

Lisfranc Injuries

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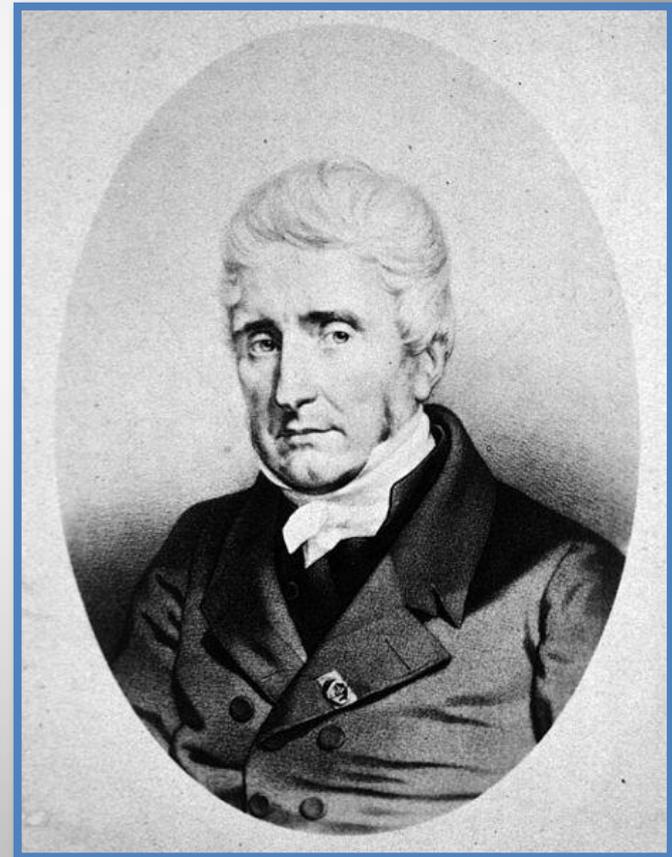


Disclosures

- None

History

- Jacques Lisfranc de Saint-Martin
 - Surgeon in Napoleon's army
 - 1813-1814
 - Midfoot amputations
 - Frostbite
 - Gangrene



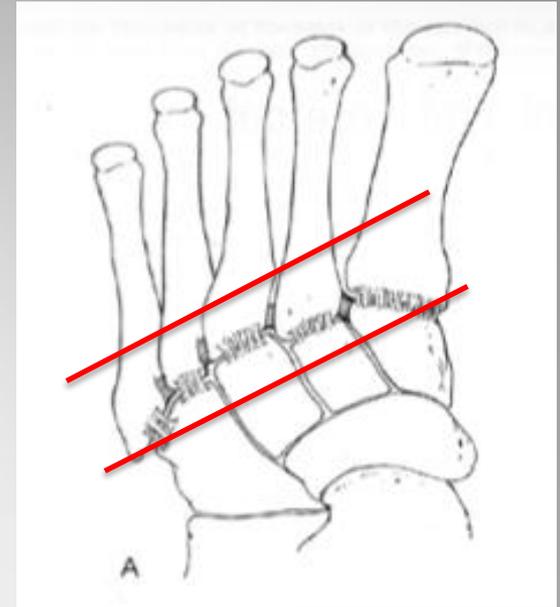
Midfoot Anatomy

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



Lenczner et al (J Trauma 1974)

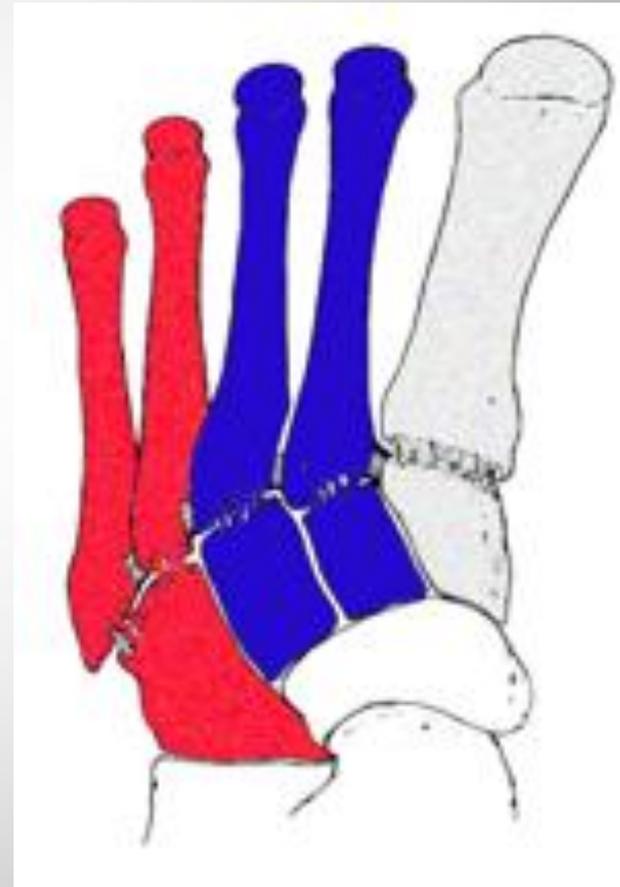
Midfoot Anatomy

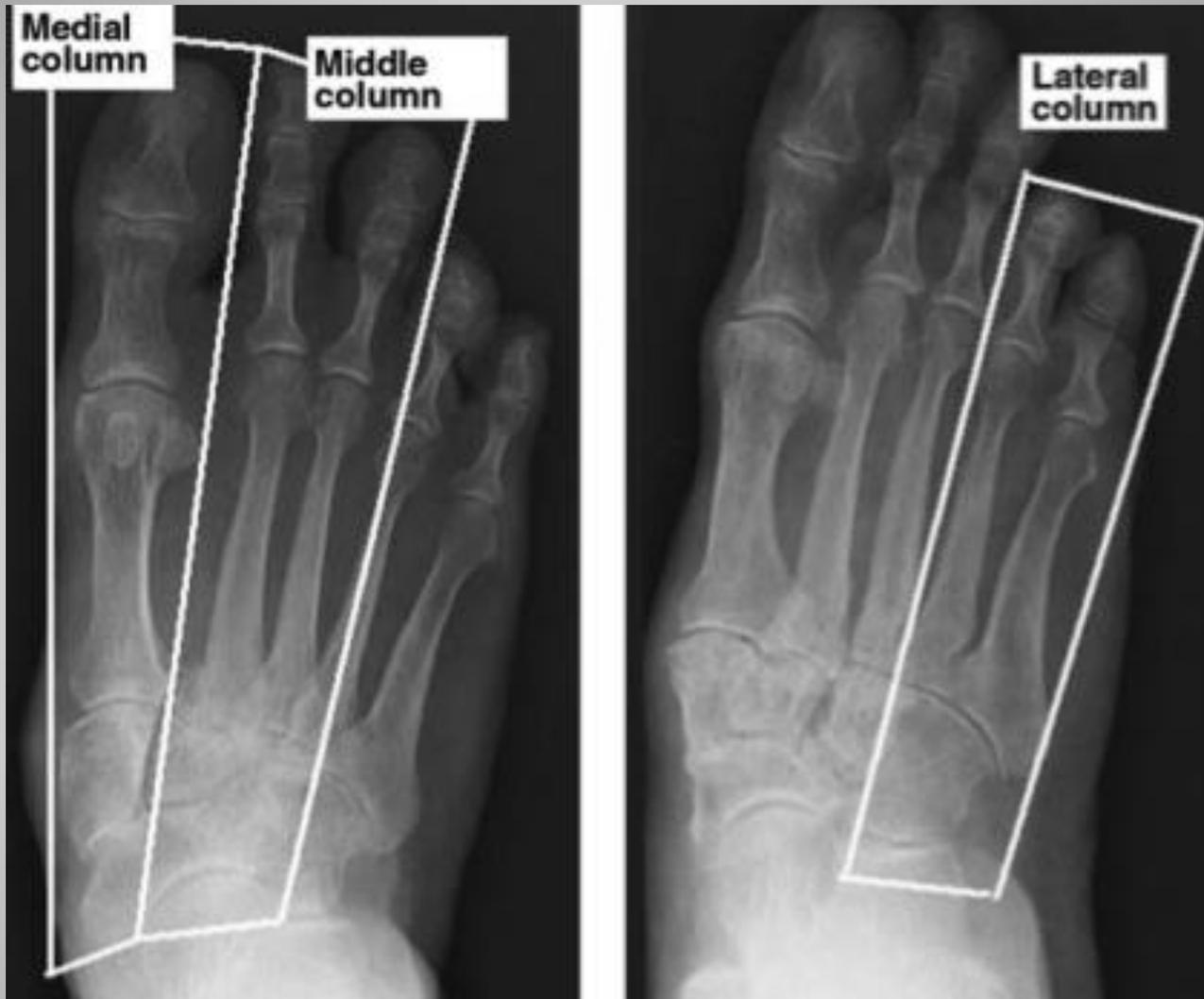


- “Lisfranc complex”
 - All 5 MT bases & respective articulations
 - Tarsometatarsal (TMT) joint complex
 - Forms transverse arch of the foot
 - Supported by
 - Strong plantar and interosseous ligaments
 - Plantar soft tissue structures
 - Plantar fascia & peroneus longus tendon

Midfoot Columns

- Medial
- Middle
- Lateral





Patel et al (JAAOS 2010)

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

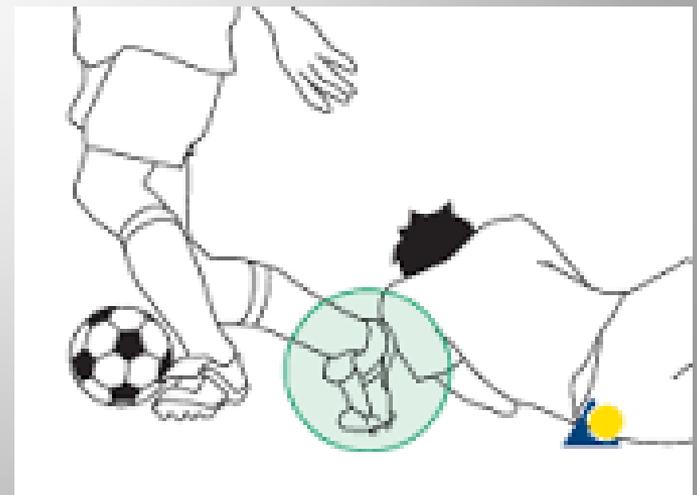
Mechanism of Injury

- Direct trauma
 - High energy/blunt trauma to dorsal foot
 - Crush injuries with extensive soft tissue edema
 - Worse outcomes

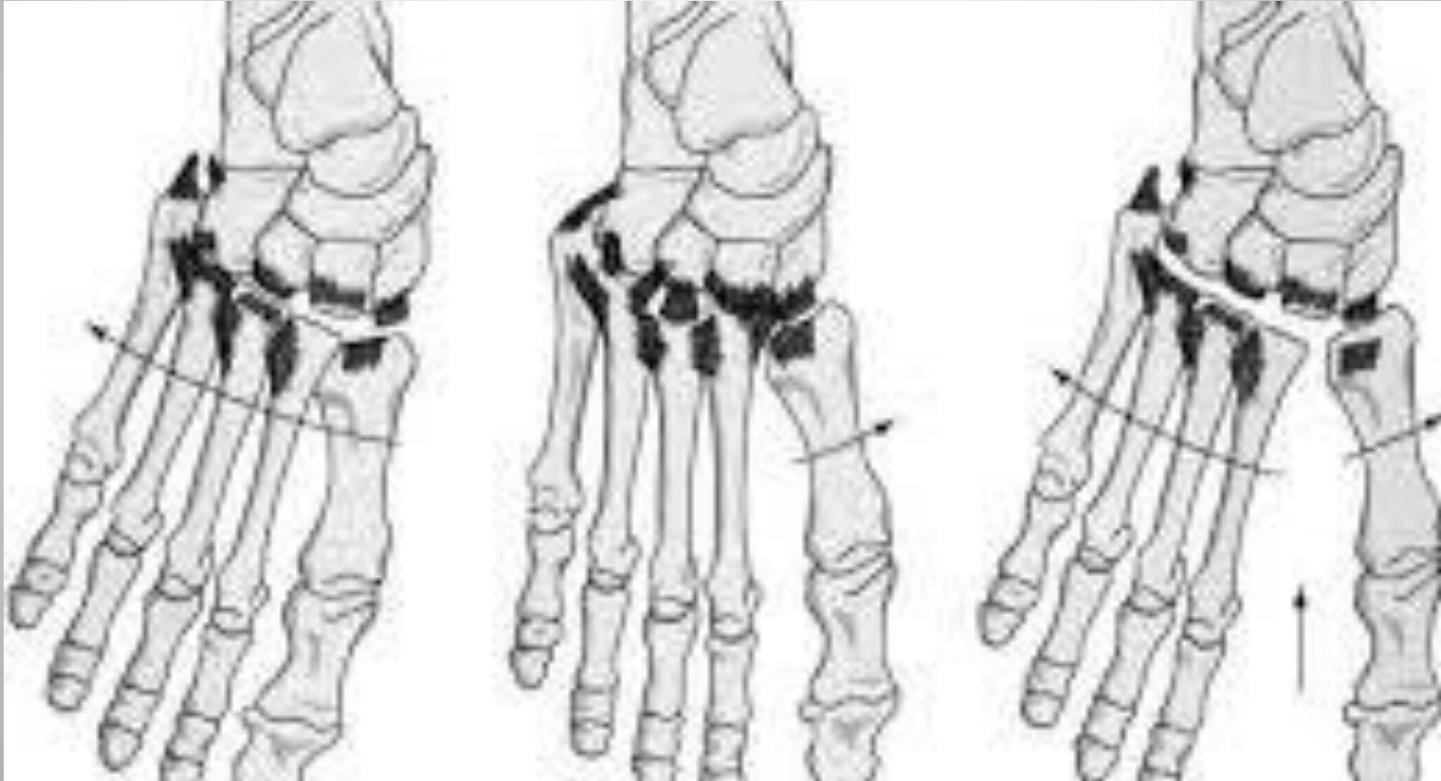


Mechanism of Injury

- Indirect trauma
 - Axial loading of a plantarflexed foot
 - Forced abduction or twisting of the foot



Classification of Injuries



Diagnosis

- Direct, high energy, crush injuries



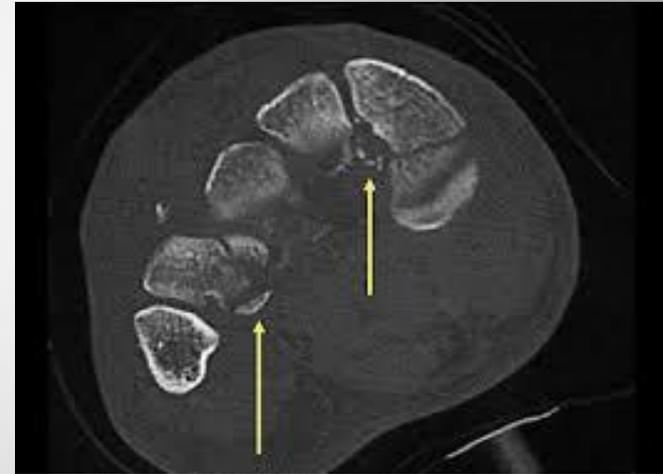
Diagnosis

- 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
 - Rao et al (J Orthop Sports Phys Ther, 2009)
 - Khosla et al (FAI, 2009)
- Full-length \gg $\frac{3}{4}$ 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)

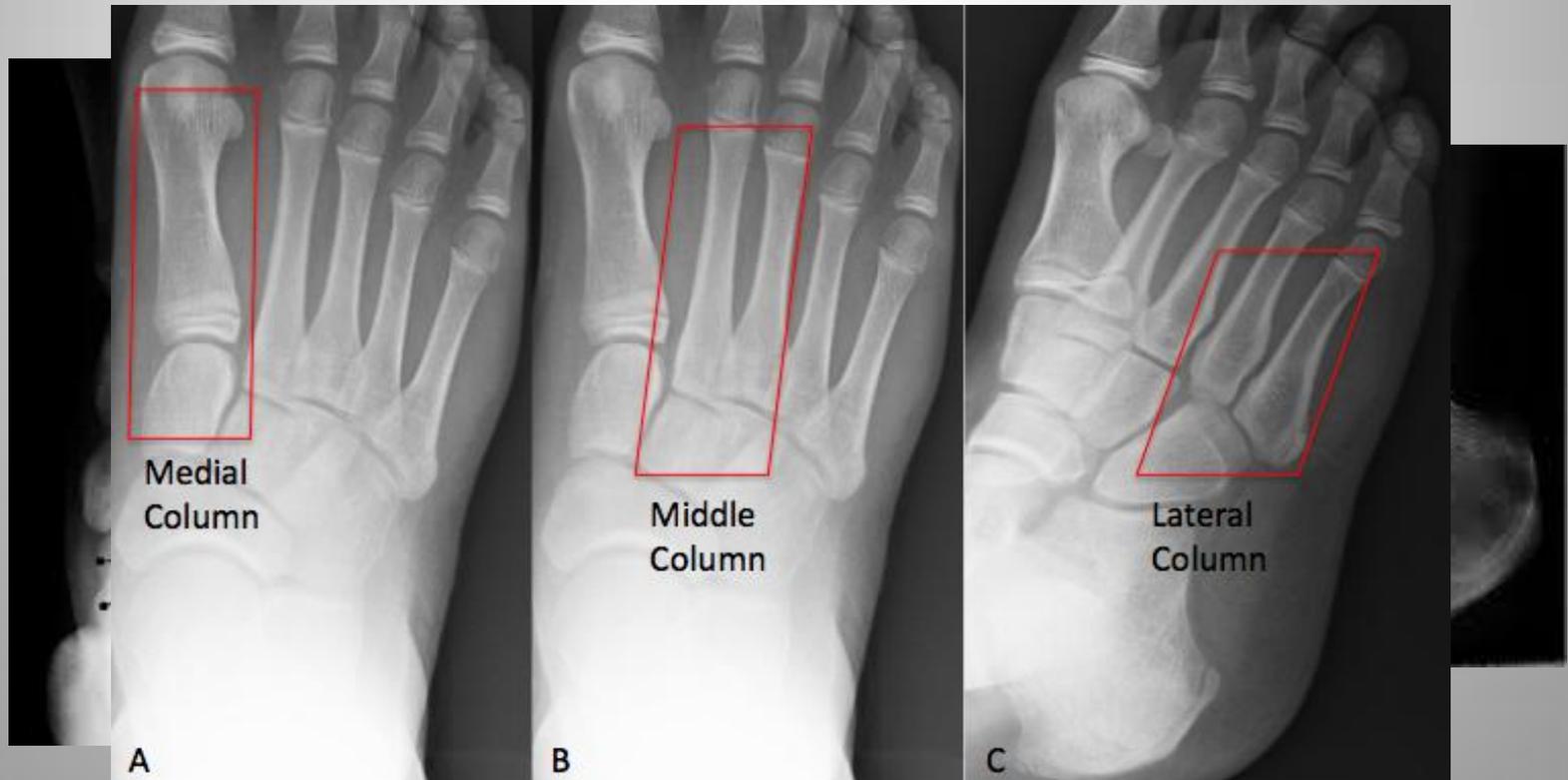
- Indications for PA
 - Purely ligamentous disruptions
 - Multidirectional instability
 - Comminuted intra-articular fracture at 2nd MT
 - Crush injury with intra-articular fx-dislocation
- Contraindications to PA
 - Open physes
 - Subtle injury, minimal to no displacement
 - Unidirectional instability
 - 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-1st 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





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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