Musculoskeletal Radiology In-Training Test Questions for Diagnostic Radiology Residents

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Committee on Residency Training in Diagnostic Radiology

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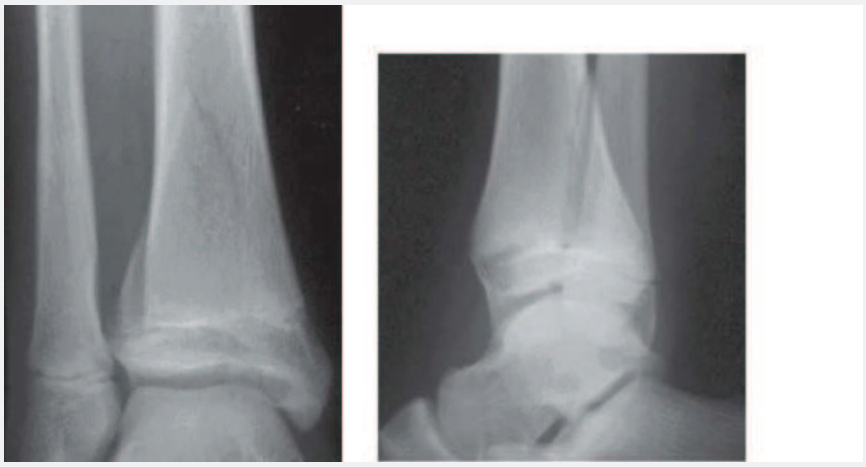
1. You are shown frontal and lateral radiographs of a12-year-old boy who fell from his skateboard. What is the fracture type?

A. Tillaux
B. **Triplane**
C. Pilon
D. Maisonneuve



Rationale:
A. Incorrect. A Tillaux fracture is a Salter type III avulsion of the anterolateral aspect of the distal tibial epiphysis.
B. Correct. The radiograph shows a coronally oriented fracture of the distal metaphysis of the tibia, a horizontally oriented fracture of the lateral aspect of the physis, and a sagittally oriented fracture of the distal epiphysis, all of which comprise a triplane fracture. The injury results in part due to the partially fused tibial physis, closure progressing medial to lateral.
C. Incorrect. A pilon fracture is a comminuted fracture of the distal tibia and tibial plafond due to impaction of the talus into the tibia.
D. Incorrect. A Maisonneuve fracture involves the proximal fibula shaft and is associated with rupture of the distal syndesmotic ligaments and widening of the tibia-fibular syndesmosis.

Reference:
None

2. Concerning the various arthropathies, which one of the following is TRUE?

A. Osteoarthritis of the hand and wrist has a predilection for the radioscaphoid joint compartment.
B. The inflammatory arthritides spare the bare areas of the joint.
C. **Joint space narrowing is a late manifestation of gout.**
D. New bone formation is characteristic of adult onset rheumatoid arthritis

Rationale:

A. Incorrect. Osteoarthritis has a predilection for the radial aspect of the wrist, including the scaphoid trapezium trapezoid complex and the trapezium first metacarpal joint compartment. The radioscaphoid joint compartment, however, is typically spared unless there has been prior trauma. The PIP and DIP joints are also preferentially involved.

B. Incorrect. The bare area of the joint refers to the intracapsular portion of bone not covered with articular cartilage. These areas therefore are more susceptible to the inflammatory process, often an early site of erosion before the articular cartilage is destroyed and the joint narrowed.

C. Correct. Although the hyaline articular cartilage is a common site for urate disposition and subsequent tophi, intervening areas of noninvolved cartilage maintain the joint space until late in the course of the disease, when all of the cartilage may be destroyed. This differs dramatically from the inflammatory arthritides where cartilage destruction is a more uniform and more rapid process.

D. Incorrect. The carpal bones and tarsal bones may fuse during the progression of adult onset rheumatoid arthritis as the joints of the wrist and foot are uniformly destroyed. Otherwise, new bone formation is characteristically absent and is, rather, more typical of the sero-negative arthropathies. Bony ankylosis, periostitis, appositional new bone formation at the end of the bone (cupping), and ossification at the origin and insertion of ligaments and tendons (enthesopathy) are manifestations of this productive tendency.

Reference:

None

3. You are shown an AP radiograph and coronal fast spin-echo proton density image of a 13-year-old boy with knee pain (Figures 4A and 4B). What is the MOST likely diagnosis?

A. Enchondroma
B. Chondromyxoid fibroma
C. Clear cell chondrosarcoma
D. **Chondroblastoma**

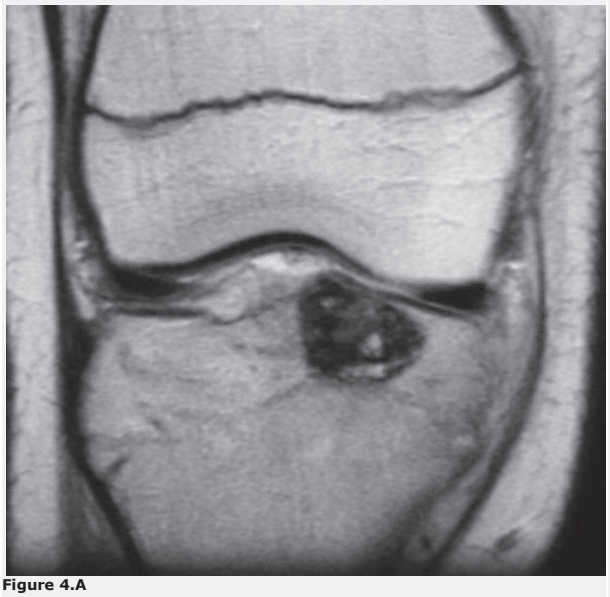


Figure 4.A

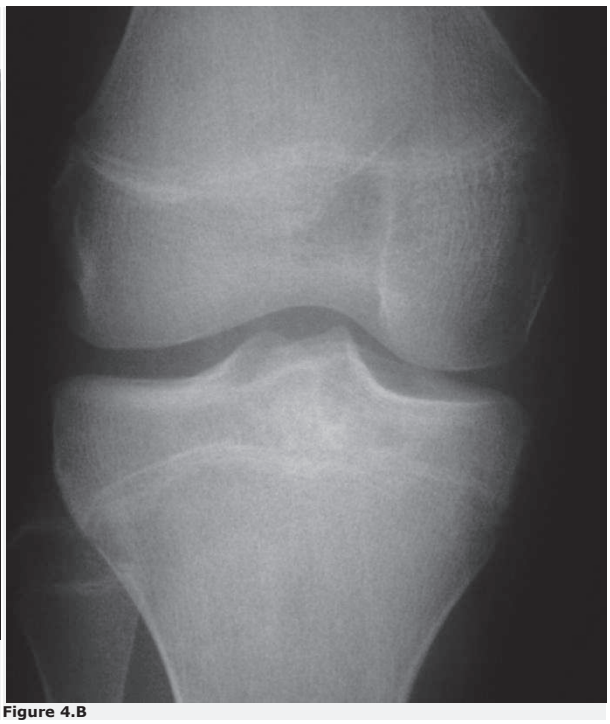


Figure 4.B

Rationale:

A. Incorrect. Enchondroma is a common lesion characterized by the formation of mature hyaline cartilage. It is seen throughout life, usually in young adults. In long tubular bones, enchondromas are most often metaphyseal. Conventional radiographs show a lytic lesion, with or without cartilaginous calcification, well-defined, with a lobulated border. Endosteal scalloping may be present with larger lesions. They are most common at the metacarpals and phalanges. Most are asymptomatic until pathologic fracture.

B. Incorrect. CMF is a rare metaphyseal lesion, most common about the knee. It is the least common benign cartilage neoplasm. Patients are adolescents and young adults. Conventional radiographs show an eccentric lesion with a sclerotic inner margin and some degree of expansile remodeling.

C. Incorrect. Clear cell chondrosarcoma, like chondroblastoma and giant cell tumor, is an end-of-the-bone lesion occurring in middle age and young adults. A rare, low grade malignancy, it is most common at the proximal femur and humerus. Conventional radiographs show a lytic lesion with well-defined sclerotic borders, similar in appearance to chondroblastoma, though usually larger. Lesions may also have poorly defined margins. About one third of cases show calcification within the lesion.

D. Correct. Chondroblastoma is a benign cartilaginous tumor of childhood that occurs in the epiphysis or apophysis, most commonly about the knee. Most patients are between 10 and 20 years of age. Patients may

present after reaching skeletal maturity. These lesions are usually small and well defined, usually with a sclerotic border. Conventional radiographs demonstrate cartilaginous calcification and periosteal reaction in less than half the cases. Associated bone marrow edema may be noted with MR imaging. There is a small, well defined lesion at the proximal tibial epiphysis.

Reference:

Dorfman and Czerniak Bone Tumors 1998, p253-254, 410-420 Resnick. Diagnosis of Bone and Joint Disorders. 4th ed. Saunders, 2002.

4. You are shown an AP radiograph (Figure 5) of a 20-year-old woman. Which one of the following is associated with this disorder?

A. **Malignant transformation**
B. Sexual precocity
C. Multiple fractures
D. Renal disease

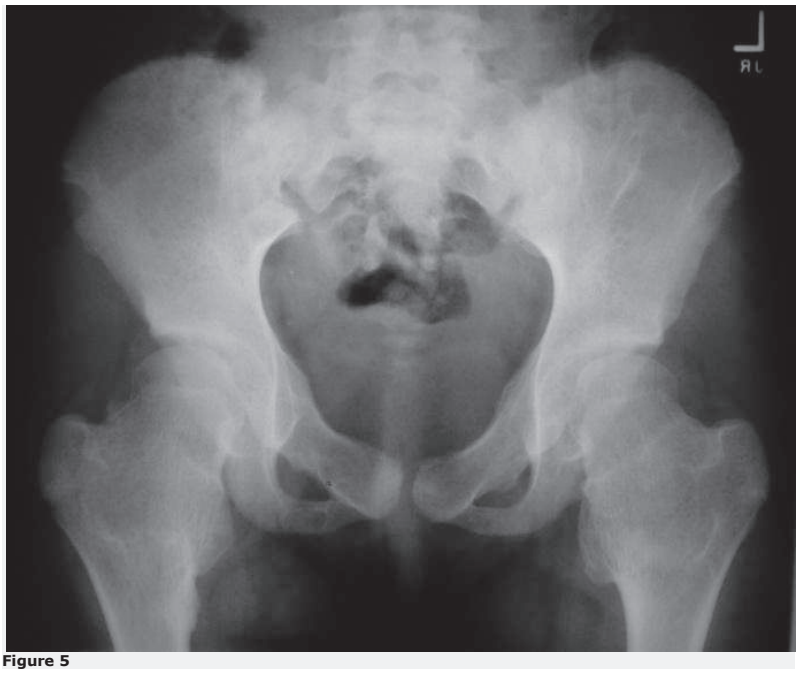


Figure 5

Rationale:

A. Correct. Malignant transformation to chondrosarcoma is a well known complication of multiple hereditary exostoses. The literature describes an incidence ranging from 1-25%, 2-5% more likely.

B. Incorrect. Sexual precocity or precocious pseudopuberty is associated with fibrous dysplasia, the McCune-Albright syndrome. Multiple sessile osteochondromata about the hips characterize this case of multiple hereditary exostoses.

C. Incorrect. Bone that is more prone to fracture is seen with many congenital/developmental and metabolic disorders including osteogenesis imperfecta, osteopetrosis, and renal osteodystrophy. Patients with multiple hereditary exostoses are not more prone to fracture.

D. Incorrect. Renal osteodystrophy is characterized by osteomalacia and secondary hyperparathyroidism. Radiographic findings include subperiosteal resorption, brown tumors, insufficiency fractures, osteopenia and osteosclerosis.

Reference:

Dorfman and Czerniak Bone Tumors 1998, p 343, Miller and Schweitzer Diagnostic Musculoskeletal Imaging, 2005, p 264-272 Resnick. Diagnosis of Bone and Joint Disorders. 4th ed. Saunders, 2002.

5. Concerning Type I Neurofibromatosis, which one of the following is associated?

A. **S-shaped scoliosis**
B. Posteromedial bowing of the tibia
C. Multiple exostoses
D. Atlanto-axial subluxation

Rationale:

A. Correct. Scoliosis and /or kyphosis are one of the most common problems of patients with Type I NFBT. Although a dysplastic, sharply angulated, short segment curve is virtually diagnostic, a typical S-shaped, idiopathic like, scoliosis is common.

B. Incorrect. Anterolateral bowing of the infant tibia and fibula is characteristic of Type I NFBT. Eventual fracture is difficult to treat with repeated episodes of non-union hence the term "congenital pseudarthrosis of the tibia and fibula."☐ Posteromedial bowing of the tibia and fibula is rare and more benign. The bow spontaneously straightens over time and any limb length discrepancy is easier to treat.

C. Incorrect. Numerous bony lesions/deformities are typical of Type I NFBT. Bony defects, scalloping, overgrowth, multiple non-ossifying fibromas have all been described. Multiple exostoses are not a manifestation of the mesodermal dysplasia.

D. Incorrect. Numerous congenital disorders are associated with ligament laxity and scoliosis, including Down's, Marfans, and Ehlos-Danlos Syndrome. Ligament laxity is not a feature of NFBT. Joints may be deformed but are stable. Atlanto-axial subluxation is not a complication.

Reference:

None

6. Concerning osteopetrosis, which one is TRUE?

A. In the adult, bone is more resistant to fracture and undergoes bone marrow suppression.
B. **Alternating bands of sclerosis indicate the fluctuating course of the disease.**
C. The radiographic hallmark is diffuse cortical thickening.
D. Osteoblastic activity results in excessive bone production.

Rationale:

A. Incorrect. The abnormal bone of adults with osteopetrosis is more prone to fracture. This is the most common complication. Bone marrow suppression is present in the infantile, lethal type.

B. Correct. The degree of abnormal diminished osteoclastic activity varies during skeletal growth and development. This results in alternating bands of sclerosis parallel to the respective growth plates.

C. Incorrect. The radiographic hallmark is the diffuse loss of corticomedullary junction in the long tubular bones. Skeletal dysplasias may be classified according to the type of bone formation, endochondral , intramembranous or both, that is affected by the diminished osteoclastic activity. These are further classified according to the stage of skeletal development, either primary or secondary. Osteopetrosis, for example, involves a defect in endochondral bone formation during the initial development of the skeleton. It is therefore, the medullary bone that is affected. Cortical or periosteal bone formation is intramembranous, without a preexisting cartilage template. A defect in intramembranous bone formation, therefore would result in cortical thickening as seen in progressive diaphyseal dysplasia (Engelmannâ€™s disease).

D. Incorrect. Defective osteoclastic activity and subsequent diminished bone resorption is felt to be the primary abnormality of the sclerosing dysplasias, infantile osteopetrosis being the most studied entity in this regard.

Reference:

None

7. Concerning mixed connective tissue disease, which of the following is TRUE?

A. Males and females are equally affected.
B. It is a combination of scleroderma, systemic lupus erythematosus, and polyarteritis nodosa.
C. Erosive disease is not characteristic.
D. **Serology is essential to diagnosis.**

Rationale:

A. Incorrect. Approximately 80% of patients are woman.

B. Incorrect. Mixed connective tissue disease (MCTD) is a disorder characterized by clinical abnormalities typical of SLE (systemic lupus erythematosus), PSS (progressive systemic sclerosis or scleroderma), dermatomyositis and rheumatoid arthritis.

C. Incorrect. Joint involvement is typical resembling the changes of rheumatoid arthritis. Occasionally, nonerosive deformities similar to SLE are seen.

D. Correct. The one feature of MCTD which distinguishes it as a unique disorder is a positive serologic test for antibody to the ribonucleoprotein (RNP) of extractable nuclear antigen (ENA).

Reference:

Miller and Schweitzer. Diagnostic Musculoskeletal Imaging. McGraw-Hill, NY, 2005. Greenspan, A. Orthopedic Radiology: A Practical Approach. Lippincott Williams Wilkins, 3rd. ed., 2000.

8. Concerning pars interarticularis defects, which of the following is TRUE?

A. Symptomatic spondylolisthesis is typically associated.
B. **Associated spondylolisthesis is most common at L5-S1.**
C. They represent an acute injury.
D. Magnetic resonance imaging is the preferred imaging method.

Rationale:

A. Incorrect. Only approximately twenty-five percent of patients with spondylolysis develop spondylolisthesis. Progression to significant slippage is uncommon.

B. Correct. Spondylolisthesis associated with spondylolysis is most common at L5-S1, approximately 90% of cases. The remainder usually occur at L4-L5. Spondylolisthesis associated with degenerative disease is most common at L4-L5.

C. Incorrect. Pars interarticularis defects are considered to represent fatigue stress fractures. Most are believed to develop in childhood. They are especially common in athletic children.

D. Incorrect. Imaging should begin with conventional radiographs. The lateral and oblique views are nearly equally sensitive in diagnosing the defect. CT also easily displays the lesion. SPECT imaging can be useful in identifying pars interarticularis defects that are symptomatic. Magnetic resonance imaging plays little role. Difficulty in recognizing an intact pars interarticularis leads to a low positive predictive value.

Reference:

Garry JP, McShane J. Lumbar spondylolysis in adolescent athletes. J Fam Pract. 1998; 47(2): 145-149
Standaert CJ, Herring SA. Spondylolysis: a critical review. Br J Sports Med 2000; 34(6): 415-422 Resnick. Diagnosis of Bone and Joint Disorders.4th ed. W.B. Saunders, NY, 2002

9. Concerning the vertebral column, which of the following is TRUE?

A. Paget's Disease spares the posterior elements.
B. **Hematogenous infection preferentially seeds the vertebral body.**
C. Soft tissue extension excludes the diagnosis of hemangioma.
D. The inflammatory spondyloarthropathies spare the intervertebral discs.

Rationale:

A. Incorrect. Paget's disease of the spine typically involves the vertebral body and the posterior elements. This may be a helpful diagnostic clue when differentiating Paget's disease, blastic metastases/ lymphoma and hemangioma.

B. Correct. Hematogenous infection of the spine begins as an osteomyelitis near one of the vertebral body endplates. Typically, the infection then spreads across the disc to the adjacent vertebral body resulting in destruction and erosion of the endplates and disc. Less commonly, the infection may spare the disc tracking beneath the anterior or posterior longitudinal ligaments, a pattern usually seen with tuberculous involvement. Despite the use of the term "discitis," infection involving the spinal column rarely originates within the disc itself.

C. Incorrect. Large hemangiomata may extend beyond the cortex into the para vertebral soft tissues and be symptomatic.

D. Incorrect. The inflammatory spondyloarthropathies comprise the sero-negative disorders which typically involve synovial, cartilaginous and fibrous joints. The cartilaginous joints in the adult skeleton are the intervertebral discs and the symphysis pubis. Syndesmophyte formation and subsequent ossification of the intervertebral disc in patients with ankylosing spondylitis is an example of such involvement.

Reference:

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

10. Concerning the osteochondroses, which of the following entities represents normal development?

A. Kohler's
B. Scheurermann's
C. Kienbock's
D. **Sever's**

Rationale:

A. Incorrect. The osteochondroses compromise a group of entities characterized by involvement of the epiphysis, apophysis or epiphyseoid bone with radiographic findings of fragmentation, collapse and sclerosis suggesting osteonecrosis. Although some of these entities represent osteonecrosis, others are the sequela of abnormal stress and others represent normal development. Kohlerâ€™s disease involves the tarsal navicular and is rare. It is a self-limited disorder, difficult to distinguish from variations of normal ossification. When a child is symptomatic and radiographic findings of flattening and sclerosis are detected in a previously normal navicular bone, the diagnosis of osteonecrosis is more certain.

B. Incorrect. Scheuermann's disease represents a growth disturbance of the spine characterized by multilevel anterior vertebral body wedging, vertebral body endplate irregularities with Schmorl's node formation and increasing thoracic kyphosis. These changes are variable and most likely secondary to stress related intraosseous displacement of disc material (cartilagenous node formation) through cartilaginous endplates weakened on a congenital or traumatic basis.

C. Incorrect. Kienbock's disease represents osteonecrosis of the lunate seen in patients 20-40 years of age.

D. Correct

Reference:

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