

ORGANIZATION: **Los Angeles Radiological Society**  
 VENUE: **66<sup>th</sup> Annual Midwinter Radiology Conference**  
 DATE: **February 22-23, 2014**  
 TITLE: **MRI of Arthritis, Marrow, and Muscle**

**Presenters:**

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**Mark Schweitzer, MD** – Professor & Chair of Radiology, Stony Brook University School of Medicine  
**Robert D. Boutin, MD** – Professor of Clinical Radiology UC Davis Health System

**ANSWER KEY**

**PRESENTATION 1: Update on Arthritis**

<b>QUESTION 1</b>	<b>DISCUSSION RE: ANSWER OPTIONS</b>
Spondyloarthropathy comprises a group of chronic inflammatory rheumatic diseases including all of the below except <ol style="list-style-type: none"> <li>Reactive arthritis</li> <li>Ankylosing spondylitis</li> <li>Psoriatic arthritis</li> <li>Spondylitis associated with inflammatory bowel disease</li> <li>Rheumatoid arthritis</li> </ol>	Answer: E. Rheumatoid arthritis  Rheumatoid arthritis is an inflammatory arthritis not associated with spondyloarthropathy.

**REFERENCE FOR QUESTIONS 1**  
 Sacroiliitis Associated with Axial Spondyloarthropathy: New Concepts and Latest Trends; María Navallas, Jesús Ares, Brigitte Beltrán, María Pilar Lisbona, Joan Maymó, Albert Solano RadioGraphics, 2013, Vol.33: 933-956

<b>QUESTION 2</b>	<b>DISCUSSION RE: ANSWER OPTIONS</b>
MRI exams for spondyloarthropathy diagnosis should include all of the below except <ol style="list-style-type: none"> <li>STIR images</li> <li>Coverage of entire SI joint space</li> <li>Routine lumbar spine protocol</li> <li>Correlation with conventional radiographs</li> </ol>	Answer: C. Routine lumbar spine protocol  Routine lumbar spine protocols may not cover entire SI joints, and may not have STIR weighted sequences, both essential in the work up of spondyloarthropathy.

**REFERENCE FOR QUESTIONS 2**  
 Sacroiliitis Associated with Axial Spondyloarthropathy: New Concepts and Latest Trends; María Navallas, Jesús Ares, Brigitte Beltrán, María Pilar Lisbona, Joan Maymó, Albert Solano; RadioGraphics, 2013, Vol.33: 933-95.

**PRESENTATION 2: MRI of Marrow: Basic Principles**

<b>QUESTION 3</b>	<b>DISCUSSION RE: ANSWER OPTIONS</b>
Which of the following is true <ol style="list-style-type: none"> <li>The least sensitive sequence is STIR- false very sensitive</li> <li>T2 fat sat is not useful in evaluating- except for low field this is preferred</li> <li>T1 is more specific than STIR-correct</li> <li>All of the above</li> </ol>	Answer: C a. STIR- false very sensitive b. T2 fat sat, except for low field, is preferred. c. CORRECT - T1 is more specific than STIR. d. First two choices are not correct.

**REFERENCE FOR QUESTIONS 3**  
 Crit Rev Diagn Imaging. 1996 Sep;37(4):261-303.; Magnetic resonance imaging (MRI) of the knee: a pattern approach for evaluating bone marrow edema.; Yu JS, Cook PA.

<b>QUESTION 4</b>	<b>DISCUSSION RE: ANSWER OPTIONS</b>
In the differential diagnosis of marrow edema the following is included <ol style="list-style-type: none"> <li>trauma</li> <li>Infection</li> <li>Arthritis</li> <li>All the above</li> </ol>	Answer: D. All the above  There are 7 causes of marrow edema: trauma, infection, arthritis, infarction, tumor, reactive, and some normal variants.

**REFERENCE FOR QUESTION 4**  
 Crit Rev Diagn Imaging. 1996 Sep;37(4):261-303.; Magnetic resonance imaging (MRI) of the knee: a pattern approach for evaluating bone marrow edema.; Yu JS, Cook PA.

**PRESENTATION 3: MRI of Muscle: The Top 10 List**

<b>QUESTION 5</b>	<b>DISCUSSION RE: ANSWER OPTIONS</b>
Which of the following is true in regard to MRI of muscle injuries? <ol style="list-style-type: none"> <li>With acute traumatic injuries, low T2 signal is characteristic, due to fibrosis, hemosiderin, and/or heterotopic ossification.</li> </ol>	CORRECT ANSWER: E  A. False. In fact, in the acute setting, a feathery appearance of high T2 signal in muscle is common, owing to interstitial hemorrhage and edema. B. False. In fact, in the chronic setting, low T2 signal is characteristic, due

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**ANSWER KEY**

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| <p>b. With non-acute (chronic) traumatic injuries, a feathery appearance of high T2 signal in muscle is the most characteristic finding, owing to interstitial hemorrhage and edema.</p> <p>c. Hamstring injuries that disrupt the central (intramuscular) tendon within the muscle belly have a shorter recovery time than injuries involving only muscle, epimysial fascia, or the musculotendinous junction.</p> <p>d. As long as there is edema signal in the muscle, athletes should be prohibited from returning to playing their sport.</p> <p>e. MRI is reliable for grading and determining prognostic parameters for acute hamstring strains, including craniocaudal length of the acute muscle tear.</p> | <p>to fibrosis, hemosiderin, and/or heterotopic ossification.</p> <p>C. False. In fact, it is particularly important to distinguish between injury to the hamstring muscle and injury to the hamstring tendon, even when the tendon is within the muscle. Hamstring injuries that disrupt the central tendon enclosed within the muscle belly require a longer recovery time than injuries involving only muscle, epimysial fascia, or the musculotendinous junction.</p> <p>D. False. Clinically recovered muscle injuries commonly exhibit persistent abnormal signal intensity. At the time athletes return successfully to playing their sport, the vast majority have residual edema signal in their muscle that was strained.</p> <p>E. TRUE. Excellent interobserver and intraobserver reliability is found for grading and prognostic MRI parameters in acute hamstring injuries. Thus, in daily practice and research, we can be confident that scoring hamstring injuries is reproducible.</p> |
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**REFERENCE FOR QUESTION 5**

- Comin J, Malliaras P, Baquie P, Barbour T, Connell D. Return to competitive play after hamstring injuries involving disruption of the central tendon. *Am J Sports Med.* **2013** Jan;41(1):111-5.
- Reurink G, Goudswaard GJ, Tol JL, Almusa E, Moen MH, Weir A, Verhaar JA, Hamilton B, Maas M. MRI observations at return to play of clinically recovered hamstring injuries. *Br J Sports Med.* **2013** Nov 19 [Epub ahead of print].
- Sanfilippo JL, Silder A, Sherry MA, Tuite MJ, Heiderscheid BC. Hamstring strength and morphology progression after return to sport from injury. *Med Sci Sports Exerc.* **2013** Mar;45(3):448-54.
- Silder A, Sherry MA, Sanfilippo J, Tuite MJ, Hetzel SJ, Heiderscheid BC. Clinical and morphological changes following 2 rehabilitation programs for acute hamstring strain injuries: a randomized clinical trial. *J Orthop Sports Phys Ther.* **2013** May;43(5):284-99.
- Hamilton B, Whiteley R, Almusa E, Roger B, Geertsema C, Tol JL. Excellent reliability for MRI grading and prognostic parameters in acute hamstring injuries. *Br J Sports Med.* **2013.** [Epub ahead of print]

**QUESTION 6**

What is an imaging feature that describes benign heterotopic ossification?

- Looks immature peripherally
- Increases in size with time
- Adjacent osteolysis
- Perilesional edema signal in the acute and subacute setting
- Zonal architecture is easier to see in the acute setting than in the chronic setting

**DISCUSSION RE: ANSWER OPTIONS**

**CORRECT ANSWER: D**

- False. In fact, a characteristic feature that helps differentiate heterotopic ossification (HO) from osteosarcoma is that HO has a zonal architecture, with ossific tissue that appears most mature peripherally.
- False. In fact, a characteristic feature that helps differentiate HO from osteosarcoma is that HO decreases in size over time.
- False. In fact, a characteristic feature that helps differentiate HO from osteosarcoma is that HO is not associated with underlying bone destruction.
- TRUE. Perilesional edema signal in the acute and subacute setting is typical of HO. This feature, however, sometimes inappropriately leads the misdiagnosis of aggressive neoplasm. With time, edema signal around HO diminishes.
- False. In fact, zonal architecture or organization is best appreciated in the chronic setting. Compared to MRI, CT generally allows a more confident diagnosis of HO.

**REFERENCE FOR QUESTIONS 6**

Boutin RD, Pathria M. MRI of Muscle. In: Hodler J (ed), *Musculoskeletal Diseases 2013-2016: Diagnostic Imaging and Interventional Techniques.* Springer-Verlag 2013. ; Zagarella A, Impellizzeri E, Maiolino R, Attolini R, Castoldi MC. Pelvic heterotopic ossification: when CT comes to the aid of MR imaging. *Insights Imaging.* 2013; 4:595-603.