Syndesmotic and Midfoot Sprains in the Athlete: Beware of the Subtle Variety

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DISCLOSURE

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PREFACE

You may not have seen it but it has seen you…

The eye sees what the mind knows…

Dr. Bill Hamilton
Experience is the mother of knowledge…

Nicholas Breton

An error does not become a mistake until you refuse to correct it…

John F. Kennedy
Orlando Battista

Orthopaedic Surgery is not all about diagnostic studies/images

• Not everything is “frank” or apparent
• Take a good history/examine the patient/review the video (when available)
• Element of “gestalt”

SPORTS FOOT and ANKLE
Sport-related Injuries

- **Foot and ankle at risk**
  - 50% of pro basketball
  - 25% of pro football
  - 20% all NCAA sports
    - 72% in football (Kaplan et al, Am J Orthop)

- The only part of the body with an apparent increasing injury rate

**WHY?**

Foot and Ankle Injuries

- Better recognized/reported
- More physical players, higher energy injuries
- Shoewear changes
- Field/turf conditions

Foot and Ankle Injuries

- Shoewear changes = less protective
  - Lighter weight
  - More flexible
    - Midsole cut-out

Foot and Ankle Injuries

- Field/turf conditions
  - Trend towards more injuries in certain turf/in-fill designs
    - i.e Field Turf
Foot and Ankle Injuries

• Cleat/surface interaction
  – Wrestle between performance and risk
  • Traction relates to performance
  • Torque relates to injury
  – Threshold not known

Foot and Ankle Injuries

• Cleat/surface interaction
  – If surface slick
    longer cleats used
  – Cleats catch deep in turf/between seams (corn rows) and torque increases

Foot and Ankle Injuries

• Cleat/surface interaction
  – Ligament injuries can occur as a result of torque/twist and may be subtle
    • Frank diastasis not always present
  – Unstable joint segments may progress to deformity/DJD

LISFRANC INJURIES
How Lisfranc Injuries Occur

Classic description = axial load to the back of the heel with foot fixed to the ground

Indirect Lisfranc Injuries

Not all are classic or readily apparent
- 23 y/o NFL WR with right foot injury on punt return
- Minimal clinical findings
- Normal xrays/stress
- MRI = edema

Case: Midfoot “Sprain”

- Failed to improve with casting/boot x 3 months
- Decision made to proceed with open exploration
Case: Midfoot “Sprain”
- Managed with “home run” screw
  - 3.7mm, solid, fully threaded

Indirect Mechanism - Axial???
- Twisting component actually more common
  - NFL Database
- Does not require contact or axial loading

Indirect Mechanism - Twisting
- More common etiology in NFL
  - NFL Database
- Especially in defensive ends

Mechanism for Injury
Indirect
- Happens quickly
- Quite subtle
Noncontact Indirect Injuries
Meyer et al, AJSM ’94
- 2nd most common foot injury among collegiate football players
  - 4% annual incidence
  - 29% offensive linemen
- 50% twist, 37% axial load

NFL Study: Reproducing the Injury very Difficult!
- To create the injury
  - Forefoot, and especially the 2nd ray, has to be engaged in turf
  - Must have dorsiflexion thru mp joints

What we found (NFL/Uva)...
- Certain shoe types may be implicated – excessive forefoot bend
Wide Variety of Injury Patterns Possible

- Quenn and Kuss (1909)
- Hardcastle (1982)
- Myerson (1986)
  - Mid-tarsal involvement

Injury Not Always Apparent

Indirect types may be subtle (20% missed)
- Painful WB
- Heel rise difficult
- Swelling and point tenderness
  - Often medial column (n-c)

Subtle Signs

Exam
- Plantar ecchymosis may be a clue

Radiographic Exam

- 1st TMT joint
- 2nd TMT joint
- 1-2 interspace
- Intercuneiform
- Naviculocuneiform
**Radiographs**

- Obtain contralateral views – look for asymmetry
- Standing AP can be a good stress test!
  - Single limb if feasible

**Subtle Signs**

- Beware of the *proximal variant*!
  - Increasing incidence in American football
    - Hammit/Anderson
      - AOFAS ’04
      - TFAS ’05

**Proximal Variant**

- Occurring in all field sports
  - Effect of artificial surfaces?
    - Cleat interaction???
**Proximal Variant**

- Force of injury extends thru intercuneiform joint to exit out naviculo-cuneiform joint

*Epitome of a significant ligamentous injury…*

**Proximal Variant**

- Results in an unstable first ray → difficulty with push-off

**Proximal Variant**

- Results in an unstable first ray → difficulty with push-off
- Also lead to joint deterioration if left untreated

**Assessing Subtle Injuries**

Formal stress testing
- Requires anesthesia, fluoroscopy
  - Very difficult to get relaxed in office
- Maneuver
  - Adduction-pronation
Stress Testing

Assessing Subtle Injuries

CT
- Not done routinely
- Static test
  - May help guide treatment only if diastasis or intra-articular injury noted
- Identifies unusual fx patterns

Assessing Subtle Injuries

MRI
- Helpful if a vague presentation; identifies location and extent of injury
- Also a static test

Assessing Subtle Injury

MRI = good for subtle changes
- Proximal variant with edema in navicular
**Treatment Goal**

- Obtain/maintain anatomic reduction
  - Stabilize injured joints
    - Eliminate risk for progression
    - Assist with rehab
  - Maintain a “normal” posture of the foot
    - Improved prognosis

**Surgical Indications**

- No specific parameters!
- Treat individually
  - Pain? Lack of improvement?
  - Can not push-off?
  - Unable to heel rise?
  - Progressive diastasis?
  - *Unstable* pattern confirmed by stress?

**Recommendations for Fixation**

- “Subtle” proximal variant type with any displacement needs surgery
  - Tend to progress

**Surgical Technique**

- Open reduction advantageous
  - Remove debris
    - Leave soft tissue/ligaments
  - Can assess articular surface
    - *Intercuneiform or other subtle areas of instability*?
  - Confirms anatomic reduction and stability
Surgical Technique

- Screws
  - Prefer solid/cortical
- Bridge plates
  - Can use on 1st and 2nd TMT joints; avoids cartilage damage

Surgical Technique

- Bridge plates
  - Hardware breakage not a concern, as it can be with transfixation screws
  - Risk for joint damage

It just makes sense...

Case Example

- 26 y/o running back with noncontact injury and midfoot pain
  - Subtle proximal variant

R.B. - Proximal Variant Lisfranc

- “Home run” and intercuneiform screw
- RTP at 6.5 months
Typical Postop Recommendations

- Splint, NWB x 2 wks
- Boot, NWB X 3-4 wks
- Screw/plate removal 4-6 months
  - Remove all crossing TMT
  - “Home run” optional
  - Keep intercuneiform
    - Lessens risk for late diastasis

What if Pain and Dysfunction Persist?

- Consider…
  - Synovitis vs DJD
  - Subtle Instability

  Consider fluoroscopic-directed injection

Hardware Removal

- Stress intraop
  - Place suture-button if persistent instability

Chronic Pain with Normal Studies

- 21 y/o DB failing to improve after “stable” Lisfranc – left foot
- Difficulty with push-off
- Exam suspicious for hypermobile 1st ray
Chronic Pain with Normal Studies

- Intraop instability of 1st TMT joint
Chronic Pain with Normal Studies

• Intraop instability of 1st TMT joint

Midfoot “sprain” that doesn’t get better

• 20 y/o LB w/ midfoot twisting injury
• Initial xray negative, stress under anesthesia = stable
• MRI = intact Lisfranc lig, mild midfoot edema at 2nd TMT jt.
• Persistent midfoot pain
• Temporary relief with fluoro guided injection 2nd TMT jt.

Midfoot sprain that doesn’t get better

• OR at 6mo post-injury: chondral injury and subtle instability → 2nd TMT fusion and home-run screw for 1-2 instability
• Post-op:
  – 6 wks NWB, 6wks WB in boot
  – CT at 12 wks confirmed union
  – Rehab w/ arch support
  – Ran at 4 mo., RTP at 7 mo.

Outcomes/Prognosis: Subtle Injuries

• Small case series of elite athletes
  – Curtis et al, AJSM ’93: 16/19 return to sport
  – Hammitt/Anderson, TFAS ’05: Proximal variants = 9/9 returned to full athletic participation
• Don’t want to miss these – have a high suspicion if not getting better
  – Ultimate outcome related to adequacy of reduction and severity of initial injury
    • Kuo et al, JBJS 2000
SYNDESMOTIC INJURIES

Syndesmotic Injuries

- Not as uncommon as once thought!
  - NFL 2011: 218 reported
    - Days lost to injury >8400
  - NFL 2012: >250
  - Role of artificial surface?
    - Cleat-surface interface

Anatomy

- Sickle shaped joint with cartilage on both sides
  - Functional joint = rotates, pistons
- Surrounded by ligaments which serve to keep fibula in the notch and mortise stable
  - PITFL strongest, then AITFL

Mechanism of Injury

- Classic = foot in fixed stable position and valgus thrust on leg
  - External Rotation with dorsiflexed foot
    - Dorsiflexion brings wide part of talus to syndesmosis, increasing stresses across the joint
  
  **But there are wide varieties - some noncontact and subtle**
Mechanism of Injury

- Injury force
  - *External rotation always present*
    - Dorsiflexion
    - Eversion
  
  *Can be non-contact as well*

Diagnosis – Physical Exam

- Tenderness over the syndesmosis
- Deltoid tenderness/dimple
- Proximal fibular tenderness
- Standing stress test
- Squeeze test
- External rotation test
  - *Last 2 = high specificity, low sensitivity (de Cesar et al: FAI ’11)*

How do we Diagnosis?

- Plain radiographs
  - *Standing – single limb may accentuate areas of diastasis and instability*
Stress Radiographs?

– Beumer et al (2003): not reliable for diagnosis of syndesmotic instability
– *I have difficulty getting patients to relax!!!!*

Stress Flouroscopy

Helpful when positive...

Role of CT and MRI?

• MRI is very sensitive for detecting syndesmotic injuries – *but not prognostic* (Oek, 2003)
• CT is able to detect minor (2-3mm) diastasis, though clinical significance is undetermined (Ebraheim, 1997)
• MRI/CT is *not predictive for instability – static studies!*

Arthroscopy?

• Probably the best diagnostic tool
• Very helpful in cases of negative xray, positive MRI and protracted recovery with vague pain
• Lue et al. found that arthroscopic evaluation was superior to fluoroscopic stress testing
  – Arthroscopy 2005
Syndesmotic Instability

• I agree = arthroscopic evaluation is superior to any imaging studies in subtle injuries
  – Done with EUA – different exam with patient relaxed

Arthroscopic Evaluation

• Helpful to assess medial instability as well
• Example: 25 y/o football player with history of high ankle sprains/impingement/pain

Case JM

• 21 y/o point guard with recurrent high ankle sprains
• Difficulty with “cutting”
• Normal x-rays, stress imaging, flouro exam
• MRI: chronic ligament changes medial and lateral, chondral defects

Case JM

• Scope
  – Chondral changes
  – Loose body
  – Unstable syndesmosis; absent inferior syndesmotic ligaments
Case JS

- 26 y/o RB
- Unable to return for last 6 games of '12 season due to left ankle pain after “minor” high ankle sprain
- Normal x-rays/stress; MRI with edema in syndesmosis/OCDs

Is Syndesmotic Reduction Important?

- 1mm of lateral displacement of the talus results in 42% reduction in tibiotalar contact (Ramsey and Hamilton, 1976)
- Chissel and Jones, JBJS, 1995 – threshold of 1.5mm diastasis with worsening results with increasing malreduction/diastasis
- Weening and Bondari, JOT, 2005 – “the only significant predictor of functional outcome was reduction of the syndesmosis”

Syndesmotic Injuries

- Subtle instability may also lead to chondral injury and eventual DJD
  - How do we identify those athletes with subtle syndesmotic injuries and in need a surgical stabilization
  - When do we go to the OR and do a scope?

Treating Syndesmotic Injuries

Surgery an easy decision if...
1. Any diastasis
2. Instability with stress
   - Stress plain films
   - Weightbearing ankle x-rays
   - Fluoroscopic exam

Reduction/fixation recommended to reduce risk for DJD
Subtle Syndesmotic Instability

- Diagnosis not just about images!!!
- Need to also consider clinical/functional exam
  - Inability to perform heel rise
  - Persistent pain with activity
  - Lack of improvement
  - Chronic inflammation

*May point to subtle instability pattern*

Subtle Instability - Treatment

- *In a young active patient* with no diastasis but instability identified on stress/scope…
  - Consider fixation to allow for a quicker return and improved rehab
  - Minimizes risk for progression and articular injury

Syndesmotic Fixation Options

- Screws or suture-button or both (hybrid)…
  - Percutaneous
  - I place 2cm above ankle joint line to avoid “true” syndesmotic joint

Subtle Syndesmotic Instability

- Wolf BR, Amendola A: *Curr Opin Orthop* 2002
  - Described a test for dynamic instability = “syndesmotic taping”
    - Player asked to perform single limb heel rise with and without tape wrapped around distal tib-fib
    - If tape assists then consider instability and need for syndesmotic fixation

from Wolf et al
Fixation Options

• When placing screws/suture button in the athlete...
  – Addition of fibular plate may allow for earlier and safer return to play

Case P.T.

• 25 y/o RB with recurrent high ankle sprains
• Difficulty with “cutting”
• Normal x-rays, stress imaging, flouro exam
• MRI: chronic ligament changes medial and lateral, chondral defects

Case P.T.

• Intraop exam
  – EUA – medial instability pattern
  – Arthroscopic: medial laxity and syndesmotic instability

Case P.T.

• Intraop exam
  – EUA – medial instability pattern
  – Arthroscopic: medial laxity and syndesmotic instability
Case P.T.

- Intraop exam
  - Arthroscopic: chronic bipolar OCL lateral

Case P.T.

- Intraop repair
  - Chondral debridement
  - Superficial deltoid
    - Medial Brostrom
  - Syndesmotic stabilization
    - Suture-button fixation

Case MP

- 24 y/o football player with “high ankle sprain”
  - normal xrays and stress; MRI c/w injury
- Boot x 4 weeks
- Recurrent sprains/pain/dysfunction the following year

Case MP

- MRI repeated
  - Chronic syndesmotic inflammation
    - Persistent
    - Progressive
  - Joint okay
Case MP

- Repeat stress tests negative
- CT: incomplete synostosis with progression
- Suspected subtle syndesmotic instability

Case MP

- Scope confirmed
- Open debridement

Subtle Syndesmotic Injuries

My Experience
- I have managed 23 college/pro players with this entity
- All had intraosseous edema and/or OCD of the talus or medial malleolus
- Unstable by scope
- Fixed with suture buttons or hybrid and all have RTP
I’m Still Trying to Learn: Case LF

- 37 y/o Pro Bowl LB – normal xrays and stress
- Played all year with vague ankle pain
- Difficulty “cutting”
- Scope: what is pathologic???

Subtle Syndesmotic Injuries

Summary

- Have a high index of suspicion → diastasis not always present
  - Try to assess for instability with stress (standing, flouro)
    - Clinical signs (heel rise) and lack of recovery can be as helpful as imaging
  - EUA/scope/open if not improving
  - Fix if unstable to reduce risk of chondral injury and deformity

Thank You!