

Musculoskeletal Radiology In-Training Test Questions for Diagnostic Radiology Residents



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Sponsored by:

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1. Concerning calcium pyrophosphate dihydrate (CPPD) deposition which one is TRUE?
- A. Polarized light microscopy demonstrates needle-shaped crystals with negative birefringence.
 - B. Water sensitive MR sequences are most sensitive to the detection of chondrocalcinosis.
 - C. Chondrocalcinosis is synonymous with pseudo-gout.
 - D. Pyrophosphate arthropathy is most common at the knee.

Rationales:

A. *Incorrect.* Polarized light microscopy demonstrates rhomboid crystals with weak positive birefringence. Monosodium urate crystals are needle shaped and demonstrate strong negative birefringence.

B. *Incorrect.* A gradient echo sequence, T2* GRE, is the most sensitive technique for the detection of chondrocalcinosis because of the increased magnetic susceptibility. Multiple hypointense punctuate foci are characteristic of such chondral calcification.

C. *Incorrect.* Chondrocalcinosis refers to the presence of calcification within hyaline and fibrocartilage. The crystal is usually, though not necessarily CPPD. The patient may be asymptomatic. Pseudogout is one of several possible clinical presentations of CPPD deposition disease, similar to attacks of acute gouty arthritis. Theoretically, there is some degree of cartilage damage, shedding of crystals into the joint, synovial deposition and inflammation when the patient is symptomatic. Pyrophosphate arthropathy refers to the type of structural joint damage that may eventually result in some patients.

D. **Correct.** The arthropathy related to CPPD deposition is similar to osteoarthritis in that joint space narrowing, subchondral sclerosis, subchondral cyst and osteophyte formation may be present. There are features, however that are unique to CPPD arthropathy. Weight-bearing and non-weightbearing joints may be involved. The unusual distribution of involvement within a given joint is notable i.e., patella-femoral compartment at the knee, radiocarpal at the wrist. Subchondral cyst formation may be numerous and quite large. Osteophyte formation is quite variable. Destructive bone changes may be severe and progressive resembling neuropathic disease. Pyrophosphate arthropathy is most common at the knee. The wrist and MCP joints are commonly involved but any joint is susceptible.

2. Which of the following is TRUE concerning acromegaly?
- A. Stimulation of intramembranous bone formation results in gigantism
 - B. Stimulation of endochondral bone formation results in gigantism
 - C. Stimulation of endochondral bone formation results in widening of osseous structures
 - D. Stimulation of endochondral bone formation results in enlargement of the costochondral junction

Rationales:

A. *Incorrect.* Stimulation of endochondral ossification before growth plate closure leads to gigantism. In adults, stimulation of endochondral ossification leads to new bone formation at existing cartilagebone junctions such as the costochondral junctions. The widening of osseous structures in patients with acromegaly is secondary to periosteal new bone formation which is intramembranous in nature.

B. *Incorrect.* Gigantism refers to the sequela of growth hormone hypersecretion in the skeletally immature. Excessive height results from endochondral bone formation at the open growth plates. Acromegaly refers to the sequela of growth hormone hypersecretion in the skeletally mature patient. Intramembranous bone formation in the adult results in periosteal new bone formation and widening of osseous structures.

C. **Correct.** Endochondral bone formation in the adult occurs at existing chondro-osseous junctions such as the costochondral junction resulting in the acromegalic rosary.

D. *Incorrect.* Gigantism refers to the sequela of growth hormone hypersecretion in the skeletally immature. Excessive height results from excessive endochondral bone formation at the open growth plates. Acromegaly refers to the sequela of growth hormone hypersecretion in the skeletally mature patient. There is no increase in height. Only chondro-osseous junctions in the adult, such as the costochondral junction are susceptible to endochondral stimulation and new bone formation.

Citations:

Resnick, D. Pituitary Disorders. In: Resnick D, ed. Diagnosis of Bone and Joint Disorders. 4th ed. Philadelphia, PA: W.B. Saunders, 2002: 2003-2025.

3. Concerning multidirectional glenohumeral instability, which ONE is associated?
- A. Trauma
 - B. Unilateral involvement
 - C. Rotator cuff tear
 - D. Primary impingement

Rationales:

A. *Incorrect.* Multidirectional glenohumeral instability is often found in individuals with generalized joint laxity of varying degrees. Preceding trauma is not typical.

B. *Incorrect.* Because multidirectional glenohumeral instability is generally found in individuals with generalized joint laxity, it frequently involves both shoulders. Although the underlying condition is usually bilateral, only one glenohumeral joint may be symptomatic.

C. **Correct.** Since multidirectional instability is a cause of secondary impingement and all forms of impingement may be associated with rotator cuff tear, multi-directional instability is associated with rotator cuff tear.

D. *Incorrect.* Primary impingement refers to those conditions of and about the coraco-acromial arch that predispose to compression of the rotator cuff at its outlet. This is usually due to osteoarthritis of the acromioclavicular joint with subsequent osteophytic impingement of the subacromial space or subacromial spurs. Multidirectional glenohumeral instability is the most common cause of secondary, or non-outlet impingement. In this condition, laxity is present in many directions. In addition to antero-inferior laxity, the humeral head may also sublux superiorly, reducing the space in which the cuff must function. Another cause of secondary impingement is a prominent greater tuberosity (fracture malunion).

4. Concerning Blount's disease, which of the following is TRUE?
- A. It is also known as tibia valga.
 - B. Radiographic abnormalities are evident in the first 2 years of life.
 - C. The disorder can occur in infants, children and adolescents.
 - D. It is usually self-limited and requires no treatment.

Rationales:

A. *Incorrect.* Blount's disease is also known as tibia vara. The disorder affects the medial aspect of the proximal tibia. The deformity consists of varus angulation and internal rotation at the proximal tibial metaphysis. Factors contributing to the disorder include varus stress, focal growth suppression and disruption of endochondral ossification.

B. *Incorrect.* Radiographic abnormalities in the infantile form rarely are evident before 2 years of age at which time they resemble physiologic bowing. The varus deformity, however, occurs at the metaphysis, not the knee. Eventually, the medial metaphysis becomes depressed and an osseous excrescence or outgrowth may develop.

C. **Correct.** The early onset or infantile group occurs in children less than three years of age. The late onset group consists of a juvenile and an adolescent form. Deformity is more likely in the younger age groups.

D. *Incorrect.* The natural history of the disease is that of irreversible deformity resulting from changes at the growth plate. In the infantile form, orthotic bracing is usually the first line of treatment. If this fails, an osteotomy is required. In the adolescent form, treatment is usually surgical.

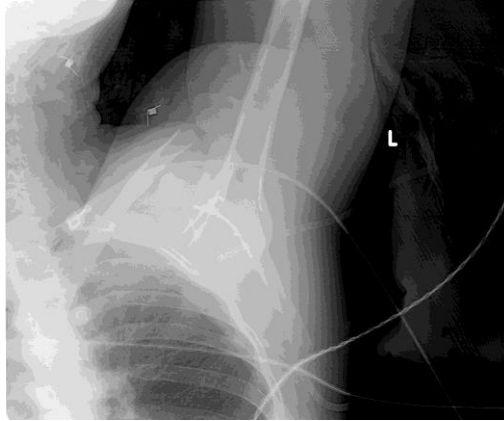
Citations:

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Blounts Disease. Wheeless' Textbook of Orthopaedics. Duke Orthopaedics.
www.wheelessonline.com/ortho/blounts_disease.

Resnick, Niwayama. Diagnosis of Bone and Joint Disorders. W.B. Saunders. 2002, Philadelphia, PA. Fourth Ed.

5. You are shown an AP radiograph. Which one of the following is correct?



- A. There is posterior dislocation.
- B. Neurologic and vascular injury may result.
- C. Rotator cuff tears are unusual.
- D. Open reduction is necessary.

Rationales:

- A. *Incorrect.* This is characteristic inferior glenohumeral dislocation, luxatio erecta humeri. With posterior dislocation, the arm is fixed in internal rotation and at one's side. Typically, there is lack of the normal overlap of the humeral head and glenoid on standard, non-oblique AP radiographs.
- B. **Correct.** Approximately 60% of patients suffer neurologic injury, most commonly the axillary nerve. Vascular injury, usually to the axillary artery is uncommon, less than 4% of cases.
- C. *Incorrect.* Associated fractures, labral tears and rotator cuff tears are extremely common.
- D. *Incorrect.* Reduction is performed in the Emergency Department. Surgical reduction is not necessary.

6. Concerning acute ankle inversion, which ligament is FIRST to be injured?

- A. Calcaneofibular
- B. Anterior talofibular
- C. Posterior talofibular
- D. Posterior talofibular

Rationales:

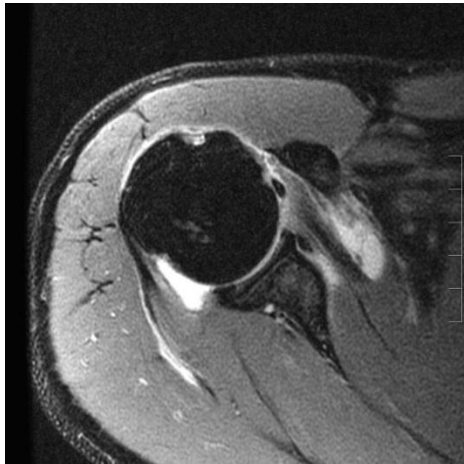
A. *Incorrect.* The calcaneofibular ligament originates at the anterior apex of the lateral malleolar tip and extends inferiorly and posteriorly to insert on the lateral calcaneus. With an inversion injury, it is usually the second of the lateral ankle ligaments to tear.

B. **Correct.** The anterior talofibular ligament originates at the anterior margin of the lateral malleolar tip and courses medial and anterior to insert at the talus. With a relatively low-grade inversion ankle injury, the anterior talofibular ligament will stretch. With more severe injuries, the ligament will partially or completely tear. A complete tear is often accompanied with a "pop", severe pain and swelling, and an inability to walk. It is the first of the ankle ligaments to be injured.

C. *Incorrect.* The posterior talofibular ligament extends horizontally between the posterior aspects of the lateral malleolus to the posterior process of the calcaneus. Tears of the posterior talofibular ligament are uncommon relative to tears of the other two lateral collateral ligaments.

D. *Incorrect.* The deltoid ligament lies medial to the ankle joint, arising on the medial malleolus. Superficial fibers insert on the navicular bone, the calcaneus and the talus. Deep fibers insert on the talus. Deltoid ligament tears result from abduction or eversion injuries.

7. You are shown an MR image of the right shoulder of a 29-year-old man. What is the most likely diagnosis?



- A. Bankhart lesion
- B. Deltoid muscle tear
- C. Joint bodies
- D. Long biceps tendon dislocation

Rationales:

- A. *Incorrect.* The anterior labrum is hypoplastic at its superior aspect. The middle glenohumeral ligament, at its usual location, just anterior to the glenoid neck/anterior labrum, is prominent compatible with a Buford complex. The long biceps tendon is dislocated medially, absent at the bicipital groove. The subscapularis tendon is characteristically torn. The contour of the posterior proximal humerus, below the level of the corocoid, represents the normal posterior humeral groove. There is no Hill-Sachs lesion.
- B. *Incorrect.* The high signal intensity fluid deep to the deltoid muscle is within the subacromial-subdeltoid bursa.
- C. *Incorrect.* There is a medially dislocated long biceps tendon which is absent at the bicipital groove. There is a prominent middle glenohumeral ligament at its charactersitic location just anterior to the glenoid neck and anterior glenoid labrum. Sequential axial, coronal and sagittal images show the course of these structures, which on a single axial image appear as focal bodies.
- D. **Correct.** There is an intra-articular dislocation of the long biceps tendon which is absent at the bicipital groove. There is tear of the subscapularis tendon.

8. A 65 year old woman presents with painful swelling of the hand. What is the most likely diagnosis?



- A. Rheumatoid arthritis
- B. Erosive osteoarthritis
- C. Psoriatic arthritis
- D. Systemic lupus erythematosus

Rationales:

- A. **Incorrect.** Rheumatoid arthritis characteristically has a proximal distribution, typically involving the metacarpophalangeal joints and intercarpal joints, and is characterized by marginal erosions, symmetric joint space narrowing, and periarticular osteopenia. There are no productive changes such as subchondral sclerosis and osteophytosis.
- B. **Correct.** Erosive osteoarthritis typically occurs in older women and involves the IP joints, often in a symmetric manner. There is joint space narrowing, subchondral sclerosis, osteophyte formation and central erosion producing the so-called "seagull" or "gullwing" appearance.
- C. **Incorrect.** Psoriatic arthritis often involves the IP joints and radiographic abnormalities may be similar to those of erosive OA. The osseous erosions of psoriatic arthritis, however, are both central and marginal and subchondral sclerosis is not seen with active inflammation. In addition, the productive changes of psoriatic arthritis manifest as periostitis, ankylosis, new bone formation at entheses and "cupping." The osteophyte formation of erosive OA is not present.
- D. **Incorrect.** The arthropathy of SLE is deforming but non-erosive.

9. You are shown radiographs of 30-year-old man. What is the most likely diagnosis?



- A. Osteosarcoma
- B. Osteoid osteoma
- C. Chronic osteomyelitis
- D. Stress fracture

Rationales:

- A. *Incorrect.* The most common surface osteosarcoma, parosteal osteosarcoma, usually demonstrates more focal new bone formation on the periosteal surface encircling the shaft, not long segment cortical thickening. There is no sequestrum or sinus tract. Periosteal osteosarcoma is a surface osteosarcoma that is characterized by focal, sunburst periostitis with bone spicules that are perpendicular to the cortex, with a circumferential soft tissue mass that may scallop the diaphysis. The more common intramedullary osteosarcoma involves the medullary canal with a more aggressive periosteal reaction.
- B. *Incorrect.* The more common cortically based osteoid osteoma is characterized by a small lytic nidus surrounded and often "hidden" by focal, dense, fairly smooth, fusiform new bone formation.
- C. **Correct.** There is a long segment of undulating periosteal reaction with focal sinus tract formation containing a sequestrum, characteristic of chronic osteomyelitis.
- D. *Incorrect.* A stress fracture is characterized by either linear cortical lucency or linear trabecular sclerosis. There may be associated focal periosteal reaction.

10. A 54-year-old man presents with bilateral knee pain. What is the most likely diagnosis?



- A. Multifocal osteosarcoma
- B. Pleural mesothelioma
- C. Melorheostosis
- D. Chronic recurrent multi-focal osteomyelitis

Rationales:

- A. *Incorrect.* Multifocal osteosarcoma, like the more common monostotic form, involves the medullary bone and provokes an aggressive periosteal reaction.
- B. **Correct.** Hypertrophic osteoarthropathy refers to a clinical triad of digital clubbing, extremity enlargement secondary to periosteal new bone formation and painful, swollen joints. There is a primary or idiopathic form also known as pachydermoperiostosis and the more common secondary form which is associated with many underlying conditions, most, but not all, pulmonary in origin. Most cases of secondary HOA are associated with bronchogenic carcinoma. About 5% of patients with bronchogenic carcinoma will develop HOA. Rarely, patients with bronchogenic carcinoma will initially present with arthralgia. As many as 50% of patients with much less common pleural mesothelioma may develop HOA.
- C. *Incorrect.* Melorheostosis is a rare sclerosing dysplasia predominantly involving intramembranous bone formation (periosteal in the skeletally mature) characterized by painful swelling, limited range of motion, muscle contracture and tendon and ligament shortening of the affected extremity, usually a single limb. There is a sclerotome distribution. Radiographs show cortical hyperostosis along the length of a bone or bones, simulating dripping candle wax. There may be soft tissue involvement.
- D. *Incorrect.* Chronic recurrent multifocal osteomyelitis (CRMO) is now considered an autoinflammatory disorder of children and young adults that is characterized by nonbacterial inflammation of the bone. Patients typically present with bone pain. There is a relapsing and remitting course. The etiology remains unclear although several recent studies suggest a genetic component. It remains a diagnosis of exclusion. Radiographic findings include lytic and sclerotic lesions at the metaphyses of long bones and the medial clavicles. Other common sites of involvement are the vertebral bodies, pelvis, ribs, and mandible. CRMO is often bilateral and multifocal at presentation. In the early stages, plain radiographs typically demonstrate an osteolytic lesion located adjacent to the growth plate in the metaphysis. With time, progressive sclerosis is seen around the lytic lesion, so that chronic lesions may be predominantly sclerotic with associated hyperostosis.

11. You are shown radiographs of a 58-year-old woman. What is the most likely diagnosis?



- A. Gout
- B. Amyloid deposition
- C. Hemophilic arthropathy
- D. Rheumatoid arthritis

Rationales:

- A. *Incorrect.* There are no focal soft tissue masses or focal erosions to suggest chronic tophaceous gout. The joint space is typically preserved with chronic urate deposition.
- B. *Incorrect.* Amyloid produces random erosion of bone and preserves the joint space until late in the course of the disease. There is not uniform destruction of articular cartilage.
- C. *Incorrect.* Chronic hemarthroses leads to dense synovium, overgrowth of the ends of the bones, and secondary degenerative arthritis.
- D. **Correct.** Inflammatory arthritis uniformly destroys articular cartilage and erodes underlying bone. With extensive bone loss, the joint may appear, paradoxically, widened.