

## Common Foot & Ankle Injuries

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## Acknowledgement

- Professor Emeritus Ian J. Alexander

### Disclosures

- None

## Foot & Ankle Center of Excellence



- Comprehensive care for all adult foot and ankle problems:
  - Sports injuries / Sprains / Cartilage disorders
  - Arthritis / Degenerative conditions
  - Deformities
  - Trauma / Fractures
  - Bunions / Hammertoes
  - Whatever is causing your pain



## Common Problems of the Foot & Ankle

- Acute ankle sprains
  - Late pain after ankle sprains / associated injuries
- Stress fractures
- Achilles tendon ruptures
- Plantar fasciitis
- Bunions
- Ankle arthritis

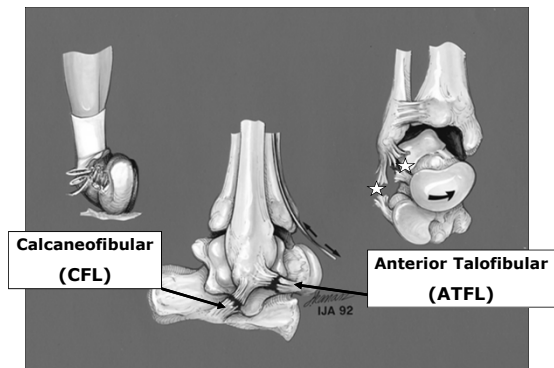
## Acute Ankle Sprain

- Exceedingly common
  - 10-40% of civilian athletic injuries annually
    - Significant time lost to injury
  - 1 inversion event per 10,000 people per day
    - 23,000 to 30,000 ankle injuries per day in U.S.
    - 10% or ER visits in U.S.
- 45% of all basketball injuries
- 31% of collegiate football injuries
- 20% of soccer injuries
- Leading cause of time loss in NFL
- Most common cause of acute injury in volleyball

## The Ankle Sprain

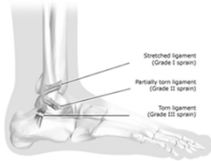
- Mainstay of treatment is functional rehabilitation
  - 80% make a full recovery with conservative treatment
  - 20-30% may be symptomatic 3 months after surgery
- Associated injuries may result in continued pain and dysfunction
- Repeat sprains or inadequate rehabilitation may result in chronic lateral instability in 20%

## Anatomy and Biomechanics



## Mechanism

- Position of instability: plantarflexion and inversion
  - Talus is more narrow posteriorly
- Failure occurs in predictable order
  - Anterolateral capsule
  - ATFL (involved in 85%)
    - Restraint to inversion in PF
  - CFL (also injured in 20-40%)
    - Restraint to inversion in neutral or dorsiflexion
  - PTFL rarely injured



## Diagnosis

- History of injury
  - Mechanism of injury
    - Forces involved
    - Direction of foot deviation
  - Prior episodes and frequency
  - Immediate ability to weight bear

## Examination of the Foot & Ankle

### •Examination

- Be systematic (knee to toe)
- Inspection / gait
  - Ecchymosis and swelling
  - Localize tenderness
    - » Soft tissue vs bony
  - Ambulatory capacity
  - Neurovascular exam
  - Range of motion



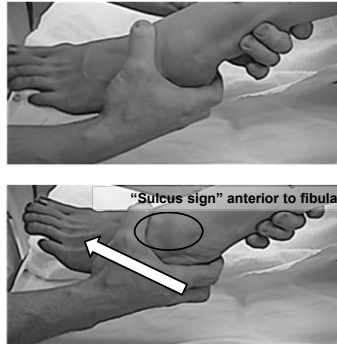
## Examination of the Foot & Ankle

- Examination – special tests
  - Anterior drawer
  - Squeeze test
  - External rotation stress test

## Anterior Drawer

- Allow the leg to hang freely with foot plantarflexed 25°
- Stabilize the tibia with 1 hand and grasp the heel with the other.
- Pull foot anteriorly, allowing it to rotate internally (around the deltoid) as it translates.
- Incompetent ATFL => Excessive anterior translation relative to other side

\* Acute laxity does not correlate with development of late symptoms = does not always require surgery

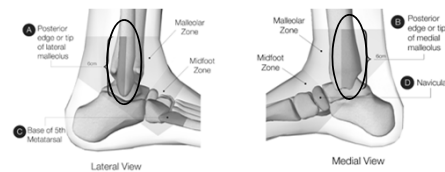


## Are RADIOGRAPHS indicated?

### • Ottawa rules

### • ANKLE X-rays

- Posterior tenderness distal 6 cm of tibia or fibula
- Malleolar tip tenderness
- Both immediate inability to WB and not able to walk more than 4 steps in ED

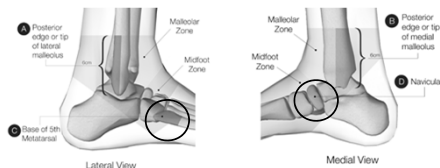


## Are RADIOGRAPHS indicated?

### • Ottawa rules

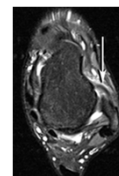
### • FOOT X-rays

- Navicular tenderness
- 5<sup>th</sup> metatarsal base tenderness
- Both immediate inability to WB and not able to walk more than 4 steps in ED



## MRI

- Not required in the ACUTE setting
- Considered for the patient with chronic pain (>6 weeks) after ankle sprain
  - Useful for assessing concomitant pathology
  - 90% accuracy for ATFL and CFL tears
- Does not give an absolute indication for surgery



## Clinical Classification

- **Mild Sprain**
  - Able to walk without limp
  - Minimal swelling or point tenderness
  - Pain with reproduction of mechanism of injury
- **Moderate Sprain**
  - Walking with a limp
  - Localized swelling with point tenderness
  - Unable to rise on toes or hop on injured ankle
- **Severe Sprain**
  - Prefers crutches and has difficulty bearing weight
  - Diffuse tenderness and swelling

	Grade I	Grade II	Grade III
Edema, ecchymosis	Localized, slight	Localized, moderate	Diffuse, significant
Weight bearing	Full or partial without significant pain	Difficult without crutches	Impossible
Ligament pathology	Ligament stretch	Partial tear (ATFL)	Complete tear (ATFL + CFL)
Instability testing (anterior drawer)	None	None or slight	Definite
Time to return to sport	11 days	2-6 weeks	4-26 weeks

- Mainstay of treatment is nonoperative management, even in the athletic population



## Treatment – Acute Ankle Sprain

- **P.R.I.C.E**
  - Protection
  - Rest
  - Ice
  - Compression
  - Elevation
- Progressive weightbearing as tolerated
- Early range of motion
- Physical Therapy – functional ankle rehabilitation



## Treatment – Acute Ankle Sprain

- **Bracing**
  - Protection from inversion to prevent weaker type III collagen → elongation
  - 3 weeks → collagen starts to mature, controlled stress on the ligament promotes proper collagen orientation
- **Functional Rehabilitation**
  - Ankle motion, stretching and strengthening will avoid harmful effects of immobilization on muscle, joint cartilage, and bone
  - Full return to activities between 4-8 weeks

## Treatment – Acute Ankle Sprain

- **Bracing**
  - **Semi-rigid ankle support: shorter time to return to work & sport, less symptomatic instability at short-term follow-up**



## The Ankle Sprain

- **Functional Rehabilitation**
  - Achieve full ROM
  - Peroneal tendon strengthening and proprioception
  - Gradual progression of weightbearing and return to play
- Supervised PT has better outcome with regard to strength and proprioception in the short term
  - Reinjury rates and long term functional results similar to home therapy plans



## The Ankle Sprain

- Grade I and II → good to excellent
- Grade III → a little more controversial

## Acute Sprain → Chronic Instability

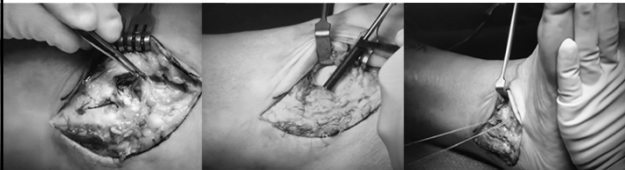
- 10-20% risk after ankle sprain
- Two types
  - Mechanical
    - Abnormal clinical laxity
    - pathologic hypermobility of the tibiotalar joint
    - Sign
  - Functional
    - Subjective instability
    - unreliable ankle, no demonstrable radiographic signs of instability
    - Symptom

## Operative Indications for Lateral Ankle Reconstruction

- Continued pain and instability despite extensive non-operative management
  - Must rule out and/or treat other pathology

## Surgical Management of Lateral Ankle Instability

- Anatomic reconstruction
  - Modified Brostrom lateral ligament reconstruction
  - Allograft lateral ligament reconstruction



## Return to Play after Lateral Ligament Reconstruction

- Outcomes of athletes after Brostrom
  - 58% returned to preinjury level
  - 16% competing at a lower level
  - 26% discontinued sport but still active
  - (Maffulli et al, AJSM 2013)

## Rehab and Recovery after Reconstruction

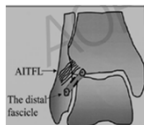
- Phase I – ROM
- Phase II – Endurance
- Phase III – Strength
- Phase IV – Power
- Phase V – Return to Sport Testing and Physician Clearance
  - Achieve 90% of contralateral limb strength

## Clinically significant late pain after ankle sprain

- Clinically significant pain >6 weeks after injury without recurrent injury or instability
  - Consider pathology that may be in conjunction with an ankle sprain or consider a different diagnosis
    - Soft tissue lesions
    - Bone / articular lesions

## Soft Tissue Lesions

- Anterolateral soft tissue impingement
- Complaint: focal anterolateral pain, worse with dorsiflexion and cutting maneuvers
- Exam: focal anterolateral ankle tenderness
- Treatment: steroid injection; arthroscopic debridement



## Soft Tissue Lesions

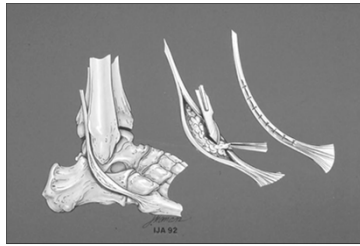
- Peroneal tendon tear
- Complaint: focal lateral pain, worse with eversion
- Exam: swelling, focal lateral tenderness, pain with eversion





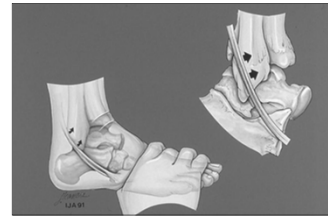
## Soft Tissue Lesions

- **Peroneal tendon tear**
- **Treatment:** NSAID/immobilization, lateral heel wedge, surgical debridement or repair if no response



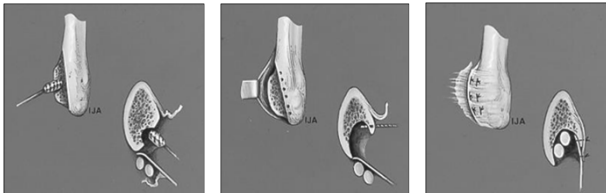
## Soft Tissue Lesions

- **Peroneal tendon subluxation**
- **Complaint:** pain and snapping of tendons over fibula
- **Exam:** swelling, focal ttp posterior to distal fibula, dislocation of tendons with resisted eversion



## Soft Tissue Lesions

- **Peroneal tendon subluxation**
- **Treatment:** fibular groove deepening and retinacular reconstruction



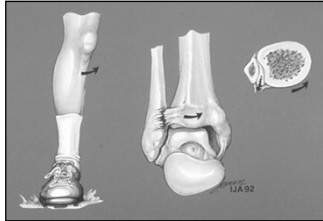
## Soft Tissue Lesions

- **Sinus tarsi syndrome**
- **Complaint:** pain and swelling lateral hindfoot, exacerbated on uneven surfaces
- **Exam:** swelling, focal ttp anterior to distal fibula
- **Treatment:** NSAID/immobilization, steroid injection, arthroscopic debridement



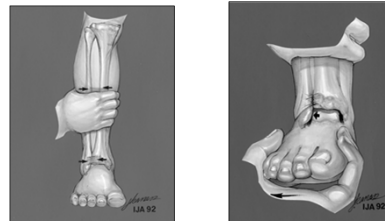
## Syndesmotic Injury – High Ankle Sprain

- Collision sports, 10% of all ankle sprains
- Mechanism: external rotation
  - Direct force posterior calf of downed player with foot externally rotated
  - External rotation force on knee while foot firmly planted



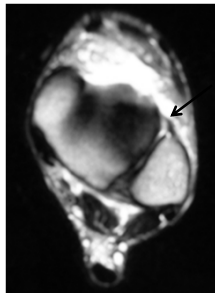
## Soft Tissue Lesions

- Syndesmotic injury
- Complaint: pain in distal leg and ankle with cutting/twisting
- Exam: external rotation stress test; squeeze test
- Xrays/MRI/US:
  - Stress xrays: disruption or widening of syndesmosis



## Syndesmotic injury - Treatment

- Grade I and II:
  - RICE, PT, ankle brace or taping
- Grade III:
  - Acute- ORIF (screws/Tightrope)
  - Chronic- arthroscopic debridement + fixation
- Longer time to return to play and more residual symptoms than simple ankle sprain



## Soft Tissue Lesions

- Superficial peroneal neuropraxia – intermediate branch

- Complaint: anterolateral pain / burning / numbness
- Exam: focal ttp, + tinels, decreased sensation dorsolateral foot
- Treatment: neurentin / lidoderm patch / desensitization
  - Neurolysis vs. transection

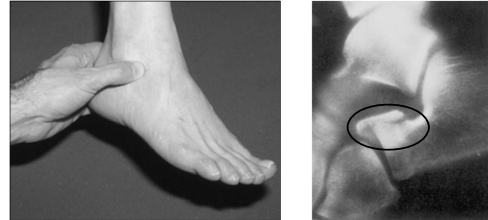


## Bone / Articular Lesions

- Juxta-articular fractures
  - Complaint: pain swelling in the area of the fx
  - Exam: focal ttp, pain with provocative maneuvers
  - Imaging: often apparent on xray but must look closely
    - Bone scan: hot locally
    - CT scan: define fragment size and articular involvement to define surgical plan
  - Treatment: immobilization in cast or boot 4-6weeks
    - Excision vs. ORIF if large articular fragments

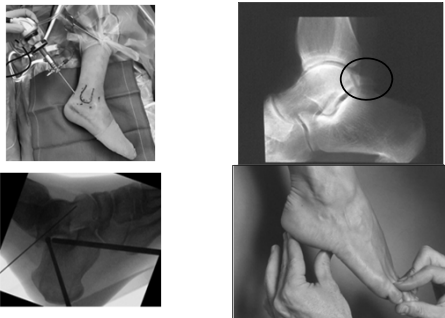
## Bone / Articular Lesions

- Juxta-articular fracture
  - Anterior process of the calcaneus



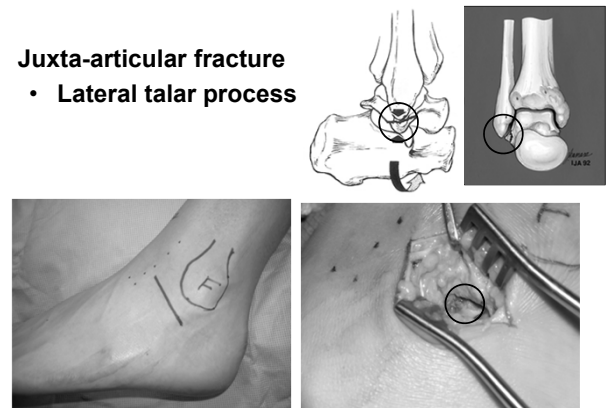
## Bone / Articular Lesions

- Juxta-articular fracture
  - Posterior talar process (Stieda process)



## Bone / Articular Lesions

- Juxta-articular fracture
  - Lateral talar process



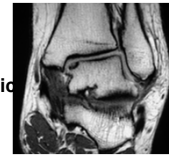
## Bone / Articular Lesions

- Juxta-articular fracture
  - Dorsal navicular rim avulsion
- Distal fibular avulsion
- Cuboid avulsion



## Bone / Articular Lesions

- Osteochondral lesion of the talus (OLT)
- Complaint: swelling, sharp pain/aching deep in joint, occasional mechanical locking/catching
- Exam: focal ttp @medial / lateral shoulder of talus
- Imaging: xray may show cyst in chronic OLTs, CT/MRI is diagnostic
- Sometimes an incidental finding
  - If not symptomatic does not require treatment



## Bone / Articular Lesions

- Osteochondral lesion of the talus (OLT)
- Non-operative management
  - Non displaced acute lesions
    - Immobilization x 6 weeks
- Operative Management:
  - Failed conservative care, large and/or displaced fragments

## Bone / Articular Lesions

- Osteochondral lesion of the talus (OLT)
- Surgical Treatment:
  - Mesenchymal cell stimulation
    - Microfracture, abrasion chondroplasty
  - Autograft osteochondral transfer
  - Allograft osteochondral transfer
  - Allograft chondral transfer
  - Autologous chondrocyte implantation (ACI)
  - Juvenile particulated allograft cartilage
  - Biocartilage



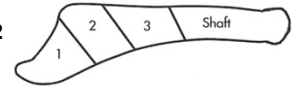
## Bone / Articular Lesions

### • 5<sup>th</sup> metatarsal fractures

- Poor blood supply to zone 2

#### • Clinically assess for:

- Area(s) of tenderness
- Cavovarus foot posture
- Chronicity of fracture (sclerosis or periosteal reaction)



#### Zones:

1= tuberosity avulsion fractures (may enter 5<sup>th</sup> MT-cuboid articulation)

2= Jones fractures (metaphyseal-diaphyseal junction)

3= stress fractures (distal to 4/5 IM ligaments, extends distally into diaphysis for 1.5cm)

### Zone1- 5<sup>th</sup> MT tuberosity avulsion fractures

- Treatment usually hard-soled shoe or boot
- 4 wks usually patients asymptomatic
- Time to healing approximately 8 wks
  - Symptomatic nonunion- excise fragment



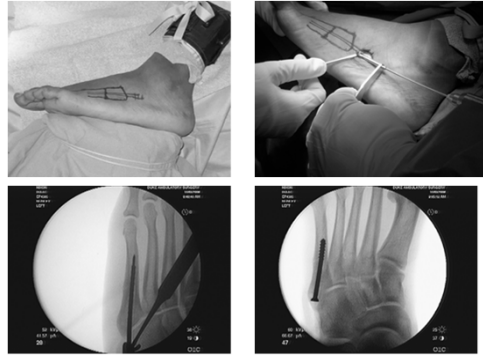
### Jones Fracture



## 5<sup>th</sup> Metatarsal Jones fracture

- **Non-displaced fractures:** Nonweightbearing cast or boot 6-8 wks
- **Consider surgery if:**
  - **Displaced fracture**
  - **Athlete**
    - Quill 1995: 25-50% of fractures treated closed found not to heal or to re-fracture
  - **Delayed union or nonunion:**
- **Return to play @8-10wks post ORIF if radiographically healed fracture**

## Jones fracture

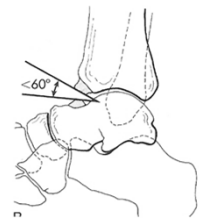


## Bone / Articular Lesions

- **Tarsal coalition**
- **Complaint:** recurrent ankle sprains in the adolescent, lateral hindfoot pain
- **Exam:** rigid subtalar motion
- **Imaging:**
  - *Calcaneonavicular bar*
  - *Talocalcaneal coalition*
- **Treatment:** immobilization always first step
  - Resection/arthrodesis depending on size and location of refractory

## Bone / Articular Lesions

- **Anterior impingement**
  - "Footballer's ankle"
  - Runners and jumpers
  - Pain, localized anteriorly
  - Limited ROM
  - Xrays: exostosis distal tibia (usually lateral), cupping of talar neck +/- spur
  - **Treatment**
    - Conservative: ↓ activity
    - Surgery if persistent symptoms and xray evidence of impingement



## Metatarsal stress fractures

- “March” fractures
- Military recruits or dancers frequently affected
  - Increase in duration or intensity of exercise
  - 2<sup>nd</sup> MT involved more commonly than 3<sup>rd</sup> MT
- Fatigue-type fractures
- Point tenderness over affected metatarsal (not web)
  - Circumscribed swelling over dorsal foot that does not extend to medial or lateral border of foot
- Initial xrays usually negative
- Treatment: hard-soled post-op shoe, cessation of inciting activity
- Recovery variable: usually return to normal footwear by 6-8wks
  - Shoe modification with orthosis

## Navicular Stress Fractures

- Exam:
  - Dorsomedial vague pain, prolonged symptoms
  - Positive percussion test over navicular
  - Limited motion of subtalar joint (50%)
  - Pain generated in navicular area when patient stands on toes
- Often xrays negative:
  - Bone scan sensitive, CT determines fx location and extent, MRI shows early edema



## Navicular stress fracture

- Incomplete or nondisplaced fractures:
  - Cast and nonweightbearing for 6 wks
  - Protected WB for 6 wks
  - RTP avg 4 months; +/- orthotic with medial longitudinal arch support
- Operative treatment considered:
  - Complete fractures with sclerosis
  - Displaced fractures
  - ?High-demand athletes with nondisplaced fractures
    - Quicker RTP (83% healing, RTP 3.6mos vs 5.6mos)
  - Persistent symptoms or failed conservative treatment

## Stress fractures

- MRI – most accurate test for suspected lower extremity stress fractures
  - Meta-analysis
    - Radiographs (sensitivity 12-56%)
    - Bone Scans (sensitivity 50-97%)
    - CT scans (sensitivity 32-38%)
    - Ultrasound (sensitivity 43-99%)
    - MRI (sensitivity 68-99%)

– Wright, et al Am J Sports Med 2016

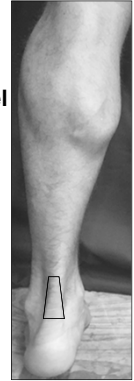
## Achilles Tendon Rupture

- Dual blood supply
  - Muscles above
  - Bony attachment below
  - Watershed zone
    - 1-4 inches above tendon attachment to heel bone



## Achilles Tendon Rupture

- Complete disruption of Achilles tendon
  - Location
    - Often 5-7 cm above insertion to heel bone
  - Commonly affected
    - Middle aged (average age in 40s)
    - Men (M:F ~3:1)
    - “weekend warriors”



## Achilles Tendon Rupture

- History
  - Mechanism of injury
    - Eccentric loading (pushing off)
  - Pop
    - “someone hit the back of my ankle”
  - Inability or difficulty walking
  - Pain behind ankle
  - Possible association with
    - Prodromal symptoms
    - Recent fluoroquinolone use
    - Recent steroid use

## Achilles Tendon Rupture

- Examination
  - 20-30% delayed diagnosis
  - High clinical suspicion
  - Thompson Test
  - Gap sign
  - Loss of resting equinus



## Achilles Tendon Rupture

- Examination
  - Thompson Test



## Achilles Tendon Rupture

- Examination



## Achilles Tendon Rupture

- Imaging – not usually required
  - Xrays
    - May rule out fracture
  - MRI
    - Helpful for delayed presentation or equivocal clinical exam
  - U/S
    - Inexpensive, can confirm diagnosis and localize tear

## Achilles Tendon Rupture

- Initial Treatment
  - Immobilize in plantarflexion
  - Keep nonweightbearing with crutches
  - RICE therapy
  - Counsel on signs and symptoms of DVT

## Achilles Tendon Rupture

### • Treatment

- Controversial
  - With early diagnosis and immobilization, may achieve similar results
- Management depends on surgeon and patient preference
- May favor surgery for athletes, younger patients, and delayed diagnosis with diastasis of tendon ends

## Achilles Tendon Rupture

### •Treatment

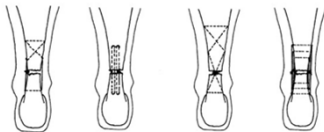
- Nonoperative
  - NOT a passive treatment program
  - Immediate immobilization in plantarflexion
  - Progression to formal Physical Therapy for functional rehab after 2 weeks
    - Transition to boot with 2cm heel lift
    - Progressive return to weightbearing and controlled strengthening



## Achilles Tendon Rupture

### •Treatment

- ✓ Operative
  - Multiple options
  - Open
  - Limited incision
  - No significant differences confirmed between methods



## Heel Pain – Plantar Fasciitis

- Most common cause of plantar heel pain
- Peak age of incidence between 40-60 years
- Risk factors include runners, prolonged standing, obesity, limited dorsiflexion of the ankle



## Plantar Fasciitis

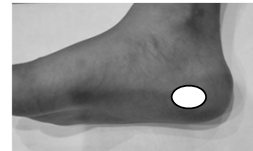
### • History

- Insidious onset without trauma
- Typical pain with start up or initiation of weight bearing
- First thing in the morning or after sitting for periods of time (watching TV, driving, eating)
- Typically lessened or not symptomatic during activity
- Often recent increase in activity or change in shoe wear

## Plantar Fasciitis

### • Examination

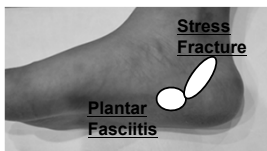
- Pain at the medial tubercle of the calcaneus



## Plantar Fasciitis

### • Differential

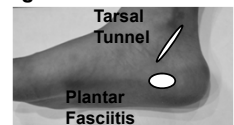
- Calcaneal stress fracture
  - Specific onset of symptoms
  - Constant pain
  - Tender on both sides of the heel
  - Worse with weight bearing
  - Present on plain radiographs



## Plantar Fasciitis

### • Differential

- Neurogenic (tarsal tunnel, peripheral neuropathy, radiculopathy)
  - Pain may not be specific to the medial calcaneal tuberosity
  - Patients often report burning and tingling pain
  - Tinel's sign
  - Radiating symptoms
  - Lack of focal symptoms to exam
  - Not specific to weight bearing



## Plantar Fasciitis

### • Treatment

- Non-operative treatment
  - Majority of patients >90% will improve with non-operative treatment
  - Tissue specific plantar fascia stretching
    - Achilles stretching
  - Heel cups
  - Over the counter orthotics
  - Night splints
  - NSAIDs



## Plantar Fasciitis

### • Treatment - Nonoperative

- Injections
  - Cortisone
  - Platelet rich plasma
    - Limited studies documenting its efficacy
- Extracorporeal shockwave treatment
  - High and low energy options
  - Well tolerated
- Immobilization
  - Cam boot 2-4 weeks

## Plantar Fasciitis

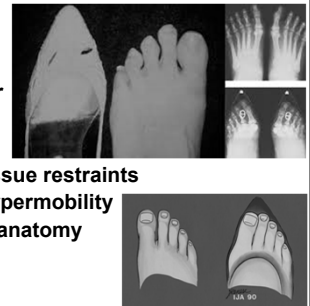
### • Treatment – Surgical

- Recalcitrant cases > 12 months
  - Plantar fasciotomy
    - Open or endoscopic techniques
    - Assess lateral plantar nerve
  - Achilles or Gastrocnemius lengthening

## Hallux Valgus - Bunions

### • Common causes

- Extrinsic
  - Inappropriate shoe gear
- Intrinsic
  - Hereditary
    - » Incompetent soft tissue restraints
    - » Generalized joint hypermobility
    - » Predisposing bony anatomy



## Hallux Valgus - Bunions

- Conservative Therapy is always the first line
  - Operate on the shoe
  - Pads, Spacers



## Bunions

- Surgical Treatment
  - Symptoms that persist despite nonsurgical treatment
  - Factors to consider
    - Existence of arthritis or arthrosis
    - Degree of deformity and passive correctability
  - Patient expectations
    - May potentially discourage surgery in
      - Athletes not willing to potentially give up sports
      - Women wanting to constantly wear high heels with narrow toe boxes

## Bunions

- Surgical Treatment
  - Requires Osteotomy (cutting and resetting) or Fusion



### • Minimally Invasive



### • Traditional

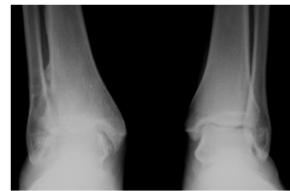


## Ankle Arthritis

- Etiology
  - Osteoarthritis is not the most common etiology
    - Trauma
    - Inflammation
    - Infection
    - Instability

## Ankle Arthritis

- Symptoms
  - Band of pain and swelling around ankle
  - Limited motion (loss of dorsiflexion more common)
  - Possible deformity
  - Gait disturbance / Limp



## Ankle Arthritis

- Xrays
  - Loss of joint space
  - Periarticular osteophytes
  - Subchondral sclerosis and cysts



## Ankle Arthritis

- Nonoperative Treatment
  - Activity modification
  - NSAIDs
  - Bracing
  - Rocker bottom shoes
  - Injections



## Ankle Arthritis

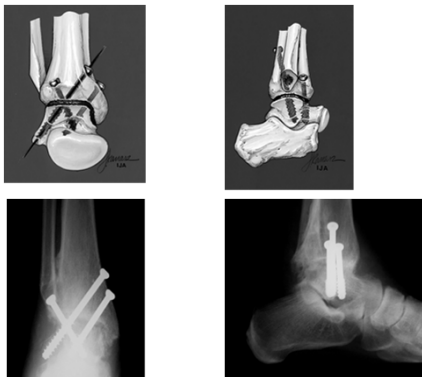
- Surgical Treatment
  - Arthroscopic/ open debridement
  - Bone and soft tissue impingement
  - Tibial/ calcaneal osteotomy
  - Distraction arthroplasty
  - Allograft replacement
  - Arthrodesis
  - Total ankle replacement

## Ankle Arthritis

- Surgical Treatment
  - Tibial osteotomy

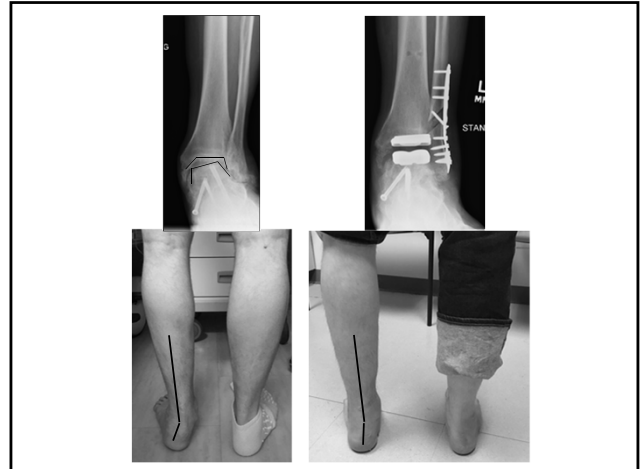
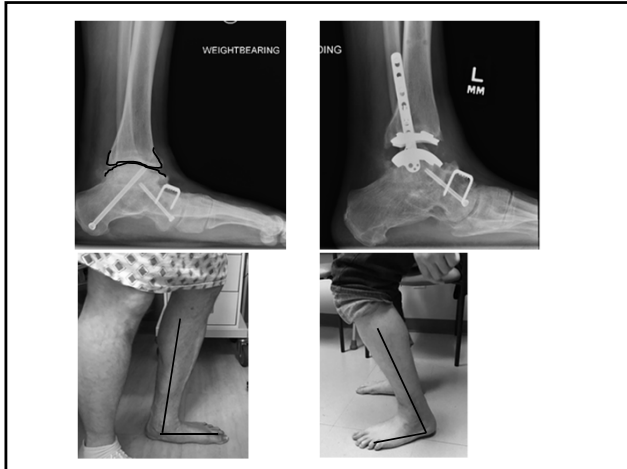


## Ankle Arthrodesis



## Total Ankle Replacement

- Ideal patient
  - Reasonably mobile
  - Middle-to-old aged patient
  - Normal or low BMI
  - Good bone stock
  - Minimal deformities
  - Multiple joint arthritis
    - Rheumatoid arthritis
  - No neurovascular impairment



## Summary

- Treatment of foot and ankle conditions can prove quite complicated
  - impact quality of life
  - minor foot and ankle problems can turn into big ones
- We provide comprehensive care responsive to current and long-term patient needs
  - Most problems can be treated effectively without surgery
- Forefront of orthopaedic technology, offering cutting-edge techniques and developing new procedures for difficult problems