Lisfranc and Midfoot Injuries

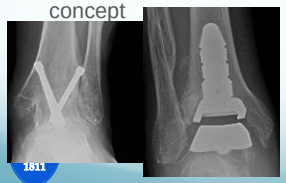
A. Holly Johnson, M.D.
Massachusetts General Hospital
Harvard Medical School
Boston, MA

Disclosure

I have no potential conflicts to disclose.

Essential and nonessential joints

- Want to stiffen or maintain motion
- Lisfranc debate is culmination of this concept



Lisfranc Injuries

- Uncommon – only .2% of all fractures
- Commonly missed (20%)
- Need high degree of suspicion
- Late morbidity, consequences

Lisfranc Injuries

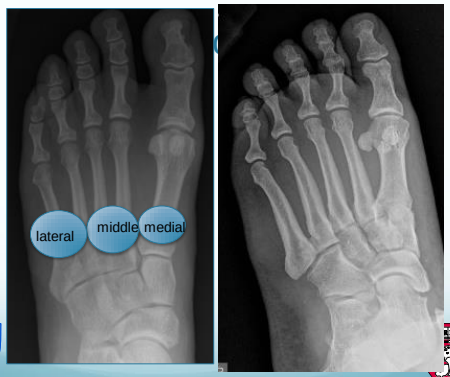
- Uncommon – only .2% of all fractures
- Commonly missed (20%)
- Need high degree of suspicion
- Late morbidity, consequences

Athletic Injury

- Increased rate over last decade, esp NFL
  - Athletes
  - Turf
  - Shoe wear
- 16% sports injuries occur in foot
  - Midfoot sprain – 4%football
  - 29% offensive linemen
- NFL Foot and Ankle Injury Task Force

Jacques Lisfranc de Saint-Martin (1787-1847)

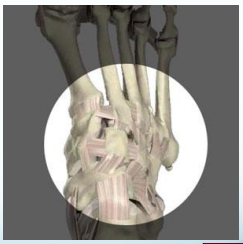
- Famous French surgeon
- Innovator in general and gynaecologic surgery
- Napolean's field surgeon
- Described midfoot injury:
- Soldier falls off horse with foot caught in stirrup
- Amputation through the midfoot for gangrene



- Roman Arch
  - Trapezoidal shape of MT bases
    - Dorsally wide, narrow plantarly
- Motion different between columns
  - 3.5mm medial
  - .6mm middle
  - 13mm lateral
    - Ouzounian, et al FAI: 1989
- Injury most common at most stable – 2nd TMT joint

Ligamentous Anatomy

- Strong attachments
- Dorsal, Interosseous, plantar
- Longitudinal, oblique, transverse
  - Long, obli connect cun-MT
  - TV connects MT-MT
- Plantar lig strongest, stiffest



Lisfranc Ligament

- No TV 1st-2nd MT ligament
- Lisfranc ligament – medial cunieform to base of 2nd MT
  - Interosseous
  - Plantar portion – thickest, strongest
  - Stabilizes pronation, abduction
- Strongest, highest load to failure
  - Solan, et al. FAI: 2001

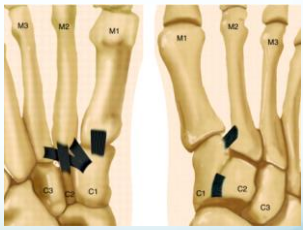
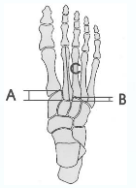


Image from Watson, et al JAAOS 2010

Anatomic predisposition to injury

- Shallow medial mortise depth (Peicha et al, JBJS Br 2002)



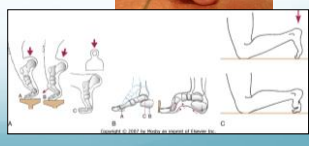
- Ratio of 2nd MT:foot length - <29% (Gallagher et al, JBJS 2013)

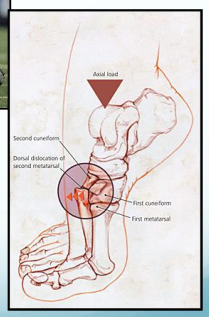
Mechanism of Injury

- Direct
  - Crush injury
  - Dropped object

Mechanism of Injury

- **Indirect**
  - Forced abduction
  - Axial load on PF foot
    - Fall from height
    - MVA
  - Athletic injury

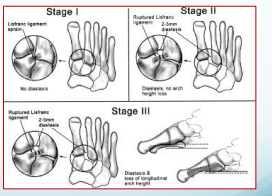




Classification

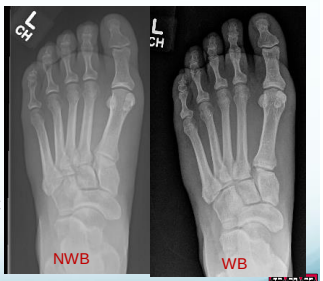
- Myerson FA 1986
- For traumatic, severe injury

- Nunley AJSM 2002
- For Sprains

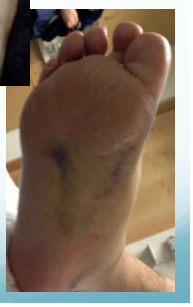


Beware of the subtle Lisfranc!!

- Obvious for crush, high energy injury
- Pt may describe a pop
- Fell off a curb
- Slipped down the stairs
- Pile-up
- Ankle sprain that won't get better



Physical Exam



Physical exam

- Variable degree of swelling
- Assymetry
- Pain with weight bearing
- Midfoot tenderness
- Pain with forced pronation and abduction
- **Plantar midarch ecchymosis

Imaging

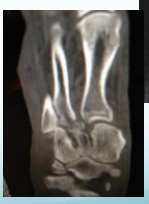
- Plain XR – may be missed initially
- Weight bearing XR
- Contralateral foot

Imaging

- Look for:
  - Alignment of columns
    - Medial border 3rd MT, lat cunieform
  - Widening between 1st and 2nd ray
  - Dorsal subluxation
  - Fleck sign

Imaging

- XR normal – high suspicion – MRI
- Edema
- Tear
- Step-off
- Severe injury – CT for operative planning



Determine stability – stress radiographs

- May need sedation, in OR
- Pronation-abduction
- Flexion-Extension
- Compression of the midfoot
  - Helps confirm diastasis between cuneiforms or MT

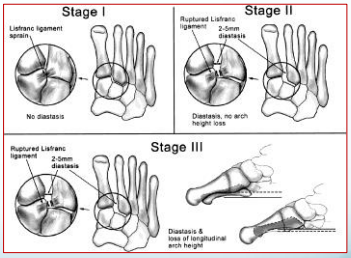
- Myerson et al JBJC 2008

Treatment - nondisplaced

- WB XR normal
- MRI shows no step-off, fracture
- No displacement with stress (XR or OR)
- Need to prove it

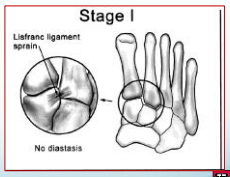
Treatment

- Nunley 2002 AJSM
- Described a treatment algorithm based on his stages
- Retrospective study on 15 athletes



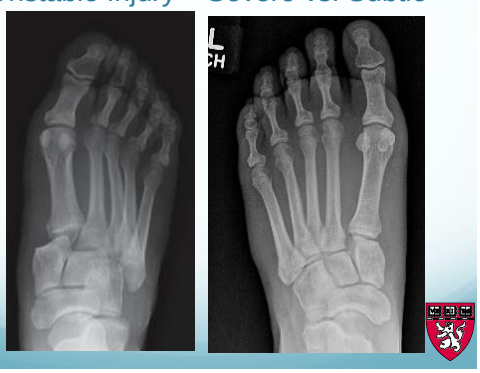
Treatment – Stable Injury

- Nonoperative treatment well-established
- NWB 4-6 weeks
  - Serial WB xrays to confirm stable
  - When pain-free, stable XR, may WBAT
- Progress in boot until 8-10 weeks with orthotic
- Stiff-soled shoe, rigid orthotic for six months
- Resume cutting, twisting at 3-4 mos
- May take 6-12 months to return to sport
- **MANAGE EXPECTATIONS!**



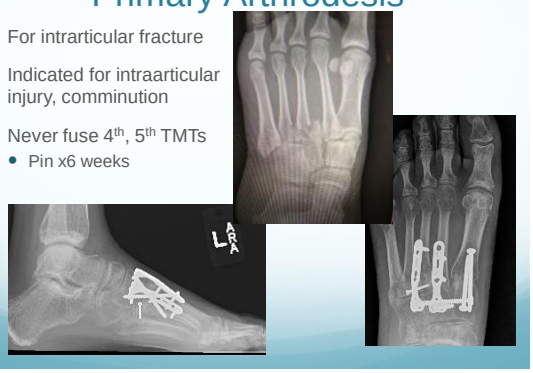
Unstable Injury-Ligamentous vs. Fracture

Unstable Injury – Severe vs. Subtle



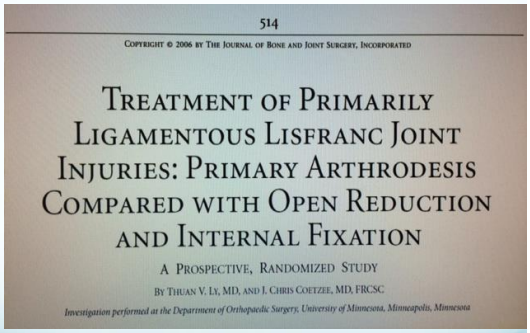
Primary Arthrodesis

- For intrarticular fracture
- Indicated for intraarticular injury, comminution
- Never fuse 4th, 5th TMTs
  - Pin x6 weeks



Traditional Treatment

- Anatomic Reduction a must
- Early – CRPP
- Later – ORIF (Seattle group)
- Earlier studies high complication rate, low satis with fusion
  - Mulier et al FAI 2002:
    - 25 % nonunion
    - 50% RSD
    - Even ORIF only had 66% satis
    - **unusually high complications
- Kuo et al, FAI 2002
  - ORIF with stable fixation
  - Anatomic reduction = less PT DJD
  - **Ligamentous injury did poorly despite anatomic reduction**
    - Fusion "may be a better option for patients with purely ligamentous injury."



514

TREATMENT OF PRIMARILY LIGAMENTOUS LISFRANC JOINT INJURIES: PRIMARY ARTHRODESIS COMPARED WITH OPEN REDUCTION AND INTERNAL FIXATION

A PROSPECTIVE, RANDOMIZED STUDY

BY THUAN V. LY, MD, AND J. CHRIS COETZEE, MD, FRCSC

Investigation performed at the Department of Orthopaedic Surgery, University of Minnesota, Minneapolis, Minnesota

Primary Arthrodesis for Ligamentous Injuries

- ORIF vs Arthrodesis
- Ligamentous LF
- PRCT
- 20 underwent ORIF
- 21 Primary Arthrodesis 1, 2, +/- 3 TMT
- 42.5 mos avg f/u

	% preinjury level 24 mos	Satisfaction (very/dissatis)
Arthrodesis	92%	16/0
ORIF	65%	8/6

•5/6 dissatisfied in ORIF underwent fusion
•One nonunion in arthrodesis group

Primary Arthrodesis for Ligamentous Injuries

Primary Arthrodesis for Ligamentous Injuries

- Authors' Conclusions:
  - Poor healing of oss-ligament interface
  - Loss of correction
  - Incr deformity
  - DJD

Primary Arthrodesis for Ligamentous Injuries

- Other Issues:
  - 16/20 in ORIF underwent ROH
  - High energy injuries both groups
    - 22 – MVA, snowmobile, ATV, dirt bike
    - 12 fell from height
    - 2 stirrup, 3 deep hole
    - Only 2 athletes (hockey, baskeball)
- ***NOT athletic or low energy injuries
- Subsequent studies support equal or better outcomes with PA (Levine FAI 2012, Henning FAI 2009), less return to surgery

Joint Sparing vs Articular Screws

- No (unknown) long-term difference:
- Avoids articular disruptions
- Avoids screw breakage
- Larger approach
- Prominent

- Alberta et al. (FAI 2005)
  - Cadaver study
  - similar ability to maintain reduction

Suture Button Fixation

- Minimal data – all cadaver studies
  - Vinod et al, JBJS 2009 (Industry sponsored) – equiv to screws
  - Pelt et al, FAI 2011 – equiv to screws
  - Ahmed et al, FAI 2010 – weaker than screws

Subtle or low energy injury

- Trauma data may not be so useful
- Primary arthrodesis for isolated low energy ligament dispurtion?
- Primary arthrodesis for high level athlete?

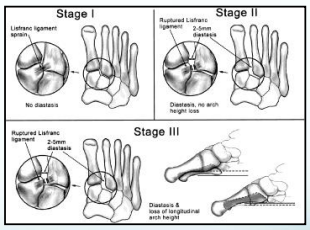
Subtle or low energy injury

- Same rules apply:
  - If displaced >2mm – needs stabilization
  - Anatomic reduction and fixation a must
- **Primary Arthrodesis not recommended in athletes despite the data**
  - **Bigger dissection**
  - **Difficult procedure**
  - **Need to maintain motion**

Outcomes for Athletes

- No data comparing tx
- No long term results of ORIF in athletes

- Nunley et al AJSM 2002
  - All 15 were stage I, II
  - 8 had late ORIF
  - 93% excellent result (return to full activity)
- Chilvers et al FAI 2007
  - 5 gymnasts, 3 avail for f/u
  - Only one RTS



ORIF in Athletes

- Anatomic reduction a must!
- Screws or bridging plates
- Check stability
- Postop:
  - NWB for 2-4 weeks
  - ROM when wounds healed
  - Pool, bike 6 weeks
  - Progress WB 6 weeks
  - d/c boot 8-10 weeks
  - Rigid orthotic in stiff shoe
- ROH 3-6 mos postop

- Cutting, twisting at 4-6 months
- Typical return to elite sport by 6-10 mos
- MANAGE EXPECTATIONS!

Missed Injury, late collapse

- Post-injury DJD – 25-58%
  - Better outcomes a/w accuracy of reduction
- Collapse of TMTs, midfoot
- Nunley – good results with delayed ORIF (before DJD and rigid collapse)

Missed Injury, late collapse

- Non-op treatment
  - Rocker-bottom shoe
  - Steel shank
  - Orthotic
- Guided injections

Missed Injury, late collapse, DJD

- Arthrodesis
  - More difficult reduction
  - Bone quality poor
  - Nonunion rate higher

Late collapse after ORIF

- Coetze reports this in ¼ of ORIF group
- May be associated with ROH
- May be associated with poor initial reduction

Late collapse after ORIF

- Closed reduction not adequate
- Symptomatic 2nd TMT DJD 1 year out

Conclusion

- Don't miss the injury – high index of suspician
- Understand the indications surgery
- Who is the right candidate for ORIF vs Fusion?
  - Still up for debate
- Need data collection on ORIF group beyond 2 years

Thank you