Diagnosing and Managing Chronic and Acute Conditions of the Foot and Ankle

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Eevee
Overview

1) Anatomy + Physical Exam Findings
2) Arthritis: ankle, first MTP
3) Chronic conditions
   1) Flatfoot (Pes Planus)
   2) High arch (Pes Cavus)
4) Acute Injuries:
   1) When a sprain isn’t a sprain
   2) Achilles rupture
5) Bunions (Hallux Valgus)
ANATOMY
Ankle Bones

- Tibia
- Fibula
- Talus
Ankle Bones – Medial View

A - Tibia
B – Talar Body
C – Talar Neck
D – Talar Head
Foot Bones

- Calcaneus
- Talus
- Navicular
- Cuboid
- Cuneiforms
- Metatarsals
- Phalanges
Foot Joints

A - Ankle
B – Subtalar (ST)
C – Talonavicular (TN)
D – Calcaneocuboid (CC)
E – Naviculocuneiform (NC)
Joint Range of Motion

• Ankle
  ▪ 10-20 degrees Dorsiflexion
  ▪ 50 degrees Plantarflexion

• Subtalar/ Talonavicular
  ▪ 20-40 degrees Inversion
  ▪ 10-20 degrees Eversion

• First MTP
  ▪ 70-90 degrees Dorsiflexion
  ▪ 20-30 degrees Plantarflexion
Joint Range of Motion

- **Ankle**
  - 10-20 degrees Dorsiflexion
  - 40 degrees Plantarflexion
- **Subtalar/ Talonavicular**
  - 20-40 degrees Inversion
  - 10-20 degrees Eversion
- **First MTP**
  - 70-90 degrees Dorsiflexion
  - 20-30 degrees Plantarflexion
Physical Exam Components

- Inspection
  - Standing exam
  - Sitting exam
- Palpation
- Range of motion
- Neurovascular assessment
  - Circulatory
  - Sensory
  - Motor
- Special tests
Inspection

• Hindfoot valgus

• Hindfoot varus
Inspection

- Pes Planus
- Pes Cavus
Inspection

• Hallux Valgus
Inspection

- Hammertoes
Inspection

• Callus / Ulceration
Inspection

- Hallux Rigidus
Inspection / Palpation

- Lateral Landmarks
  A - Peroneus Tertius
  B - Lateral Malleolus- Fibula
  C - Syndesmotic Ligament
  D - Ankle Joint
  E - ATFL- Ankle Ligament
  F - Sinus Tarsi- Subtalar Joint
  G - Peroneus Brevis
Inspection / Palpation

- Anterior Landmarks
  A - Peroneus Tertius
  B - Lateral Malleolus- Fibula
  C - Syndesmotic Ligament
  D - Ankle Joint
  E - Anterior Tibial Tendon
Inspection / Palpation

- Medial Landmarks
  A - Anterior Tibial Tendon
  B - Ankle Joint
  C - Medial Malleolus- Tibia
  D - Posterior Tibial Tendon
  E - Navicular Tuberosity
  F - Achilles Tendon
  G - Plantar Fascia Origin
ARTHRITIS
What is arthritis?

• Arthritis
  • Articular cartilage damage
  • Osteophyte formation
  • Pain
  • Decreased joint range of motion
    • Disrupts normal functional relationship between the leg and the foot
    • Alters gait
    • Increases stress on adjacent joints
Where can arthritis occur?

- Ankle joint
- Subtalar joint
- Talonavicular joint
- Midfoot (many joints)
- 1st MTP joint
Causes

• Post-Traumatic
• Osteoarthritis
• Inflammatory
• Infectious
• Synovial abnormalities
• Metabolic
  • Neuropathic

• Congenital/Developmental
  • Clubfoot
  • Coalition
• Neoplasm
• Hematologic
  • Hemochromatosis
• Neurologic
Inflammatory

- Rheumatoid arthritis
- Reiter’s
- Psoriatic
- Ankylosing spondylitis
- Crystal deposits (Gout, Pseudogout)
- Connective tissue disorders (SLE)
- Inflammatory bowel (Crohn’s, Ulcerative colitis)
Imaging Studies

- Plain x-rays
  - Weight-bearing views
- Findings
  - Joint space narrowing
  - Bone malalignment
  - Osteophyte formation
  - Subchondral sclerosis and cysts
Imaging Studies

• CT Scan
  • 3D images to fully show where the joint is damaged
  • Helpful for surgical planning
  • Articular incongruity
    • Loose bodies
  • Bone spurs
  • Adjacent arthritis
Treatment Goals

- Pain relief
- Deformity
  - Correction
  - Prevention of progression
- Function --> stable “shoe-able” foot
  - Preservation
  - Restoration
Non Operative Treatment

NSAID’s
  Oral
  Topical

Acetaminophen

Injections
  Corticosteroid + local anesthetic

Activity modification
  Physical therapy
  Assistive devices
    Cane
    Bracing
    Orthotics

Shoe Modifications
  Rocker-bottom soles
  SACH heel
  Prefabricated orthoses
    Arch support
    Ankle brace
    CAM walker
Non Operative Treatment

- Custom Orthoses
  - Semi-rigid functional “orthotic”
    - Flexible hindfoot deformity
  - UCBL
  - AFO
    - Solid or hinged
  - Arizona brace
  - PTB
    - Unloads foot and ankle
Treatment Options for Ankle Arthritis

- Operative:
  - Debridement/Cheilectomy (Bone spur removal)
  - Ankle arthrodesis (Fusion)
  - Ankle arthroplasty (Joint replacement)
Debridement and/or Cheilectomy

- Early degenerative changes, mild-moderate
- Anterior ankle impingement
- Synovitis
Arthrodesis (Fusion)

- Ankle = tibio-talar
- Subtalar = talo-calcaneal
- Triple arthrodesis = talo-calcaneal, talo-navicular, and calcaneal-cuboid
- Tibiotalocalcaneal fusion = Ankle + Subtalar
  - “hindfoot fusion”
- Pantalar = Ankle + Triple (tibio-talar, talo-navicular, talo-calcaneal, calcaneal-cuboid)
Surgical Technique

• Bone Graft
  • Facilitates union/healing
  • Not always needed for primary fusion with good bone apposition

• Maintain joint congruity, denude cartilage, subcortical fracture technique
Arthrodesis Fixation

- Screws
- Plates
- Intramedullary rod
- External fixator
Ankle Arthroplasty (TAR = Total Ankle Replacement)

• Goals
  • Pain relief
  • Maintenance of ROM
  • Preservation of surrounding joints
  • Improved gait
Ankle Arthroplasty

• Newer designs
  • Less-constrained
  • Non-cemented
  • Better intermediate term results
Patient Conversation

• Pain Relief: roughly equivalent between Fusion and TAR
  • Significant improvement in all outcomes after surgery regardless of surgery type (Fusion vs Replacement)

• Step Count:
  • Fusion and TAR both have increased steps by 3-5% vs preop step count
    • Roughly same stride length and walking speed
  • Biggest Benefit: ability to perform increased continuous activity (ie, roughly same activity level postop eventually for fusion and TAR)

• 3 year satisfaction rate for both TAR + fusion is about 94%
Patient Conversation

• Fusion lasts about 25 years, and TAR lasts about 15 years (?)

• After fusion, may develop subtalar arthritis 2-15 years down the road
  • TAR protects surrounding joints

• Ideal TAR candidate
  • Age >55
  • Deformity on xray/CT → coronal plane <10-15 degrees
  • Ligamentous insufficiency → must be “fixable”

• Patient specific OR instruments
  • Custom made (3D printed) based on CT protocol
Postop Course Overview

- Stay in hospital 1 night → home after that
  - Usually able to go home (not SNF/Rehab)
- Pain control (oral medicine, regional block)
- 2 week postop appt: Splint off + sutures out
- CAM boot x4 weeks at all times
  - Don’t remove to sleep
- Non-weight bearing 6 weeks, then progress weight bearing in CAM boot
  - 50% PWB x2 weeks, 75% PWB x2 weeks, WBAT x2 weeks
Ankle Replacement Surgery: Restoring Quality of Life

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At 72-years-old, Shari Pinney was not planning on running any marathons.
In September, Shari had her first appointment with Dr. Clayton Carmody. She remembers he was “very tall” but, more importantly, he took time to answer all questions regarding her ankle pain. At times when Shari didn’t understand his answers, Dr. Carmody took even more time to further explain.

After their discussion, Shari didn’t hesitate to schedule her ankle replacement surgery. It would give her more functionality and mobility than any other option. Getting back to an independent and active lifestyle was her top priority.

When the day of her ankle replacement surgery came, Shari was ready. With all of her questions answered, she was prepared and had realistic expectations about recovery.

“I spent one day in the hospital after surgery, and the nurses were all very kind,” recalls Shari. “They were focused on patient care and ensured my pain was under control.”

Under the watchful care of her physical therapists, Shari left the hospital in a cast. She eventually traded the cast in for a boot before finally upgrading to a cane. Three months after her surgery, Shari was finally enjoying life free from arthritic pain.

“I have normal muscle pain from muscles I haven’t used in a while,” she says. “I can do all kinds of things that I couldn’t before.”

Shari does not celebrate her success alone. She is grateful for the physical therapy team who always went the extra mile to encourage her and address any discomfort immediately. She also appreciates Dr. Carmody who was personally invested in her successful recovery.

“The day they took my cast off, he grinned from ear to ear,” says Shari. He was excited with every step that brought her back to full mobility again.

While Shari decided to retire after more than five decades as a pediatric nurse, she has been making plans after recovering from her surgery. Shari is now busy visiting with her grandchildren and taking her dog out for pain-free walks.
First MTP arthritis

- Symptoms: stiffness of big toe, pain with walking/bending
- Causes: same as arthritis anywhere
  - Gout, RA, trauma
- Treatments:
  - Nonoperative
  - Operative
Non Operative Treatment

- NSAID’s (oral, topical), Acetaminophen
- Injections
  - Corticosteroid + local anesthetic
- Stiff soled shoes, orthotics
- Physical therapy
Treatment Options for 1\textsuperscript{st} MTP Arthritis

- Operative:
  - Debridement/Cheilectomy (Bone spur removal)
  - 1\textsuperscript{st} MTP Cartiva implant (somewhat experimental)
  - 1\textsuperscript{st} MTP arthrodesis (Fusion)
Bone spur removal

Large dorsal osteophyte
Cartiva
1\textsuperscript{st} MTP Fusion
Summary

- Arthritis ➔
  - pain
  - stiffness
  - difficulty walking on uneven ground, uphill/downhill, on stairs

- Referral sooner rather than later is usually beneficial
  - Positioning the foot in more optimal position
  - Correcting dynamic muscle imbalances (PT)
  - Can help prevent other joints from wearing out as well
Chronic Conditions: FLATFOOT & HIGH ARCHES (planus & cavus)
Cavus vs. Planus
Valgus vs. Varus
Flatfoot

• Posterior tibial tendon insufficiency is the most common cause in adults

• risk factors (most common: women in 60’s)
  • obesity
  • hypertension
  • diabetes
  • increased age
  • corticosteroid use
  • inflammatory disorders

• leads to loss of medial longitudinal arch dynamic stabilization
  • Arch of the foot collapses
Flatfoot
Flatfoot
High arch (Cavus)

- Characterized by elevated longitudinal arch
  - hindfoot varus (heel tipped in)
- Causes
  - neurologic condition
  - hereditary/congenital
  - Most common: subtle and bilateral
- History
  - Recurrent ankle sprains
  - Lateral foot pain
  - Stress fractures
  - Plantar fasciitis
  - Painful callouses
High arch (Cavus)
High arch (Cavus)
Subtle Cavus
Coleman Block Orthotics
Treatment

• Nonoperative
  • Change in shoewear
  • Anti-inflammatory
  • Orthotics
  • Different types of braces
  • Physical therapy

• Success of nonoperative treatment depends on how long the process has been going on, severity of problem (how much the foot has changed shape), and joint degeneration on x-ray
• 80-90% of people can avoid surgery with the correct regimen of nonoperative treatment
Treatment

- **Operative**
  - Muscle lengthening
    - Achilles, PTT, Peroneals
  - Tendon transfers
    - Peroneals, FDL to PTT
  - Osteotomies
    - Calcaneus (lengthening, lateral/medial slide)
  - Joint fusions
    - Ankle, subtalar, talonavicular, 1st TMT
Summary

• Referral sooner rather than later is usually beneficial
  • Positioning the foot in more optimal position
  • Correcting dynamic muscle imbalances (PT)
  • Can help prevent other joints from wearing out as well
Acute Injuries
Ankle Sprains

Incidence of Ankle Sprains in the USA:

850,000 per year
70,833 per month
16,346 per week
2,328 per day
97 per hour
1.6 per minute
Anatomy of an Ankle Sprain

• Most common ligament injured is the Anterior Talofibular Ligament
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
Standard Imaging

• A/P, Mortise, and Lateral x-rays with patient weight bearing if they can tolerate it

• NO ROLE FOR ACUTE MRI
Stress Radiographs

- Talar tilt
- Anterior Drawer
Non-Operative Treatment

Mainstay of treatment, even in athletes
Acute Treatment

• Rest
• Ice
• Compression
• Elevation
Failed Nonop Treatment

• 10 -20% fail non-operative treatment and have recurrent instability

• Risk factors
  • Hx of dislocation
  • Major anterior drawer sign
  • 10° more talar tilt than normal side
  • Clinical or radiographic evidence of complete rupture of both ATFL and CFL
  • Osteochondral injury
Instability Operative Management

- Anatomic reconstruction
  - Brostrum
  - Gould modification
  - Allograft reconstruction
When a “sprain” isn’t really a ”sprain”…

• Associated injuries
  • OCD/OCL (osteocondral defect/lesion)
  • Peroneal tendon injuries
  • Syndesmotic disruption
  • fractures
    • 5th metatarsal base
    • anterior process of calcaneus
    • lateral or posterior process of the talus

• A sprain that doesn’t improve → BE SUSPICIOUS!
  • Consistent pain pattern
  • Dysfunction (sports, work, ADLs, etc)
  • Significant swelling/bruising
Lateral Process of the Talus Fracture

- Dorsiflexion and eversion injury
- Can be missed on plain radiographs
- CT scan can further evaluate
- Articulating portion of the subtalar joint
- Often needs surgery
  - <1 cm in size lean toward excision
  - >1 cm in size lean toward fixation
“Foot Sprain”
“Foot Sprain”
Achilles Tendon Anatomy

- Achilles tendon
  - Largest tendon in the body
  - Tendon for three muscles
    - Lateral gastrocnemius
    - Medial gastrocnemius
    - Soleus (deep to gastrocs)
  - Dual blood supply
    - Muscles above
    - Bony attachment below
    - Watershed zone
      - 1-4 inches above insertion to heel bone
History

- Often recreational athlete – 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
- Commonly affected
  - Middle aged (average age in 40s)
  - men (M:F ~3:1)
  - “weekend warriors”
Physical Exam

- Often limited due to pain
- Seek site of maximal tenderness
- Swelling and bruising
  - Generalized about foot
  - Progressive
- Compare resting posture to contralateral side
Physical Exam

• Thompson’s test
  • Prone position
  • Alternate
    • kneeling position

• Normal test:
  • Squeeze calf
  • Ankle plantarflexes

• Abnormal test:
  • Squeeze calf
  • Ankle does not plantarflex

Normal: Plantarflexion with squeeze
Abnormal: No plantarflexion with squeeze
Treatment

• Controversial

• Non-operative vs Operative
  • Recent studies suggest similar outcomes

• Non-operative
  • Not a passive treatment program
  • Aggressive intervention
  • Early immobilization in plantarflexion
  • Rapid progression to therapy protocol
Summary

• Acute ankle sprain $\rightarrow$ non-operative treatment
  • Functional rehab
  • No MRI

• A “sprain” that doesn’t improve $\rightarrow$ be suspicious!!!
  • Appointment with Orthopedic Surgeon for focused examination
Summary

• Achilles Tendon ruptures
  • Immobilize with ankle in plantarflexion (cast, boot)
  • Keep NWB
  • Referral ASAP!!!
HALLUX VALGUS (BUNION)
Bunion (Hallux Valgus)

- Painful prominence over medial aspect of 1\textsuperscript{st} MTP joint (big toe)
- Not a single deformity, but rather a complex deformity of the first ray
  - Usually associated with muscle imbalances
- Risk factors (more common in women)
  - genetic predisposition (70% have family history)
  - ligamentous laxity (1st tarso-metatarsal joint instability)
  - Bony alignment/structure
  - 2nd toe deformity/amputation
  - pes planus
  - Inflammatory conditions: rheumatoid arthritis
  - shoes with high heel and narrow toe box
  - Tight calf muscles
Bunion (Hallux Valgus)

- Proximal phalanx of great toe drifts to the side, and the first metatarsal drifts toward the midline
Bunion (Hallux Valgus)
Treatment

• Nonoperative
  • Change in shoewear (wide shoes)
  • Anti-inflammatories
  • Orthotics/straps
  • Physical therapy

• Success of nonoperative treatment depends on how long the process has been going on, severity of problem (how much the foot has changed shape), and joint degeneration on xray
Treatment

• Operative
  • Bunionectomy
    • Modified Lapidus technique
    • Gastroc lengthening
Tips for Routine Daily Foot/Ankle Care

• Shoe wear
  - Comfortable
  - Supportive

• Stretching
  - Depends on the problem
  - Supervised: Physical therapy
  - Home exercises

• Avoiding pain provoking activities

• Something bothering you or you’re concerned about → make an appt!
QUESTIONS?
THANK YOU!!!

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