• **Lisfranc Injuries:** Controversy abounds with a paucity of guiding literature!

• Incidence: Figures Vary, but probably underestimated

• Low vs. High Energy Injuries
  - Same Name but Very Different Animals
  - Treatments may Differ Depending on Energy of Injury
  - Think of a Lisfranc “Complex,” Not simply a Lisfranc Joint
• Anatomy
  o Unique Bony Anatomy
  o More Motion in Lateral Columns than Medial or Middle
    - Like the Hand, More Motion on Ulnar Side CMC Joints
  o 26% of Lisfranc ligaments are double bundled (Panchbhavi, FAI 2013)
  o There are Intermetatarsal Ligaments between Metatarsal 2-5, not between 1 & 2
  o Shear forces across the Lisfranc ligament, not compression
    - May Lead to Poor Outcomes

• Mechanism of Injury
  o Direct: MVA, Motorcycle, Industrial, Crush Injury (High Energy)
  o Indirect: Sports Using straps: Windsurfing, Equestrian
    - Longitudinal Forces Applied to Plantar Flexed Foot (American Football)
    - Abduction of Midfoot

• Diagnosis – Up to 20% missed initially especially with lower energy type
  o A stable midfoot sprain does occur but is rare
  o Nunley classification scheme helpful for low energy types
  o Watch for Plantar Ecchymosis with “normal” x-rays
  o Pain out of proportion
  o Decreased 2 Point Discrimination in First Web Space (Pourcho FAI, 2013)
  o Weight Bearing X-rays: Both Feet (AP view) on one cassette
  o MRIs helpful for low energy Lisfranc injuries
    - Look for increased signal around Lisfranc ligament on axial views
  o CT scans show small fractures or comminution
Stress Views are very helpful
   - Time consuming and painful for patient in the clinic
   - Usually done in the OR when suspicion is high
   - Abduct lesser four rays or entire foot, look at Lisfranc joint and first and second TMT joints
   - If stress views are negative, patient can be treated non surgically, but this is rare

Surgical Treatment Questions:
   - Timing: as soon as swelling allows and patient is stable
   - Open or Percutaneous: almost always an open approach personally although the percutaneous approach has its advocates
     - Difficulty is not removing tissue or debris out of Lisfranc joint with percutaneous approach and still achieving anatomic reduction
   - Approaches: 3 basic workhorse
   - Staged Approach for High Energy Injuries with External Fixator (Tarkin, FAI, 2014)
   - Fix or Fuse: We try to avoid fusion in higher level, younger athletes as motion in the TMT joints seems to be important for sports function although this is largely expert opinion (Myerson ICL 2008)
   - Fusion is preferred in higher energy, purely ligamentous cases:
     - Also preferred for a salvage procedure for a failed ORIF
     - Definitive surgery with decreased reoperation rate
     - Lateral column may need temporary spanning external (or internal) fixator +/- Cuboid ORIF for high energy crush injuries
Controversy: How to Fix: Intra-articular screws, dorsal plate, endo-button

- Screws can break at the joint, which are hard to remove, but are still probably “the gold standard.” Solid screws are preferred to cannulated given their increased strength. The number of missed attempts with a 2.5 mm drill is usually not recorded!
  - Partially Threaded for Compression?
  - Lag Technique?
- Dorsal Plating is a newer approach but is clinically untested and unpublished.

Endo Buttons are another intriguing idea but offer litesagittal plane support. Technically, a drill hole occurs through “normal” cartilage as well. Hardware removal is usually not needed though.

Controversy: Timing: When (if ever) is it Too Late to Fix: Perhaps 8-10 weeks but evaluate on case by case basis, presence of intra-articular comminution would mandate a fusion

- Limited Fusion? – Debriding the Lisfranc “Joint” for subacute low energy injuries

Controversy: To Remove the Hardware or Not: Almost always recommended at a minimum of 4 months for plate or screws, keep in longer in heavier patients (more than 250 lbs.), lateral column K-wires should be removed at 6 weeks. Some propose when removing
hardware to replace with an endo button device but this too is unproven by the literature.

- Leaving hardware in is thought to be likened to a fusion by some
- Bioabsorbable implants with comparable outcome in recent study (Ahmad, CORR, 2016)

- Controversy: Weight Bearing Post op: Do Patients need to be Non Weight Bearing?
  - Case by case but usually heel weight bearing in the compliant patient is allowed at 3-4 weeks, definitely by 6 weeks. Also, consider adding a semi-rigid medial arch support to shoe for at least 6 months and possibly forever.

- Post Operative Management – Low Energy
  - Bicycle at 4-6 weeks
  - Progressive Weight Bearing at 6-8 weeks
  - Boot is off at 8-10 weeks
  - Importance of a medial arch support or carbon shank
  - Most athletes can return to play at 6-9 months

- Post Operative Management – High Energy
  - Cast for 6 weeks
  - Non Weight Bearing for 8-10 weeks
  - If fusion, guarded weight bearing at 8-10 weeks, increasing to full weight bearing by 12 weeks
  - For both a full year until complete recovery (Dubois-Ferrière, JBJS, 2016)

- Complications
  - Residual pain & stiffness midfoot / forefoot
  - Arthritis
  - Persistent numbness / tingling (DPN)
  - Hardware failure
  - Planovalgus deformity

- Miscellaneous -- Lisfranc
  - Worker’s Compensation cases have a worse outcome irrespective of type or severity of injury.
  - 90% of NFL players were able to return to play at an average of 11.1 months from injury after surgery (McHale, AMJSM, 2016)
  - Nonoperative treatment for subtle Lisfranc injuries is rare but does occur. Stable with stress tests but a positive bone scan (or MRI). These patients were casted for 6 weeks in Nunley’s series.
• Jaques Lisfranc de St. Martin was bellicose and unpopular in his day.

**Metatarsal and Forefoot Injuries:**

- First Metatarsal Fractures, especially ones that are displaced, are often treated surgically to create a stable ray
  
  - Controversy: Peri-Articular Fractures of First TMT Joint
    - Often temporary internal fixation (2.4 - 2.7 mm) to span the joint is needed to create a stable construct. Especially in those that involve the joint itself and with significant comminution
    - If possible a “T” shaped plate can be used at the base of the first MT to avoid going across the joint which will then mandate a hardware removal

- Metatarsals 2, 3, and 4 are often treated without surgery
  
  - Unless there is severe sagittal plane deformity / angulation in either plantar or dorsiflexion as this will create a transfer metatarsalgia

- Distal 5th Metatarsal shaft fractures are often treated non surgically as well, even those with wide displacement (Raikin, 2013)
  
  - Higher incidence of ORIF in Europe
  - As always with lateral column injuries, especially stress fractures, watch out for the subtle cavus foot

- Great Toe Fractures

- Lesser Toes Fractures
  
  - Usually treated non operatively, buddy taping
  - Acute dislocations that cannot be reduced closed, can be pinned through an open approach

References:


• Pourcho AM, Liu YH, Milshteyn MA. Electrodiagnostically confirmed posttraumatic neuropathy and associated clinical exam findings with lisfranc injury. Foot Ank Int. August 2013, 1068-73.


• Mulier T, Reyndersm Broos et al. Severe Lisfranc injuries Primary arthrodesis or ORIF. 23; 10: 902-905. FAI 2002 Compared primary arthrodesis vs. ORIF for severe Lisfranc injuries. Retrospective, surgeon randomized study advocating ORIF or partial arthrodesis for severe Lisfranc injuries. Primary complete arthrodesis (all 5 MT) should be reserved as a salvage procedure.


• Ahmad J, Jones K. Randomized, Prospective Comparison of Bioabsorbable & Steel Screw Fixation of Lisfranc Injuries. J Orthopa Trauma 2016. 5: 765-772.

All x-rays from TGH library.