



Introduction

Plain film evaluation is the most ubiquitous radiologic examination ordered for musculoskeletal and pain complaints. This chapter will discuss the most important findings in common conditions.

Peripheral Joint Plain Film Evaluation

Primary joint centered pain can be seen in a wide range of pathology. This section is designed to be a short introduction into the differentiation between degenerative joint disease (DJD) or osteoarthritis (OA), inflammatory arthritis and avascular necrosis (AVN). Despite having common findings occurring in a predictive course, these processes can coexist with overlapping findings at a single joint.

Degenerative Joint Disease

OA is the result of articular cartilage damage and wear over time related to repetitive microtrauma of a synovial joint. The radiographic appearance of typical OA begins with marginal osteophyte (bony spur) formation, an attempt to stabilize the

joint after early articular cartilage damage is sustained. Subsequent radiographic findings serve to grade the severity of OA and include joint space narrowing (classically asymmetric), subchondral sclerosis and subchondral cyst formation.

OA changes in the knees and hips typically begin after the 4th and 5th decade of life. The hip demonstrates superior and lateral, rather than medial migration as this is the predominant weight-bearing location in the joint. Frog-leg views better reveal rim or collar osteophytes that can be seen in patients with underlying acetabular dysplasia.

In the shoulder, small osteophytes are typically seen along the inferior margin of the glenoid rim. Joint space narrowing is best visualized on a Grashey view, which is directly oriented along the line of the joint space. In advanced shoulder and hip OA, all of the previously mentioned markers of OA can be seen with severe joint space narrowing, subchondral sclerosis/cystic change and large, bulky osteophytes [1].

Inflammatory Arthritis

The hallmark radiographic finding for a chronic joint centered inflammatory process is the marginal erosion and overall lack of bony proliferation. Articular cartilage is relatively resistant to inflammatory mediators in the joint space and protects the subchondral bone plate. This leaves the exposed bone at the cartilage margin prone to destructive changes which manifest as erosions on radiographs. The erosions are

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sometimes small in the early stages of disease. Multiple views can often aid in their detection. Uniform joint space narrowing is a second important finding within an inflamed synovial joint. Lastly, soft tissue swelling can be seen as extension into the surrounding tissues. In chronic disease, hyperemia of the joint leads to periarticular osteopenia.

Radiographic findings in rheumatoid arthritis (RA) include erosions, uniform joint space narrowing and soft tissue swelling. Untreated disease can become quite severe and result in significant deformity as subluxation develops.

Classic findings of RA in the hips are seen as acetabular protrusion, which appears as medial (axial) migration of the femoral heads which cross over the iliopubic lines. This is in contradistinction to OA which results in superior and lateral migration [2].

Avascular Necrosis

Osteonecrosis, also termed avascular necrosis or ischemic necrosis, results from lack or complete loss of blood flow to bone. As most patients are asymptomatic, the true incidence of this process is likely underestimated. Commonly involved sites are the femoral and humeral heads, the knee (including distal femur and proximal tibia), femoral metadiaphysis, tibial metadiaphysis, as well as other bones including the scaphoid, lunate and talus.

There are a wide variety of etiologies for osteonecrosis, which are most commonly idiopathic, post-traumatic and chronic corticosteroid use, however, alcoholism, sickle cell anemia, and collagen vascular disease are also commonly associated. Radiographic findings in the early changes of AVN are patchy sclerosis with central lucency. Weakening of the bone can lead to subchondral collapse and eventually secondary osteoarthritis as the articular cartilage is no longer supported by the underlying trabecular bone, a finding that is most effectively evaluated with magnetic resonance imaging (MRI).

Spine Plain Film Evaluation

Degenerative Changes in the Spine

Degenerative disc disease (DDD) manifests as intervertebral disc desiccation and/or herniation. The presence of gas in intervertebral disc is referred to as “vacuum disc phenomenon” and is typical for DDD. Complications include spinal canal stenosis, neural foraminal stenosis from the disc as well as degenerative spondylolisthesis which produce destabilization leading to compensatory facet hypertrophy, end plate osteosclerosis and osteophytosis which subsequently cause bony spinal canal and neural foraminal narrowing.

Vertebral body and intervertebral disc articulations are fibrocartilaginous joints. As OA affects only synovial joints, OA occurs only in facet and uncovertebral joints (in C3–7 cervical spine) [3].

Cervical Spine

The C1 vertebra is also called the “atlas” and the C2 vertebra as the “axis.” The axis has an elongated process called the dens and is also the most superior vertebral body which will aid in counting of vertebrae in the cervical spine. Increased atlanto-dental interval (>2.5 mm) can be seen in ligamentous laxity and subluxation. The base of clivus is also called the basion. Increased basion-dental interval (>12 mm) suggests craniocervical dissociation [3, 4].

There are four critical lines which should be evaluated on every lateral cervical spine examination. Anterior and posterior vertebral lines trace the anterior and posterior margins of the vertebral bodies, respectively. Spinolaminar and spinous process lines trace the posterior margin of spinal canal and posterior tip of spinous processes, respectively. Any discontinuity in these four lines should raise suspicion for possible injury.

Evaluation of neural foraminal narrowing is best performed using oblique views in the setting of chronic pain.

Thoracolumbar Spine

A three column concept is used to assess the stability of thoracolumbar spine. The anterior column comprises the anterior two-third portion of vertebral bodies and anterior longitudinal ligament. The middle column includes the posterior one-third of the vertebral bodies and posterior longitudinal ligament. The posterior column includes the posterior elements of the vertebral bodies and posterior ligaments including supraspinous and infraspinous ligaments, and the ligamentum flavum [3, 5].

Spondylolysis refers to fracture of the pars interarticularis whereas spondylolisthesis refers to anterior or posterior subluxation of one vertebral body over the vertebral body below it. Though spondylolisthesis can be seen with or without spondylolysis, spondylolysis is usually associated with significant degree of spondylolisthesis [3, 5]. The most common causes of spondylolisthesis, however, are degenerative in nature.

The “*scotty dog*” sign refers to the normal appearance of lumbar spine seen on 15–25 degrees oblique radiographic projections. On these views, the transverse process forms the nose, the pedicle forms the eye, the inferior articular facet forms the front leg, the superior articular facet forms the ear and the pars interarticularis forms the neck of the scotty dog. Pars interarticularis refers to the portion of lamina between the facets. On an oblique radiograph, spondylolysis appears as defect (or collar) in the neck of “scotty dog”.

Diffuse Idiopathic Skeletal Hyperostosis

Diffuse idiopathic skeletal hyperostosis (DISH) is defined as large, bridging, bulky, anterior osteophytes across at least four vertebral levels with normal intervertebral disc spaces. It is typically seen in elderly patients and has an unknown etiology. It is usually asymptomatic, however, it can present with dysphagia in cervical spine. The osteophytes themselves are classically not painful, however, they can fracture which can cause severe pain. There has to be a high clinical suspi-

cion for fracture and comparison studies are usually necessary to make the diagnosis. DISH is typically associated with ossification of the posterior longitudinal ligament which can lead to spinal canal stenosis [3]. DISH is often contrasted with ankylosing spondylitis (AS).

Ankylosing Spondylitis

In contrast to DISH, AS presents with thin bridging osteophytosis and can be quite painful without significant radiologic findings. Spinal involvement typically ascends from the lumbar to the cervical spine. It is important to remember that AS presents with symmetric inflammatory sacroiliitis which means the osseous changes, including erosions, widening and sclerosis will be symmetric, unlike psoriatic arthritis and reactive arthritis (which are important diagnoses but beyond the scope of this review chapter). Romanus lesions (erosions of edges of endplate) and shiny corners are typically seen in the spine but best identified earlier on MRI. In later stages, squaring of vertebral body disc margins develop. In advanced cases, spinal ankylosis (bamboo spine) occurs and only minor trauma can result in fracture [3].

Sacroiliac Joints

The superior portion of sacroiliac joint is a syndesmotic joint and the inferior portion of sacroiliac joint is a synovial joint. As mentioned earlier, osteoarthritic changes are only seen in synovial joints, so typical degenerative changes are only seen at the inferior portion of sacroiliac joint. If erosions are seen superiorly, consider alternative diagnoses such as inflammatory conditions.

High Yield Points

- Degenerative joint disease, inflammatory arthritis as well as avascular necrosis represent a few commonly encountered diagnoses in the evaluation

of joint pain, each of which demonstrate characteristic radiographic findings.

- Complications of DDD include spinal canal stenosis, neural foraminal stenosis and degenerative spondylolisthesis.
- Any discontinuity in four critical lines should raise suspicion for possible injury to cervical spine.
- Three column concept is used to assess the stability of thoracolumbar spine.
- “*Scotty dog*” sign refers to the normal appearance of lumbar spine seen on oblique radiographic projections.

- A. osteophytosis
- B. subchondral sclerosis
- C. subchondral cysts
- D. periarticular osteopenia

Answer: D

3. _____ column concept is used to assess the stability of thoracolumbar spine.
- A. One
 - B. Two
 - C. Three
 - D. Four

Answer: C

Questions

1. Periarticular osteopenia in inflammatory arthritis is typically caused by _____.
 A. Hyperemia
 B. Ischemia
 C. Infection
 D. Trauma
 Answer: A
2. All of the following are hallmarks of osteoarthritis EXCEPT:

References

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