Radiographic Evaluation of Arthritis
“The Many Types of Arthritis that affect our Patients!”

DANIEL P. EVANS, DPM, FACFAOM
Professor, Department of Podiatric Medicine and Radiology
Dr. Wm. Scholl College of Podiatric Medicine
CONFLICT OF INTEREST

I have no conflicts of interest pertaining to the material presented in this lecture.
OUTLINE

- Incidence of Arthritis of the Foot and Ankle
- Various Arthritides of the foot and ankle
- How Radiographic Evaluation assists in the diagnosis of Arthritis
HOW MANY DIFFERENT TYPES OF ARTHRITIS CAN YOU NAME?

Which of the Arthritides is the MOST common?
Classification of Arthritides

Non-Inflammatory
- Degenerative Joint Disease

Inflammatory
- **Seropositive Arthritide:**
  - Rheumatoid Arthritis
- Erosive Osteoarthritis
- **Seronegative Arthritides:**
  - Psoriatic Arthritis
  - Reactive Arthritis (Reiter’s Disease)
  - Ankylosing Spondylitis
  - Enteropathic

Metabolic
- Gout
- CPPD Disease

Neuropathic
- Neuropathic Joint Disease

Miscellaneous
- DISH (Diffuse Idiopathic Skeletal Hyperostosis)
- PHO (Pulmonary Hypertrophic Osteoarthropathy)
- PVNS (Pigmented Villonodular Synovitis)

Collagen Vascular Disorders
- SLE
- Scleroderma
Degenerative Joint Disease
Degenerative Joint Disease

AKA: Osteoarthritis

Local disorder of individual joints, independent of infection and systemic disease, brought out by abnormal mechanical conditions in conjunction with age, trauma or other degrading change in the articular cartilage
Degenerative Joint Disease

Asymmetric/Unilateral Joint Involvement with Asymmetric Joint Space Narrowing
So....
What joints of the foot do you think are prone to develop Degenerative Joint Disease?
Degenerative Joint Disease

Note the absence of erosions. Remember that OA has normal to increased bone mineralization. It is a “degenerative” arthridite not a “destructive/erosive” arthridite. Don’t mistake a subchondral bone defect or cyst for an erosion.
If we evaluate the x-ray before performing our physical exam, we would expect to find decreased ROM of the 1st MPJ left with possible crepitus & pain associated with dorsiflexion of the hallux. We would likely note a palpable exostosis/spur at the dorsal surface of the 1st MPJ as well as POP to that dorsal flag.
Degenerative Joint Disease

- Osteophyte
- Subchondral Sclerosis & Joint Space Narrowing (Ebarnation)
- Subchondral Cysts
Rheumatoid Arthritis
Rheumatoid Arthritis

- A chronic, systemic inflammatory disorder that may affect many tissues and organs, but principally attacks synovial joints.

- **Age of onset:** 40 – 60 yoa
  - Peak Incidence: 40 – 50 yoa, males = females
  - Between 20 – 40 yoa, females 3:1 males

- **Lab Findings:**
  - Seropositive for rheumatoid factor antibodies: 70-90%
  - Positive for Anti-CCP (Cyclic Citrullinated Peptide)

- **Distribution:**
  - C-spine
  - Bilateral joint involvement
  - Symmetrical joint space narrowing
So....
What joints of the foot do you think are prone to develop Rheumatoid Arthritis?
Rheumatoid Arthritis
Later Stage of RA with Fibular Deviation at the MPJs & Joint Destruction

*Toes will typically drift toward the outside of the foot due to thinning/weakening of the soft tissue structures at the plantar & medial aspect of joints.
Rheumatoid Arthritis

- **Forefoot** is the most common site for radiographic changes
  - Forefoot is the initial site of radiographic change in 15% of patients with RA
  - Of the FF joints, the 1st and 5th MPJs are most often affected first

- **Erosive processes** favor the medial-plantar aspect of the 1st-4th MPJs, medial aspect of the hallux IPJ, & medial/lateral aspects of the 5th MPJ
**RA: Soft Tissue Manifestation**

- **Rheumatoid Nodule:**
  - Extra-articular subcutaneous lesion/mass
  - 20%-30% of RA patients will develop nodules
  - Occur almost exclusively in patients who are rheumatoid factor positive
  - Usually located on extensor surfaces of the arms & elbows
  - Can develop at pressure points on the feet & knees
Rheumatoid Arthritis

Subtle 1st MPJ distention due to inflammation
Rheumatoid Arthritis

Narrowing of the ankle, STJ, and TN joint is a radiographic feature seen towards the end of the “early radiographic changes period” and continues on in the later stages of RA. Notice the disuse osteopenia/deossification & cortical thinning, as well as the presence of pseudocysts at the talar head/neck.
Rheumatoid Arthritis

In this x-ray, we see absent joint spaces throughout the lesser tarsus (signifying ankylosis) with the exception of the narrowed CC joint.
Rheumatoid Arthritis
Metabolic Arthritides
Gouty Arthritis
Gouty Arthritis

- **In-borne error of purine metabolism**
  - Hyperuricemia

- **Clinical features**
  - Age: 40 – 50 yoa
  - Gender: Male 20:1 Female

- **Lab findings**
  - Elevated serum uric acid
    - 10% uricosuric
  - Polarizing microscopy
    - Negatively bi-refringent urate crystals
    - Needle-shaped & blue in color when oriented perpendicular to the compensator
So….

What joints of the foot do you think are prone to develop Gouty Arthritis?
Gouty Arthritis
Gouty Arthritis

**Primary gout** (hormonal/genetic factors cause metabolic abnormalities)
- Hyperuricemia due to:
  - *Over-production* of uric acid due to error in purine metabolism
  - *Under-excretion* of urates by kidneys

**Secondary gout**
- Hyperuricemia precipitated by drug therapy or a medical condition
  - Drug therapy: **SPEED** - Salicylates, Pyrazinamide, Ethambutol, Ethanol, Diuretics (ie. thiazide - decrease excretion of uric acid)
  - Hyperparathyroidism – increases serum Ca which impairs renal excretion of urates
Gouty Arthritis

- Primary gout
  - Urate crystals are deposited in fairly avascular tissue:
    - Cartilage
    - Synovial membrane
    - Ligaments
    - Bursa
    - Subcutaneous tissue
Gouty Arthritis

Primary gout

- Hereditary tendencies:
  - Males after the age of 40
  - Females rarely (post-menopause or hysterectomy)

- Serum hyperuricemia may persist without producing symptoms

- Serum hyperuricemia usually present but may be reduced during an acute attack
Gouty Arthritis

- **Acute Monoarticular Gout (3-10 days)**
  - Quick onset
  - Severe crushing pain
  - Affected joint (usually 1st MPJ) edematous, hot and dry
  - 10% will never experience another attack
  - 60% experience a second attack within a year

Red, hot, swollen joint, so why isn’t Gout considered an Inflammatory Arthritis?

*Inflammation is short-lived (7-10 days)*
Polyarticular Gout

- Recurrent attacks may or may not affect joint initially involved
- Attacks less severe but prolonged
- X-ray changes in 33% of patients
Gouty Arthritis

**Chronic Gout**

- Increasingly uncommon due to current medications
- Joints become stiff, enlarged and deformed with extensive bone and joint destruction
- Presence of tophi (large multiple urate deposits)
Gouty Arthritis

Radiographic Features:
- First MPJ most often affected
  - Low pH (acidic) & low temperature can trigger urate crystal precipitation in tissues
  - Arthritic degeneration and increased vascularity
- X-ray findings appear late in disease usually after several years and multiple attacks and diagnosis already established
- Radiographs of little diagnostic value early
  - Rule out septic or infectious arthritis

The Spiral of Gout

Attack Starts

Crystals Form

Proteins lower pH making it possible for more crystals to form

White blood cells attack

Crystals ‘pop’ the cell

Proteins ‘call in’ more white blood cells and cause inflammation/pain

Cell releases proteins
Gouty Arthritis

Tophi
Gouty Arthritis

Tophi forming away from the 1\textsuperscript{st} MPJ
Inflammatory Seronegative Arthritides
Psoriatic Arthritis
True or False.

The vast majority of individuals suffering from Psoriasis will develop joint arthritis.
False.

Only 7 - 15% of patients with psoriasis will develop psoriatic arthritis.
Psoriatic Arthritis

**Incidence:**
- 7 - 15% of patients with psoriasis will develop psoriatic arthritis
- 80% in those exhibiting nail changes

**Clinical features:**
- Age: 20 – 50 yoa
- No gender predilection

**Lab findings:**
- HLA-B27 antigen
  - 25%-75% SI involvement
  - 30% with peripheral joint involvement (hands)

**Distribution:**
- Asymmetrical joint involvement (typically DIPJs)
- Unilateral joint involvement
Psoriatic Arthritis

Take Home Point: Erosions & Bone Formation
Psoriatic Arthritis

- **Soft-tissue changes**
  - Inflammatory synovitis leads to symmetrical soft-tissue edema around involved joint, similar to RA.
  - However, in PA the edema extends beyond joint creating a *sausage-like* appearance of the digit.
Psoriatic Arthritis

Soft Tissue Outline of a “Sausage Toe”
Psoriatic Arthritis

Periostitis
Psoriatic Arthritis

**Joint Spaces**
- Favors distal joints (DIPJs/PIPJs)
- Articular cartilage uniformly destroyed with symmetrical narrowing
- In smaller joints, the erosive changes create the illusion of a widened joint space

**Erosions**
- IPJ of hallux (common location)
- Acro-osteolysis ("acro" = tip; "osteo" = bone; "lysis" = destruction)
Psoriatic Arthritis

Erosions of the Distal Joints
Psoriatic Arthritis

“Pencil Point” Metatarsals
Reactive Arthritis
Reactive Arthritis

An aseptic, peripheral, idiopathic disease complex preceded by a history of diarrhea or sexual contact followed by:

- Conjunctivitis
- Urethritis
- Polyarthritis
- Mucocutaneous lesions
Reactive Arthritis

Saying:
“Can’t See, Can’t Pee, Can’t Climb a Tree”

- Feet are affected in 84-93% of patients suffering from Reactive Arthritis/Reiter’s Disease
- At presentation the knee & ankle are most commonly affected

- Previously known as Reiter’s Syndrome.
Hans Conrad Julius Reiter (February 26, 1881 – November 25, 1969) was an infamous German physician who was convicted of war crimes for his medical experiments at the Buchenwald concentration camp. He wrote a book on "racial hygiene" called Deutsches Gold, Gesundes Leben - Frohes Schaffen. Reiter was born in Reudnitz, near Leipzig in the German Empire. He studied medicine at Leipzig and Breslau (now Wrocław), and received a doctorate from Tübingen on the subject of tuberculosis. After receiving his doctorate, he went on to study at the hygiene institute in Berlin, the Pasteur Institute in Paris and St. Mary's Hospital in London, where he worked with Sir Almroth Wright for two years.[1] Reiter was also known for implementing strict anti-smoking laws in Nazi Germany.
Reiter was a member of the Schutzstaffel during World War II and participated in medical experiments performed by the Nazis. After the Nazis were defeated, he was arrested by the Red Army in Soviet Union-occupied Germany and tried at Nuremberg. During his detention, he admitted to knowledge of involuntary sterilization, euthanasia, and the murder of mental hospital patients in his function as the gatherer of statistics and acting as “quality control” officer, and to helping design and implement an explicitly criminal undertaking at Buchenwald concentration camp, in which internees were inoculated with an “experimental” typhus vaccine, resulting in over 200 deaths. He gained an early release from his internment, possibly because he assisted the Allies with his knowledge of germ warfare.
PLUS JAMAIS
NEVER AGAIN
NIE WIEDER
НИКОГДА БОЛЬШЕ
Reactive Arthritis

Clinical features
- Age: 18 – 40 yoa
- Gender: Male 50:1 Female

Lab findings
- HLA-B27 – 75%
- Elevated ESR

Distribution
- Asymmetrical joint involvement
- Unilateral joint involvement
- Lower extremity
- Axial skeleton involved 15%-30% of time in patients with family history or HLA-B27 +
Reactive Arthritis

Clinical features:

– Symptoms are mild and spontaneously regress
– Etiology unknown but attributed to gonococcal infection or chlamydia
– Clinical diagnosis

Two types:

- **Endemic** – venereal/genitourinary
- **Epidemic** – post-dysenteric (Salmonella infection/food poisoning/drinking contaminated water)
Reactive Arthritis

Clinical features (continued):

- **Endemic (venereal)**
  - Males 20-40 yoa

- **Epidemic (post-dysenteric)**
  - Women and children
  - More prevalent in Europe
Reactive Arthritis

Clinical features (continued):

- Prior history of diarrhea or sexual exposure 3-11 days prior to onset of classic triad:

- Conjunctivitis
- Urethritis
- Polyarthritis
  - Develops within a month of initial infection
  - Balanitis and keratoderma blennorrhagica are also consistent findings
- Triad can occur in any sequence and not all may be manifested
Reactive Arthritis

Retrocalcaneal Bursa with Rarefaction & Erosion
Reactive Arthritis

Enlarged Inferior Heel Spur
CONCLUSION

- There are many different forms of Arthritis.
- The foot and ankle are commonly affected by these disorders.
- Many of these Arthritic processes lead to marked pain and destruction of bone.
- Some may be associated with other disease processes.
- Radiographs are a crucial component in the diagnosis of these arthritic diseases.
THANK YOU!

DANIEL P. EVANS, DPM, FACFAOM
Professor, Scholl College of Podiatric Medicine