Lisfranc and Midfoot Injuries
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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

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
- Napoleonic 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
- 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 cuneiform to base of 2nd MT
  - Interosseous
  - Plantar portion – thickest, strongest
  - Stabilizes pronation, abduction
  - Strongest, highest load to failure

Image from Watson, et al JAAOS 2010
Anatomic predisposition to injury

- Shallow medial mortise depth (Paicha 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

- 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

- Variable degree of swelling
- Asymmetry
- 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

- Look for:
  - Alignment of columns
  - Medial border 3rd MT, lat cuneiform
  - 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 x-rays 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

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
  - Muller et al FAI 2002:
    - 25 % nonunion
    - 50% RSD
    - Even ORIF only had 66% sats
  - "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.”

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/dissats)
    - Arthrodesis 92% 16/0
    - ORIF 65% 8/6
  - 5/6 dissatisfied in ORIF underwent fusion
  - One nonunion in arthrodesis group

Authors’ Conclusions:
- Poor healing of oss-ligament interface
- Loss of correction
- Inor deformity
- DJD

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, basketball)
- ***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 disruption?
- 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
    - CIC 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

- Coetzee 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 suspicion
- 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