2023 Napa Primary Care Conference

November 8-12, 2023

16 hours CME Credit™

Physicians, Nurses, Physical Therapists, Athletic Trainers and other medical professionals

ANKLE PAIN

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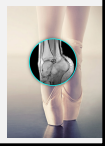
OBJECTIVES

- Review common ankle occupation and dance related conditions
- Refresh special physical exam tests
- Outline the evaluation and management options for these conditions



PHYSICAL EXAMINATION

- **Inspection**
- **Range of Motion**
- **Palpation**
- **Neurovascular Exam**
  - **Strength**
  - **Sensation**
  - **+/- Reflexes**
- **Special Tests**

COMMON ANKLE PROBLEMS

QUIZ

30 yo M construction worker reports rolling his ankle 2 hours ago. He was able to walk to your office but has tenderness to palpation over the medial malleolus and navicular regions.

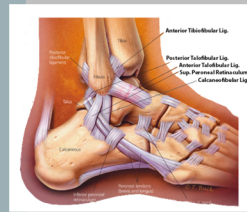
What imaging does he need?

- A) No imaging needed
- B) Ankle Xray
- C) Foot Xray
- D) Ankle MRI
- E) B and C

- Lisfranc joint
- Navicular

LATERAL ANKLE ANATOMY

Key Ligaments:
ATFL → CFL → PTFL



https://upload.orthobullets.com/topic/7028/images/ankle%20ligaments.jpg

LATERAL ANKLE SPRAIN

- Most common ankle sprain
- INVERSION mechanism
- Typically:
  - ATFL → CFL → PTFL
  - May involve others if severe
- Look for associated injuries
- Exam may be limited in acute setting

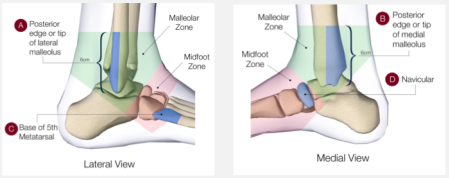
- Exam:
  - Rule out fracture
  - Rule out associated injuries
  - Rule out neurovascular injury
  - Anterior drawer (ATFL)
  - Talar tilt (CFL)

Anterior Drawer

Talar Tilt

http://www.theottawarules.ca/ankle_rules

WHEN TO XRAY? OTTAWA CRITERIA



LATERAL ANKLE SPRAIN

- RICE (weak LOE)
- NSAIDs for symptom relief only (minimize)
- Aircast / cast BETTER than ACE wrap or CAM boot
  - 10 days or less
  - Avoid prolonged immobilization
- Functional brace x 12 mo reduces recurrence
- Unclear if PT or home exercise program is better
- Consider MRI imaging if not better after ~ 8 weeks
  - Rule out mimics and other injuries
- Recurrent instability with tear may need surgical repair
  - Consider PRP

Table 1: Classification of Ankle Sprains

Severity	Physical Examination Findings	Impairment	Pathophysiology	Typical Treatment*
Grade 1	Minimal tenderness and swelling	Minimal	Microscopic tearing of collagen fibers	Weight bearing as tolerated No splinting / casting Isometric exercises Full range-of-motion and stretching / strengthening exercises
Grade 2	Moderate tenderness and swelling Decreased range of motion Possible instability	Moderate	Complete tears of some but not all collagen fibers in the ligament	Immobilization with air splint Physical therapy with range-of-motion and stretching / strengthening exercises
Grade 3	Significant swelling and tenderness Instability	Severe	Complete tear / rupture of ligament	Immobilization Physical therapy similar to grade 2 sprains but over a longer period Possible surgical reconstruction

* Patients must receive treatment that is tailored to their individual needs. This table outlines common treatment protocols.

Reprinted with permission from Bernstein J (ed): Musculoskeletal Medicine, Rosemont, IL: American Academy of Orthopaedic Surgeons, 2003, p.242.

https://health.uconn.edu/msi/clinical-services/orthopaedic-surgery/foot-ankle-and-podiatry/ankle-sprain/

ANKLE SPRAIN MANAGEMENT BY GRADE

- Grade I
  - Acute taping, elastic support
  - Early mobilization
- Grade II-III
  - Immobilization
  - PRP
  - Consider early surgery (7-10 days) if complete
- Rehab: pool, Pilates, gastroc/peroneal strength

ASSOCIATED INJURIES

- Fractures
  - 5th metatarsal fractures:
    - Avulsion (good)
    - Jones (bad)
    - Shaft (ok)
  - Navicular (bad)
  - Talar Dome
- Tendon injury
  - Peroneal tendons
- Other
  - OCD lesion of Talar dome

CHRONIC LATERAL ANKLE PAIN

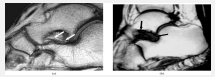
- Osteoarthritis
  - Decreased ROM, pain, +/- swelling
  - Tx: Pain reliever, NSAIDs, bracing for activity, heat/cold modalities, steroid injection, arthroplasty
- Subtalar Arthritis
  - Decreased eversion/inversion
  - Difficult to diagnose

CHRONIC LATERAL ANKLE PAIN

- Anterolateral Impingement
  - "lateral gutter syndrome" after inv injury
  - NSAIDS, steroid inj, PT, debridement
- Chronic Subtalar Instability
  - Frequent giving way after inv injury
  - PT, bracing during sport, surgical ligament reconstruction

CHRONIC LATERAL ANKLE PAIN

- Subtalar Synovitis or Impingement
  - Sinus Tarsi syndrome
  - Chronic synovitis after inv injury
- Treatment
  - PT, injection, surgical debridement



CHRONIC LATERAL ANKLE PAIN

- Nerve Injury
  - Direct blow, stretch, entrapment
  - Spontaneous improvement vs surgery
- Peroneal tenosynovitis/subluxation
  - Brevis affected more often
  - Immobilize 4-6 weeks, surgery if persists
- Occult Bony Pathology
  - OCD talus, avulsion calcaneous, stress fx
  - Immobilize 4-6 weeks, scope if persistant

QUIZ

A 40 yo office worker presents after twisting her ankle walking down the stairs. The exact mechanism is unclear. On exam, there is swelling and she is tender to palpation anteriorly but not over the lateral or medial ankle ligament regions. Putting her ankle into dorsiflexion with eversion reproduces pain.

What is the most likely diagnosis?

- A) ATFL sprain
- B) CFL sprain
- C) Deltoid sprain
- D) Talar dome OCD
- E) High ankle sprain (Syndesmosis)

HIGH ANKLE SPRAIN

- AKA "Syndesmosis injury"
- Mechanism DORSIFLEXION + EVERSION typically
- Pain located at Tib-Fib junction anterior and superior to ankle joint line
- Exam
  - Rule out fracture
  - Rule out associated injuries
  - Rule out neurovascular injury
  - Squeeze test
  - Figure-4 Dorsiflexion & Eversion test

Squeeze Test

Dorsiflexion + Eversion Test

HIGH ANKLE SPRAIN

- Make sure WB Xray
- Xray findings typically guide management
- May need advanced imaging
- No mortise instability
  - → CAM boot, RICE, PT
- Mortise instability
  - → surgery

QUIZ

A 30 yo male slipped while carrying a heavy load going down stairs. His weightbearing foot was plantarflexed. He felt a pop and had severe pain over his midfoot. His foot appears like this →

What injury must be ruled out?

A) Plantar fascia rupture
B) Flexor hallucis longus tear
C) Lisfranc injury
D) Posterior tibialis tendon tear

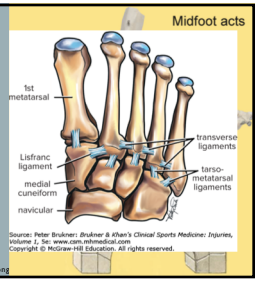
LISFRANC INJURY

- Commonly missed; high risk of long term morbidity without proper treatment
- Mechanism: PLANTARFLEXION with axial load
- May see plantar midfoot bruising
- Exam:
  - Rule out associated injuries and fracture
  - Rule out neurovascular injury
  - Piano key test
  - Torsion test
- Get WB AP films of both feet to compare
- Often need advanced imaging

LISFRANC COMPLEX

2nd MT base + medial cuneiform

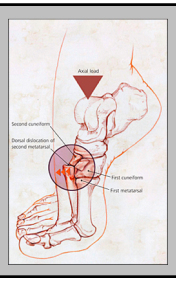
"Keystone" structure



https://drwolgin.com/lisfranc-fracture/
https://csm.mhmedical.com/data/books/1970/bru61384_4312.png

MECHANISM

Dorsal dislocation of the 2nd metatarsal base



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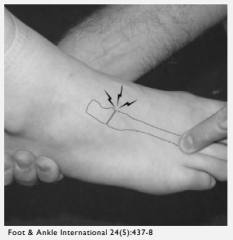


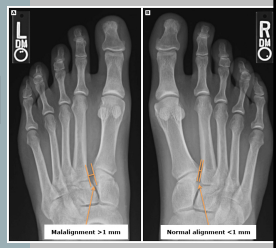
Foot & Ankle International 24(5):437-8

LISFRANC INJURY

- NWB, CAM boot initially
- Generally refer ALL for surgical consult
- Ligamentous injury only
  - Low grade: NWB 8 weeks
  - High grade: surgery
- Bony injury
  - Most are treated surgically

LISFRANC INJURY

Look for associated chip fractures



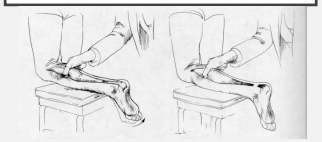
QUIZ

A 57 yo baseball fan presents to your office urgently after celebrating in the stands- jumping up to cheer just as another fan jumped onto their back. They felt an acute pain in the back of their left heel along with a 'pop'. An image is shown. What is the best exam maneuver?

- A) Fulcrum test
- B) Ober test
- C) Burnham's maneuver
- D) Thompson test

https://www.bmj.com/content/351/bmj.h4722

THOMPSON'S TEST



ACHILLES RUPTURE

- Relatively common injury
- Typically explosive calf contraction or eccentric load
- 30-40 yo range
- Exam
  - Rule out associated injuries and fracture
  - Rule out neurovascular injury
  - May have palpable defect, bruising
  - Decreased plantarflexion strength
  - Thompson test
- Imaging may not be needed; US can rapidly confirm dx

ACHILLES RUPTURE

- NWB, RICE initially
- Non-surgical:
  - Functional brace with heel lift or CAM boot with heel lift
  - Gradual increase in ROM over 6-8 weeks
  - Physical therapy
  - CONs: Higher rate of re-rupture, ↯light strength decrement
- Surgical:
  - Direct repair
  - CONs: Higher rates of infection, DVT, sensory changes

QUICK HITS

WHAT IS WRONG WITH THIS DANCER?

https://www.physicaltherapt.com/field-research-blog/tag/Dance+Medicine

EN POINTE:

Common Injury 1

Flexor Hallucis Longus (FHL) tendinopathy

A change in the tendon that can cause pain and reduce function of the tendon itself through either too much load too soon or too much load for the tendon's current capacity. Pain can be felt in multiple locations on the foot.

HTTPS://WWW.PHYSIOTEC.COM.AU

Visit: physiotec.com/en-pointe-common-foot-injuries-in-ballet-dancers - to read more on this topic

WHAT'S WRONG WITH B?

WHAT'S WRONG WITH A? B?

https://footeducation.com/achilles-tendonitis/

ACHILLES TENDINOPATHY

https://kineticlabs.ca/blog/quick-facts-on-achilles-tendinitis/

ANKLE IMPINGEMENT- ANTERIOR

- Anterior impingement
- Seen in athletes with repetitive dorsiflexion
- Bone or soft tissue pinched between anterior distal tibia and talar dome
- Presentation: limited demiplie, pain landing jumps
- PE: limited DF, ATFL tenderness, audible click, palpable exostoses

ANKLE IMPINGEMENT- POSTERIOR

- Posterior impingement: posterior tibia and calcaneus in plantar flexion
  - Os trigonum or prominent Steida's process: posterolateral tenderness
  - FHL tendonitis: posteromedial tenderness
  - Achilles tendonitis: posterior tenderness
  - Presentation: pain en pointe, demi, and relevé
  - PE: localize pain with passive forced PF
  - FHL may cause triggering of great toe, crepitus

REFERENCES

- Journal of Foot & Ankle Surgery 1999; 38(2):102-108.
- J Fam Practice 2012; 61(4):198-204.
- Ottawa Ankle Rules. http://www.theottawarules.ca/ankle_rules
- Lancet. 2009;373(9663):575.
- Br J Sports Med. 2014 Aug;48(16):1235-9.
- Br J Sports Med 2018;52:956.

THANK YOU!

- Please use the following slides for your reference.

DON'T MISS

- Fracture
  - Jones (base 5th MT)
  - Navicular
  - Maisonneuve
- Bone stress injury
  - Jones (base 5th MT)
  - Navicular
  - Anterior tibia
- Tendon/Ligament
  - Achilles rupture
  - Lisfranc injury
  - Syndesmosis injury (high ankle sprain)
- Other:
  - Acute compartment syndrome

DIFFERENTIAL BY LOCATION

- Anterior
  - Anterior ankle impingement
  - Tibialis anterior tendinopathy
  - Osteoarthritis
  - OCD lesion
  - Superficial peroneal neuropathy
- Posterior
  - Achilles tendinopathy or rupture
  - Haglund deformity / syndrome
  - Retrocalcaneal bursitis
  - FHL tendinopathy
  - Os trigonum syndrome
  - Posterior ankle impingement
  - Plantaris rupture

DIFFERENTIAL BY LOCATION

- Medial
  - Deltoid ligament injury
  - Posterior tibialis tendinopathy
  - FHL or FDL tendinopathy
  - Anteromedial impingement
  - OCD lesion
  - Stress fracture – medial malleolus
  - Lumbar radic (L4)
  - Tarsal tunnel syndrome (tibial nerve)
- Lateral
  - Fibularis tendinopathy/dislocation/subluxation
  - Lateral ligament injury
  - Anterolateral impingement
  - Stress fracture – distal fibula or cuboid
  - Syndesmotic injury
  - OCD lesion
  - Lumbar radic (S1)
  - Sinus tarsi syndrome

DIFFERENTIAL BY LOCATION

- Heel
  - Plantar fasciitis or rupture
  - Calcaneal stress fracture
  - Calcaneal spur
  - Rheum – RA, Spondyloarthropathies, Gout
  - Lumbar radiculopathy (S1/S2)
  - Fat pad syndrome
  - Plantar nerves, Baxter's nerve entrapment

DIFFERENTIAL BY LOCATION

- Midfoot
  - Stress fracture – cuboid, navicular, cuneiforms, MT
  - Superficial peroneal nerve entrapment
  - EHL, ED tendinopathy
  - Osteoarthritis
  - Lisfranc injury
- Forefoot
  - Morton's neuroma
  - Freiberg's disease (AVN MT head)
  - Metatarsalgia
  - Sesamoiditis or sesamoid stress fracture

ANTERIOR LEG

Muscle	Origin	Insertion	Action	Nerve Supply
tibialis anterior	shaft of tibia and interosseous membrane	medial cuneiform and base of first metatarsal	extends the foot at ankle; inverts foot at subtalar and transverse tarsal joints helps to maintain the medial longitudinal arch of foot	deep peroneal nerve
extensor digitorum longus	shaft of fibula and interosseous membrane	extensor expansion of lateral four toes	extends toes; dorsiflexes (extends) foot	deep peroneal nerve
peroneus tertius	shaft of fibula and interosseous membrane	base of fifth metatarsal	dorsiflexes (extends) foot; everts foot at subtalar and transverse tarsal joints	deep peroneal nerve
extensor hallucis longus	shaft of fibula and interosseous membrane	base of distal phalanx of big toe	extends big toe; dorsiflexes foot; inverts foot at subtalar and transverse tarsal joints	deep peroneal nerve
extensor diditorum brevis	calcaneus	long extensor tendons to 2nd, 3rd, and 4th toes	extends big toe	deep peroneal nerve
extensor hallucis brevis	calcaneus	proximal phalanx of big tow	extends big toe	deep peroneal nerve

POSTERIOR LEG

Superficial Group

Muscle	Origin	Insertion	Action	Nerve Supply
gastrocnemius	medial and lateral condyles of femur	calcaneum	plantar flexes (flexes) foot; flexes knee	tibial nerve
plantaris	lateral supracondylar ridge of femur	calcaneum	plantar flexes foot; flexes knee	tibial nerve
soleus	shafts of tibia and fibula	calcaneum	with gastrocnemius, a powerful plantar flexor of ankle; main propulsive force in walking and running	tibial nerve

POSTERIOR LEG

Deep Group

Muscle	Origin	Insertion	Action	Nerve Supply
flexor digitorum longus	shaft of tibia	distal phalanges of lateral four toes	flexes distal phalanges of lateral four toes; plantar flexes foot; supports lateral longitudinal arch of foot	tibial nerve
flexor hallucis longus	shaft of fibula	base of distal phalanx of big toe	flexes distal phalanx of big toe; plantar flexes foot; supports medial longitudinal arch of foot	tibial nerve
tibialis posterior	shafts of tibia and fibula and interosseous membrane	tuberosity of navicular bone	plantar flexes foot; inverts foot at subtalar and transverse tarsal joints; supports medial longitudinal arch of foot	tibial nerve

LATERAL LEG

Muscle	Origin	Insertion	Action	Nerve Supply
peroneus longus	shaft of fibula	base of first metatarsal and the medial cuneiform	plantar flexes (flexes) foot; everts foot at subtalar and transverse talar joints; supports lateral longitudinal arch and transverse arch of foot	superficial peroneal nerve
peroneus brevis	shaft of fibula	base of fifth metatarsal bone	plantar flexes (flexes) foot;everts foot at subtalar and transverse talar joints; holds up lateral longitudinal arch	superficial peroneal nerve

FOOT

Muscle	Origin	Insertion	Action	Nerve Supply
First Layer				
abductor hallucis	medial tubercle of calcaneum	medial side, base proximal phalanx big toe	flexes, abducts big toe. Supports medial longitudinal arch	medial plantar
flexor digitorum brevis	medial tubercle of calcaneum	middle phalanx of four lateral toes	flexes lateral four toes. Supports medial and lateral longitudinal arches	medial plantar
abductor digiti minimi	medial and lateral tubercles of calcaneum	lateral side base proximal phalanx fifth toe	flexes, abducts fifth toe. Supports lateral longitudinal arch	lateral plantar
Second Layer				
accessory flexor (quadratus plantae)	medial and lateral sides of calcaneum	tendon flexor digitorum longus	aids long flexor tendon to flex lateral four toes	lateral plantar nerve
lumbricals	tendons of flexor digitorum longus	dorsal extensor expansion of lateral four toes	extends toes at interphalangeal joints	first: lumbrical-medial plantar; remainder-deep branch lateral plantar

FOOT

Muscle	Origin	Insertion	Action	Nerve Supply
Third Layer				
flexor hallucis brevis	cuboid, lateral cuneiform tibialis posterior insertion	medial and lateral sides of base of proximal phalanx of big toe	flexes metatarsophalangeal joint of big toe; supports medial longitudinal arch	medial plantar
adductor hallucis, oblique head	bases second, third, fourth metatarsal bones	lateral side base proximal phalanx big toe	adducts big toe, supports transverse arch	deep branch lateral plantar
adductor hallucis, transverse head	capsules 3, 4, 5 metatarsophalangeal joints	lateral side of base of proximal phalanx, big toe	adduct big toe	deep branch lateral plantar
flexor digiti minimi brevis	base of fifth metatarsal	lateral side base of proximal phalanx small toe	flexes little toe	lateral plantar
Fourth Layer				
dorsal interossei (4)	adjacent sides of metatarsals	bases of phalanges and dorsal expansion of corresponding toes	abduct toes, using second toe as reference flex metatarsophalangeal joints; extend interphalangeal joints	lateral plantar
plantar interossei (3)	3rd, 4th, 5th metatarsals	bases phalanges and dorsal expansion 3rd, 4th, 5th toes	adduct toes using second toe as reference flex metatarsophalangeal joints; extend interphalangeal joints	lateral plantar

DDx by Chronicity

ACUTE	CHRONIC
Achilles tendon rupture	Achilles tendinopathy
Acute compartment syndrome	
Ankle sprain	
Calcaneal stress fracture	Calcaneal stress fracture
First MTP joint sprain	
Metatarsal fractures	Metatarsal fractures
Os trigonum (Posterior impingement)	Os trigonum (Posterior impingement)
Plantar fasciitis	Plantar fasciitis
Sinus tarsi syndrome	Sinus tarsi syndrome
Stress fractures	Stress fractures
Syndesmotic ("High") ankle sprain	
Tarsal tunnel syndrome	Tarsal tunnel syndrome

	Exam	Workup	Treatment
Maisonneuve fracture	Tenderness over deltoid ligament, syndesmosis and proximal fibula near fracture	Ankle series and dedicated films of proximal tibia	6-8 weeks of casting if intact ankle mortise
Achilles tendon rupture	Palpable gap in tendon may be present. Thompson test positive in complete rupture	Clinical diagnosis, but MRI or US may be helpful	Casting and immobilization for 8-12 weeks or functional bracing with early rehabilitation. Surgery may be considered
Medial tibial stress syndrome	May have tenderness along distal 2/3 of posteromedial tibia. Navicular drop test may be positive	MRI can help differentiate medial tibial stress syndrome from tibial bone stress injury	Relative rest with gradual increases in activity
Tibial bone stress injury	Tenderness at site of reported pain with possible swelling	MRI is study of choice	Immobilization, followed by non-impact activities
Ankle sprain	Swelling may be present. Perform anterior drawer, inversion stress, squeeze and external rotation tests	Use Ottawa ankle rules to determine need for radiographs. If symptomatic > 6 weeks, CT or MRI should be considered	Rest, ice, compression, and elevation, but no prolonged immobilization
First MTP joint sprain	May have swelling, ecchymosis, malalignment, and tenderness at the joint	Weight bearing AP, lateral and sesamoid axial radiographs. MRI may be helpful	Rest, ice, compression, elevation, and NSAIDs. Short leg cast with toe spica extension in slight plantar flexion may be helpful
Fifth metatarsal fracture	Tenderness with surrounding ecchymosis and swelling	AP, lateral and 45 degree oblique radiographs and should be repeated 10-14 days after onset symptoms	Conservative if non-displaced, depending on fracture location and individual patient factors
Lisfranc injury	Plantar ecchymosis and tenderness at the mid-foot	Weight-bearing AP, lateral and 30 degree oblique radiographs. MRI if clinical suspicion persists despite normal XR and CT images	Immobilization, rest, ice and elevation with progression to mobility as tolerated with walking cast or controlled ankle motion boot. Often needs surgical evaluation.

MEDIAL ANKLE SPRAIN

- Much less common
- EVERSION mechanism
- Deltoid ligament is broader, stronger
- Higher risk for associated injuries
  - ?Maisonneuve
- Exam
  - Rule out fracture
  - Rule out associated injuries
  - Rule out neurovascular injury
  - Talar tilt

MEDIAL ANKLE SPRAIN

- Ottawa rules to guide X-ray
- If there is significant deltoid laxity or concern for such, MRI may be warranted
- Stretch (Grade I)
  - Aircast brace, RICE, rehab
- Partial/Complete Tear (Grade II-III)
  - Surgical consultation