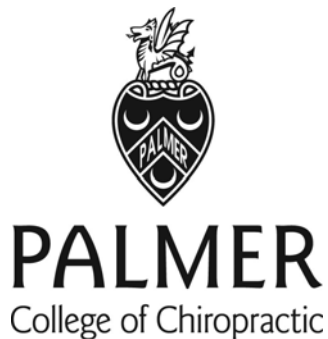


Imaging Practicum: Arthritis

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2007

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Imaging Practicum: Arthritis

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Iowa Communications Network
October 18, 2007

Arthritis

Classifications

- Degenerative arthritis:
 - Primary
 - Secondary
- Inflammatory arthritis & connective tissue arthritis
 - Seropositive: Rheumatoid
 - Seronegative: Psoriatic, Enteropathic, Ankylosing spondylitis, Reiter's (Reactive)
 - Connective Tissue: SLE, Jaccoud's, scleroderma
- Metabolic (crystal-induced) arthritis
 - Gout, CPPD, HADD

Factors that help distinguish arthritides

- Patient age and gender
- Clinical symptoms:
 - Joint swelling, stiffness, ROM
- Laboratory studies:
 - ESR, RA factor, ANA, HLA-B27
- Plain film appearance:
 - Mono or polyarticular
 - Sites of joints involved

Degenerative Arthritis

Osteoarthritis

- AKA: degenerative joint disease, degenerative disc disease, degenerative spondylosis, spondylosis deformans
- OA is the most common of all the arthritis types
- OA and cardiovascular disease are the most common causes of disability

Osteoarthritis (OA): Etiologies

- Primary: AKA—idiopathic
 - Used when the cause of the OA is unknown
- Secondary: The most common category
 - Trauma
 - Congenital deformities (DDH-hip dysplasia-- blocked vertebrae, achondroplasia)
 - Avascular necrosis/Legg-Calve-Perthes
 - Paget's disease and other bone diseases
 - Collagen diseases

Osteoarthritis: Risk Factors

- Age
- Gender
- Obesity
- Physical activity
- Trauma
- Heredity
- Bone density?

Osteoarthritis: Findings—IVD

- A patient with DDD can demonstrate any or all of the following:
 - Decreased disc space
 - Osteophyte formation
 - Vacuum phenomenon
 - Intercalary ossicle
 - Posterior translation (retrolisthesis)
 - Subchondral sclerosis (eburnation)
 - Schmorl's nodes
 - Uncinate (Luschka joint) hypertrophy—C-spine

Osteoarthritis: Findings—Spine

- A patient with OA of the spine can demonstrate any or all of the following:
 - Posterior facet arthrosis (hypertrophy and shape change of the articular surfaces)
 - Anterior translation (anterolisthesis)
 - Do you know another name for anterolisthesis?

OA of the Spine: Disc Herniation

- Nomenclature
 - Bulge: symmetrical or asymmetrical; < 3mm of extension beyond the body
 - Herniation: Disc material displacement; > 3mm
 - Focal: < 25% of circumference involved
 - Broad-based: 25-50% of circumference involved
 - Protrusion: width > depth
 - Extrusion: width < depth
 - Sequestration: extrusion that has detached

Associated Conditions: DISH

- Diffuse idiopathic skeletal hyperostosis
- AKA: ankylosing hyperostosis, Forestier's
- Age: more common in middle-aged and elderly
- Gender: more common in males
- Co-existing conditions: seen more in diabetic patients (13-49%) than the general population (8-20%)

DISH: Findings

- DISH can occur anywhere, but the ALL is most commonly involved
- DISH can be confused with OA and AS, so the following criteria are used for DISH:
 - 4 contiguous segments demonstrating flowing ossification of the ALL
 - Preservation of disc height
 - No evidence of sacroilitis or facet ankylosis
- Also helpful to note that the ossification follows the path of the ALL, mid-body to mid-body insertion

Ossification of the Posterior Longitudinal Ligament (OPLL)

- AKA: “Japanese Disease”
- Can occur alone or with DISH
- Age: elderly
- Gender: 2 times as common in males
- Complications:
 - Can significantly narrow the canal (25% of OPLL patients have cervical cord compression)

OPLL: Findings

- The ossification of the PLL will be more linear than ossification of the ALL
- On the lateral view, a thin rod of calcification or ossification may be seen adjacent to and paralleling the vertebral bodies
- CT is the best examination

DISH and OPLL: Management

- Because of the high association with diabetes, serological testing is advised
- Possible complications:
 - Spinal stenosis
 - Dysphagia, hoarseness
 - Spinal fracture (rare)
- CT and MRI are helpful to evaluate stenosis and neurological compromise
- Can you adjust these patients?

Associated Conditions: OCI

- Osteitis Condensans Illii
 - Triangular shaped ILIAC-based sclerosis
 - Most common in multiparous females, rarely in males
 - Usually bilateral, but asymmetrical
 - NO EROSIONS (DDX from AS, Psoriasis)
 - Dedicated S-I views are helpful
 - Clinical significance? Possible low back pain

Complications of OA of the Spine

- Spinal stenosis
- Causes: Bony or soft tissue:
 - OA, disc herniation, DISH, OPLL, Paget's, hemangioma, congenital anomalies or dysplasias can all narrow the canal space

Osteoarthritis: Findings—Extremities

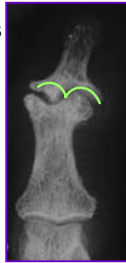
- A person with OA of a joint can have any or all of the following:
 - Decreased joint space (asymmetrical loss)
 - Joint misalignment
 - Subchondral sclerosis
 - Subchondral cysts (geodes)
 - Osteophyte formation
 - Joint fragments (joint mice)

Associated Conditions: Erosive OA

- AKA: Kellgren arthritis – Primary degeneration of the inter-phalangeal articulations
- Age: middle-aged, but slightly younger than secondary OA
- Gender: more common in postmenopausal females
- More likely to be painful than secondary OA

Erosive OA: Findings

- DDX: secondary OA, RA, and psoriasis
- Distal IP more than proximal
- Usually bilateral
 - Secondary OA is usually unilateral and involves the proximal joints more
 - RA usually involves the wrists and MCPs
- Central joint erosions = “gull wing” appearance on PA views
 - Psoriasis also likes the DIPs, but the erosions are marginal with periostitis



Osteoarthritis: Management

- Plain films
- Consideration for advanced imaging (especially for disc herniations, spinal stenosis)
- Adjustments
- Lifestyle modifications
- Physical therapy
- Pharmacology
- Surgery

Inflammatory Arthritis

Classifications

- Seropositive arthritis
 - Adult rheumatoid arthritis (RA)
 - Juvenile rheumatoid arthritis (JRA)
- Seronegative arthritis
 - Both RA and JRA have forms that are seronegative
 - Psoriatic
 - Enteropathic
 - Ankylosing spondylitis
 - Reiter's (Reactive)
- Connective tissue arthritis
 - Systemic lupus erythematosus (SLE, lupus)
 - Jaccoud's arthropathy
 - Scleroderma

Rheumatoid Arthritis (RA): Demographics and Etiology

- Women: 3:1
- Age: onset is usually 40-70 years
- Proposed etiologies:
 - Genetics
 - Immunological factors (T cell initiated changes)
 - Hormonal factors
 - Environmental factors

Rheumatoid Arthritis

- RA is an autoimmune, multisystem disease and is the most common of all the inflammatory arthritides
- The hallmark of RA is the formation of a PANNUS (hyperplastic synovitis)
- The pannus causes:
 - Symmetrical loss of joint space
 - Erosions (leading to cartilage and bone destruction)

RA: Joint Involvement

- Although RA can begin in one joint, the distribution is typically polyarticular
- **BILATERAL and SYMMETRICAL**
- Can involve any synovial articulation, but especially prevalent at:
 - Hands
 - Wrists
 - Shoulders
 - Feet
 - Knees
 - Hips
 - Any synovial articulation of the spine

RA: Findings—Extremities

- The first signs of this INFLAMMATORY disease are soft tissue swelling within the capsule—seen both clinically and on x-ray
- Inflammation causes hyperemia—which then can lead to juxta-articular osteoporosis
- Uniform joint space narrowing (symmetrical)
- Erosions that begin in the “bare area” and eventually involve the entire articular surface
- Subchondral cysts may form
- Joint deformity
- Bony fusion

RA: Findings—Hands and Feet

- RA is typically demonstrated in the hands and feet first
- Bilateral and symmetrical
- Uniform loss of joint space
- MCP and PIP first (OA likes DIP and PIP)
- Swan neck deformity: flexion at DIP and extension at PIP)
- Boutonniere deformity: extension at DIP and flexion at PIP
- Ulnar deviation of fingers or toes at MCP

RA: Findings—Wrists

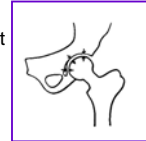
- RA loves the WRIST!
- Erosions of the radial and ulnar styloid processes
- Erosions in the carpals (spotty carpal sign)
- Eventual carpal fusion

RA: Findings—Shoulders

- Erosions at the AC joint, sometimes causing resorption of the distal clavicle
 - DDX: RA, hyperparathyroidism, and trauma cause resorption of the distal clavicle
- Erosions can be seen in the humeral head and the acromion process
- Erosions around the supraspinatous tendon lead to a rotator cuff tear, which results in elevation of the humeral head
 - Roentgenometric: decreased acromiohumeral space

RA: Findings—Hips

- As the acromiohumeral joint space can be diminished, so can the iliofemoral joint space
- The joint space has 3 divisions: superior, medial, and axial (oblique)
- RA causes UNIFORM loss of the joint space in all 3 divisions
 - DDX: OA causes joint space loss most commonly in the superior direction



RA: Findings—Knees

- Uniform loss of joint space
 - DDX: OA causes joint space loss on the medial side
- Joint deformity can occur (genu valgus more commonly than genu varus)
- As in all other joints, secondary OA can occur, demonstrating subchondral sclerosis, subchondral cysts
- Soft tissue complications:
 - Bursal formation, Baker's cyst

RA: Findings—Spine

- Though any synovial articulation can be involved the atlantoaxial joints are most commonly involved
 - About 50% of RA patients have cervical involvement
- Pannus formation can occur around the insertion of the transverse ligament, resulting in ligament laxity or rupture
 - How can we best look for transverse ligament laxity?

RA: Findings—Spine

- Plain film evaluation of the RA patient should include cervical flexion and extension radiographs
- Both the ADI and the spinal canal space at C1/C2 should be examined
- MRI may be needed for neurological evaluation

RA: Investigation

- Clinical signs (per Amer. College of Rheumatology)
 - AM stiffness lasting more than 1 hour (6 weeks)
 - Swelling of at least 3 joints (6 weeks)
 - Swelling of the wrist, MCP, or PIP joints (6 weeks)
 - Symmetric swelling (6 weeks)
 - Rheumatoid nodules
 - Positive RA factor
 - Radiographic evidence of RA
- Laboratory studies:
 - RA factor is positive in 70-80%
 - ESR
 - CRP
 - ANA

RA: Management

- Can you adjust the patient with RA?
- Adequate sleep
- Dietary changes or supplements
- Exercise
- Joint mobilization
- Pharmacology: NSAIDs, Anti-Rheumatic drugs, corticosteroids
- Radiographic re-evaluation: every 6 months for 2 years
- MRI when necessary
- Surgical joint replacement

Seronegative Spondyloarthropathies

Seronegative Spondyloarthropathies

- PEAR: psoriatic, enteropathic, AS, and Reiter's/Reactive arthritis
- Many clinical and radiographic similarities
- Similar laboratory findings

Ankylosing Spondylitis (AS)

- AS is the most common seronegative spondyloarthropathy
- AKA: Bechterew's, Marie-Strumpell
- Males: 2:1 to 8:1 ratios reported
- Clinically, onset of low back pain and stiffness begins around late adolescence to mid-thirties
- HLA-B27 is positive in more than 90%
 - Positive in 6-8% of general population

AS: Findings—Sacroiliac joints

- AS loves the SI joints!
- SI joints are typically the first site of involvement and almost always precedes any spinal involvement
- As with the other inflammatory arthropathies, erosions are characteristic
- About half of AS patients will eventually have full ankylosis of the SI articulations

AS: Findings—Spine

- Approximately half of AS patients will have spinal involvement, primarily of the thoracic and lumbar regions
- Any entheses (ligament or tendon attachment to bone) or synovial articulation can be affected
- Important signs to note:
 - Squaring of the vertebrae
 - Syndesmophytes (why not osteophytes?)
 - Dagger sign
 - Railroad sign
 - Trolley Track sign
 - Shiny corner sign
 - Romanus lesion
 - Disc calcification
 - Andersson lesion

AS: Investigation

- Clinical and demographic correlation
- Plain films are good tools
 - Dedicated SI views should be accomplished
- MRI and CT may further define the osseous changes, as well as characterize any neurological complications
- Laboratory studies
 - HLA-B27 (90% positive, but not specific)
 - ESR (usually positive, but not specific)
 - RA factor (negative)
 - ANA (negative)

AS: Management

- Patient education for safe activities
- Joint mobilization to decrease or delay ankylosis and deformities
- Exercise
- Pharmacology
 - NSAIDs, tumor-necrosis factor-alpha

Enteropathic Arthritis

- Enteropathic arthritis is associated with bowel disorders:
 - Crohn's
 - Ulcerative colitis
 - Whipple's disease
 - Infections, i.e. Salmonella, Shigella, Yersinia, Chagas'
- Enteropathic arthritis can also be seen in intraabdominal diseases:
 - Liver (cirrhosis)
 - Pancreatitis

Enteropathic Arthritis: Etiology

- May arise from simultaneous infections of both the bowel and the joints
- May occur because of bowel infections that proceed to the joint
- May be the result of antibody production for the bowel that affects the joints
- May be the result of a genetic predisposition

Enteropathic Arthritis: Findings

- The axial and appendicular skeletons are variably involved, influenced by which bowel disease is present
- Enteropathic arthritis can mimic AS in the axial spine and early RA in the appendicular skeleton (both clinically and radiographically)
- When the bowel disease flares up, so do the radiographic features

Enteropathic Arthritis: Investigation

- So, if EA mimics AS, how do you know which disease it is?
- Clinical history: IBS symptoms, hx of surgery
- Plain films
- GI studies: bowel contrast studies
- Laboratory:
 - HLA-B27: positive in 60-70%
 - ESR: usually elevated
 - ANA: negative
 - RA factor: negative

Enteropathic Arthritis: Management

- Treatment is focused on the management of the bowel disease
 - Anti-inflammatory medications
 - Bowel resections
- Ankylosis is not as common
 - Joint mobilization
 - Pain reduction

Psoriatic Arthritis

Psoriatic Arthritis

- Approximately 5-25% of patients with dermatological psoriasis develop the inflammatory arthropathy (the more severe the skin lesions, the more likely the arthropathy)
- The etiology is unknown, but it is thought to be an immune-mediated response to environmental triggers in those with genetic susceptibility
- Age: onset generally between 30-50 years
- No gender predilection

Psoriatic Arthritis: Findings

- PA likes the hands, feet, and axial skeleton
- Can range from mild to debilitating and mutilating
- Like AS, psoriatic arthritis demonstrates:
 - Erosions
 - Symmetrical joint space narrowing
 - Eventual ankylosis
- Unlike AS, psoriatic arthritis demonstrates:
 - Asymmetrical distribution
 - Normal bone density
 - Periostitis
 - Osteolysis

Psoriatic Arthritis: Findings—Digits

- Important signs of psoriatic arthritis:
 - Sausage digit: swelling of an entire digit
 - Ray pattern: involvement of all joints of a digit
 - Mouse ears: fluffy, disorganized periostitis
 - Pencil-and-cup: widening of distal margin with narrowing/whittling of the proximal margin, giving the appearance of one telescoping into the other
 - Acroosteolysis

Psoriatic Arthritis: Findings—Spine

- The SI changes mimic AS with erosions, sclerosis, and possible ankylosis
- But, the involvement is less likely to be bilateral and symmetrical than AS
- Enthesopathic changes are noted around the iliac crests and ischial tuberosities more so than in AS

Psoriatic Arthritis: Findings—Spine

- In psoriatic arthritis, the syndesmophytes are unlike those of AS
 - Non-contiguous (skip lesions—best seen on AP view)
 - Bulky
 - Asymmetric
 - Non-marginal (begin above the disc insertion)

Psoriatic Arthritis: Investigation

- If psoriasis is suspected on the plain films, an evaluation of possible cutaneous lesions should be performed
- Inspect for digital swelling and nail changes
- Laboratory:
 - HLA-B27: elevated in 25-60%
 - ESR: elevated
 - RA factor: negative
 - ANA: negative

Psoriatic Arthritis: Management

- Re-examination with plain films every 6 months for 2 years
- Monitor skin lesions
- Pharmacology:
 - Anti-inflammatories (NSAIDs)
 - Anti-rheumatic drugs

Reiter's Arthritis/Reactive Arthritis

- Not common
- Males: 5:1
- Age: adolescence to mid-thirties
- Typically follows a gastrointestinal (like enteropathic arthropathy) or genitourinary infection (STD)
- May also be linked to genetic factors
- Classic triad (minority of patients)
 - Arthritis
 - Urethritis
 - Conjunctivitis

Reiter's Arthritis: Findings

- Reiter's likes the lower extremity joints
- Distribution is asymmetric and can mimic psoriatic arthritis
- So, how can you tell them apart? Psoriatic is more common and likes the upper extremities more than Reiter's
- Reiter's may have one or more of the classic triad and does not as commonly demonstrate nail changes

Reiter's Arthritis: Investigation

- Clinical correlation: the arthropathy typically presents a few days to weeks after the initial GI or GU infection
- Laboratory:
 - HLA-B27: positive in about 75%
 - ESR: elevated
 - RA factor: negative

Reiter's Arthritis: Management

- Treatment of the underlying infection is the primary concern
- Pharmacology:
 - NSAIDs and other anti-inflammatory medications

Connective Tissue Arthritis

Systemic Lupus Erythematosus (SLE)

- SLE is a MULTI-SYSTEM disease process, affecting the musculoskeletal system, eyes, skin, liver, kidneys, GI system, chest
- Age: 30 to 50 years
- Gender: women of child-bearing age
- Race: blacks slightly higher than whites
- Clinically: malar rash in some, joint deformities in 90%

SLE: Findings

- The hallmark of SLE is NON-EROSIVE, REDUCIBLE joint deformities, though not present in all patients
- SLE likes the MCPs and PIPs of the hands
- Joint spaces spared
- Joint deformities: swan-neck and boutonniere
- DDX: RA has a similar distribution and deformities possible, but has erosions, reduced joint space
- DDX: Jaccoud's arthropathy (to follow)

SLE: Investigation

- Clinical correlation for skin lesions, photosensitivity, joint lesions, and other system diseases
- Laboratory:
 - ANA: antibodies present in almost all SLE pts
 - RA factor: may be present in minority
- Drug-induced lupus should be excluded

SLE: Management

- Treatment is focused on pain management and inflammation reduction
 - NSAIDs
 - Corticosteroids
- Use of sunscreens and avoidance of sun
- Treatment for co-current manifestations—renal, liver, lymphatics
- MRI for neurological compromise

Jaccoud's Arthropathy

- First described as a post-rheumatic fever complication
- Now known to be seen in other conditions, such as SLE, scleroderma, sarcoidosis
- Clinically, mimics SLE in the hands, but without the severe multi-system complications or pain
- Radiographically: **just like SLE**

Scleroderma

- Sclera = hard; derma = skin
- AKA: progressive systemic sclerosis (PSS)
- Age: 30-60
- Gender: marked female predilection
- Race: blacks affected more than whites

Scleroderma

- Like SLE, it is a MULTI-SYSTEM disease process
- Affects all connective tissues: skin, heart, blood vessels, kidneys, GI tract
- Some scleroderma types might also cause:
 - CREST: calcinosis, Raynaud's, esophageal lesions, sclerodactyly, and telangiectasia

Scleroderma: Findings

- Most PSS patients develop joint lesions, with the hands showing the most findings
 - Ungual tuft resorption (acro-osteolysis)
 - Soft tissue atrophy
 - Soft tissue calcification (often globular)
 - Erosions in the DIPs, PIPs, and CMC joints

Scleroderma: Investigation

- No single laboratory test will make the definitive diagnosis
 - ESR: elevated in most
 - RA factor: elevated in some
 - ANA: present in 90%
- Capillary refill time may be useful

Scleroderma: Management

- Chest films and CT
- Upper GI contrast studies for esophagus
- Treatments:
 - Avoidance of stimuli for Raynaud's
 - Diet
 - Physical therapy
 - Exercise
- Drug therapies: not well established, mostly reduce inflammation

Metabolic Arthritis/ Crystal-Induced Arthritides

Gout

- Gout is the most common inflammatory arthritis in men older than 40
- Onset: 40-50 years
- Gender: 20 times more common in men

Gout: Etiology

- Gout is associated with hyperuricemia (from purine metabolism)
- The excess uric acid occurs either because the kidneys don't excrete enough or because too much is produced
- Only about 20% of patients with hyperuricemia develop the arthritic changes
- 2 forms: primary/idiopathic (MC) and secondary (acquired disorder)

Gout: Phase

1. Asymptomatic gout: hyperuricemia without clinical symptoms (>20 years to develop)
2. Acute gouty arthritis: "attacks" typically involving the 1st MTP joint first
3. Intercritical gout: periods of remission; could last weeks, months, or years
4. Chronic tophaceous gout: radiographic evidence of gout; could take > 10-12 years to develop (if ever)

Gout: Findings

- Tophaceous gout: Gout is a slow, indolent process; therefore, the radiographic findings appear less aggressive than other inflammatory arthritides
- Tophi are deposited in and around joints, causing the bony changes
- Erosions—some with "overhanging margins"; typically better defined than in other arthritides
- "Lumpy-Bumpy" joints—seen both clinically and radiographically

Gout: Investigation

- Laboratory:
 - Blood urate levels > 7 mg/dl = hyperuricemia
 - May need to be repeated due to remission
- Plain films:
 - Early gout will not be radiographically evident, even if the patient is clinically symptomatic

Gout: Management

- Pain management options: anti-inflammatory medications (NSAIDs, corticosteroids)
- Lifestyle modifications:
 - Evaluation of triggers that lead to attacks:
 - High meat diets, seafood
 - Alcohol use, drug use
 - Legumes
 - Yeast
 - Obesity

Calcium Pyrophosphate Deposition Disease (CPPD)

- Age: prevalence increases with increasing age; rare before 40
- Gender: no gender preference
- Etiologies: unknown, but is often associated with hyperparathyroidism, diabetes, hemochromatosis, gout, and neuropathic arthropathies

CPPD

- CPPD causes crystal deposition in the joints
- CPPD likes knees, wrists, MCPs, pubis
- 3 Presentations of CPPD:
 - Chondrocalcinosis: CPPD is the MC disease to cause cartilage calcification, but not the only crystal to do so
 - Pyrophosphate arthropathy: Intra-articular deposition of crystals that cause joint arthropathy
 - Pseudogout: symptomatic CPPD with inflamed joints that mimic gout

CPPD: Findings

- Chondrocalcinosis: cartilage calcification can occur in both the hyaline cartilage and the fibrocartilage
 - Hyaline calcification: appears to outline the articulation
 - Fibrocartilage calcification: thick, irregular calcification, especially the knee menisci, glenoid and acetabular labrum, triangular fibrocartilage of the wrist
- Pyrophosphate arthropathy: mimics severe OA, but in atypical OA locations or distributions (non-weight-bearing); progressive

CPPD: Investigation

- Clinically, CPPD may mimic acute phases of RA or gout
- Plain films: not all CPPD shows chondrocalcinosis; may be difficult to distinguish from primary OA
- Laboratory:
 - Confirmatory: joint aspiration with evaluation of crystals
 - To DDX from other diseases:
 - RA factor: negative
 - Uric acid levels: normal
 - Glucose levels

CPPD: Management

- Exercise
- Adequate rest
- Joint mobilization
- Pharmacology:
 - NSAIDs

Hydroxyapatite Deposition Disease (HADD)

- Easy to confuse with CPPD, but is radiographically distinct
- An acceptable synonym: calcific tendonitis
- Age: onset usually above age 40
- Gender: no preference demonstrated
- Etiologies:
 - Degenerative process
 - Trauma
 - Genetic factors
- Clinically, usually asymptomatic, but could present with edema and swelling

HADD: Findings

- Typically MONOARTICULAR, though multiple sites of involvement are possible
- HADD likes:
 - Shoulder (MC)
 - Hand, wrist, elbow
 - Hip
 - Cervical spine and lumbar spine
- Characteristically: globular calcification in a tendon, without affecting the underlying bone

HADD: Investigation

- Plain films ordered for other reasons may reveal the calcification in an asymptomatic patient
- Laboratory:
 - Not specific for HADD, but may exclude other illnesses

HADD: Management

- If symptomatic, pain management can consist of:
 - NSAIDs and other anti-inflammatories
 - Physical therapy modalities
 - Massage