Lateral Ligament Instability of the Ankle

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I have no disclosures

Introduction

- **Lateral ankle sprains**
  - disruption of the ligamentous support of the lateral aspect of the ankle and/or subtalar joints.
- **Acute**
- **Chronic**
  - defined as recurrent sprains leading to both functional and mechanical instability.
Instability

- **Functional instability**
  - subjective complaint of giving way
- **Mechanical instability**
  - objective documentation of ankle and/or subtalar laxity

Incidence

- 7 per 1,000 persons per year
- Most common sports-related injury
  - 40% of all athletic injuries
- 40% incidence of residual symptoms
- 20% will develop symptoms of functional instability

Mechanism of Injury

- Forced ankle plantarflexion and inversion.
- Anterior talofibular ligament (ATFL) is the first and most frequently injured
  - due to its vulnerable position in plantarflexion
- Calcaneofibular ligament (CFL) and posterior talofibular ligament (PTFL) follow in progression.
- Deltoid Ligament sprains are rare.
  - Eversion injury
Medial Instability-deltoid ligament

Combination with Posterior tibia tendon Injury

Combination with syndesmotic

Classification

- Ligament injured
- The degree of disruption
- The clinical impression

<table>
<thead>
<tr>
<th>Grade</th>
<th>Ligament Injured</th>
</tr>
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<tbody>
<tr>
<td>I</td>
<td>ATFL</td>
</tr>
<tr>
<td>II</td>
<td>ATFL/CFL</td>
</tr>
<tr>
<td>III</td>
<td>ATFL/CFL/PTFL</td>
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</tbody>
</table>

Classification

- Ligament injured
- The degree of disruption
- The clinical impression

<table>
<thead>
<tr>
<th>Grade</th>
<th>Degree of disruption</th>
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<tbody>
<tr>
<td>1.</td>
<td>Minor ligamentous injury</td>
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<tr>
<td>2.</td>
<td>Partial ligamentous injury</td>
</tr>
<tr>
<td>3.</td>
<td>Complete ligamentous injury</td>
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</table>
Classification

- Clinical Impression

<table>
<thead>
<tr>
<th>Grade</th>
<th>Presentation</th>
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<tbody>
<tr>
<td>Mild</td>
<td>Intraligamentous tear with minimal or no swelling, point tenderness, with mild functional loss</td>
</tr>
<tr>
<td>Moderate</td>
<td>Partial ligament tear with pain, localized swelling, tenderness, and moderate functional loss</td>
</tr>
<tr>
<td>Severe</td>
<td>Complete ligamentous rupture with marked pain, swelling, tenderness, and loss of function</td>
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Diagnosis

- Careful physical examination
  - Acutely the exam can be difficult.
  - Greater reliability at 4 to 7 days later
  - As the swelling decreases, tenderness becomes more localized and the instability tests can be performed.

Patient History

- Inversion injury followed by acute lateral ankle pain
- Popping or tearing sensation
- Swelling develops immediately
- Severe sprains, the patient might have difficulty bearing weight.
Patient History

- Patients with repeated ankle sprains
- Chronic ankle instability
- Pain or instability, or both.
- If pain in the interval between sprains, then consider a secondary diagnosis

Physical Exam

- Lower limb alignment
- Palpation
- Peroneal tendon exam
- Stability tests
- Nerves around the ankle

Lower Limb Alignment

- Hindfoot alignment
  - Varus hindfoot predisposes to inversion injuries
  - Hindfoot flexibility should be assessed and compared to the opposite side if normal
  - Coleman block testing
    - Forefoot vs hindfoot driven varus

Most important when evaluating chronic instability cases
Palpation

- Immediately after injury helps to localize the injured structure.
- But a few hours later swelling develops and the tenderness becomes more diffuse.
- In chronic symptomatic ankles, examine the whole ankle and foot region for tenderness to rule out an associated pathology.

Peroneal Tendon Examination

- Look for tenderness along the tendons’ course
- And along peroneal retinaculum attachment to distal fibula
- Palpate the tendons for subluxation from behind the fibula, by resisting eversion with the ankle dorsiflexed.

Stability Testing

- Anterior drawer
  - May elicit pain in acute ruptures of ATFL
  - Patient seated, knee flexed 90 degrees
  - The distal tibia is stabilized with one hand and the heel is grasped and pulled forward with the other hand
  - Compare with the other side
  - Translation of 5 mm more than the normal side or an absolute value of 10 mm is considered positive.
  - Absence of a firm endpoint indicates a complete ATFL rupture.
Stability Testing

- **Talar Tilt Test**
  - Will induce pain or instability with CFL injuries.
  - Distal tibia stabilized with one hand and the hindfoot is rotated into inversion.
  - Degree of talar tilt and endpoint are compared with the normal side.

Nerves Around the Ankle

- Sural
- Superficial peroneal
- Deep peroneal
- Tibial

Imaging

- **Routine radiographs:**
  - Anteroposterior
  - Lateral
  - Mortise
  - Standing, if patient able to bear weight
- **Stress radiographs**
  - Not required in acute ankle sprains, as they will not change the treatment plan
  - More helpful in chronic conditions
Stress Radiographs
• Talar tilt view
  – AP view of ankle
  – Inversion stress applied to the heel
  – Knee is slightly bent, ankle in relaxed plantarflexion position
  – Test is performed either manually or with a commercially available jig
  – A tilt 10 degrees greater than the normal side is positive

Stress Radiographs
• Anterior drawer stress view
  – Lateral view of the ankle
  – Anterior drawer stress applied to back of the heel with foot in a relaxed plantarflexion
  – Test is performed either manually or with a commercially available jig
  – ATFL rupture is considered if anterior translation is 5 mm greater than the normal side

Osteochondral Lesions with Ligamentous Instability
• EUA all ankles prior to treatment for OCL
• Typically treat the OCL first, and lateral ligament repair last
• Postop dilemma: early ROM for OCL vs. immobilization 4-6 weeks for ligament repair
Imaging

- MRI and CT
  - Helpful in diagnosing associated pathologies in chronic ankle instabilities.

Differential Diagnosis

- Nearby bony injuries
  - Fracture anterior process calcaneus
  - Calcaneocuboid capsular avulsion or compression injuries
  - Fifth metatarsal base fracture
  - Talar fractures
    - Lateral talar process, "snowboarders" fracture
    - Posterior process
    - Osteochondral lesions
    - Neck fracture
  - Malleolar fractures
  - Navicular/Navicular-Lisfranc (tarsometatarsal) complex injury
  - Tarsal coalition

- Nearby soft-tissue injuries
  - Syndesmosis injury
  - Intra-articular soft-tissue impingement
  - Subtalar instability
  - Peroneal tendon injuries
    - Distocation
    - Subluxation
    - Longitudinal tears
    - Ruptures
    - Tenosynovitis
    - Os peroneum fracture
Differential Diagnosis

- Nerve injuries of the lateral leg and ankle
  - Sural
  - Superficial peroneal
  - Proprioception defect

Management

- **Acute sprains**
  - **Conservative treatment**
    - Functional treatment
      - Rest, Ice, Compression, and Elevation (RICE)
      - Weightbearing as tolerated
      - Physical therapy
    - Immobilization
      - 1-3 weeks if needs for comfort in severe injuries
  - Surgical treatment
    - Acute repair almost never indicated

Acute Sprains

- **Functional Protection**
  - Goal to decrease the swelling and maintain the ankle in a neutral to dorsiflexed position and prevent inversion
  - Protect the injured ligaments during the first 3 weeks
  - Excessive stress on the ligaments leads to weaker type III collagen fibers rather than the stronger type I collagen

- **Types of protection:**
  - Walking cast/Cam boot
  - Ankle brace
  - Elastic wrap
  - Tape
Physical Therapy

- **Range of motion exercises**
  - Dorsiflexion with limited plantarflexion
  - Avoid inversion
- **Conditioning**
  - Swimming or cycling
- **Strengthening**
  - All ankle muscles
  - Peroneal muscles***
- **Proprioceptive training**
  - Tilt board
  - Wobble board
- **Modalities**
  - Cryotherapy

Acute Sprain: General Guidelines

- Initially, RICE is important to decrease inflammation, swelling, and pain.
- Weeks 1-3 the ligament should be protected (proliferative phase)
- By week 3, the collagen maturation phase starts.
  - Controlled mobilization orients the collagen fibers parallel to stress lines, minimizing the side effects of immobilization.
- Weeks 4-8 the goal is to speed up recovery and return to activity.

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Acute Sprain: Guidelines by Grade

- **Functional rehabilitation**
  - Superior to both cast immobilization and surgical repair in the management of most acute ankle sprains.
- **Sports-specific activities**
  - Started any time from 3 to 6 weeks
  - Depending on severity of the injury

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Functional Management

- Kannus and Renstrom (JBJS Am 1991)
- Review of literature of acute lateral ankle sprains
- Grade III: Functional management rec’ed
  - Decreased incidence of complications
  - Decreased cost
  - Similar incidence of residual instability compared with surgery
- Surgical treatment recommended for:
  - Large avulsion fractures
  - “Severe medial and lateral injury”???

Chronic Instability

- **Conservative treatment**
  - Most successfully managed by physical therapy and bracing
  - Surgical treatment is reserved for unstable ankles that sustain repetitive sprains during daily activities
  - Proprioception, peroneal strengthening, and flexibility exercises are an important component of rehabilitation

39 year old male ankle pain instability

Non weightbearing film
Pes Cavus

- “peek-a-boo” heel on physical exam
- Differentiate between “forefoot driven” varus and
  “hindfoot driven” varus
- Using a Coleman block test

Pes Cavus

- “forefoot driven” varus
- The hindfoot (subtalar joint) is flexible
- And corrects to neutral/slight valgus with Coleman block testing
- Deformity stems from a plantar flexed first metatarsal
- Surgical treatment is a dorsal closing wedge osteotomy at the base of the first metatarsal
Pes Cavus

• “hindfoot driven” varus
• The hindfoot (subtalar joint) is stiff, stuck in varus
• Stays in varus with Coleman block testing!

Pes Cavus “hindfoot driven” varus

• Deformity present in both the forefoot (plantar flexed 1st ray) and hindfoot (calcaneus fixed in varus)
• Surgical treatment requires dorsiflexion osteotomy at base 1st metatarsal and lateral sliding (Dwyer) calcaneal osteotomy.

Idiopathic Pes Cavus

• Non neurologic
• Present as…
• Chronic ankle instability,
• Peroneal tendon disorders
• 5th MT stress fractures,
• Ankle arthritis,
• Sesamoiditis
• Coleman block

“peak-a-boo” heel
Cavus foot insert/orthotic

• Forefoot pronation with hindfoot in neutral
• Lateral forefoot posting
  – Drops the first ray
• Heel lift
• Lateral heel flare (on shoe)

Chronic Ankle Instability and Arthropathy

• Harrington KD
  – JBJS Am. 1979 Vol 61, Issue 3 354-361
• Long-standing lateral ligament instability of the ankle results in unbalanced loading of the medial joint space and the possible development of degenerative arthritis.
Indications for Surgery

- Severe ankle instability
  - Sprains with ADL’s
- Failed nonoperative treatment

Surgical Contraindications

- Main complaint pain, not instability
  - Differential diagnosis
- Noncompliant patient
- Inflammatory arthritis
- Peripheral vascular disease
- Peripheral neuropathy
- Chronic steroid use
- Heavy tobacco user

Surgical Complications

- Limited ankle and/or subtalar motion***
- Recurrent instability (rare)
- Nerve injury
  - Sural
  - Superficial peroneal
- Wound problems
  - Infection/dehiscence
  - Skin necrosis
  - Scar sensitivity/pain
- Deep vein thrombosis (DVT)
Surgical Treatment

- **Anatomic**
  - Direct repair
  - Examples: Brostrom and Modified Brostrom-Gould
- **Non-anatomic**
  - Reconstructions using peroneus brevis
  - Example: Evans and Chrisman-Snook

### Anatomic Repairs

**Brostrom**
- Reported a direct lateral repair in 1966 with a success rate of 80%

**Gould**
- Modified this procedure by using the extensor retinaculum to reinforce the repair.
- Technique Pearl
  - Tag ext. retinaculum on the way in...easier to find later

### Position:
- **Lateral bean bag**
  - Lateral ligament repair only
- **Supine**
  - Done in conjunction with ankle arthroscopy
Modified Brostrom

Modified Brostrom

Modified Brostrom

Modified Brostrom
Brostrom Results

- 90% of the time it works
- Low complication rate
- Maintained ROM
Anatomic Reconstruction

- Isometric routing of graft
- Maintains ROM
- Graft Options
  - Allograft
  - Hamstring
  - Peroneals 10% loss of eversion strength

Anatomic Repairs

- Results
  - Karlsson et. al (JBJS Am 1988) Brostrom only on 152 ankles and reported 87% good to excellent
  - Hamilton et. Al (FAI 1993) Modified Brostrom technique on 28 ankles, 14 were professional dancers. 26 excellent, one good, and one fair

- Complications
  - SPN nerve injury
  - Recurrence of instability
  - Stiffness in ankle and subtalar joint
Non-Anatomic Reconstruction

- **Evans**
  - Utilizes a tenodesis of the peroneus brevis tendon to the fibula.

- **Chrisman-Snook**
  - Uses a split peroneus brevis tendon to reconstruct the ATFL and CFL

**Indications:** ideal for ligamentous laxity, >10yrs chronic instability, friable soft tissues

Non-Anatomic Reconstruction

- **Results**
  - Chrisman and Snook (JBJS Am 1985)
  - 48 ankles found 38 with excellent, 7 good, 2 fair and 1 poor, with significant reinjury in the latter 3

- **Complications**
  - Loss of subtalar inversion***
  - Pain in patients with "over-tightening"***
    - Leading to early ankle/subtalar arthritis
  - Wound complications in procedures with a long posterolateral incision to harvest the peroneus brevis tendon graft.

Anatomic vs Non-Anatomic Repairs

- Tenodesis procedures do not restore isometricity of lateral ankle ligaments
- Prospective randomized comparison: Brostrom better than Chrisman-Snook
- Anatomic procedures restore kinematics to near normal and do not restrict ankle ROM
- No prospective comparison of anatomic repair (Brostrom) vs anatomic reconstruction (tendon graft)
Surgical Treatment

- Varus hindfoot or distal tibia alignment
- Recommend:
  - Lateral ligament repair/reconstruction
  - Corrective osteotomy
  - Valgus calcaneal (Dwyer)
  - Distal tibia/fibula opening or closing wedge

Surgical Treatment

- Osteochondral defect talus
  - EUA ankle under fluoroscopy before every OCD case
  - 40% of the time you will find occult instability
  - Treated with lateral ligament repair at end of case

Surgical Treatment

- Ankle arthroscopy
  - Should this be done before every instability case???
  - Dr. Ferkel would say yes!
    - Chams and Ferkel (FAI 2006)

<table>
<thead>
<tr>
<th>Table 1: Findings at ankle arthroscopy (n = 20)</th>
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<tr>
<td></td>
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<tr>
<td>Synovitis</td>
</tr>
<tr>
<td>Achilles</td>
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<tr>
<td>Chondromalacia</td>
</tr>
<tr>
<td>Osteitis</td>
</tr>
<tr>
<td>Loose Bodies</td>
</tr>
<tr>
<td>OLTI</td>
</tr>
<tr>
<td>Osteophyte</td>
</tr>
<tr>
<td>Total</td>
</tr>
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</table>
Summary

• Acute ankle sprains
  – Majority resolve with conservative management

• Chronic ankle instability
  – Address mal-alignment
  – Anatomic repair preferred

Thank you
QUESTIONS?

Osteochondral Lesions of the Talus

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University of Michigan
Introduction

- Osteochondral Lesions (OCL)
  - Talar articular cartilage
  - Subchondral bone

Etiology and Epidemiology

- Trauma
- Idiopathic
  - Ischemic or
  - Avascular etiology

Etiology and Epidemiology

- Lateral talar OCL
  - Traumatic etiology
  - Anterolateral location
- Medial talar OCL
  - 70-80% Traumatic
  - 20-30% no history of traumatic event
  - Ischemic?
  - 10-25% bilateral lesions
  - Posteromedial location
Etiology and Epidemiology

• Berndt and Harty, 1959 JBJS Am.
  – 21 out of 24 patients reports a traumatic injury
• First to propose a traumatic etiology and a mechanism

• Lateral OCL
  – Inversion/ dorsiflexion
• Medial OCL
  – Inversion/ plantarflexion

Etiology and Epidemiology

• Lateral OCL
  – Shear mechanism
  – Oval shaped lesions
• Medial OCL
  – Torsional impaction (axial loading)
  – Deep, cup shaped

Berndt and Harty, 1959 JBJS Am.

Fig. 1. Mechanism by which traumatic lesions of the lateral collateral ligament to the talocalcaneal joint occur, according to Berndt and Harty's 1959 article. A, talus; B, subtalar; C, talus in inversion; D, talus in inversion against the fibula; E, talus in inversion against the lateral malleolus. Each letter represents the talus alignment and begins outside of the clip. E clip is displaced.
Staging

• Berndt and Harty 1959

• Radiographic
  – Grade I
  – Grade II
  – Grade III
  – Grade IV

• CT/MRI
  – Grade V
  – Grade VI

Staging

• Radiographic
  – Stage I, a small compression fracture;
  – Stage II, incomplete avulsion of a fragment;
  – Stage III, complete avulsion without displacement;
  – Stage IV, avulsed fragment displaced within the joint.

Staging

• CT scan/MRI
  – Stage V, cystic lesion
  – Stage VI, large with structural collapse (C.Frey)
Clinical Evaluation

• **History of Trauma**
  – Acute ankle sprain
  – Persistent pain/instability after unsuccessful treatment

• **Sudden sharp pain with loaded motion**
  – Localizing to the side of the lesion

• **Instability/giving way**
  – Stress x-rays r/o co-existing lateral ligament laxity

Clinical Evaluation

• **Point tender on medial or lateral talar dome**
  – Plantarflexion: anterolateral
  – Dorsiflexion: posteromedial

• **Synovitis/effusion**
  – Intermittent

• **Recurrent painful clicking, catching or grinding**
  – True joint locking (knee) less common

Radiologic Evaluation

• **Radiographs**
  – AP/Lat/Mortise WB
  – Mortise in maximum dorsi and plantarflexion

• **Bone Scan**
  – Helpful at 8-12 weeks post injury if x-rays are normal and pain persists
Radiologic Evaluation

• **CT scan**
  - Study of choice when an osseous lesion identified on x-rays
  - Delineate size, location and displacement

Radiologic Evaluation

• **MRI**
  - Useful when x-rays are negative and pain persists
  - Bone and soft tissue imaging

Treatment

• **Controversy**
  - Inadequacy of imaging studies
• **No accurate way of determining the integrity of the cartilage other than arthroscopy**
• **Must consider the patient age, size, location, intactness and chronicity of lesion**
Nonoperative

• Ideal for Grade I, II, III injuries
• Up to 12 months
  – Doesn't compromise results of subsequent surgical treatment
• Weightbearing limitation
• Cast/brace
• Physical therapy
  – Very little data to support one nonoperative treatment over another

Nonoperative

• Diagnostic / Therapeutic injection of the ankle
  – Technique
    • 10cc syringe: 1cc 40mg Depo, 5cc 0.25% marcaine plain, and 4 cc 1% lido plain
    • Anteromedial approach and direct needle centrally
• Helpful in identifying the pain source
  – coming from inside the ankle with a positive injection
• And if a surgical candidate

Surgical Options

• Open Arthrotomy
• Arthroscopy
  1. Drilling of intact lesions,
  2. Internal fixation of intact or separated lesions,
  3. Bone grafting,
  4. Fragment excision followed by curettage, abrasion, or drilling of the base of the lesion
Open Arthrotomy

- Anterolateral
  - Chaput osteotomy
  - Fibular osteotomy

- Anteromedial
  - Tibial plafondplasty
    - 6-8mm burred away
  - Medial malleolar osteotomy

Osteochondral Lesions with Ligamentous Instability

- EUA all ankles prior to treatment for OCL
- Typically treat the OCL first, and lateral ligament repair last
- Postop dilemma: early ROM for OCL vs. immobilization 4-6 weeks for ligament repair
Arthroscopic Approach
- Outpatient
- 2.7mm scope (30 and 70 degree)
- Noninvasive distractor
- Small (2.5/2.9mm) and large 3.5mm shaver
- Small curettes and pituitaries
- Drilling 0.045 and 0.062-inch k-wires

Drilling Intact Lesions
- Cartilage intact
  - AVN
  - Adolescent cases
- Antegrade
  - Transmalleolar
- Retrograde
  - Transtalar and bone grafting
- Provides a route for vascularization

Debridement and Drilling
- Detached OCL’s or loose bodies
- Fragment removal and debridement of bone bed
- Curettage to a stable rim of cartilage
- Microfracture/drilling
- Fibrocartilage repair
ORIF of OCD Lesions

- Young patient
- Acute traumatic lesion
- Size >1 cm
  - Larger do better
- Subchondral bone with attached articular cartilage

ORIF of OCD Lesions

- Approach
  - Arthroscopic
  - Open Arthrotomy
  - Osteotomy for adequate visualization
- Fixation
  - Bioabsorbable
  - Counter sunk small diameter cortical screws

Transplantation

- Auto or Allograft osteochondral tissue
- Failed previous open or arthroscopic
- Large (>2.0 cm) or high Grade (IV-VI) lesions
Autograft

- O.A.T.S. or Mosaicplasty
- Single setting procedure
- Ipsilateral knee
  - Donor site morbidity
- Ipsilateral talus
  - Non-articular areas
  - Small lesions

Allograft

- Fresh tissue, not frozen
  - Chondrocyte viability?
- No donor site morbidity
- Size matching, no tissue typing
- Great for large cystic or collapsed defects >2cm
- Results are too early to tell
- Expensive $$
  - Grafts cost 6-12K

Autologous Chondrocyte Implantation (A.C.I)

- Implanted in-vitro cultured autologous chondrocytes
- Periosteal tissue cover
- After expansion of isolated chondrocytes
**Autologous Chondrocyte Implantation (A.C.I)**

**Pro’s**  
- Autologous tissue  
- Hyaline-like tissue  
- No donor site morbidity  
- Can treat larger lesions

**Con’s**  
- Technically difficult: periosteum  
- Staged, arthroscopy required  
- High cost (reimbursable?)  
- Bone loss needs staged grafting or “sandwich procedure”  
- Extended recovery

**Results**  
- Small studies  
- Ferkel: 11 patients  
  - 82% good-excellent  
  - 16% fair

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**Postop Rehabilitation**

- Depends on type of procedure performed  
- And size of the lesion

**Drilling or Debridement**  
- 3-4 weeks NWB with AROM following 1 week post op casting  
- Then advance WB in a boot and start low impact aerobic activity  
- High impact at 3 months

**ORIF or OATS**  
- Immobilized and NWB for 3 weeks  
- Continue NWB but may start early AROM after 3 weeks  
- Advance WB in a boot at 6 weeks with low impact activities  
- Shoe at 10-12 weeks  
- High impact at 4-6 months
Summary

- High index of suspicion for an OCL in patients who fail nonop mgt for “routine” ankle sprains
- Or patients with chronic ankle pain with history of a sprain and negative x-rays
- Conservative management in most cases for a minimum 3-6 months
- The majority of OCL’s are treated successfully with surgery

Thank-you

- Questions?