The Intricacies of the Elusive Lisfranc Sprain

Scott T. Doberstein, MS, ATC, LAT
Senior Lecturer/Head Athletic Trainer
University of Wisconsin – La Crosse

National Athletic Trainers' Association
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Overview… where we are headed!

Introduction
Anatomy
Mechanism of Injury
Clinical Presentation
Clinical Evaluation
Imaging
Treatment/Rehabilitation
Complications
Prognosis
Case Report

Common Themes

Accurate diagnosis – 1st line of defense
High degree of suspicion
Don't downplay this injury
Be honest with athlete
Patient advocacy
Applicative learning

Introduction

Jacques Lisfranc de Saint Martin (1790-1847)
- French surgeon for Napoleon's Army
- Foot amputation for equestrian soldiers
- Lisfranc joint injuries (LJI) rare in athletics but can be very complex
  - 2 broad categories (fracture/dislocations & **subtle sprains**)

Introduction

Often under diagnosed and inadequately treated = poor outcomes
- Up to 20% LJI missed on initial exam (Myerson et al, 1986)
- WHY???? → Sherief et al, 2006

Introduction

Sherief et al, 2006

- 30 sets of foot x-rays with various diagnoses
- NWB, 7 normal x-rays
- Reviewed by 9 MD's (experienced)
- 18/30 were MRI/CT/Surgery confirmed LJI
- Only 11/18 (61%) LJI detected by all 9
- 8/9 (90%) missed the same LJI
- Overall, 19% missed LJI diagnosis

Introduction

Missed Lisfranc injuries = one of most common reasons for malpractice lawsuits against radiologists and ER MD's (Chesbrough, 2002)

Over 50% of patients with LJI pursued legal claims within 2 yrs post injury (Calder et al, 2003)

Need high index of suspicion with any foot injury!

Introduction

LJI sprains 2nd only to MTP sprains for most common athletic foot injuries!

Reports in **GYM**, SC, FB, BK, BB, running, ballet, equestrian, windsurfing, et al

Males affected 2-4x more than females (DeOrio et al, 2009)

Anatomy

Tarsometatarsal joint = "the Lisfranc joint"

- separates midfoot from forefoot

Divided into 3 columns/articulations

1. Medial = 1st MT → medial cuneiform
2. Central/Middle = 2nd & 3rd MT's → middle & lateral cuneiforms
3. Lateral = 4th & 5th MT's → cuboid

Anatomy

Little bony inherent stability, but….

"KEYSTONE" = 2nd MT recessed between medial & lateral cuneiforms – "locks" MT's to the midfoot

- Disruption here = entire LJ instability (Berg et al, 1998)

Anatomy

Peicha, et al 2002

- Measured depth of the 2nd MT mortise in 33 LJI patients
  - Most were very significant athletic injuries
- Controls = 84 cadaveric feet

Peicha, et al 2002
Anatomy

Peicha, et al 2002

- LJI patients had significantly shallower mortises than controls
- Chance of LJI goes up significantly as the depth of the mortise decreases
- Genetic predisposition??

Anatomy

LIGAMENTS are its "strength" x 3 sets = maintain the "roman arch"
Dorsal ligaments – weakest and fail first (significant # of dislocations dorsally)

Anatomy

Plantar ligaments – much stronger

- Plantar transverse intermetatarsal lig – connects bases of MT's 2-5, not 1 & 2 (weakest link)!
- *Lisfranc ligament (LL)* = single large oblique lig from medial cuneiform to 2nd MT, not 1st MT!
  - 3x stronger than dorsal ligaments (Kura et al, 2001)
  - Stabilize the "key in the mortise"

Interosseus ligaments – many and varied

Mechanism of Injury

High energy (direct, OBVIOUS) – not usually athletic, crush, MVA, fall from height, etc – not our focus
Low energy (indirect, SUBTLE) – usually athletic related and usually soft tissue only = false sense of security!

Mechanism of Injury

Severity of injury determined by amount and direction of force on LJ
Axial load in plantarflexion – force on hindfoot
TWISTING = forced pronation or supination of forefoot

MOI → Axial Load in PF
MOI → Axial Load in PF
MOI → Axial Load in DF
MOI → Common in FB
MOI → Forefoot Abduction
Clinical Presentation

Pain & swelling over midfoot are hallmark

- Normal gross appearance even with LJ instability (Wang 2004)

Difficulty bearing weight/antalgic gait
Inability to stand on toes/1 legged hop/weak PF

Clinical Presentation

Flattened medial longitudinal arch more common with Fx/Dislocation
Plantar ecchymosis sign (Ross, 1996)
X-rays often read as normal!

Clinical Evaluation

NEED high index of suspicion!
Pain with palpation over portion/entire TMT joint
Clinical evaluation tools at your disposal?

Clinical Evaluation

Several CLINICAL TECHNIQUES - don't MISS subtle LJI

- Passive abduction/pronation maneuver (Myerson, 1986)
- Apprehension Sign (Lattermann, 2007) – modification
- Passive adduction/supination maneuver (Meyer, 1994)
- Midfoot compression test (Shapiro, 1994)
- Intermetatarsal glide test (Shapiro, 1994)
- Midfoot mobility testing

Abduction/Pronation Maneuver

Meyerson, 1986

- Hindfoot held in neutral/inversion
- Passively abduct/pronate forefoot
- Painful?
- Laxity?

Abduction/Pronation Maneuver
Apprehension Sign

Lattermann, 2007 – modification of passive abduction/pronation

- Passively dorsiflex and abduct the forefoot
- Create "apprehension" due to pain in patient?

Apprehension Sign
Adduction/Supination Maneuver

Meyer, 1994

- Hindfoot held in neutral/inversion
- Passively adduct/supinate forefoot
- Painful?
- Laxity?

Adduction/Supination Maneuver
Midfoot Compression Test

Shapiro, 1994

Squeeze metatarsals (mid-shaft) together

Attempting to increase height of transverse arch

Painful?

Midfoot Compression Test

Intermetatarsal Glide Test

Shapiro, 1994

Stabilize 2nd MT head

Displace 1st MT head dorsally and plantarly

Painful?

Intermetatarsal Glide Test

Midfoot mobility testing

Stabilize hindfoot in eversion (loose-pack)

Hold 4th & 5th MT heads

Move heads obliquely dorsally and plantarly

Repeat with hindfoot in inversion (close- pack)

Painful?

Laxity?

Midfoot mobility testing

Imaging

Imaging

NWB x-rays will miss the subtle LJI!!

Need bilateral WB x-rays!

50% of normal NWB x-rays showed abnormal WB x-rays (Nunley & Vertillo, 2002)

MRI very helpful with subtle LJI

Used to visualize the integrity of the LL

Fleck Sign (Myerson, 1986) – small avulsion of LL from base of 2nd MT

Fleck Sign

Imaging

Lateral x-ray (Burroughs, 1998) – NWB should show normal dorsal alignment

Lateral X-ray

Imaging

Lateral x-ray (Fasciszewski et al, 1990) – WB should show normal longitudinal arch alignment

Imaging

Imaging

Gap sign (Davies, 1999) – FWB x-ray to detect 1-2 MT diastasis

This needs to be ruled out in every instance!

Normal WB X-ray

Diastasis with WB X-ray
Gap Sign
Imaging

Dorsal injuries = no diastasis of 1st & 2nd intermetatarsal space = STABLE

Plantar injuries = progression of dorsal injury, DIASTASIS = UNSTABLE and often results in a fracture and/or dislocation

Imaging

Any Fx of 1-3 MT bases needs to raise the suspicion of LJI

If no Fx, stress x-rays under general anesthesia may be indicated to assess instability

Stress View
Treatment/Rehabilitation

Many classification systems – Tx may be based upon???
MUST be individualized – too many variables
Stable vs. unstable – is it known or inferred?

Treatment/Rehabilitation

How can we get anatomic reduction? = good outcome!
Surgical fixation vs. conservative management

** ***ALL these issues need to be considered by MD so we can better assist our patients***

Treatment/Rehabilitation

Meyer et al, 1994
- Retrospective of 24 non-surgical LJI
- All FB players over 4 year period
- 4% of all FB injuries were LJI
- 29.2% of LJI were OL

Treatment/Rehabilitation

Meyer et al, 1994
- Increased medial LJ pain = longer healing and RTP
- Increased lateral LJ pain = shorter healing and RTP

Treatment/Rehabilitation

Need early recognition!!!!

Immobilization will be part of the protocol
NWB → PWB → FWB
Arch support is KEY!

Treatment/Rehabilitation

Standard mods/exercises for ROM, strength, proprioception apply
Slow progression to sport specificity
Be honest – months not weeks!

Complications

Reinjury = increasing instability/dysfunction
Arthritis (traumatic) – most common eventuality
DJD
Chronic pain

Complications

Residual deformity
Residual ligamentous instability
Antalgic gait

Complications

Bony exostosis
CRPS (RSD)
Flattening of medial longitudinal arch = worse prognosis (Faciszewski et al, 1990)
Foot stiffness/intrinsic contracture/dysfunction

Complications

Difficulty wearing shoes
Possible arthrodesis

Complications increase with delayed diagnosis!!

Prognosis

Poor → Fair Good → Very Good → Excellent
Dependent on:
- Severity of injury
- Early diagnosis
- Anatomic reduction most important prognostic indicator (Hunt et al, 2006)
- Complications

Must give patient accurate info about this kind of injury!

Faciszewski et al, 1990

15 patients with subtle LJI in 11 yr period
All had 2-5mm diastasis between 1-2 MT's
None had fracture or other foot injuries
Followed up 2-26 yrs post injury

Faciszewski et al, 1990

Major conclusions:

- Flattened medial longitudinal arch = poor outcome (remember diagram?)
- Bilateral FWB x-rays vital to assess flattened arch
- Measurement of the distance between plantar surfaces of medial cuneiform and 5th MT is reliable indicator of degree of longitudinal arch flattening (20 controls had +1.5mm difference, none with negative relationship)

Faciszewski et al, 1990

Faciszewski et al, 1990

Major conclusions

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- Bilateral FWB x-rays vital to asses flattened arch
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Faciszewski et al, 1990

Case Report

TY, 20 yo FB player
Fall from 10-12 feet through floor (Sat pm)
MOI – axial load on PF foot
Urgent care x-rays negative (Sun am)
Dx = contusion
ATR exam (Mon pm, < 48 hrs post)

Case Report

Case Report - Normal

Case Report - Abnormal

Case Report

Refer to MD for FWB x-rays
Read normal by MD, but abnormal by radiologist
MRI revealed 30 LL rupture
Referred to Mayo for surgery next day

Conclusions

LJI can be very subtle but a serious injury
Need firm and early diagnosis
Need immobilization to provide stability
Need individualized treatment and rehab protocols
Need slow progression for RTP

Conclusions

"The only remarkable feature of the examination of athletes with suspected LJI is that it is often UNREMARKABLE!" (Wadsworth, 2005)

Questions???

THANKS and enjoy the rest of the symposium!!

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