Lecouvet, MD, Brussels, Belgium (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify achievements, indications and future developments of whole skeleton MRI in oncology. Know new treatment paradigms and expectations from imaging in oncology. 2) Understand the growing importance of multiparametric approaches and radiomics in oncologic marrow imaging. 3) Differentiate various spontaneous epiphyseal lesions sharing bone marrow edema at MRI as common feature. 4) Understand the prognostic role of MRI. 5) Identify the upcoming technical developments and new indications of MRI and dual energy CT in bone marrow pathology.

SPIS61N  **Top Trends in Extremity Imaging**

Friday, Nov. 30 12:00PM - 12:15PM Room: E450A

Participants

Christine B. Chung, MD, La Jolla, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify current challenges and gaps in clinical practice for evaluation of musculoskeletal tumors, bone marrow and extremity pathology. 2) Apply novel imaging and post-processing techniques that improve diagnosis and characterization of musculoskeletal tumors, bone marrow and extremity pathology.

SPIS61O  **Discussion**

Friday, Nov. 30 12:15PM - 12:30PM Room: E450A
SST05

Musculoskeletal (Spine)

Friday, Nov. 30 10:30AM - 12:00PM Room: E351

Participants
Corrie M. Yablon, MD, Ann Arbor, MI (Moderator) Nothing to Disclose
Marcelo Bordalo-Rodrigues, MD, PhD, Sao Paulo, Brazil (Moderator) Nothing to Disclose

Sub-Events
SST05-01 Location of First Radiographic Spinal Fracture as Determinant of Future Vertebral Fracture Risk

Friday, Nov. 30 10:30AM - 10:40AM Room: E351

Participants
Fjorda Koromani, MD, MSc, Rotterdam, Netherlands (Presenter) Nothing to Disclose
Ling Oei, MD, MA, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Stephan J. Breda, MD, Rotterdam, Netherlands (Abstract Co-Author) Institutional research collaboration, General Electric Company
Enisa Shevroja, MD, MSc, Lausanne, Switzerland (Abstract Co-Author) Nothing to Disclose
Mohammad A. Ikram, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Fernando Rivadeneira, MD, PhD, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Edwin H. Oei, MD, PhD, Palo Alto, CA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
f.koromani@erasmusmc.nl

PURPOSE
We aimed to examine if the location of a first radiographic vertebral fracture (VF) determines the risk of future incident radiographic VFs.

METHOD AND MATERIALS
Prevalent radiographic VFs were scored in 3882 subjects aged 55 years or older at baseline and after a mean follow-up of four years, using two methods: SpineAnalyzer® Quantitative Morphology (QMSA) and Algorithm Based Qualitative (ABQ). We defined the location by a) three regions: T4-T8; T9-T12 and L1-L4, b) exact vertebral level from T4 to L4. The association between the location of first prevalent VF and occurrence of future incident VFs was examined using logistic regression models adjusted for age, sex, BMI, and FN- BMD.

RESULTS
At least one incident VF was observed in 3.9% (QMSA) and 2.0% (ABQ) of the participants. As compared to participants without VFs, individuals with multiple fractures at baseline had three (OR= 2.7; 95%CI 1.7-4.2 for QM) to 12 (OR= 12.4; 95%CI 4.8-31.9 for ABQ) times increased likelihood of suffering incident VFs. A first QMSA VF at T4-T8 was associated with increased risk of incident VF (OR= 7.7; 95%CI 4.3; 13.8) at T9-T12 (OR=2.5; 95% CI 1.0; 6.1) and L1-L4 (OR= 3.5; 95% CI 1.2; 10.5). A first ABQ VF at T4-T8 was associated with increased risk of incident VF (OR= 17.2; 95%CI 4.8; 61.4), at T9-T12 (OR=4.2; 95% CI 1.3; 12.7) but not at L1-L4 (OR= 1.9; 95% CI 0.5; 6.5). Of all vertebral levels, subjects with VFs arising at T8 had (with both methods) the highest risk for incident VFs (OR= 16.0; 95%CI 2.5; 102.2) for ABQ and (OR=11.5; 95%CI 4.5; 29.1) for QMSA, as compared to participants without VFs. Fractures at T6 scored with QMSA (OR=16.8; 95%CI 5.3; 52.6), T7 (OR=5.5; 95%CI 1.9; 15.2), L1 (OR=7.3; 95%CI 2.3; 22.6) and at T12 scored with ABQ (OR=5.6; 95%CI 1.5-20.8) were also associated with incident VFs. No other vertebral body locations were significantly associated with future VFs risk.

CONCLUSION
A first radiographic VF located at the upper thoracic region (T4-T8) and specifically at T8, is strongly and robustly associated with increased risk for future VFs independent of age, sex and BMD according to two different scoring methods.

CLINICAL RELEVANCE/APPLICATION
Since VFs in the upper thoracic spine (T4-T8), and specifically at T8, are strongly associated with increased risk for future VFs, such fractures require special attention for radiologists and warrant referral for monitoring and appropriate treatment.

SST05-02 UTE MR Morphology of Disco Vertebral Junction: Correlation with Disc Grade and T2 Values

Friday, Nov. 30 10:40AM - 10:50AM Room: E351

Awards

Friday, Nov. 30 10:50AM - 11:00AM Room: E351

Student Travel Stipend Award

Participants
Tim Finkenstaedt, MD, San Diego, CA (Presenter) Nothing to Disclose
Karen C. Chen, MD, Providence, RI (Abstract Co-Author) Nothing to Disclose
Palanon Sinwanarangsun, MD, Bankok, Thailand (Abstract Co-Author) Nothing to Disclose
Michael Carl, Menlo Park, CA (Abstract Co-Author) Researcher, General Electric Company
Nirusha Abeydeera, BS, La Jolla, CA (Abstract Co-Author) Nothing to Disclose
Sheronda Statum, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Graeme M. Bydder, MBChB, San Diego, CA (Abstract Co-Author) Nothing to Disclose
Christine B. Chung, MD, La Jolla, CA (Abstract Co-Author) Nothing to Disclose
Won C. Bae, PhD, La Jolla, CA (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
wbae@ucsd.edu

PURPOSE

We have previously reported unique capability of ultrashort echo time (UTE) MRI to image the morphology of the discovertebral junction (DVJ) in human lumbar spines. In this cadaveric study, we sought to determine if DVJ morphology correlates with disc Pfirrmann grades and T2 values.

METHOD AND MATERIALS

Lumbar spines from 37 cadavers (30 males, 60±10.1 yrs, mean±SD) were imaged at 3T using UTE (TR=300 ms, TEs=0.01 and 5.5 ms, FOV=16 cm, matrix=512x512) and spin echo T2 map (TR=2000 ms, 8 TEs=10 to 70 ms) sequences. UTE images were used to define morphology of the DVJ as being normal (distinct linear high signal intensity, Figure 1A, arrows) or abnormal with focal signal loss (Figure 1A, arrowhead) and/or irregularity (Figure 1A, curved arrow). Spin echo data was used to perform Pfirrmann grading of the disc (Figure 1B), and T2 mapping (Figure 1C). T2 values of nucleus pulposus was determined using an atlas-based automated region of interest. Using statistics, we compared proportion of disc grades (Figure 1D) and nucleus T2 values (Figure 1E) when the disc was adjacent to normal DVJs, 1 abnormal DVJ, or 2 opposing abnormal DVJs.

RESULTS

Out of 278 DVJs, 198 were normal, 45 had focal signal loss, and 35 were irregular. There was greater proportion of higher disc grades (Figure 1D; chi-square p=0.00004), as well as lower T2 values (Figure 1E; ANOVA p=0.18), in discs adjacent to 2 opposing abnormal DVJs, compared to discs adjacent to normal DVJs.

CONCLUSION

These results suggest that the prevalence of abnormal DVJs in human lumbar spines are quite high (~25%), and given the association between DVJ and disc degeneration, altered DVJs could be important for the etiology of disc degeneration.

CLINICAL RELEVANCE/APPLICATION

By direct assessment of the DVJ with UTE MRI early detection of beginning disc pathology in a preclinical stage is feasible. DVJ may play a biomechanical/metabolic role in support of healthy discs.

Student Travel Stipend Award

Participants
Hoseok Lee, Daegu, Korea, Republic Of (Presenter) Nothing to Disclose
Young Hwan Lee, Daegu, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Seo Young Park, MD, Daegu, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jae Hyuck Yi, MD, Daegu, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jae-Kwang Lim, Daegu, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sang Yub Lee, Daegu, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jongmin J. Lee, MD, PhD, Daegu, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
firehs@naver.com

PURPOSE

To determine the availability of zero echo time (ZET) sequence for the evaluation of osseous foraminal stenosis (OFS) and presence of peridiscal osteophyte (PO), discal calcification (DC), and ossification of posterior longitudinal ligament (OPLL) by comparison with CT as reference standard.

METHOD AND MATERIALS

Twenty one patients (mean age, 67.7 years; 10 male, 11 female) who underwent cervical MRI including 3D ZET sequence and concomitant CT within 1 months (mean interval, 3.8 days; range, 0-27 days) were retrospectively enrolled from November 2017 to March 2018. Two independent musculoskeletal radiologists evaluated ZET images and CT in separate sessions for the followings at each level: 1) grading of OFS by a visual 4-point scale from 0-3 (0=none or minimal, 1=mild, 2=moderate, 3=severe) on oblique sagittal images from C2-3 to C7/T1 (total 252 foramina); 2) presence of PO and DC of central zone of central canal from C2-3 to C7/T1 (total 126 disc level); 3) presence of OPLL from C2 to C7 (total 126 vertebral body level). Intermodality agreement between ZET and CT, and intra- and interobserver agreements for ZET were measured with the kappa (κ) statistics.

RESULTS

Intermodality agreements for detecting PO, DC, and OPLL between ZET and CT were almost perfect by 2 readers (κ=0.943-1 by reader 1; κ=0.867-1 by reader 2, respectively). Substantial to almost perfect agreements (κ=0.826 by reader 1, κ=0.787 by reader
2) were found for grading of OFS between ZET and CT. Overall intra- and interobserver agreements were substantial to almost perfect for ZET (κ=0.788-1).

CONCLUSION
The results of our study shows strong intermodality agreement between ZET sequence of MRI and CT in the cervical spine for evaluation of osseous structures and calcification.

CLINICAL RELEVANCE/APPLICATION
ZET sequence of MRI can demonstrate 'CT-like' contrast for the evaluation of cervical spine.

SST05-04 Effect of Physical Activity on Thoracic and Lumbar Disc Degeneration - a MRI Based Analysis of 385 Healthy Controls from the KORA Cohort

Friday, Nov. 30 11:00AM - 11:10AM Room: E351

Participants
Sven S. Walter, MD, Tuebingen, Germany (Presenter) Nothing to Disclose
Elke Wintermeyer, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Sergios Gatidis, MD, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
Roberto Lorbeer, Greifswald, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE
Depending on the type and extent of physical activity, there isn’t always a health preventing and health promoting impact found. Less information is available on the impact of physical activity on vertebra disc degeneration. Therefore, the purpose was to evaluate the impact of physical activity on intervertebral disc degeneration of the thoracic and lumbar spine.

METHOD AND MATERIALS
A total of 385 patients of the KORA study (Cooperative Health Research in the Augsburg Region) were included in this study. All subjects underwent full body dual-echo Dixon and T2 Haste sequence MR scan performed on a 3T scanner (Magnetom Skyra, Siemens Healthcare). Furthermore, they were tested on the basis of a standardized assessment tool inter alia on anthropometric data such as age, weight and heights as well as physical activity/work, daily bike rides and daily walks. In order to quantify thoracic and lumbar disc degeneration, assessment was performed by two experienced radiologists according to the Pfirrmann Score (Grade >2 = pathological). Statistical analysis was performed by univariate and multivariate analysis.

RESULTS
Age (BWS-Pfirrmann score:0.15; p<0.001, LWS Pfirrmann score:0.06; p<0.001 and Overall-Pfirrmann score:0.21, p<0.001), BMI (BWS-Pfirrmann score:0.11; p<0.05, LWS Pfirrmann score:0.05; p<0.01 and Overall-Pfirrmann score:0.16, p<0.01) as well as no physical activity (BWS-Pfirrmann score:1.96; p<0.01, LWS Pfirrmann score:0.99; p<0.001 and Overall-Pfirrmann score:2.95, p<0.001) lead to significant thoracic and lumbar disc degeneration when testing for univariate correlation. When testing on interdependency, we showed that age (BWS-Pfirrmann score:0.15; p<0.001, LWS Pfirrmann score:0.06; p<0.001 and Overall-Pfirrmann score:0.21, p<0.001) and no physical activity (BWS-Pfirrmann score:1.85; p<0.01, LWS Pfirrmann score:0.97; p<0.001 and Overall-Pfirrmann score: 2.82, p<0.001) still correlate with disc degeneration in multivariate analysis. On the other hand, we found that much physical activity also leads to a thoracic and lumbar disc degeneration.

CONCLUSION
No or less physical activity as well as age and BMI correlate with thoracic and lumbar disc degeneration.

SST05-05 The Assessment of Disco-Ligamentous Complex Injury on Magnetic Resonance Imaging (MRI) and CT Scan After Acute Cervical Spine Trauma

Friday, Nov. 30 11:10AM - 11:20AM Room: E351

Participants
You Seon Song, Busan, Korea, Republic Of (Presenter) Nothing to Disclose
Insook Lee, Busan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jong Woon Song, Busan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To investigate useful imaging findings to assess disco-ligamentous injury after acute cervical spine trauma.

METHOD AND MATERIALS
Between January 2015 and December 2017, 96 patients (11 women, 85 men, age range 20-83 years, mean age 58 years) performed cervical spine MRIs and CT scans after acute trauma. We evaluated pre-vertebral hematoma, edema of cervical back muscles, high signal intensity (SI) within the spinal cord (contusion), instability, discontinuity of anterior longitudinal ligament (ALL), abnormal high SI of disc, ossification of ALL or anterior spur formation, and fracture of posterior elements. The presence or absence of disco-
RESULTS

Disco-ligamentous complex injuries were identified in 58 patients (60%) at surgery. The instability of the bony structure associated with fracture was seen only 27 patients (28%). Prevertebral hematoma (mild; 26, moderate; 27, severe; 34) were presented in 87 (91%), edema of cervical back muscles in 75 (78%), spinal cord contusion in 86 (90%), high SI of disc in 67 (70%), and OALL or spur formation in 44 (46%). The agreement between the imaging assessment of ALL discontinuity and the disco-ligamentous injury identified in surgery was very low (kappa value; 0.25). There was a high correlation between disco-ligamentous complex injuries identified in surgery and cord contusion, abnormal high SI of disc and fractures of posterior elements on the images.

CONCLUSION

The imaging findings of cord contusion, abnormal high SI of disc and fractures of posterior elements might be useful for assessment of disco-ligamentous complex injury while the imaging assessment of ALL discontinuity is less accurate.

CLINICAL RELEVANCE/APPLICATION

If instabilities or fractures are not well seen on the images, it is difficult to directly recognize ALL rupture including disc. Therefore these secondary imaging findings might be useful to recognize disco-ligamentous complex injury before surgery and scoring subaxial cervical spine injury.

SST05-06 Prediction of Abnormal Bone Density and Osteoporosis from Lumbar Spine MR Using Modified Dixon Quant in 257 Subjects with QCT as Reference

Friday, Nov. 30 11:20AM - 11:30AM Room: E351

Participants
Yinxia Zhao, MD, New York, NY (Presenter) Nothing to Disclose
Mingqian Huang, MD, Syosset, NY (Abstract Co-Author) Nothing to Disclose
Jie Ding, MS, Stony Brook, NY (Abstract Co-Author) Nothing to Disclose
Xintao Zhang, Guangzhou, China (Abstract Co-Author) Nothing to Disclose
Xiaodong Zhang, Guangzhou, China (Abstract Co-Author) Nothing to Disclose
Quan Zhou, Guangzhou, China (Abstract Co-Author) Nothing to Disclose
Chuan Huang, PhD, Stony Brook, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE

To investigate the predictive value of using vertebral bone marrow fat fraction (BMFF) obtained from lumbar spine MRI to assess abnormal bone density and osteoporosis

METHOD AND MATERIALS

257 participants (181 females, and 76 males; age: 48.9±14.7 years old; BMI: 22.9±3.04 kg/m2) were recruited for the study with written consent and approved by local institutional review board (IRB). Exclusion criteria: history of known spinal tumor, trauma, dysplasia, spinal surgery and hormone therapy. All subjects underwent lumbar MRI (Ingenia 3.0T, Philips) including modified Dixon (mDixon) Quant for assessment of BMFF at L1, L2 and L3 by manually drawing ROI (region of interest) on the fat fraction map (InterlliSpace TM Portal, Philips). Quantitative computed tomography (QCT) was performed on all subjects for determination of bone mineral density (BMD). Partial correlation analysis between vertebral BMFF and BMD was first performed. Logistic regression analysis using independent training and validation data sets were performed to evaluate the performance of predicting abnormal BMD (osteopenia [80 to 120 mg/cm3] and osteoporosis [<80mg/cm3]) or osteoporosis using BMFF.

RESULTS

All participants were divided into three groups based on their BMD from QCT: normal bone density (>120mg/cm3, 135 subjects), osteopenia (82 subjects) and osteoporosis (40 subjects). Moderate inverse correlation was found between vertebral BMFF and BMD after controlling age, gender and BMI (r =-0.529, p<0.001). The logistic regressions were trained using 2/3 of the cases and the performance was evaluated using the independent validation set comprised of the rest 1/3 cases. The area under the curve, sensitivity, specificity of predicting abnormal bone density were 0.940, 0.902, and 0.867, respectively and 0.906, 0.929 and 0.764, respectively for predicting osteoporosis. Its positive predictive value was found to be 0.907, making it an excellent screening tool.

CONCLUSION

Our study demonstrates statistically significant moderate correlation between vertebral BMFF and BMD. mDixon Quant as a fast, simple, non-invasive and non-ionizing imaging method to access vertebral BMFF has a high predictive power for identifying abnormal bone density and osteoporosis.

CLINICAL RELEVANCE/APPLICATION

Lumbar spine MRI is one of the most commonly performed study in clinical practice, added value of prediction of abnormal BMD using mDixon Quant would greatly benefit the patients.

SST05-07 Quantitative Assessment of Fat Infiltration in Lumbar Multifidus Muscle using T2-Weighted Multipoint Dixon in Patients with Low Back Pain: Correlation with Herniated Nucleus Pulposus

Friday, Nov. 30 11:30AM - 11:40AM Room: E351

Participants
Yeo Ryang Kang, MD, Goyang, Korea, Republic Of (Presenter) Nothing to Disclose
Seul KI Lee, MD, Gyeonggi, Korea, Republic Of (Abstract Co-Author) Research Grant, Dongkook Life Science Co, Ltd
Joon-Yong Jung, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jin-Hee Jung, Gyeonggi-do, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jae Jun Yang, Goyang, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
benefy@naver.com
PURPOSE
This study is to quantitatively assess fat infiltration in lumbar multifidus muscle using T2-weighted multipoint Dixon (T2 Dixon) and to reveal the relationship with hemiated nucleus pulposus (HNP) in patients with low back pain (LBP).

METHOD AND MATERIALS
Among 241 patients who performed MRI of lumbar spines (L-spine) for LBP on 1.5T scanner, 114 patients (age, 42.7±1.4y; 58 females) were enrolled, excluding patients with prior spine surgery, malignancy, compression fracture, spondylolisthesis, spondylitis, and advanced spinal stenosis. The presence and level of HNP were recorded. Two readers independently measured multifidus sectional area from T2 Dixon of axial L3 level and coronal L-spine. Volumetric multifidus measurement was performed using Syngo.via. Fat fraction (FF) of multifidus was calculated from signal intensity (SI) of in-phase (IP) and out-of-phase (OP) images by using the formula: \((\text{SI}_{\text{IP}} - \text{SI}_{\text{OP}})/2\times \text{SI}_{\text{IP}} \times 100(\%)\).

RESULTS
Inter-reader agreement of FF for each method and inter-method agreement of FF were excellent (ICCs: 0.81 to 0.98). 20 patients had no HNP (age, 39.3±15.7y; 9 females; BMI, 22.4±2.4) and 94 patients had HNP (age, 43.7±14.6y; 49 females; BMI, 25.3±3.4). Among positive HNP, 76 patients had HNP less than 3 levels (age, 40.8±13.9y; 38 females; BMI, 25.3±3.4) and 18 patients had multi-level (>3 levels) HNP (age, 56.0±10.3y; 11 females; BMI, 25.4±3.7). In positive HNP, coronal FF (20.1±2.8%) and volumetric FF (19.8±2.6%) were significantly higher than those of negative HNP (18.0±3.8%, 17.6±3.2%; \(P<0.001\), respectively). In multi-level HNP, axial-L3 FF (22.1±2.9%) and coronal FF (22.2±2.0%) were significantly higher than those of HNP less than 3 levels (19.0±3.3%, 19.6±2.7%; \(P<0.001\) for each). Multivariate logistic regression analysis adjusted for age, sex, and BMI showed that BMI is significantly associated with HNP (odds ratio [OR]: 1.376, \(P=0.004\)), while age and coronal FF are significantly associated with multi-level HNP (OR: 1.075, 1.524, \(P=0.021, 0.015\), respectively).

CONCLUSION
Coronal FF from T2 Dixon of L-spine has the best discriminating power to quantify the fatty infiltration of lumbar multifidus in patients of HNP. Increased coronal FF was significantly associated with multilevel HNP.

CLINICAL RELEVANCE/APPLICATION
The fat fraction of lumbar multifidus using coronal T2 Dixon is recommended method for patient of LBP to discriminate multi-level HNP from one or two level HNP.

SST05-08 Epidural Fibrosis and Nerve Root Changes on Magnetic Resonance Imaging (MRI) After Lumbar Disc Surgery: Correlation with Clinical Symptoms

PURPOSE
To investigate correlation between epidural fibrosis and nerve root changes on Magnetic resonance image (MRI) and clinical symptoms after lumbar disc surgery

METHOD AND MATERIALS
Between January 2010 and May 2017, 75 patients (32 women, 43 men, age range 30-87 years, mean age 60 years) who performed lumbar disc surgery at unilateral side of only one level examined follow-up lumbar spine MRI due to back pain or variable neurologic symptoms. We investigated size change, abnormally increased signal intensity, distinction in the epidural space, displacement and compression of nerve root and epidural fibrosis at operative site on mainly axial sequences. Also, the presence or absence of arachnoiditis was evaluated. The clinical symptoms were compared with MR imaging findings using statistical analysis.

RESULTS
Symptoms related with lumbar disc surgery were found in 31 patients (41.3%). The size change of nerve root was seen in 43 patients and high SI of nerve root in 44. The displacement of nerve root was presented in 11 patients and there were no patients showing definite nerve root compression. 51 patients showed epidural fibrosis and definite distinction of nerve root in the epidural space was seen in 45 patients. Arachnoiditis was seen in only 22 patients. The size change of nerve root at surgery site was the only significant MR finding correlating with symptom (\(p <0.05\)).

CONCLUSION
The size change of nerve root at surgery site was significantly correlated with new or persistent symptoms after lumbar disc surgery.

CLINICAL RELEVANCE/APPLICATION
MR imaging findings of size change and abnormally high SI of nerve root, indistinction of nerve root in the epidural space and epidural fibrosis are common after lumbar disc surgery. However, these findings except size change of nerve root were post-operative changes unrelated to new or persistent symptoms.

SST05-09 Assessment of Osseous Cervical Foraminal Stenosis in Spinal Radiculopathy Using Susceptibility-Weighted MRI
Participants
Guenther Engel, MD, Berlin, Germany (Presenter) Nothing to Disclose
Yvonne Y. Bender, Berlin, Germany (Abstract Co-Author) Nothing to Disclose
Lisa C. Adame, MD, Berlin, Germany (Abstract Co-Author) Nothing to Disclose
Sarah M. Boker, Berlin, Germany (Abstract Co-Author) Nothing to Disclose
Moritz Wagner, MD, Berlin, Germany (Abstract Co-Author) Nothing to Disclose
Ute L. Fahlenkamp, MD, Berlin, Germany (Abstract Co-Author) Nothing to Disclose
Gerd Diederichs, MD, Berlin, Germany (Abstract Co-Author) Nothing to Disclose
Bernd K. Hamm III, MD, Berlin, Germany (Abstract Co-Author) Research Consultant, Canon Medical Systems Corporation; Stockholder, Siemens AG; Stockholder, General Electric Company; Research Grant, Canon Medical Systems Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Siemens AG; Research Grant, General Electric Company; Research Grant, Elbit Imaging Ltd; Research Grant, Bayer AG; Research Grant, Guerbet SA; Research Grant, Bracco Group; Research Grant, B. Braun Melsungen AG; Research Grant, KRAUTH medical KG; Research Grant, Boston Scientific Corporation; Equipment support, Elbit Imaging Ltd; Investigator, CMC Contrast AB
Marcus R. Makowski, Berlin, Germany (Abstract Co-Author) Nothing to Disclose

For information about this presentation, contact:
guenther.engel@charite.de

PURPOSE
The aim of this study was to evaluate the diagnostic performance of susceptibility-weighted MRI for the evaluation of osseous foraminal stenosis of the cervical spine compared to conventional MR sequences, using CT as a reference standard.

METHOD AND MATERIALS
Twenty-one patients with suspected radiculopathy of the cervical spine were prospectively included. As standard of reference, 280 neuroforamen of the cervical spine, including 58 foraminal stenosis, were identified on sagittal CT images. T1, T2 and SW-MRI of the cervical spine were performed. For this study, the presence of foraminal stenosis was assessed on sagittal views on T1, T2 and SW-MR images. Sensitivity / specificity were calculated and differences in detection rate, severity scoring and sagittal diameter of spinal foraminal stenosis between the different sequences were tested. CT was used as reference standard for all analysis.

RESULTS
56 of 58 osseous foraminal stenosis could be correctly identified on SW-MR magnitude images. SW-MR imaging achieved a sensitivity of 96.6% and specificity of 99.5% for the identification of foraminal stenosis of the cervical spine. In comparison, conventional T1 spine MR sequences achieved a sensitivity and specificity of 43.1% and 100% respectively. Conventional T2 spine MR sequences achieved a sensitivity and specificity of 65.5% and 99.1%, respectively. The overall detection rate was significantly (p<0.05) higher on SW-MR imaging and there was no significant difference (p>0.05) in severity scoring compared to CT imaging. T1/T2-weighted MR underestimated the degree of foraminal stenosis. Intermodality and interobserver agreement were highest for SW-MR sequences.

CONCLUSION
Susceptibility-weighted MRI enables the reliable detection of osseous foraminal stenosis of the cervical spine in patients with spinal radiculopathy with a higher sensitivity and specificity compared to conventional T1/T2 MR sequences, with CT as a reference standard.

CLINICAL RELEVANCE/APPLICATION
The main limitation of MRI, compared to CT, is limited value for the detection of osteophytic changes as a cause of foraminal stenosis. Standard MR T1 and T2-weighted sequences often do not allow a differentiation these changes. Therefore, CT or conventional radiographs are often required to detect and quantify these changes. SW-MRI may therefore replace additional tests and prevent radiation exposure for patients as well as speed up diagnostic work up.