Common Problems of the Foot and Ankle

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Disclosures

• Speaker’s Bureau - Radius Health
• Committee member - American Orthopedic Foot and Ankle Society
• American Orthopedic Association - Own the Bone Steering Committee
Anatomy

• Ankle- “complicated hinge”
  • Talus
  • Mortise
    • Tibial Plafond
    • Medial Malleolus
    • Lateral Malleolus
• Stability
  • Bony articulation more stable in dorsiflexion
  • Highly congruent joint
Anatomy

Lateral Ligaments

- Lateral Ligamentous Complex
  - Anterior talofibular ligament
  - Posterior talofibular ligament
  - Calcaneofibular ligament
Anatomy

Medial Ligaments

- Deep Deltoid Ligament – key to stability of the ankle
- Superficial Deltoid Ligament - arises from the anterior colliculus
Anatomy: Syndesmosis

• Anterior-inferior tibiofibular ligament (AITFL)
• Interosseous ligament (IOL)
• Posterior-inferior tibiofibular ligament (PITFL)
Standard Ankle Series

AP

Lateral

Mortise
AP Ankle

Evaluate
Tib- fib clear space
Tib fib overall
Overall alignment
15-20 degrees internal rotation
Evaluate:
Talar dome
Joint congruity
Fibular length
Evaluate:
Lateral Malleolus
Medial Malleolus
Standard Series - get all three!
Foot Series

• Obtain WB films when not concerned for fracture

AP Foot  Lateral Foot
Ankle Fractures

Danis-Weber Classification

Figure 2. Weber/AO fractures. The staging is completely determined by the level of fibular fracture. Type A occurs below the plafond, whereas type C starts above the plafond.
Case: 44 yo F
Case 1: Treatment Options

• Non-operative Treatment
  • WBAT in supportive brace (high-top shoe, elastic support brace, air cast stirrup brace, or a walking boot)

• Physical therapy
  • ROM and proprioception training

• Excellent longterm functional results:

• Complication rate- negligible
  • Rare fibular nonunion (Feitz et al. Injury 1997)
So, who needs surgery?

**STABILITY**

Which fracture patterns do we know are stable?

- Isolated Weber A?
- Isolated Weber B?
  - Stress +
Manual Stress Technique
The use of gravity or manual-stress radiographs in the assessment of supination-external rotation fractures of the ankle

H. J. SCHOCK, M. PINZUR, L. MANION, M. STOVER VOL. 89-B, No. 8, AUGUST 2007

Figure 5  A. Optimal positioning to obtain the gravity stress view. B. Gravity stress view of the contralateral normal ankle. C. Gravity stress view of the injured ankle. Note the widened medial clear space compared with the contralateral normal ankle.

Diagram showing positioning of the patient from a gravity-stress radiograph.
Radiographic Assessment: Ankle Stress Views

- Manual stress view
  - assess the integrity of the deltoïd ligament
  - medial clear space
  - 5 mm absolute widening
Case #2: 24 yo M
Manual Stress Exam
Post-op
5th Metatarsal Fractures

- Zone 1 - Avulsion fracture
- Zone 2 - Jones Fracture
- Zone 3 - Diaphyseal fracture
Zone 1 5th metatarsal fractures

- Inversion injury
- Avulsion type of fracture
- Usually non-operative
- WBAT ambulation in a boot
Zone 2
Metadiaphyseal 5\textsuperscript{th} MT Fracture (Jones fracture)

Lateral midfoot pain
• Acute injury vs stress injury

Undisplaced
• Cast x 6-8 weeks

Displaced (or high level athlete)
• ORIF – IM Screw

Recurrent fracture
• Consider correcting hindfoot varus
Zone 3 5\textsuperscript{th} metatarsal fracture

- Inversion injury
- Usually non-operative
- WBAT in boot 6-8 weeks
- Consider osteoporosis workup in women >50 y.o
Lisfranc fractures

HISTORY
• Twisting injury
• Fall
• Braking in MVA

PHYSICAL EXAMINATION
• Tender, swollen midfoot
• Plantar ecchymosis
• Pain with TMT movement ex. manipulation of MT heads
Lisfranc Anatomy

- Osseous stability:
  - Recessed base of 2\textsuperscript{nd} metatarsal
  - Roman arch in coronal plane
    - Metatarsal trapezoidal cross section
    - 2\textsuperscript{nd} metatarsal is keystone
Not all Lisfranc Injuries are the same!!
Radiographic Evaluation

• AP, Lateral, and 30° Oblique X-Rays are mandatory

• AP: The medial margin of the 2nd metatarsal base and medial margin of the medial cuneiform should be aligned
Radiographic Evaluation

• Oblique: Medial base of the 4\(^{th}\) metatarsal and medial margin of the cuboid should be aligned
Radiographic Evaluation

• Lateral: The dorsal surface of the 1\textsuperscript{st} and 2\textsuperscript{nd} metatarsals should be level to the corresponding cuneiforms
Treatment Goals

• Restoration of anatomic alignment of the joint

• Stable plantigrade foot which fits into a standard shoe

• Create a painless foot
The Great Debate

ORIF--Maintains joint motion
  • Need for HWR
  • Articular damage

Primary fusion--fewer surgeries, improved outcomes
  • Nonunion
  • Stiffness
Prognosis Return to Recreational Sports

• 94% were able to return to some form of sport
• Most patients who sustained a Lisfranc injury could return to sport and physical activity after ORIF

Mora et al. FAI 2018
Preferred Technique

- 25 yo male
- Bexar County sheriff
- 2nd opinion after offered primary fusion
Bridge Plating
2 mos S/P hardware removal
Lisfranc fractures

- DO NOT miss this injury!
- Weightbearing X-rays required
- Anatomic reduction mandatory
- For acute injuries ORIF vs. arthrodesis probably equivalent
Ankle Sprains

• Ankle sprains are common injuries
  • 40% of all sports injuries
  • Inversion injury

• Acute
  • Running, jumping, or landing
  • Popping, tearing
  • Pain and swelling

• Non-operative treatment acutely
  • RICE, bracing
What about the “high” ankle sprain?

- Eversion and external rotation
- Acute treatment
  - RICE, bracing
- Longer recovery than “low” ankle sprains
High ankle sprain = Syndesmosis Injury

High ankle sprain
- Inherently Stable
- Normal Mortise
- Able to WB

Syndesmosis disruption
- Unstable Injury
- Widened Mortise
- Disabling
Ankle Instability
Lateral ankle sprains

• Prognosis
  • 32% chronic complaints
  • 72% functional impairment at prior level
  • 19% Repeated inversion injuries
  • No correlation with initial severity of sprain

Ankle Instability

- Chronic
  - Frequent “rolling” or spraining of ankles
  - Pain
    - “Giving way” can be secondary to pain
- Trouble ambulating on uneven surfaces
- Improvement with a brace

In a select few, lateral ligament repair or reconstruction may be necessary if conservative therapy fails
Physical Exam

• Tender over the affected ligaments

• Neurologic exam
  • Superficial peroneal nerve injury – altered sensation

• Evaluate hindfoot alignment
  • Varus predisposes to inversion injury
Physical Exam

• Anterior drawer (ATFL)
  • PF, allow to rotate
  • Pain
  • Suction sign

• Tilt (CFL)
  • Invert hindfoot
    • Min. PF - tibiotalar
    • DF – subtalar

• Syndesmosis
  • Squeeze test
Radiographic Workup

• Weight bearing x-rays
  • Assess for avulsion fractures
  • Anterior osteophytes
    “Footballer’s Ankle”
  • Talus OCD
Radiographic Workup

- Stress views - BILATERAL
  - Anterior drawer
    - Translation 5mm diff or > 9mm total = instability
  - Talar tilt
    - 5deg diff or >10deg total = instability
  - External Rotation
    - Syndesmosis injury
- MRI
  - Only necessary if failed conservative treatment for at least 3 months
  - Persistent pain or instability
  - Allows assessment of all other structures around the ankle.
When is Surgery Necessary?

- **Surgical Indications**
  - Positive Physical Exam
    - Anterior drawer, talar tilt
  - Positive Stress Radiographs
  - Failed appropriate rehabilitation.
    - Need proprioceptive training
  - Trial of Bracing
    - Ideally they’ve responded well
Modified Brostrom-Gould

- L-shaped incision along posterior fibula to access Peroneal Tendons if necessary
- Dangers:
  - Superficial Peroneal Nerve
  - Sural Nerve
Modified Brostrom-Gould

• Identify the Inferior Extensor Retinaculum
Modified Brostrom-Gould

- Resect ATFL and CFL from Fibular Origin and remove excess tissue
  - ATFL is thickened capsule
  - CFL is usually underneath (medial) to the peroneal tendons
Modified Brostrom-Gould

- Make 4 holes in the fibula
- Pass Sutures through the ligament ATFL/CFL
- Tie over bone tunnels
- Place the ankle in eversion.
Modified Brostrom-Gould

- Develop flap of fibular periosteum from anterior to posterior
  - Modification for poor tissue quality
Modified Brostrom-Gould

• Suture IER to the Fibular Periosteal Flap

• Rectangular Periosteal Flap Augmentation

Kirk KL, Schon LC FAI Feb 2008
Non-anatomic Reconstructions

- Evans
  - Use of the Peroneus Brevis Tendon
    - All or Half
  - Suture to itself or to the fibula
Evans Procedure
What about the “Alabama” Procedure?

Suture Tape Internal Brace

Tightrope

TSAOG

BRIO

Burkhart Research Institute for Orthopaedics
When it is not just a “sprain”

- Talus osteochondral defects
- Peroneal Tendon disorders
- Achilles ruptures
- Posterior tibial tendon disorders
Talus Osteochondral Defects

• Clinical presentation of talar OCD lesions
  • Persistent pain after appropriate rehab
  • Pain with weightbearing
  • Catching or locking symptoms
Radiographic Imaging

- 3 X-ray views of ankle

- CT scan

- MRI
  - Reports range from 30% to 43% of lesions missed on plain radiographs then seen on MRI.
CT scan

- 91% sensitive *
- Excellent for subchondral cyst evaluation
- Excellent for following progression
MRI

• Reported sensitivities between 75% - 93%

• False positive findings
  • Bone bruise
Treatment Options

• Drilling/Microfracture
• Osteochondral Autograft Transplant (OATS)
Debride with shaver

Drill with K wire
Pick making holes
Lower water pressure allows bleeding
Tissue Transplantation

• Osteochondral Autograft Transfer System (OATS) Procedure
35 y/o M with painful swelling and mechanical symptoms in his right ankle
OATS procedure

- SPN protected
- Talar lesion
Determining appropriate graft size

Lesion after debridement
OATS cylinder harvesting device on handle
Creating recipient site in talar dome
Cylinder creation of recipient site
Recipient site harvested
Taking donor plug from femur
Harvesting of two donor osteochondral grafts
Stable thru ROM
Post-op Ankle Radiographs
Peroneal Tendons Disorders

- Tenosynovitis
  - Rest, NSAIDs, activity modification
  - Orthotics (lateral heel wedge), PT, NSAIDS
- Walking cast
- Corticosteroid injection
- Tendon ruptures
- Tendon dislocation or subluxations
Peroneal Tendon Tears

• Rupture
Peroneal Tendon Disorders

- Peroneal Tendon Longitudinal Tears

- Resection of 25-33% has been described
- Larger defect – tenodesis to intact adjacent peroneal tendon
56yo female with peroneal tendon tear
Peroneal Tendons

- **Peroneal Tendon Subluxation/ Dislocation**
  - Grade I – SPR stripped off fibula
  - Grade II – avulsion of cartilaginous rim
  - Grade III – Bony avulsion
Peroneal Subluxation
Torn Retinaculum
Suture Repair
Completed repair
ANATOMY

- Largest tendon in body
- Broad area of insertion approximately 2x2cm
- Tendon twists 90 degrees on itself prior to insertion with the fibers of the gastrocnemius lateral and soleus medial
ANATOMY

Blood supply

• Distally from calcaneus through interosseous arterioles
• Proximally from intramuscular arterial branches
• Zone of avascularity 2 to 6 cm proximal to calcaneus
History- Acute Rupture

ACUTE RUPTURE

• 5:1 male predominance
• Peak incidence in 3rd to 5th decade
• Up to 20-30% missed on initial presentation
• Sudden pain
• Audible “snap or pop” at time of injury
• Unable to bear weight or push-off on affected leg
Physical Examination
Acute Rupture

Examination
• Palpable defect
• Weak active plantarflexion
• Increased passive dorsiflexion
• Asymmetry in plantarflexion

• Calf-squeeze test
• Lack of plantarflexion with calf squeeze
Imaging - Xrays

Acute Rupture

Loss of Kager’s Triangle or avulsion of tuberosity
24 y.o. male power lifter
24 y.o male power lifter
Anatomy

• **Origin**
  • Posterior tibia/fibula/IO membrane

• **Insertions**
  • Plantar surface 3 Cuneiforms / bases 2-4 MT / Cuboid

• **Hypovascular region**
  • 2-3cm region, tip of medial malleolus to tuberosity of navicular
Function

- PT muscle inverts subtalar joint
- Normal excursion = 2 cm
- Maintains longitudinal arch
- Controls mobility of transverse tarsal joints
  - “Locks” the transverse tarsal joint prior to heel rise
TYPICAL HISTORY

• Obese, white female approximately 40 y.o.
  • 3x more common in women than men
• Long-standing flatfeet
• Posteromedial pain, worse with activities
• Symptoms not improving with time
• +/- acute event, commonly acute on chronic
PHYSICAL EXAMINATION

- Point tenderness below medial malleolus (distal Posterior tibial tendon course)
- Flattened medial longitudinal arch
- + “too many toes” sign

![Too Many Toes](image1)

Hindfoot Valgus
PHYSICAL EXAMINATION

• Inability to perform **single leg heel rise**
  = incompetent posterior tibial tendon

Normal Single Leg Heel Rise
Heel Rises and inverts
Opposite foot is off the ground

Unable to Perform
Single leg Heel Rise
-Heel does Not Invert
Acquired Adult Flatfoot Deformity

X-Rays
• Must be WB to assess bony alignment
• AP and Lateral Foot Views
• Lateral View will show a break in Talo-1st MT line (Meary’s Line)
PTTD- Classification
(Johnson and Strom, CORR 1989)

• Stage I - “Pain without collapse”
  • Tendinitis without deformity
  • Medial ankle pain
  • PTT swelling
  • Intact PT (able to perform single leg raise)

• Stage II - “Supple collapse”
  • Small tears, still intact
  • Posteromedial ankle pain
  • Flatfoot deformity
  • Incompetent PT (unable to perform single leg raise)
  • Flexible subtalar jt / hindfoot
PTTD- Classification
(Johnson and Strom, CORR 1989)

• Stage III - “Rigid with subtalar DJD”
  • Complete disruption
  • Stage 2 + arthritic or stiff hindfoot joints
  • Fixed hindfoot valgus, subtalar & midfoot degenerative changes
  • Significant sinus tarsi pain
Ankle Braces

• Ankle Stirrup
• ROM Walker boot
• Short Articulated AFO
• Posterior shell AFO
  • Hinged
  • Solid
• Arizona Brace
Footbed Support

- Accomodative orthotics
  - Do not correct foot position
  - Foamed polyethylene (Pelite, plastizote)
  - Open Cell urethane (Poron)

- Semi-Rigid Orthotics
  - Medial posting

- UCBL orthotics
  - Corrects hindfoot valgus
Calcaneal Osteotomy

- Indications
  - With tenosynovectomy in advanced Stage I
  - With FDL transfer in Stage II
- Lateral incision, 10 mm medial translation on tuberosity, single screw fixation
  - Addresses hindfoot valgus
  - Preserves hindfoot motion
FDL Transfer

Master Knot of Henry

Relationship of PTT to FDL
FDL Transfer

Transfer FDL

Tension FDL
FDL Transfer and MDCO for PTTD: A Middle -Term Follow-up
Guyton, et al Foot and Ankle Int 2001

• 26 pts
• 32 month followup
• All but three could perform SLHR
• Only 50% felt conformation of foot changed despite radiographic alignment improvement
• Pain relief 75% excellent/16 % good
• Median length of time to self-rated maximal medical improvement was 10 months
Stage III PTTD

- Surgical Indications
  - Rigid hindfoot valgus, lateral foot pain
- Goals
  - Realign hindfoot,
  - Establish plantigrade weightbearing surface
- Triple arthrodesis
Final Thoughts

• Don’t miss Lisfranc injuries!
• Not all sprains are “just” sprains
• Refer when in doubt