SPR 2015 POSTGRADUATE COURSE

Musculoskeletal Imaging

For further study

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On this knee MRI from a 16 year-old male, which component of the posterolateral corner is indicated by the arrow?

A. Popliteus tendon
B. Arcuate ligament
C. Popliteo-fibular ligament
D. Fibular collateral ligament
E. Biceps femoris tendon

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Which component of the posterolateral corner is indicated by the arrow?

- Option B is **CORRECT**. The arcuate ligament lies immediately posterior to the popliteus tendon as it exits the knee joint.
- Option A is **NOT** correct. The popliteus is anterior to the arcuate ligament.
- Option C, D and E are **NOT** correct. The popliteo-fibular ligament, fibular collateral ligament and biceps femoris tendon are all more lateral in location.

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Which component of the posterolateral corner is indicated by the arrow?

- Jadhav SP, et al. Comprehensive review of the anatomy, function, and imaging of the popliteus and associated pathologic conditions. Radiographics. 2014; 34(2): 496-513
- Vinson EN, et al. The posterolateral corner of the knee. AJR Am J Roentgenol 2008; 190(2): 449-58

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Regarding this closed mouth image from an MRI in a 15-year-old girl with JIA. What is true about the position of the intra-articular disc?

A. Normal position – the posterior band of the disc is at the 11 o'clock position
B. Normal position – the posterior band of the disc is at the 12 o'clock position
C. Anteriorly displaced – the posterior band of the disc is at the 12 o'clock position
D. Anteriorly displaced – the central intermediate zone is at the 11 o'clock position
E. The position of the disc cannot be assessed on a single view

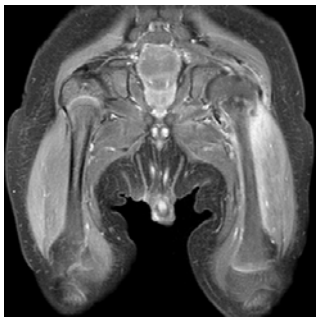
MRI in a 15-year-old girl with JIA. What is true about the position of the intra-articular disc?

- Option A is **NOT** correct. A posterior band of the disc at 11 o'clock shows the band is anteriorly displaced.
- Option B is **CORRECT**. The posterior band of the articular disc is at approximately the 12 o'clock position, which is the normal location for the closed mouth position.
- Option C is **NOT** correct. The articular disc position is normal.
- Option D is **NOT** correct. The central intermediate zone of the disc is at 11 o'clock, which is normal for the closed mouth position.
- Option E is **NOT** correct. The position of the disc is assessed on this image.

MRI in a 15-year-old girl with JIA. What is true about the position of the intra-articular disc?

- Aiken A, Bouloux G, Hudgins P. MR imaging of the temporomandibular joint. Magn Reson Imaging Clin N Am 2012; 20(3):397– 412
- Meyers AB, Laor T. Magnetic resonance imaging of the temporomandibular joint in children with juvenile idiopathic arthritis. Pediatr Radiol 2013;43(12):1632-41
- Tomas X, et al. MR imaging of temporomandibular joint dysfunction: a pictorial review. Radiographics 2006;26(3):765-81

Coronal STIR image from an 18 month-old with a 3 week history of limp and inward deviation of the foot. What is the most appropriate next imaging study?



A. MRI left knee
B. MRI right knee
C. MRI bilateral tibias/fibulas
D. MRI pelvis
E. MRI lumbar spine

Next best test in an 18 month-old with a 3 week history of limp and inward deviation of the foot.

- Option A is **NOT** correct. Focally increased signal in the epiphyseal growth cartilage of the medial femoral condyle is a common finding
- Option B is **NOT** correct. The right knee appears normal.
- Option C is **NOT** correct. The abnormal psoas muscle signal localizes the abnormality more proximally.
- Option D is **NOT** correct. Signal within the remainder of the pelvis is normal.
- Option E is **CORRECT**. Abnormal signal in the left psoas could indicate infection, and children with psoas infections are at risk for developing discitis and vertebral osteomyelitis.

Coronal STIR image from an 18 month-old with a 3 week history of limp and inward deviation of the foot.

- James SL, Davies AM. Imaging of infectious spinal disorders in children and adults. Eur J Radiol. 2006; 58(1): 27-40
- Guillerman RP. Osteomyelitis and beyond. Pediatr Radiol. 2013; 43: S193-203
- Metwalli ZA, et al. MRI of suspected lower extremity musculoskeletal infection in the pediatric patient: how useful is bilateral imaging? AJR Am J Roentgenol. 2013; 201(2): 427-32
- Fernandez M, et al. Discitis and Vertebral Osteomyelitis in Children: An 18-Year Review. Pediatrics. 2000; 105(6): 1299-304.

Images from an infant with achondroplasia. The proportionality of the bones would be best described how?

A. Micromelia
B. Acromelia
C. Mesomelia
D. Rhizomelia
E. Acromesomelia

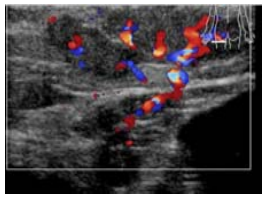
The proportionality of the bones would be best described how?

- Option A is **NOT** correct. Micromelia = diffuse shortening of all portions of the extremities.
- Option B is **NOT** correct. Acromelia = disproportionate shortening of the distal aspect of the extremities
- Option C is **NOT** correct. Mesomelia = disproportionate shortening of the mid portion of the extremities, to include the tibia, fibula, radius, and ulna.
- Option D is **CORRECT**. Rhizomelia = shortening of the proximal portions of the extremities (humerus and femur) and is typical of achondroplasia.
- Option E is **NOT** correct. Acromesomelia = disproportionate shortening of the middle and distal portions of the extremities.

The proportionality of the bones would be best described how?

- Taybi and Lachman's Radiology of Syndromes, Metabolic Disorders, and Skeletal Dysplasias, 5th ed. Lachman, R. Mosby Elsevier, Philadelphia, 2007
- Bone Dysplasias: An Atlas of Genetic Disorders of Skeletal Development, 2nd ed. Spranger, Brill, Poznanski, Oxford University Press, New York, 2002.

Based on this Doppler US image, the most likely diagnosis in a 9-day-old with a left posterior thigh mass is which of the following?



A. Venous malformation
B. Lymphatic malformation
C. Infantile hemangioma
D. Capillary malformation
E. Normal subcutaneous tissue

Based on this Doppler US image, the most likely diagnosis in a 9-day-old with a left posterior thigh mass is which of the following?

- Option A is **NOT** correct. Venous malformations are most typically ill-defined lesions consisting of dilated venous channels with low internal flow.
- Option B is **NOT** correct. Lymphatic malformations usually present as multicystic lesions with no internal blood flow.
- Option C is **CORRECT**. Infantile hemangiomas appear as circumscribed vascular masses in infants aged 0-12 months.
- Option D is **NOT** correct. Capillary malformations are typically cutaneous abnormalities (ex. port wine stain).
- Option E is **NOT** correct. A vascular mass is present.

Based on this Doppler US image, the most likely diagnosis in a 9-day-old with a left posterior thigh mass is which of the following?

- Mulliken JB, et al. Vascular anomalies. Curr Prob Surg 2000; 37: 517-584
- Kassarjian A, et al. Infantile hepatic hemangiomas: Clinical and imaging findings and their correlation with therapy. Am J Roentgenol 2004; 182: 785-795
- Cyrulnik AA, Glick SA. "Update on Propranolol for Infantile Hemangioma: Where Are We Now?." NeoReviews 2015; 16: e16-e25

A 7 week old female undergoes hip ultrasound. The hip is stable, alpha angle = 52° and femoral head coverage of 43%. Appropriate management is:

A. Treatment with Pavlik harness
B. Treatment with rigid abduction orthosis
C. Observation and repeat ultrasound in 5-7 weeks
D. Open surgical treatment
E. Perform arthrogram to evaluate for dynamic instability

The hip is stable, with an alpha angle = 52° and femoral head coverage of 43%. Appropriate management is:

- Option C is **CORRECT**: Observation and repeat US
- These parameters in a stable hip represent physiologic immaturity as defined by the Graf classification (Graf IIb). Therefore no treatment is recommended at this time, as the "abnormality" (alpha angle < 60 degrees) is likely to resolve spontaneously. A follow-up ultrasound at approximately 12 weeks of age is reasonable to determine if there is truly any evidence of dysplasia.

A 7 week old female undergoes hip ultrasound. The hip is stable, alpha angle = 52° and femoral head coverage of 43%.

- Roof AC, Jinguji TM, White KK. Musculoskeletal screening: developmental dysplasia of the hip. Pediatr Ann 2013; 42: 229-35.

Infant with short stature. Along with a J-shaped sella, this image is characteristic of which of the following?

A. Mucopolysaccharidosis
B. Pseudoachondroplasia
C. Jeune Syndrome
D. Osteogenesis Imperfecta
E. Thanatophoric Dysplasia

Infant with short stature. Along with a J-shaped sella, this image is characteristic of which of the following?

- Option A is **CORRECT**. The finding is proximal pointing of the metacarpals. The mucopolysaccharidoses share radiographic features known as "dysostosis multiplex", including a J-shaped sella, proximal pointing of the metacarpals, thickening of the ribs, anterior vertebral body beaking, and narrow inferior aspect of the iliac bones.
- Option B is **NOT** correct. Pseudoachondroplasia is characterized by anterior tonguing of the vertebral body, mini-epiphyses, and "windswept" appearance of the knees.
- Option C is **NOT** correct. Jeune syndrome is characterized by a trident shaped acetabular roof, very short ribs, and diffuse shortening of the long bones.
- Option D is **NOT** correct. OI is characterized by diffusely decreased bone mineralization, Wormian bones, and fractures.
- Option E is **NOT** correct. Thanatophoric dysplasia is characterized by short ribs, flat acetabular roofs, narrow sciatic notches, and micromelia with a curved appearance of the long bones.

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Infant with short stature. Along with a J-shaped sella, this image is characteristic of which of the following?

- Taybi and Lachman's Radiology of Syndromes, Metabolic Disorders, and Skeletal Dysplasias, 5th ed. Lachman, R. Mosby Elsevier, Philadelphia, 2007
- Bone Dysplasias: An Atlas of Genetic Disorders of Skeletal Development, 2nd ed. Spranger, Brill, Poznanski, Oxford University Press, New York, 2002.

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16 year old male with groin pain. Additional studies that would aid surgical decision making include all of the following except:

A. AP pelvis with abduction and internal rotation of the femurs (AIR view)
B. MRI left hip (noncontrast)
C. False profile lateral view
D. MR arthrogram left hip
E. Fluoroscopy guided lidocaine injection

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Additional studies that would aid surgical decision making include all of the following except:

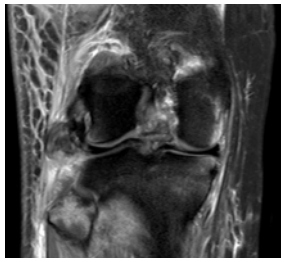
- Option A is **NOT** correct: An AIR view confirms that the femoral head can be concentrically reduced with a pelvic osteotomy.
- Option B is **CORRECT**: MRI of the hip without intra-articular contrast provides little addition clinical information in the setting of adolescent DDH.
- Option C is **NOT** correct: A false profile view give more information about anterior coverage of the femoral head.
- Option D is **NOT** correct: MR arthrogram allows improved visualization of the labrum (to evaluate for associated tears) and articular cartilage.
- Option E is **NOT** correct: Reduced hip pain after an intra-articular injection of local anesthetic can confirm that the pain is likely a result of hip pathology

Additional studies that would aid surgical decision making include all of the following except:

- Sierra RJ, et al. Hip Disease in the Young, Active Patient: Evaluation and Nonarthroplasty Surgical Options. J Am Acad Orthop Surg, 2008; 16: 689-703

17-year-old female with knee pain after injury. What type of posterolateral corner injury is seen on this image?

A. Biceps femoris tear
B. Arcuate ligament tear
C. Popliteo-fibular ligament tear
D. Popliteus tendon tear
E. Lateral collateral ligament avulsion



What type of posterolateral corner injury is seen on this image?

- Options A and B are **NOT** correct. Both structures more posterior.
- Option C is **NOT** correct. The popliteo-fibular ligament attaches on the fibular head medial to the attachment of the fibular collateral ligament and biceps femoris tendon.
- Option D is **NOT** correct. The popliteus tendon is normal.
- Option E is **CORRECT**. The lateral collateral ligament extends from the lateral femoral condyle to the lateral aspect of the fibular head. In this example, it is retracted proximally from its distal attachment to the fibular head.

What type of posterolateral corner injury is seen on this image?

- Jadhav SP, et al. Comprehensive review of the anatomy, function, and imaging of the popliteus and associated pathologic conditions. Radiographics 2014; 34(2): 496-513
- Vinson EN, et al. The posterolateral corner of the knee. AJR Am J Roentgenol 2008; 190(2): 449-58
- Juhng SK, et al. MR evaluation of the “arcuate” sign of posterolateral knee instability. AJR Am J Roentgenol 2002; 178(3): 583-8

22 month-old with an injury 1 month ago, now with pain, fever, and refusal to bear weight. Radiographs at the time of injury are shown. What is the most appropriate next imaging study?

A. Radiographs opposite tibia and fibula
B. Radiographs pelvis
C. Radiographs left tibia and fibula
D. MRI left tibia and fibula
E. MRI bilateral lower extremities

What is the most appropriate next imaging study?

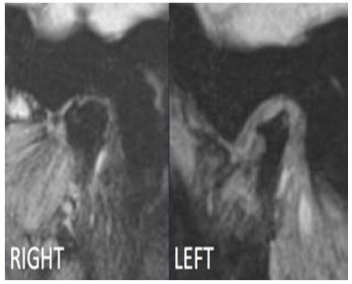
- Option A is **NOT** correct. Comparison radiographs are not routine.
- Option B is **NOT** correct. The site of injury was the left lower leg.
- Option C is **CORRECT**. MRI is the most sensitive test to look for infection or an occult fracture.
- Option D is **NOT** correct. Repeat radiographs could be helpful, but may be normal in the setting of infection.
- Option E is **NOT** correct. Unless the abnormal side cannot be localized, unilateral imaging is sufficient.

What is the most appropriate next imaging study?

- Browne LP, et al. Community-acquired staphylococcal musculoskeletal infection in infants and young children: necessity of contrast-enhanced MRI for the diagnosis of growth cartilage involvement. AJR Am J Roentgenol 2012; 198(1): 194-9

Sagittal oblique GRE images in a 17 year-old girl who does not have inflammatory arthritis. Which of the following is the most likely cause of this patient's TMJ disease?

A. Primary osteoarthritis
B. Synovial chondromatosis
C. Prior iatrogenic injury
D. Pigmented villonodular synovitis
E. Acute infection



Which of the following is the most likely cause of this patient's TMJ disease?

- Option A is **NOT** correct. Osteoarthritis is uncommon in children.
- Option B is **NOT** correct. Synovial chondromatosis is rare in the TMJ and is typically mono-articular.
- Option C is **CORRECT**. Trauma is one of the major factors associated with TMJ pathology. It may be secondary to an accidental or iatrogenic injury.
- Option D is **NOT** correct. Pigmented villonodular synovitis is rare in the TMJ and is typically not bilateral.
- Option E is **NOT** correct. Infection can occur at the TMJ in children, but it is usually unilateral and deformity/erosions are atypical in the acute setting.

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Which of the following is the most likely cause of this patient's TMJ disease?

- Sahebi S, et al. Effect of lengthy root canal therapy sessions on temporomandibular joint and masticatory muscles. J Dent Res Dent Clin Dent Prospects. 2010; 4(3): 95-7
- Meyers AB, Laor T. Magnetic resonance imaging of the temporomandibular joint in children with juvenile idiopathic arthritis. Pediatr Radiol. 2013; 43(12): 1632-41
- Safaee M, et al. Pigmented villonodular synovitis of the temporomandibular joint with intracranial extension: A case series and systematic review. Head Neck. 2014. doi: 10.1002/hed.23717
- Phelan E, et al. Temporomandibular joint osteochondromatosis: an unusual cause of preauricular swelling. Ann Otol Rhinol Laryngol. 2011; 120: 63-5

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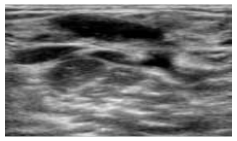
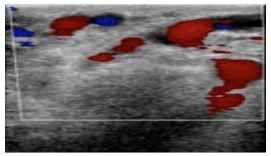
What is the most likely diagnosis for this subcutaneous lesion at the knee in a 18-year-old male with chronic knee pain?

A. Venous malformation
B. Lymphatic malformation
C. Infantile hemangioma
D. Capillary malformation
E. Normal hypervascular subcutaneous tissue





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What is the most likely diagnosis for this subcutaneous lesion at the knee in a 18-year-old male with chronic knee pain?

- Option A is **CORRECT**. Venous malformations are typically ill-defined lesions consisting of dilated venous channels with low internal flow.
- Option B is **NOT** correct. Lymphatic malformations are multicystic lesions with no internal blood flow.
- Option C is **NOT** correct. Infantile hemangiomas appear as circumscribed vascular masses in infants aged 0-12 months.
- Option D is **NOT** correct. Capillary malformations are typically cutaneous abnormalities (ex. port wine stain).
- Option E is **NOT** correct. A vascular lesion is present.

Visualize the Future

What is the most likely diagnosis for this subcutaneous lesion at the knee in a 18-year-old male with chronic knee pain?

- Mulliken JB, et al. Vascular anomalies. Curr Prob Surg 2000; 37: 517-584
- van der Vleuten CJ, et al. Effectiveness of sclerotherapy, surgery, and laser therapy in patients with venous malformations: a systematic review. Cardiovasc Intervent Radiol 2014; 37: 977-989.