Ankle Injuries: Exam Diagnosis and Conditions

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Educational Need/Practice Gap
Gap: Anatomy, Mechanism of Injury, and PE of Ankle Injuries Allows Correct Diagnosis
Need: Improve Physical Exam and Improve Diagnostic Skills by Case Presentations based on Understanding Anatomy and Compartments of the Ankle.

Expected Outcome
By Case Based Approach become more aware of diagnosis and treatment of ankle and foot injuries.

Objectives
Discuss treatment of Ankle Injuries by case examples
Review correct diagnosis and evaluation of Acute and Overuse Ankle Injuries

A good History and Physical is Key
to a Correct Diagnosis
Function

• Propulsion
• Support
• Flexibility
• Rigidity
• Gait mechanics: ankle and foot motions

Function

• All joints/tendons must work in synchrony for normal gait mechanics
  • Tibiotalar
  • Subtalar
  • Transverse talar
    • Calcaneal cuboid and talonavicular
    • Metatarsal break
  • Plantar aponeurosis
    • Windlass mechanism

Ankle Axis: Opposite with foot fixed

• With foot fixed, dorsiflexion / Plantarflexion results in rotation of the leg
  • Dorsiflexion results in internal rotation
  • Plantarflexion results in external rotation

Mechanics of Running

• Basic kinematics of the foot and ankle not significantly altered
• Gait cycle shortened
• Stance phase shortened
• Vertical forces during stance phase increase to 2.5 - 3 times body weight
• ROM of joints is increased 50%
• Phasic activity of the lower extremity muscles altered
Ankle: Modified Hinge Joint

- Bony configuration
  - Mortise
  - Circular Pretzel

- Ligamentous stability
  - ATF and CF laterally
  - Deltoid superficial and deep medially
  - Syndesmosis superiorly

Diagnosis Made by

- Compartment of the Ankle
  - Lateral most common
  - Medial
  - Posterior
  - Anterior least common
- Acute vs Chronic
- Plane Radiographs
- Mechanism of Injury

LATERAL ANKLE PAIN

- Sprain ATF and/or CF
- Sinus Tarsi Syndrome
- Subtalar Joint
- Arthrosis Fracture
- Cuboid Subluxation
- Peroneal Dysfunction
- Tarsal Coalition

Lateral Ankle Pain

Bony Origins

- Fractures
  - Os Calcis Anterior
    - Process Avulsoin
  - Talus Lateral Process
    - Fibula Tip
  - Accessory Ossicle
    - Os Subifibulare
    - Impingement
    - Fibula from Os Calcis Fracture

Lateral Ligaments

- Anterior Talofibular
- Calcaneofibular
- Posterior Talofibular
Summary of Findings From the National Collegiate Athletic Association Injury Surveillance System on Foot and Ankle Injury.*

<table>
<thead>
<tr>
<th>Sport</th>
<th>Game Injuries Relating to the Ankle (%)</th>
<th>Game Injuries Relating to the Foot (%)</th>
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<tbody>
<tr>
<td>Men’s baseball</td>
<td>7.4</td>
<td>0</td>
</tr>
<tr>
<td>Women’s softball</td>
<td>10.3</td>
<td>0</td>
</tr>
<tr>
<td>Men’s basketball</td>
<td>26.2</td>
<td>2.6</td>
</tr>
<tr>
<td>Women’s basketball</td>
<td>24.6</td>
<td>2.4</td>
</tr>
<tr>
<td>Men’s football</td>
<td>15.6</td>
<td>1.1</td>
</tr>
<tr>
<td>Men’s lacrosse</td>
<td>11.3</td>
<td>0</td>
</tr>
<tr>
<td>Women’s lacrosse</td>
<td>22.6</td>
<td>1.3</td>
</tr>
<tr>
<td>Men’s soccer</td>
<td>18.8</td>
<td>4.2</td>
</tr>
<tr>
<td>Women’s soccer</td>
<td>19.4</td>
<td>2.7</td>
</tr>
</tbody>
</table>


How I Treat.

- Control swelling
- Brace
- Acutely and during the entire season
- Proprioception
- Core
- Prevent recurrent sprains
- ? Ankle sprain preventable?
Can we prevent ankle sprain?
Even this simple question – Unknown by evidence-based studies.

Prevent – not proven, but we can lessen severity . . . Maybe!


Key Messages
- The efficacy of wearing high-top shoes is unclear.
- There is some evidence that balance training reduces the risk of ankle sprains in athletes with previous injury.


Key Messages
- The preventive effects of taping and bracing have been clearly documented, although the evidence is more convincing for players with previous ankle injury than for healthy athletes.
- Although there are some indications that braces seem to be more effective in preventing ankle sprains than tape, this has not been clearly documented.


LATERAL ANKLE PAIN
- Sprain ATF and/or CF
- Sinus Tarsi Syndrome
- Subtalar Joint
- Arthrosis Fracture
- Cuboid Subluxation
- Peroneal Dysfunction
- Tarsal Coalition

Lateral Ankle Pain

Soft Tissue

- Meniscoid of the Ankle
  - Tomansen, Denmark 1982

- Scar + Synovitis Gutter
  - Ferkel’s Phenomenon, AJSM 1991

- Distal Slip Anterior Tibiofibular Ligament
  - Bassett’s Ligament, JBJS, 1990

- Ganglion

Tibiofibular Ligament

- Dense fibrous structure maintaining ankle mortise (tibiofibular articulation)
- Source of “high ankle sprain”
- Prolonged morbidity!
- Injury occurs from eversion, especially with the foot dorsiflexed
- 1 mm lateral shift of talus within mortise reduces contact area 42%

Physical Exam of the Foot and Ankle

Syndesmosis

© 2006 Kinetics Sports Medicine
18 YO Female Gymnast

- Right ankle injury
- Landed awkwardly doing a back tuck
- Immediate pain and swelling, right ankle

Stress tests, L & R ankles

Dx lateral talus fracture displaced
Severe lateral ankle sprain

Surgery
Think About Peroneal Tendon Involvement If:
- Recurrent Ankle Complaints
- Sprain Not Getting Better
- Pain, Swelling Higher in Peroneal Tendon Sheath

In Acute Ankle Sprain, Assess Peroneal Function

Physical Exam of the Foot and Ankle

17 YO WM High school Baseball/Football Player
C/O Repeated Inversion Ankle Sprains
Maisonneuve Fracture

- Unstable mortise
- Don't miss this injury
- Results in fibular nonunion and severe tibiotalar osteoarthritis

Anterior Ankle Pain

- DX
  - Tibiotalar Impingement
  - Loose Body
- PE
  - Pain on Palpation Anteriorly
  - Palpable Osteophytes
- Radiographs
  - Forced Dorsiflexion Lateral View
  - Document Loss of Dorsiflexion
  - Amount Bone Causing Impingement

Who is the real footballer?

McMurray, TT: Footballers Ankle, JBJS, 323:68, 1950
Posterior Ankle Pain

- Differential Diagnosis
  - Posterior Process Talus Fracture – Shepherd’s Fracture
  - Os trigonum large process versus fracture
  - Tarsal Coalition
  - Osteoid Osteoma
  - Flexor Hallucis Longus Tendinitis—intrinsic versus compressive due to bony impingement

Bony Impingement of the Ankle

<table>
<thead>
<tr>
<th>MOTION</th>
<th>CONTACT AREAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dorsiflexion</td>
<td>Anteromedial Talus Tibial</td>
</tr>
<tr>
<td>Plantar Flexion</td>
<td>Posterolateral Tibia Os Calcis</td>
</tr>
</tbody>
</table>


Medial Ankle Pain

- Differential Diagnosis
  - Deltoid Sprain
  - Medial Malleolus Fracture
  - Tendinitis
    - Posterior Tibialis
    - Flexor Hallucis Longus
  - Osteochondral Talus Fracture
  - Osteochondritis Dissecans

Medial (Deltoid) Ligament

- Superficial & deep component; functions as single structure
- Primary resistance to eversion

Medial (Deltoid) Ligament

- Superficial deltoid fans out from the medial malleolus to insert on the:
  - Talus posteriorly
  - Calcaneus medially
  - Navicular anteriorly
- Deep deltoid ligament
  - Anterior fibers insert on the neck of the talus
  - Posterior fibers insert on the posterior medial tubercle of the talus
**Posterior Tibial Tendon Dysfunction**

<table>
<thead>
<tr>
<th>Stages</th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tendon Length Hindfoot</td>
<td>Normal</td>
<td>Normal</td>
<td>Elongated</td>
</tr>
<tr>
<td>Deformity</td>
<td>Normal</td>
<td>Mobile</td>
<td>Fixed Valgus</td>
</tr>
<tr>
<td>Treatment</td>
<td>None</td>
<td>Mild</td>
<td>Mod – Severe</td>
</tr>
<tr>
<td>Op</td>
<td>Non-Op</td>
<td>Transfer</td>
<td>Subtalar Arthrodesis</td>
</tr>
<tr>
<td>Synovectomy</td>
<td>FDL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Fig. 4.2. "Toe-mary-ton." sign signifies lateral laxity robation. Two and one-half toes seen on the left foot, four toes on the abnormal right foot.*
14 YO Female

- Soccer athlete
- Left ankle
- Acute lateral talar dome fracture
- Documented by plain films and bone
- Edema on MRI

Initial X-Rays

Talar Dome Fracture-45YO Golfer

Osteochondral Talar Lesions


- Osteochondritis Dissecans
  - Male 3 : 1 Female
  - Medial 2 : 1 Lateral

- Etiologies
  - Trauma
  - Vascular
  - Repetitive Loading

OCD Classification

Medial Malleolus

- Left ankle:
  18 yo went up for jump shot & felt pop & sudden onset of pain over medial aspect of ankle

17 YO Male

- Left ankle pain x3 weeks
- Trying to get in shape, played more basketball than usual
- Possible stress fracture of the medial malleolus

3 months after initial presentation

5 Months after initial presentation

Small Blue Cell Tumor
Ewings sarcoma vs. Lymphoma
7 months after symptoms started

Football athlete:
Left Ankle Injury on Astroturf
Fractures Dislocation
- Subtalar Dislocation
- Closed Reduction

Secondary Center Ossifications
- Apophysis – present 22%
  Appears > 8 years
  Fusion: 12 years - females
  15 years - males
- Os peroneum
  In tendon at cuboid level
- Os versalianum – present 15%
  Insertion peroneus brevis
  Usually bilateral – present in 0.1%
Common Accessory Bones (circles with numbers) and forefoot sesamoids (shaded circles)

High School Distance Runner with Midfoot Pain

Tarsal Navicular Stress Fracture

18 YO Freshman
Div. I basketball athlete

• C/O mid-foot pain, L > R
• Started when she was running, playing in shoes mandated by her school
• History of “normal” periods

Courtesy Martin L. Schwartz, MD
Clinical Prof. of Radiology, UAB

Navicular
• Initial x-rays
Navicular view
30º ER
Torg described

Typical orientation of navicular stress fracture

Will require ORIF
Don’t miss a Lisfranc midfoot fracture dislocation

A good History and Physical is Key
to a Correct Diagnosis

The End — Thank You!

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