Ankle Sprains: Lateral and High Sprains

Financial Disclosure

• Dr. Mark Casillas has no relevant financial relationships with commercial interests to disclose.

Outline

• Ankle Anatomy
• Ankle Biomechanics
• Pathologic Anatomy
• Classification
• Differential Diagnosis
• History
• Physical Examination
• Imaging
• Treatment
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Ankle Anatomy

• Bony Stability
• Soft Tissue Stability

Malleolar Length
Talar Width

Soft Tissue Stability
- Ankle ligaments
  - Joint capsule

Ankle Ligaments
- Lateral
- Medial
- Syndesmosis
Ankle Ligaments
- Lateral
- Medial
- Syndesmosis

Lateral Ankle Ligaments
- ATFL (3)
- CFL (4)
- PTFL (5)

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ATFL

- Origin
  - anterior fibula
- Insertion
  - lateral talar neck
- Dimension
- Orientation

CFL

- Origin
  - tip of the fibula
- Insertion
  - lateral calcaneus
- Dimension
- Orientation

Medial Ankle Ligaments

- Deltoid
  - Superficial (3)
  - Deep (1, 2, 4)
Syndesmosis Ligaments

- AITFL (2)
- PITFL (1)
- IOL

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Isolated Stress Testing

- ATFL first to fail
- Deep deltoid last to fail
Neutral Dorsiflexion

- ATFL is perpendicular to the axis of the tibia
- CFL is oriented parallel to the tibia
- CFL provides resistance to varus tilt of the talus

Plantarflexion

- ATFL is oriented parallel to the tibia
- CFL is perpendicular to the axis of the tibia
- ATFL provides resistance to varus tilt of the talus

Putting It All Together...

Neutral Dorsiflexion
- Best ligament stability
- Best bony stability
Plantarflexion

- Weak ligament stability
- Poor bony stability

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Pathologic Anatomy of Lateral Ankle Ligament Injury

- Broström, Acta Chir Scand, 1964
- Surgical exploration of 105 recent ankle sprains
- ATFL most commonly injured
- CFL second most commonly injured
Pathologic Anatomy of Lateral Ankle Ligament Injury

- Disruption of capsular mechanoreceptors
  - Loss of afferent nerve function
  - Loss of ankle motor coordination

Syndesmosis Injury

- The syndesmosis
  - Stabilizes distal tibia and fibula
  - Keeps talus under the tibia
- The tibio-talar surface
  - Must be perfectly matched
  - 1 mm lateral shift increases joint surface pressure by 42%

Syndesmosis Injury

- A failed syndesmosis
  - Leads to lateral translation
  - ↑ tibio-talar pressure
  - Promotes ankle arthritis
  - Results in a loss of function
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Classification

- AMA and O’Donoghue
  - Stretch
  - Partial tear
  - Complete rupture
- Additional information with regard to associated ligamentous injuries

<table>
<thead>
<tr>
<th>Grade</th>
<th>ATFL</th>
<th>Historical</th>
<th>Exam Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Stretch</td>
<td>Inversion injury, subacute pain and swelling, continuous athletic activity</td>
<td>Mild swelling, mild ATFL tenderness, stable ankle</td>
</tr>
<tr>
<td>II</td>
<td>Partial tear</td>
<td>Inversion injury, acute pain and swelling, inability to continue athletic activity</td>
<td>Moderate swelling, moderate ATFL tenderness, stable ankle</td>
</tr>
<tr>
<td>III</td>
<td>Complete tear</td>
<td>Inversion injury with associated “pop,” acute severe pain and swelling, inability to walk</td>
<td>Severe swelling, severe ATFL tenderness, unstable ankle</td>
</tr>
</tbody>
</table>
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Differential Diagnosis

• ATFL sprain
• CFL sprain
• Syndesmosis sprain
• Deltoid sprain
• Subtalar sprain
• Subtalar coalition
• Bifurcate sprain
• Peroneal instability
• Peroneal tendon tear
• Lateral malleolus fracture
• Talar dome fracture
• Anterior process fracture
• Fifth metatarsal fracture

Ankle Sprain

Differential Diagnosis

• ATFL sprain
• CFL sprain
• Syndesmosis sprain
• Deltoid sprain
• Subtalar sprain
• Subtalar coalition
• Bifurcate sprain
• Peroneal instability
• Peroneal tendon tear
• Lateral malleolus fracture
• Talar dome fracture
• Anterior process fracture
• Fifth metatarsal fracture

Not an Ankle Sprain
When An Ankle Sprain Is Not An Ankle Sprain

- Subtalar sprain
- Subtalar coalition
- Bifurcate sprain
- Peroneal instability
- Peroneal tendon tear
- Lateral malleolus fracture
- Talar dome fracture
- Anterior process fracture
- Fifth metatarsal fracture

Subtalar Sprain (Dislocation)

Subtalar Coalition
Fifth Metatarsal Fracture

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History

• Previous injury
• Mechanism
• Ability to continue play
• Current complaints

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Physical Examination

• Systematic approach
• Inspection
• Palpation
• Provocative maneuvers

Provocative Maneuvers

• Resisted motor function
• Squeeze test
• Stress tests
  – varus
  – valgus
  – external rotation

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Resisted Motor Function

Squeeze Test

• Syndesmosis injury
• Compress mid-leg
• Pain at syndesmosis
• Must first rule-out
  – fracture
  – contusion
  – compartment syndrome
Stress Tests

• Clinical and radiographic tool
• Grading ankle sprains
• Inadequate for reproducible diagnosis of lateral ankle ligament injuries

Anterior Drawer

• ATFL disruption
  – Contralateral comparison
  – Normal translation
  – False negative results
  – Local anesthesia

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Talar Tilt

- ATFL/CFL disruption
  - Neutral and plantarflexion test
  - Contralateral comparison
  - Normal tilt
  - False negative results
  - Local anesthesia
External Rotation Stress Test

- Syndesmosis injury
- Knee forward facing
- Examiner applies ER
- Pain at syndesmosis

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Radiographs
• AP, mortise, and lateral
  – malleolar fx
  – physeal fx
  – osteochondral fx
  – avulsion fx
  – alignment
  – translation

Radiographs
• Weight bearing
  – physiologic loading
  – not always obtainable

Bilateral Stress Radiograph
• Quantify
  – anterior translation
  – varus tilt
• Not routine
• 3-15º > contralateral
• Absolute > 9º
• No consensus
Magnetic Resonance Imaging

• Associated injuries
  – talar dome
  – subchondral bone
  – peroneal tendons
  – interosseous ligament
  – cervical ligament
  – tarsal coalition

Syndesmosis Imaging

• X-ray
  – Standing
  – ER stress test
  – Comparison view
  – Alignment
  – Associated injuries

Imaging

• X-ray
  – Standing
  – ER stress test
  – Comparison view
  – Alignment
  – Associated injuries
Syndesmosis Imaging

CT
- Axial
- Comparison
- Alignment
- Associated injuries

Syndesmosis Imaging

MR
- AITFL injury
- Alignment
- Associated injuries

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Lateral Ankle Sprain Treatment

- Grade I and II
- Grade III
- Chronic Instability

Grade I and Grade II Sprains

- RICE method
- Gentle ROM
- Protected weightbearing
- Non-rigid functional ankle brace

Grade III Sprains

- Early mobilization
- Cast immobilization
- Surgical repair
Grade III- Early Mobilization

- Functional treatment
  - Early WB
  - Early rehabilitation
  - Semi-rigid pneumatic ankle brace
- Favored method
- Avoids cast immobilization

Grade III- Cast Immobilization

- Short leg walking cast
- Early return to work
- Early discontinuation of crutch walking
- Improved compliance
- Rehab delayed by 1-2 weeks

Grade III- Surgical Repair

- Anatomic repair
- Predictable, good results
- No advantage over non-surgical tx
Rehabilitation For All Ankle Injuries: Acute Phase

- Pain
- Inflammation

Acute Phase

- Rest
- Cold therapy
- Whirlpool
- Ankle and subtalar flexibility
- Isometrics
- Weight bearing to tolerance

Sub-acute Phase

- Heat therapy
- Flexibility
- Strengthening
- Closed chain
- Cross-training
- Cold therapy
Sub-acute Phase

- Heat therapy
- Flexibility
- Strengthening
- Closed chain
- Cross-training
- Cold therapy

Return to Sport Phase

- Protective bracing
- Range of motion
- Strength activities
- Progressive activity
- Avoid re-injury

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Chronic Instability

- Mechanical instability
- Functional instability
  - frequent sprains
  - difficulty running on uneven surfaces
  - difficulty jumping
  - difficulty cutting

Chronic Instability - Rehabilitation

- Non-rigid functional ankle brace
  - Velcro
  - Lace-up
- Acute Phase
- Sub-acute Phase
- Return to Sport Phase

Chronic Instability - Surgical

- Failed supervised rehabilitation
- Broström
- Tenodesis
- Arthroscopy
Ankle Arthroscopy

- General Anesthesia
- Supine, foot off the table

Portals

- Medial
- Lateral
Ankle Arthroscopy

• Extra-articular soft tissue approach first
  • Blunt technique
  • Small and large scopes
  • Gravity inflow

Syndesmosis Treatment

• Grade I and II
• Grade III
• Chronic Instability
Grade I and Grade II Sprains
• RICE method
• Cast or cast boot
• Gentle ROM
• Tape or non-rigid functional ankle brace for return to sport

Return to Sport Phase
• Protective taping to resist ER
• Bracing
• Range of motion
• Strength activities
• Progressive activity
• Avoid re-injury

Grade III Sprains
• Surgical repair
Screw Removal

- WB after screw removal
- WB with screw
  - Physiologic motion
  - Osteolysis
  - Screw failure
  - Pain
  - Prominent hardware

Complications

- Instability
- Persistent pain
- Ossification