Lisfranc Injuries

Alan J. Zonno, M.D.
Rockhill Orthopaedic Specialists
Lee’s Summit, MO
Disclosures

• None
History

• Jacques Lisfranc de Saint-Martin
  – Surgeon in Napoleon's army
    • 1813-1814

  – Midfoot amputations
    • Frostbite
    • Gangrene
Midfoot Anatomy

• 11 Articulations
  – 5 Tarsometatarsal
  – 2 Intercuneiform & 1 Cuboid-Cuneiform
  – 3 Navicular – Cuneiform

Lenzner et al (J Trauma 1974)
Midfoot Anatomy

• “Lisfranc complex”
  – All 5 MT bases & respective articulations
    • Tarsometatarsal (TMT) joint complex
  – Forms transverse arch of the foot
  – Supported by
    • Strong plantar and interosseous ligaments
    • Plantar soft tissue structures
      – Plantar fascia & peroneus longus tendon
Midfoot Columns

- Medial
- Middle
- Lateral
Patel et al (JAAOS 2010)
Unique Features

- “Roman Arch”
- “Keystone”
- “Lisfranc ligament”
  - Plantar connection b/t 2\textsuperscript{nd} MT base & medial cuneiform
  - No ligament b/t 1\textsuperscript{st} & 2\textsuperscript{nd} MT bases
    - Increased risk to injury
      - Patel et al (JAAOS, 2010)
Biomechanics

• Function
  – Allows force transfer from hindfoot to forefoot

• Subtalar joint everts at heel strike
  – Supple midfoot at heelstrike into midstance
  – Shock absorption

• Subtalar joint inverts at toe off
  – Rigid lever arm for push-off
Etiology of “Lisfranc” Injuries

- Fairly rare
  - 1 per 55,000 annually
  - 0.2% of all fractures
- Most common at 20 – 30 years of age
- Males 2 – 3 x more common than females
- Myerson et al (Foot Ankle 1986): 76 Lisfranc fracture-dislocations
  - 66% MVA
  - 33% divided b/t crush & falls from height
  - 58% poly-trauma patients
Etiology

• 33% low energy injuries
  – 4% of NFL football players per year

• ~20% of injuries missed/misdiagnosed
Mechanism of Injury

• Direct trauma
  – High energy/blunt trauma to dorsal foot
  – Crush injuries with extensive soft tissue edema
  – Worse outcomes
Mechanism of Injury

• Indirect trauma
  – Axial loading of a plantarflexed foot
  – Forced abduction or twisting of the foot
Classification of Injuries
Diagnosis

• Direct, high energy, crush injuries
Diagnosis

• Indirect low-energy injuries
  – Require high index of suspicion
  – Pain with weight-bearing
  – Tenderness over the midfoot
  – Plantar ecchymosis
Imaging Studies

• Radiographs
  – Weight bearing (WB) if possible
  – Contralateral “normal” comparison
  – Stress views

• CT scan
  – More sensitive in subtle injuries

• MRI
  – “Lisfranc ligament” disruption or bony edema
Treatment

• Stable injuries
  – No displacement with WB x-ray or stress views
  – Midfoot “sprains”

• Unstable injuries
  – Displacement with WB x-ray or stress views
  – Spectrum of severity involving ligament and/or bony injuries
Treatment

• Non-operative
  – Reserved for stable injuries – i.e. sprains
  – Unstable injuries historically do not do well
  – 17 – 30% “good to excellent” results
Non-operative Protocol

- CAM boot for 6 – 8 weeks
  - WB as comfort permits
  - Sedentary/seated work immediately (if available)
  - RTW in boot when full WB
- Interval X-rays necessary to detect late instability
- Transition into shoes after 6 – 8 weeks
  - Physical therapy
  - Work conditioning
Life After the Boot...

- Activity modification
- Shoe wear modification
  - Stiff soles/rocker-bottoms
  - Carbon-fiber inserts
  - Orthotics
- NSAIDs
- Corticosteroid injections
• Full-length CFP
  – Reduce plantar pressures & medial midfoot contact time
    • Khosla et al (FAI, 2009)

• Full-length >> ¾ length CFP
  – 20% reduction in medial midfoot pressure (p=0.015)
  – 8.5% reduction in medial midfoot contact time (p<0.01)
    • Baumhauer et al (J Orthop Sports Phys Ther, 2009)
How about “Orthotics?”

- Ibuki et al (Prosthet Ortho Int, 2010)
  - 57 pts with custom full-length semi-rigid orthotics
  - 36 pts received CF plate as well
  - Significantly improved pain, activity level & footwear comfort in both groups
  - No difference between groups
Surgical Management

- Unstable injuries
- 50 – 90% “good to excellent” results
- Immediate technical considerations
  - ORIF
  - Primary arthrodesis (PA)
Fixation vs. Primary Arthrodesis
Coetzee et al (JBJS 2007)

• **Indications for PA**
  – Purely ligamentous disruptions
  – Multidirectional instability
  – Comminuted intra-articular fracture at 2nd MT
  – Crush injury with intra-articular fx-dislocation

• **Contraindications to PA**
  – Open physes
  – Subtle injury, minimal to no displacement
  – Unidirectional instability
  – Unstable extra-articular fx
Additional Contraindications to PA (in my humble opinion)

- Tobacco use
- Advanced peripheral vascular disease
- Severe vitamin D deficiency
- Potential noncomplicance

- Pre-existing deformity
Midfoot Realignment

- Re-establish
  - Talo-1\textsuperscript{st} MT lines
  - Column orientation
Realignment Matters...

- Sangeorzan (Foot Ankle 1990)
  - Alignment – ONLY useful factor to determine outcome after fixation of TMT joint injuries

- Myerson (JBJS 1996)
  - In situ fusion indicated with SLIGHT deformity
    - Displacement < 2mm
    - Angulation < 15 deg
Co-existing deformities?

- Hindfoot valgus
  - Medializing calcaneus osteotomy
    - Zonno & Myerson (Foot Ankle Clin 2011)

- Forefoot ABD
  - LC length if talar head uncovered > 40%
    - Bluman et al (Foot Ankle Clin 2007)

- Gastrocnemius or Achilles contracture
  - Gastroc recession or TAL
• DiGiovanni et al (JBJS 2000)
  – 35/42 with anatomic reduction s/p ORIF did best
  – Non-anatomic reduction
    • Increased % of post-traumatic DJD
  – Pure ligamentous injury
    • Tended to have higher rate of post-traumatic DJD
    • Indication for primary arthrodesis
Risk-Reward Profiles

• ORIF
  • (-) Risk of post-traumatic DJD
  • (-) Need for more hardware removals
  • (+) Nonunion is not a concern
  • (+) Pre-existing deformity less of a concern

• Primary Arthrodesis
  • (+) Fewer hardware removals
  • (+) Ligamentous injuries do better
  • (-) Nonunion risk is real (especially smokers)
  • (-) Need correct pre-existing deformities
  • (+/-) for work comp patients
Dual-Incision Approach

• Midline
  – Just lateral to 2nd MT

• Medial
  – Over 1st TMT joint
Conclusions

• Lisfranc sprains treated non-operatively
• Unstable injuries require surgery
• ORIF vs. primary arthrodesis – a time and a place for everything
• Correct concomitant deformity
• Communicate with the patient