

Arthritis in the Foot and Ankle

Arthritis Facts

- According to the CDC, there are between 53.2 and 58.5 million adult Americans with a diagnosed arthritic condition (21.2-23.7% of adult population).
- From 2019 to 2021, the unadjusted prevalence of doctor-diagnosed arthritis in the United States (NHIS) was 24.2% among women and 17.9% among men.
- According to the CDC/NIH arthritis is the leading cause of disability in the US (17.5% of disabled persons)
- Prevalence of juvenile arthritis is 3.8 to 400 cases per 100000 children depending upon study designs, disease categories, and geographical areas.
- Arthritis describes over 100 conditions that involve inflammation and damage in the joints, the tissues around the joint, and other connective tissues.

Types of Arthritis

- Degenerative or mechanical arthritis
 - Typically referred to as *osteoarthritis*. May be due to old age, wear and tear, previous injury/trauma.
- Inflammatory arthritis
 - Characterized by damaging inflammation that does not occur as a normal reaction to injury or infection. This type of inflammation is unhelpful and instead causes damage to the affected joints, resulting in pain, stiffness, and swelling. It may affect several joints, and the inflammation can damage the surface of the joints and the underlying bone.
- Metabolic arthritis
 - Gout is the most common form of metabolic arthritis.
- Infectious arthritis
 - A bacterium, virus, or fungus that enters a joint may cause inflammation
- Septic arthritis
 - May develop when bacteria or other disease-causing microorganisms spread through the blood to a joint, or when the joint is directly infected with a microorganism through injury or surgery. Bacteria such as *Staphylococcus*, *Streptococcus*, or *Neisseria gonorrhoeae* cause most cases of acute septic arthritis.
 - Organisms such as *Mycobacterium tuberculosis* and *Candida albicans* cause chronic septic arthritis, although this is less common than acute septic arthritis.
 - Septic arthritis is an emergency as it can lead to rapid joint destruction and can be fatal.
- Connective tissue disorders
 - Connective tissues support, bind together, or separate other body tissues and organs. They include tendons, ligaments, and cartilage, therefore CTD often involves joint pain and inflammation.

General Symptomology

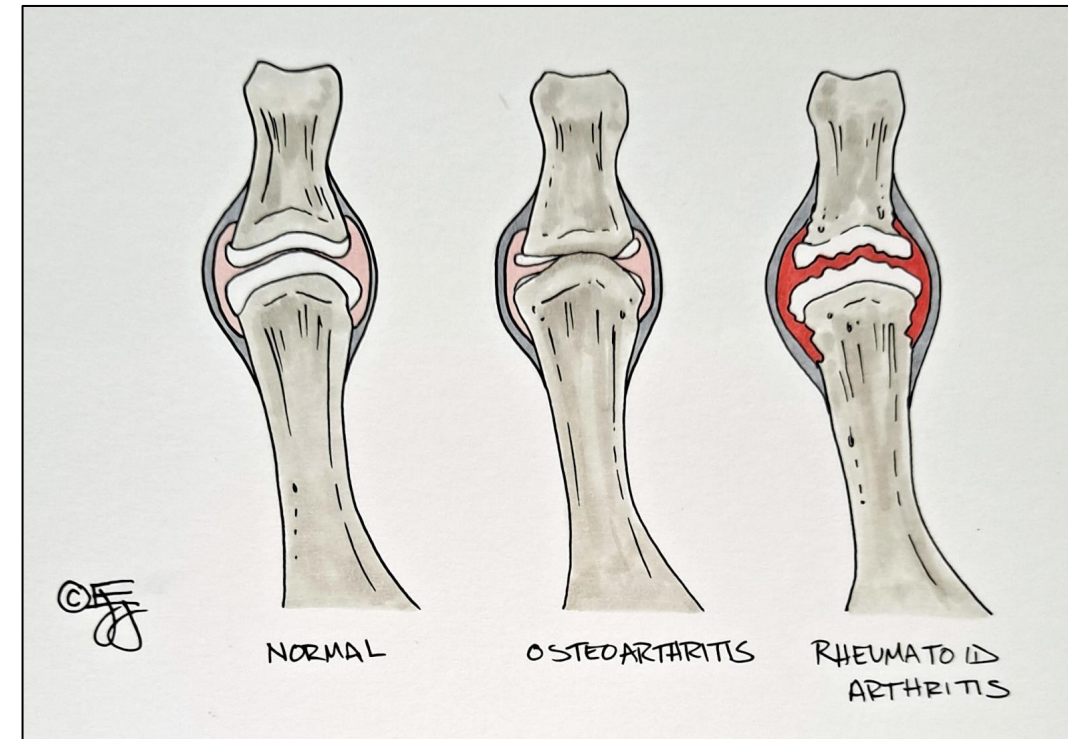
- Pain - Pain from arthritis can be constant, or it may come and go. It may affect only one part or be felt in many parts of the body.
- Swelling - In some types of arthritis, the skin over the affected joint becomes red and swollen and feels warm to the touch.
- Stiffness - Stiffness is a typical symptom. With some types, this is most likely upon waking up in the morning, after sitting at a desk, or after sitting in a car for a long time. With other types, stiffness may occur after exercise, or it may be persistent.
- Difficulty moving a joint - If moving a joint or getting up from a chair is hard or painful, this could indicate arthritis or another joint problem.
- In addition to these general signs, certain types of arthritis may cause their own unique symptoms. For example, Juvenile RA can cause eye problems, including uveitis, iridocyclitis, or iritis.
- Septic arthritis often causes fever and intense joint pain. It can become an emergency if it progresses to sepsis.

Vocabulary

- Arthralgia: Pain in a joint
- Arthritis: Acute or chronic inflammation of a joint, often accompanied by pain and structural changes
- Arthropathy: Any disease or abnormal condition affecting a joint
- Autoimmunity: The failure of an organism in recognizing its own constituent parts as *self*, which allows an immune response against its own cells and tissues
- Myalgia: Muscle pain
- Osteophyte: Smooth, bony growths, usually near joints
- Pauciarticular: Involves four or less joints
- Polyarticular: Involves five or more joints
- Polymyalgia: Pain in many muscles
- Systemic: Bodywide

Osteoarthritis

- A.k.a. Degenerative Joint Disease (DJD)
- “Old age”, overuse or “wear & tear” arthritis
 - Repetitive stress irritates cartilage
 - Joint pain and swelling
 - Cartilage begins to degenerate
 - Increase in pain, decrease in motion
 - Bone spurring around joint
 - Increase in pain, limited motion
 - Total loss of cartilage
 - Very limited, very painful motion
- Can affect a variety of joints
- Can be degenerative
- Can be asymptomatic
- Often idiopathic



Inflammatory Arthritis

Rheumatoid arthritis

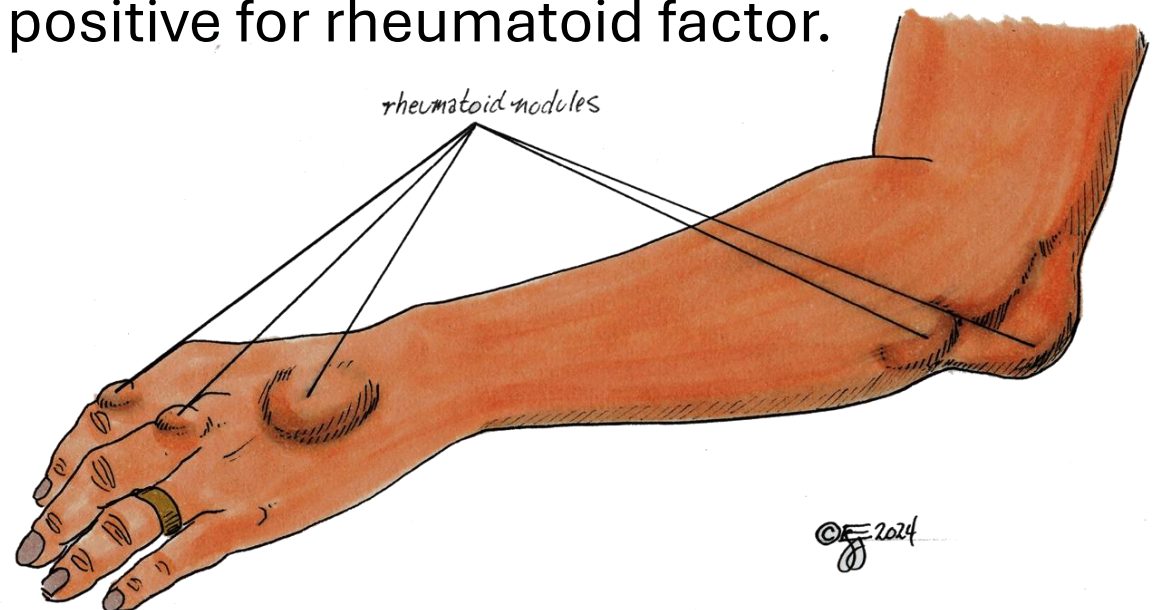
- Autoimmune disease that can cause chronic inflammation of the joints and other areas of the body.
 - Autoimmune diseases are illnesses that occur when the body's tissues are mistakenly attacked by their own immune system.
 - The immune system contains a complex organization of cells and antibodies designed normally to "seek and destroy" invaders of the body, particularly infections.
 - Patients with autoimmune diseases have antibodies in their blood that target their own body tissues, where they can be associated with inflammation.

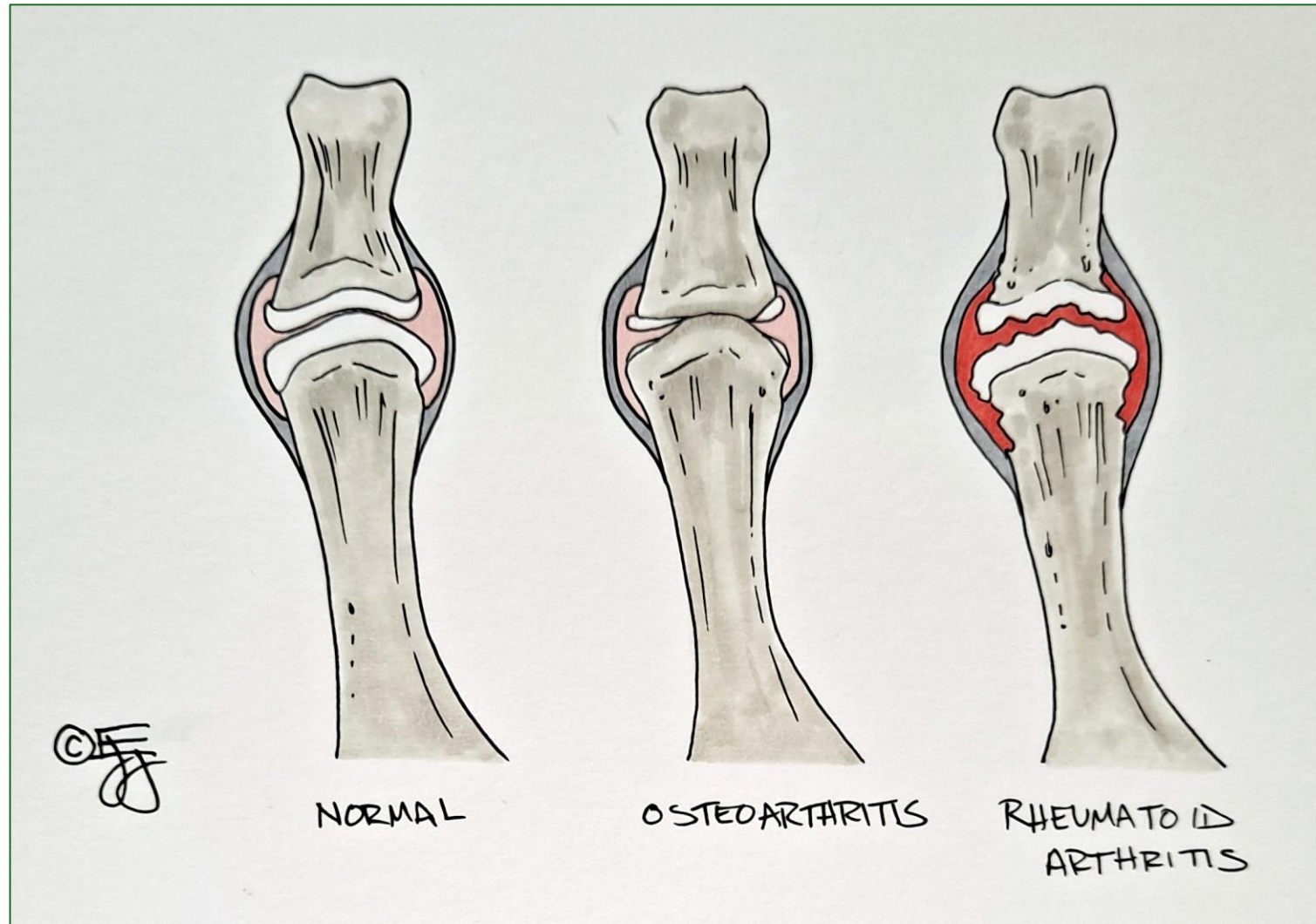
Rheumatoid arthritis

- Can and does affect people of all ages.
- The cause of rheumatoid arthritis is not known.
- Rheumatoid arthritis is a chronic disease, characterized by periods of disease flares and remissions.
- Multiple joints are usually, but not always, affected in a symmetrical pattern.
- Can cause permanent joint destruction and deformity.
- The "rheumatoid factor" is an antibody that can be found in the blood of 80% of people with rheumatoid arthritis.
- There is no known cure for rheumatoid arthritis.
- The treatment of rheumatoid arthritis optimally involves a combination of patient education, rest and exercise, joint protection, medications, and occasionally surgery.

Rheumatoid Arthritis

- Rheumatoid nodules are firm lumps located under the skin. The nodules grow close to the affected joints and can be as large as a walnut or as small as a pea.
- 20%-35% of adults with RA develop rheumatoid nodules. Sometimes the nodules are movable. Or they can be firmly connected to tendons or fascia under the skin.
- Nearly all RA patients with nodules test positive for rheumatoid factor.
- Can be quite painful.





Osteoarthritis

- Thinned cartilage
- Bone ends rub together

Vs.

Rheumatoid Arthritis

- Bone erosion
- Swollen, inflamed synovial membrane

Rheumatoid Arthritis

- *Peripheral Neuropathy in Rheumatoid Arthritis.* C. A. Pallis and J. T. Scott in Br Med J. 1965 May 1; 1(5443): 1141-7.
- *Peripheral neuropathy as seen in association with rheumatoid arthritis: A clinical and electromyographic study of seventy-two patients.* Hoerner, EF, et al in Arch Intern Med Rheumatol. 1963 Dec;17:479-516.
- 3.39% prevalence of foot ulcerations (Firth, et al, 2008)

Making the Diagnosis

- A thorough medical history, with particular attention to joint pain, stiffness, and associated functional difficulties
- A complete physical examination to assess for synovitis, limited joint motion, extraarticular disease manifestations, and signs of diseases included in differential diagnosis
- Basic and selected laboratory testing, including assays for acute phase reactants (erythrocyte sedimentation rate (ESR) and C-reactive protein(CRP)), rheumatoid factor, anti-cyclic citrullinated peptide (CCP) antibodies, and antinuclear antibodies
- Selected imaging studies, including bilateral radiographs of the hands, wrists, and feet
- Arthrocentesis (joint aspiration) if there is diagnostic uncertainty.

Rheumatoid Arthritis

- The diagnosis of RA can be made in a patient with inflammatory arthritis involving three or more joints, positive rheumatoid factor and/or CCP antibody, disease duration of more than six weeks, and elevated CRP or ESR, but without evidence of diseases with similar clinical features.

Differential Diagnosis of RA

- The differential diagnosis of RA includes multiple disorders that can generally be distinguished based upon a combination of the following features:
 - Limited duration (eg, in viral arthropathy)
 - The presence of other diseases (eg, in psoriatic arthritis or arthritis of inflammatory bowel disease)
 - The pattern of joint involvement and other symptoms (eg, in psoriatic arthritis, spondyloarthropathy, or polymyalgia rheumatica)
 - The presence of systemic features (eg, in systemic lupus or dermatomyositis)
 - Diagnostic laboratory tests associated with other conditions (eg, specific autoantibodies in SLE, synovial fluid crystals in gout or calcium pyrophosphate disease)
 - Relatively high specificity of anti-CCP antibodies for RA

Seronegative

- Seronegative means that your blood does not produce the antibodies that show up when tested for various autoimmune diseases, such as Lupus or Rheumatoid Arthritis.
- The most common antibodies to show up are called Anti-Nuclear Antibodies (ANA) and the Rheumatoid Factor. Both are indicators of autoimmune disease

Blood Tests

- What is Rheumatoid Factor?
 - Rheumatoid Factor— Rheumatoid Factor (RF) is an autoantibody, simply put: a protein that is produced by the immune system. Autoantibodies attack your own tissues by mistake.
 - Presence of RF indicates autoimmune disease, such as Rheumatoid Arthritis, however an absence of RF does not mean one is disease-free.

Blood Tests

- ***What is ANA?***

- **ANA** or ***Anti-Nuclear Antibodies*** are autoantibodies directed against a cell's nucleus. They are markers of inflammation and autoimmune disease.
- An ANA test is performed using an **immunoflorescent technique**—light microscopy using florescent dyes to examine different cell substances—and results are measured in ***titers*** (measure of concentration).
- A normal titer is about 1:40 or lower. Higher titers are indicative of an abundance of these autoantibodies and thus, autoimmune diseases, most commonly Lupus, but also in Rheumatoid Arthritis, Sjogren's Syndrome, and multiple other conditions
- You can have a positive ANA and be completely healthy or you can have a negative ANA and be ill.

Blood Tests

- If RF and ANA tests are negative, symptoms and inflammation rates (SED rates and C-reactive protein) come into play.

Blood Tests

- ***What is SED rate and C-Reactive Protein?***
 - **SED rate**, or **erythrocyte sedimentation rate (ESR)**, is an indicator of how high - or low - the inflammation is in your body.
 - **C-Reactive Protein (CRP)** is another indicator of acute inflammation in the body. Also used as a measure for heart disease risk as those with high CRP rates are at an increased risk of having a stroke, heart attack, or developing vascular diseases.

Complicating Matters...

- Healthy people with no arthritis and no medical problems at all make tiny amounts of the RF antibody.
- The number of healthy people having a positive RF rises somewhat with age (although sicker elderly people tend to have a positive RF more often than the healthy elderly).
- Other conditions associated with arthritis may result in a positive rheumatoid factor: Sjogren's syndrome and systemic lupus erythematosus are good examples.
- Certain infections, including endocarditis, viral infections, and others may trigger RF production by the body's immune system.
- People with a family history of rheumatoid arthritis are more likely to have relatives with a positive RF, even if no disease is present.

Seronegative arthritis

Seronegative Arthritis

- Common types of arthritis that are also seronegative for rheumatoid factor include:
 - Ankylosing spondylitis
 - Bacteria endocarditis
 - Calcium pyrophosphate deposition disease
 - Gout
 - Polymyalgia rheumatic
 - Osteoarthritis
 - Psoriatic arthritis
 - Reactive arthritis (Reiter's Syndrome)
 - Septic arthritis
 - Systemic lupus erythematosus
 - Undifferentiated spondyloarthropathy
 - Viral arthritis
- Other types of seronegative arthritis that are less commonly diagnosed include:
 - Dermatomyositis
 - Enteropathic arthritis
 - Juvenile onset or adult onset idiopathic arthritis
 - Polymyositis
 - Sjögren's syndrome
 - Scleroderma
 - Sarcoidosis
 - Systemic Vasculitis
 - Whipple's Disease
 - Various types of arthritis caused by bacteria (Lyme arthritis, Gonococcal arthritis, Rheumatic fever, tuberculous arthritis)

Seronegative RA

- 1 in 7 RA pts don't show RF
- 50% are negative in first 6 months of disease
- 15% are still negative after 2 years
- Generally, do not produce rheumatoid nodules
- Overall, joint destruction is less than seropositive RA

Reiter's Syndrome

- Reiter's syndrome (reactive arthritis) is a condition that may be triggered by a bacterial infection in the urinary or gastrointestinal tracts.
- Most often affects young men, although men of any age and women may also be affected.
- Symptoms:
 - Pain, swelling, and inflammation of the joints (arthritis), especially where the pelvis attaches to the spine (sacroiliac joint) and in the fingers, toes, and feet.
 - Inflammation of the eye (iritis).
 - Inflammation of the urethra and possible discharge. (urethritis).
 - Skin rash or small sores (ulcers), especially on the penis, on the soles of the feet, or in the mouth.

Psoriatic Arthritis

- Most destructive type of arthritis
- Systemic disease
- Characterized by stiffness, pain, swelling, and tenderness of the joints and surrounding ligaments and tendons
- Foot can appear like an RA foot, except often involves IP joints
- 95% have joint swelling

Psoriatic Arthritis

- Potential for peripheral neuropathy
 - *Charcot-like arthropathy: A newly-recognized subset of psoriatic arthritis.* Candia, et al, in Clin Exp Rheumatol. 2006 Mar-Apr;24(2):172-5.
 - *Psoriatic arthritis-associated polyneuropathy: a report of three cases.* Narayanaswami P, et al. J Clin Neuromuscul Dis. 2007 Sep;9(1):248-51.

Prevalence

- Psoriatic arthritis affects an estimated 520,000 patients in the US.
- Affects men and women equally
- Like psoriasis, psoriatic arthritis is more common among Caucasians than African Americans or Asians.

Epidemiology

- Skin disease psoriasis precedes arthritis in 80% of patients
- 10%-30% of people w/ psoriasis develop arthritis
- 15% develop skin psoriasis and arthritis at the same time
- 15% develop skin psoriasis following the onset of psoriatic arthritis.
- Psoriatic arthritis can develop in people who have any level severity of psoriatic skin disease from mild to very severe.
- Psoriatic arthritis tends to appear about 10 years after the first signs of psoriasis. Onset tends to occur between the ages of 30 and 55, but the disease can also affect children.
- More than 80% of patients with psoriatic arthritis will have psoriatic nail lesions.

Psoriatic Arthritis

- Common symptoms:
 - Pain, swelling, or stiffness in one or more joints
 - Joints that are red or warm to the touch
 - Sausage-like swelling in the fingers or toes (dactylitis)
 - Pain in and around the feet and ankles, especially tendinitis in the Achilles tendon or plantar fasciitis in the sole of the foot
 - Changes to the nails, such as pitting or separation from the nail bed
 - Pain in the area of the sacrum
 - Extreme exhaustion that does not go away with adequate rest - may last for days or weeks without abatement
- Psoriatic arthritis may remain mild or may progress to more destructive joint disease.
- Periods of active disease, or flares, will typically alternate with periods of remission.
- Because prolonged inflammation can lead to joint damage, early diagnosis and treatment to slow or prevent joint damage is recommended.

Sarcoidosis

- Disease of undetermined etiology
- Tiny clumps of abnormal tissue (granulomas – clusters of immune cells) form in certain organs of the body causing inflammation.
- 25% have arthropathy (joint destruction)
- Can cause peripheral neuropathy
- More common in African Americans than Caucasians
- Females are affected more often than males.
- The disease typically begins between ages 20 and 40.
- A person with a close blood relative who has sarcoidosis is nearly five times as likely to develop the condition.

Enteropathic Arthritis

- Chronic, inflammatory arthritis associated with the occurrence of an inflammatory bowel disease
 - Ulcerative colitis
 - Crohn's disease
- About 1 in 5 people with Crohn's or ulcerative colitis will develop enteropathic arthritis.
- The most common effects of enteropathic arthritis are inflammation of the peripheral joints and abdominal pain.

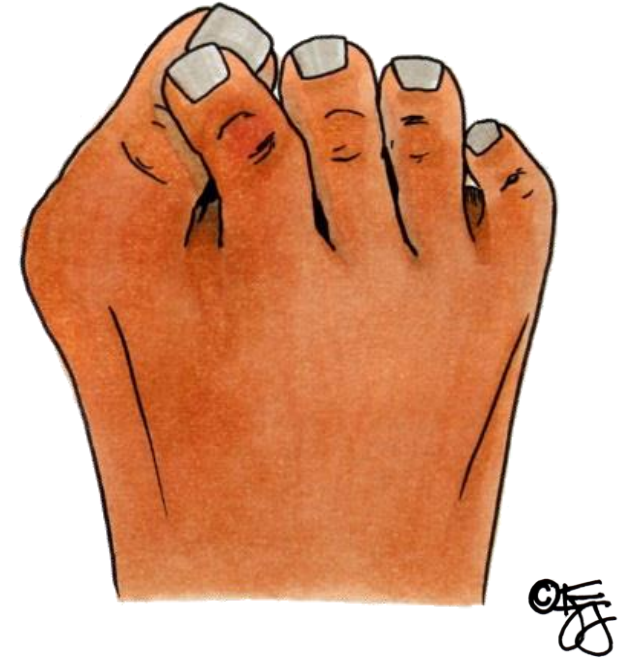
Enteropathic Arthritis

- Gastrointestinal tract contains the largest immune system in the body. The immune system is somehow altered in people who have these conditions.
- Researchers believe that the long-lasting inflammation found in the intestines of people with IBD damages the bowel and allows bacteria to enter and circulate through the blood stream. The body's reaction to these bacteria may cause other problems including inflammation in the joints and/or spine, skin sores and inflammation of the eyes.
- Currently this hypothesis is neither fully understood nor confirmed by rigorous scientific study.

Areas of Involvement

Areas of Involvement

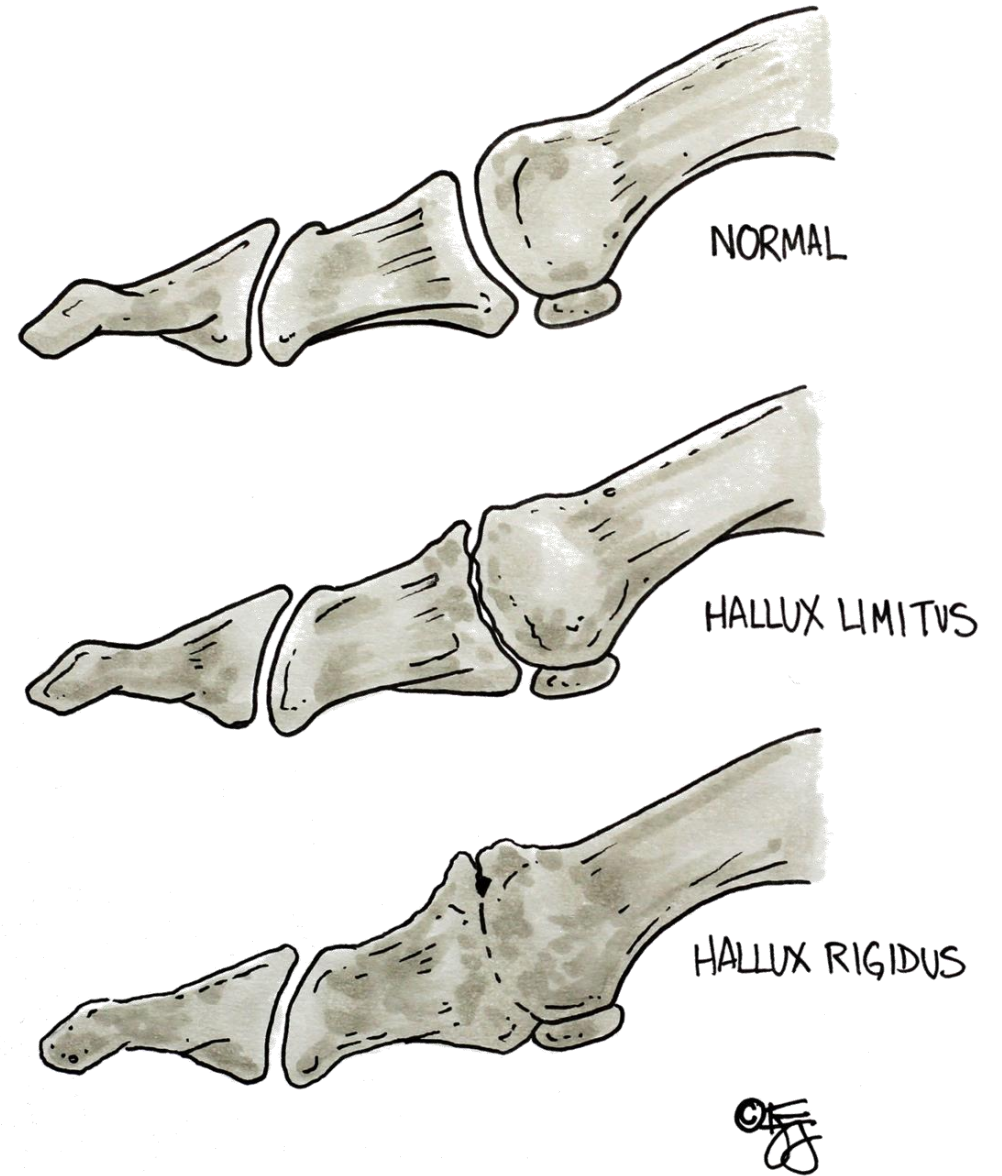
- Forefoot
 - Hammer toes, claw toes
 - Crossover toes
 - Hallux valgus/bunion
 - Hallux varus
 - Metatarsalgia
 - Inflammation in MTP joints
 - Plantar callosities
 - Nodules under areas of high pressure
 - Distal shift of fat pad and/or MTP dislocations due to hammer toes



Areas of Involvement

- Forefoot
 - Hallux Rigidus / Limitus
 - Gout

Dorsal osteophyte



Areas of Involvement

- Forefoot
 - s/p fusion or other surgical intervention
 - Transfer metatarsalgia common after bunion correction



Areas of Involvement

- Midfoot / Hindfoot
 - s/p fusion or other surgical intervention
 - Pes Planus (Flexible Vs. Rigid)
 - Post-traumatic DJD



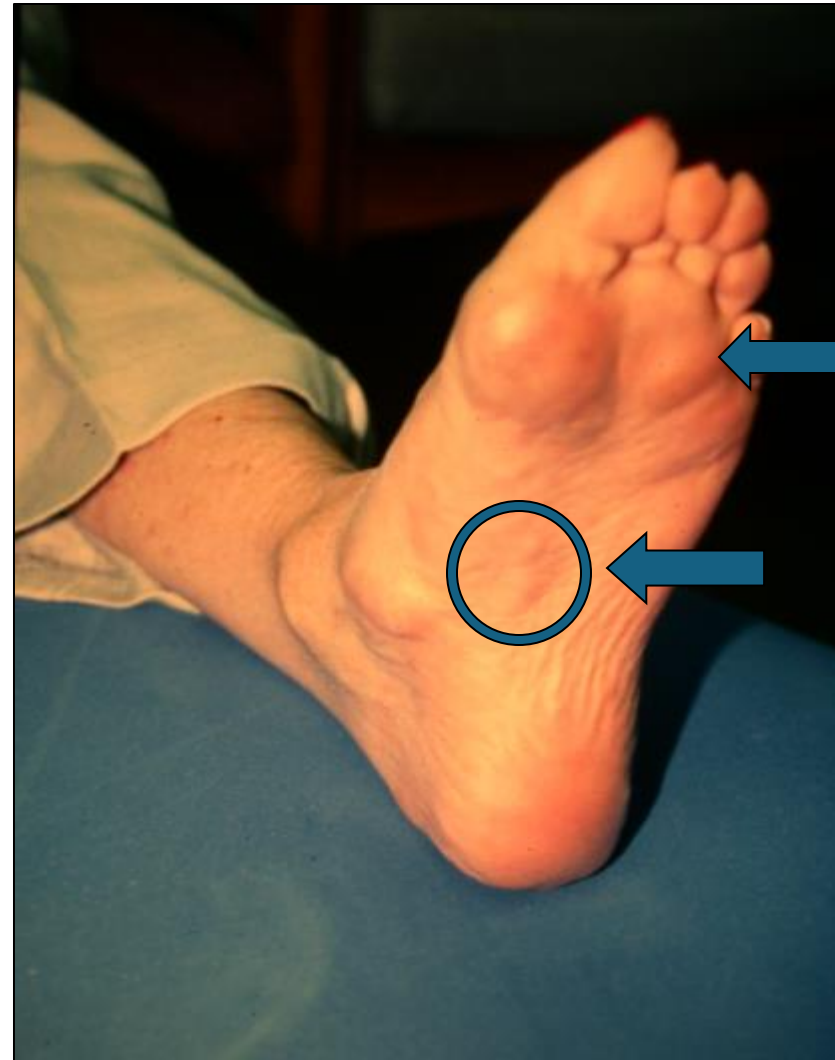
Areas of Involvement

- Ankle
 - Limited Motion
 - Painful Motion
 - s/p fusion
 - Does patient use AFO?



Areas of Involvement

- Rheumatoid Nodules
 - Under areas of high pressure
 - Metatarsal Heads
 - Midfoot
 - Heel



Areas of Involvement

- Hands
 - Is patient able to don and/or tie shoes?



Areas of Involvement

- Leg Length Discrepancies
 - Due to arthritic involvement of hips, knees, pelvis or spine
 - Post-traumatic
 - s/p Total hip



Pedorthic Treatment

Objectives of Pedorthic Treatment

- Relieve pain
- Relieve pressure
- Transfer pressure
- Limit or restrict motion
- Replace lost motion
- Provide cushion and shock absorption
- Accommodate deformities
- Provide support
- Decrease shear

Objectives of Pedorthic Treatment

- Expectation Management
 - Physician
 - Shoes Vs. Surgery + Shoes
 - Not Shoes Vs. Surgery
 - Pedorthist
 - Pedorthic modalities won't "fix" arthritis

Pedorthic Options

Pedorthic Options

- Total Contact Foot Orthoses
 - Accommodative



Pedorthic Options

- Total Contact Foot Orthoses
 - Semi-Rigid



Pedorthic Options

- Total Contact Foot Orthoses
 - Rigid or Firm



Foot Orthoses

- Relieving areas of high pressure
 - Intrinsic Vs. Extrinsic



Foot Orthoses

- Replacing atrophied or shifted fat pads
 - Viscoelastic polymers



Foot Orthoses

- Reducing bending stresses on forefoot and midfoot
 - Shank
 - Turf Toe Plate / Carbon Fiber Plate



SCFO

- When hindfoot and subtalar joint are involved, consider using subtalar control foot orthosis.
- Triplanar control is necessary.
- To appreciably restrict motion through joint, the device must span the joint.



Pedorthic Options

- Total Contact Foot Orthoses
 - Modified OTC Device



Pedorthic Options

- Shoes
 - In-depth



Pedorthic Options

- Shoes
 - Athletic / Casual



Pedorthic Options

- Shoes
 - Custom-made



Pedorthic Options

- Shoe Modifications
 - Rocker Soles



Pedorthic Options

- Shoe Modifications
 - Flares Vs. Wedges
 - Flexible deformity = Wedge
 - Fixed deformity = Flare



Pedorthic Options

- Shoe Modifications
 - Extended Steel Shank



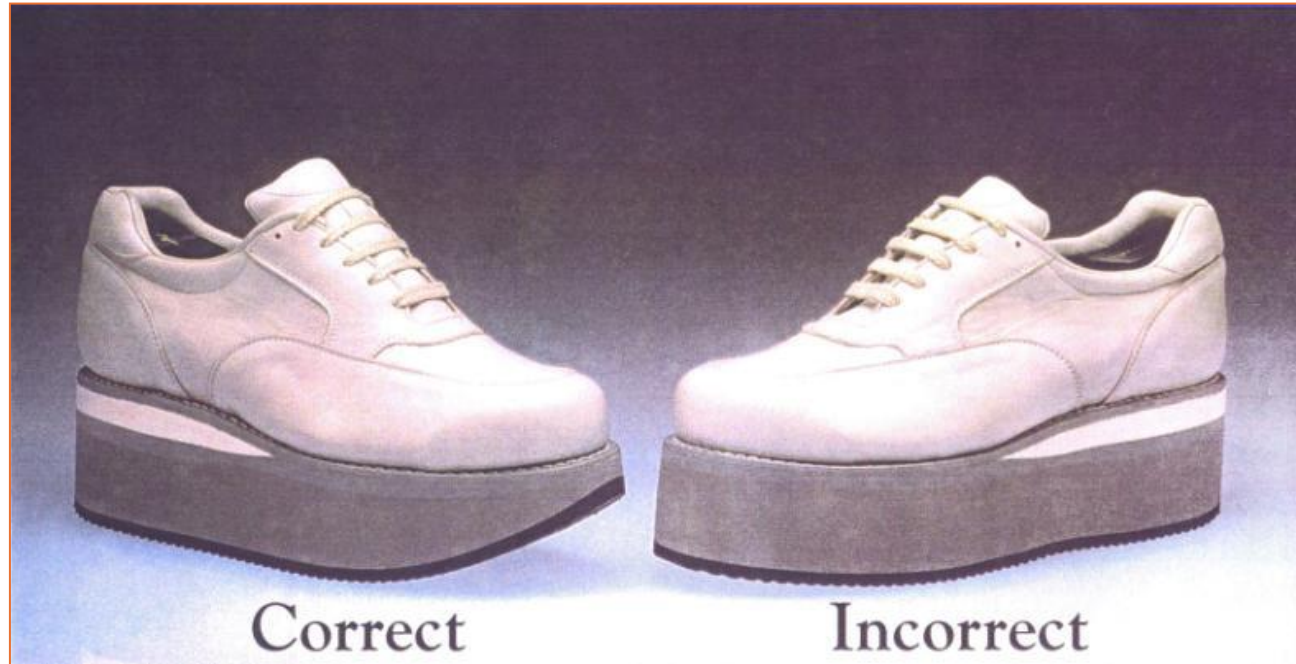
Pedorthic Options

- Shoe Modifications
 - SACH Heel



Pedorthic Options

- Shoe Modifications
 - Sole Extension for LLD



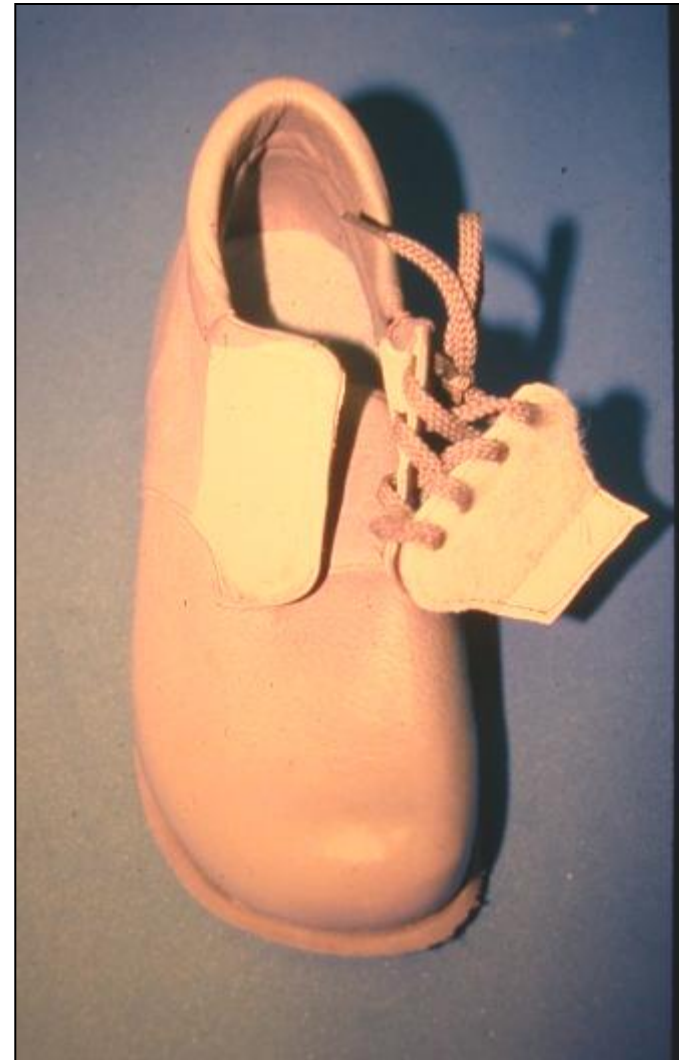
Pedorthic Options

- Shoe Modifications
 - Internal relief



Pedorthic Options

- Aids to Application
 - Hook-and-Loop (Velcro®) closures



Pedorthic Options

- Aids to Application
 - Hook-and-Loop closures
 - Elastic shoelaces



Pedorthic Options

- Aids to Application
 - Hook-and-Loop closures
 - Elastic shoelaces
 - Gripper/Reacher



Pedorthic Options

- Aids to Application
 - Hook-and-Loop closures
 - Elastic shoelaces
 - Gripper/Reacher
 - Extended shoehorn



Pedorthic Options

- Aids to Application
 - Hook-and-Loop Closures
 - Elastic shoelaces
 - Gripper/Reacher
 - Extended shoehorn
 - Posterior “Pull Loop”



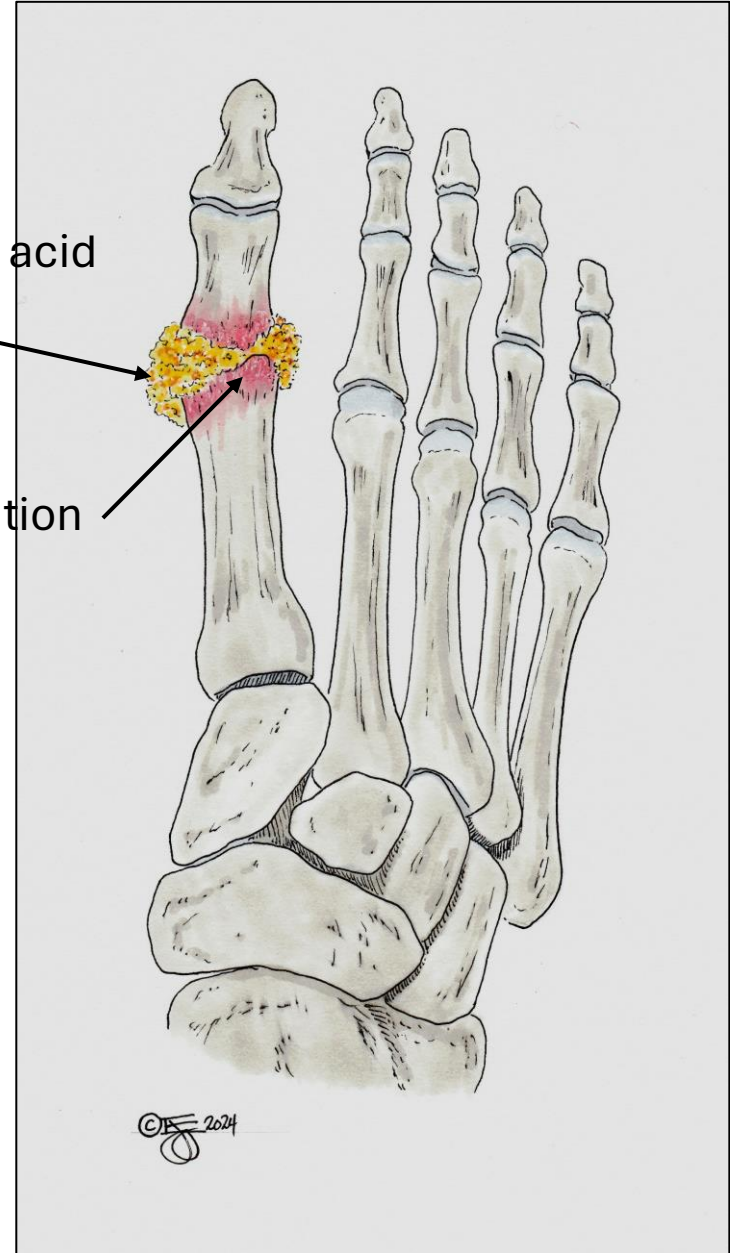
Gout

Gout

- Arthritis that occurs when uric acid builds up in blood and causes joint inflammation
- If too much uric acid builds up in the synovial fluid, uric acid crystals form and cause the joint to swell up and become inflamed.
- The crystals clump together to form a tophus.

Masses of uric acid
(tophi)

Joint inflammation



Gout

- Tophi: Lumps below the skin around joints or in other places. They may drain chalky material. Tophi usually develop only after a patient has had chronic gout for many years.



Gout

- Incidence in men > women (4x)
- Incidence of gout is 10.9% among black men and 5.8% among white men.
- After the first gouty attack, 50% will have no further symptoms; 50% will have subsequent attacks.
- Chronic gout. Those with chronic arthritis develop joint damage and loss of motion in the joints; will experience joint pain and other symptoms most of the time.

Gout

- *July 28, 2011* – **“Gout Prevalence Swells in U.S. Over Last Two Decades; Increase in Obesity and Hypertension Are Likely Contributors”** (Science Daily)
- "Prevalence of Gout and Hyperuricemia in the US General Population." Yanyan Zhu, Bhavik J Pandya, Hyon K Choi." *Arthritis & Rheumatism*; Published Online: July 28, 2011
 - Gout now affects 8.3 million (4%) of Americans

Gout

- **Four stages of gout:**
 - **Asymptomatic tissue deposition** occurs when people have no overt symptoms of gout, but do have hyperuricemia and the asymptomatic deposition of crystals in tissues. The deposition of crystals, however, is causing damage.
 - **Acute flares** occur when urate crystals in the joint(s) cause acute inflammation. A flare is characterized by pain, redness, swelling, and warmth lasting days to weeks. Pain may be mild or excruciating. Most initial attacks occur in lower extremities. The typical presentation in the metatarsophalangeal joint of the great toe (podagra) is the presenting joint for 50% of people with gout. About 80% of people with gout do have podagra at some point. Uric acid levels may be normal in about half of patients with an acute flare. Gout may present differently in the elderly, with many joints affected.
 - **Intercritical segments** occur after an acute flare has subsided, and a person may enter a stage with clinically inactive disease before the next flare. The person with gout continues to have hyperuricemia, which results in continued deposition of urate crystals in tissues and resulting damage. Intercritical segments become shorter as the disease progresses.
 - **Chronic gout** is characterized by chronic arthritis, with soreness and aching of joints. People with gout may also get tophi - usually in cooler areas of the body (e.g., elbows, ears, distal finger joints).

Gout

- Tests that may be done include:
- Synovial fluid analysis (shows uric acid crystals)
- Uric acid – blood test
- Joint x-rays (may be normal)
- Synovial biopsy
- Uric acid – urine test (not everyone with high uric acid levels in the blood has gout.)
- The gold standard for diagnosing gout is aspiration and microscopic analysis for urate crystals in joint fluid or a tophus. Urate crystals are negatively birefringent under polarized light. Infection must be ruled out.

Gout: Pedorthic Treatment

- Goal is to reduce the painful motion
- Footwear:
 - Well-fitted depth shoe to accommodate deformity and orthotic device. Stiff sole, rocker sole.
- Orthosis:
 - Custom total contact orthosis to support medial longitudinal arch and address structural deficiencies/deformities. Consider rigid footplate incorporated into, or used in conjunction with, the FO.
- Shoe Modification:
 - Extended steel shank, rocker soles to restrict DF at 1st MTP and provide dynamic offloading during ambulation.



The End