

Delta Screw Configuration for ORIF of Lisfranc Fracture/Dislocation: Surgical Technique and Patient Outcomes

Samantha A. Luer, DPM, Kyle W. Abben, DPM, FACFAS
Regions Hospital / HealthPartners Institute for Education and Research - Saint Paul, MN



STATEMENT OF PURPOSE

The primary aim of this retrospective case series was to highlight our procedure selection protocol, delta screw configuration technique and patient outcomes including incidence of hardware removal after Lisfranc open reduction internal fixation (ORIF).

LITERATURE REVIEW

There is controversy within the literature about the ideal treatment for an acute Lisfranc injury, specifically ORIF vs. primary arthrodesis (PA), and which has better outcomes. The choice is generally based on the injury type, degree of displacement, amount of fracture comminution, potential need for subsequent surgery, surgeon preference and individual patient factors.

Magill et al: performed a systematic review comparing ORIF vs. PA (1)

- Need for revision was significantly higher in ORIF group (OR 6.37, p<0.001)
- No significant difference in VAS or AOFAS scores
- Persistent pain was higher in ORIF group (OR 6.29, P=0.04)

Alcelik et al: Systematic review comparing ORIF vs. PA (2)

- No significant difference between outcomes of ORIF vs. PA in terms of return to work or activity and patient satisfaction
- ORIF had higher risk of further surgery for subsequent hardware removal (OR 13.13, P<0.00001) or secondary fusion
- Overall, complication rates were equivalent in both groups

Ly et al: Prospective, randomized clinical trial comparing PA vs. ORIF (3)

- 16/20 pts had HWR at average of 6.75 months postop

Stavlas et al: Systematic review of ORIF (4)

- 49.6% of patients with post-traumatic arthritis
- 7.8% went on to arthrodesis

Sheibani-Rad et al: Systematic review of literature (5)

- Both ORIF and PA have satisfactory results

Based on the literature, ORIF is an accepted treatment approach for certain acute Lisfranc injuries. Subsequent, scheduled hardware removal has historically been common practice after Lisfranc ORIF due to fear of hardware failure or excessive stiffness. In fact, in the majority of the literature the surgical preference post-ORIF was to remove hardware regardless of symptomatology (1). Therefore, there are few studies that report the outcomes with long term retained hardware.

CASE SERIES

- Retrospective review of consecutive cases identified by CPT codes, performed by a single surgeon at a single institution over a 1.5 year period
- Level IV study
- Inclusion Criteria:** Delta screw configuration ORIF (CPT codes: 28615, 2855), minimum 12 month follow-up
- Exclusion Criteria:** Primary arthrodesis, pathologic fracture, chronic injury, Charcot neuroarthropathy or active infection

FIGURE 1. PROCEDURE SELECTION PROTOCOL

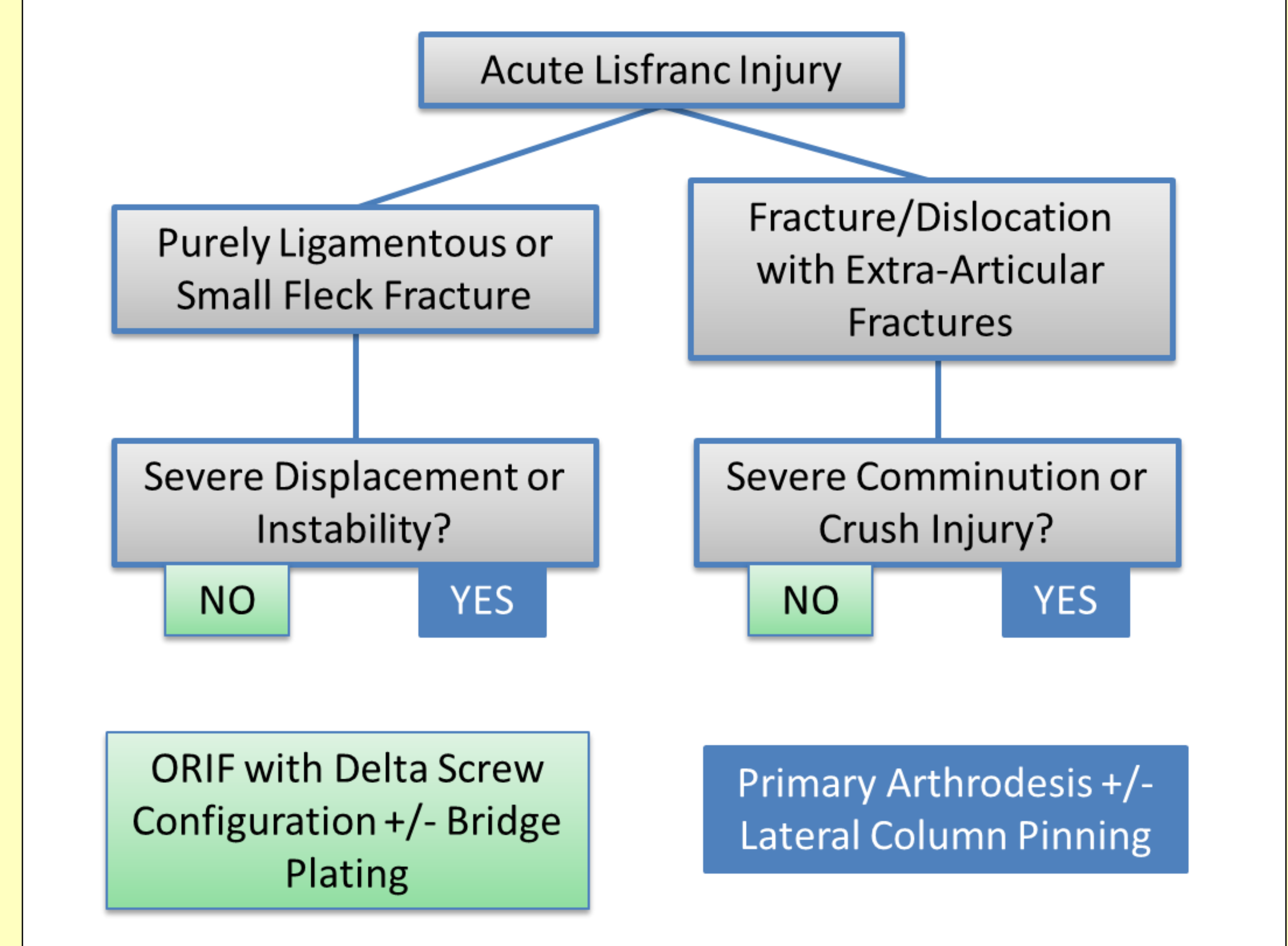


TABLE 1. PATIENT CHARACTERISTICS

Gender (Male:Female)	6 (66.7%) : 3 (33.3%)
Mean Age (years)	47.4 (24 to 72)
Laterality (Right:Left)	6 (66.7%) : 3 (33.3%)
Follow-up Time (months)	12 (12 to 14)
Nonsmoking Status	9/9 (100%)

Comorbidities
 Vitamin D Deficiency 1/9 (11%)
 Renal Insufficiency 1/9 (11%)
 Obesity 1/9 (11%)

RESULTS

- Patient Satisfaction:**
- 8/9 patients very satisfied @ 10 weeks postoperative
 - 1/9 patients neutral @ 10 weeks postoperative 2/2 midfoot stiffness with peripheral edema
 - 9/9 patients very satisfied @ 12 months postoperative
- Complications:** 0% - 1st ray overload, infection, neuritis, DVT/PE, or recurrent deformity
- Hardware Removal:** 1/9 (11%) @ 6 months postoperative
- Worker's compensation case, patient elected for HWR prior to subjective symptoms or hardware breakage

FIGURE 2. DELTA SCREW CONFIGURATION

Inter-cuneiform screw from medial cuneiform to intermediate cuneiform. This screw reduces shear forces on the homerun screw. It also stabilizes the medial column.

"Homerun" screw; 2nd metatarsal base to medial cuneiform. This screw is started in the 2nd metatarsal and aimed at the larger target of the medial cuneiform.

PROCEDURE STEPS:

- Place inter-cuneiform screw
- Use clamp from 2nd metatarsal base to medial cuneiform to reduce 2nd TMTJ
- Place homerun screw

FIGURE 3. HARDWARE REMOVAL CASE

One patient had subsequent hardware removal 6 months after the index procedure. (a) 10 week postoperative AP foot radiograph demonstrating no recurrence of deformity or hardware loosening/breakage. (b) Intraoperative AP foot radiograph demonstrating removal of hardware. (c) Intraoperative stress radiograph demonstrating preserved alignment without recurrence of deformity under stress.

ANALYSIS & DISCUSSION

Vanpelt et al published a recent article where their primary aim was to evaluate radiographic outcomes and report adverse events in patients who have undergone ORIF of acute Lisfranc injury without routine hardware removal (6). This was the first study to date reporting complications related to retained hardware after Lisfranc ORIF.

- Overall rate of hardware complications = 16.4%
- 7/61 patients (11.5%) had loss of reduction
- 4/61 patients (6.6%) had hardware failure
- 3/61 patients (4.9%) had reported pain from prominent hardware
- Older age correlated with loss of reduction and elevated BMI (>30) correlated with hardware failure

All patients with retained hardware in our case series did not have evidence of pain, stiffness, hardware breakage or loosening on intermediate term follow-up. Using our surgical technique we have found a low incidence of hardware removal (1/9, 11%) status post ORIF and this patient was asymptomatic. These findings along with recent literature suggest that routine hardware removal may not be necessary, but further studies are necessary. Until a greater body of research is obtained patients should still be educated that subsequent hardware removal after ORIF is a potential necessity. Instead of scheduling for routine hardware removal, if asymptomatic at 4-6 months have the patient follow-up at 12 months for repeat radiographs and discussion.

REFERENCES

- Magill HP, Hajibandeh S, Bennett J, Campbell N, Mehta J. Open Reduction and Internal Fixation Versus Primary Arthrodesis for the Treatment of Acute Lisfranc Injuries: A Systematic Review and Meta-Analysis. J Foot Ankle Surg 58:328-332, 2019.
- Alcelik I, Fenton C, Hannant G, Abdelrahim M, Jowett C, Budgen A, Stanley J. A systematic review and meta-analysis of the treatment of acute lisfranc injuries: Open reduction and internal fixation versus primary arthrodesis. Foot Ankle Surg. S1268-7731:30056-6, 2019.
- Ly TV, Coetzee JC. Treatment of Primary Ligamentous Lisfranc Joint Injuries: Primary Arthrodesis compared with open reduction internal fixation. J Bone Joint Surg 88 (A): 514-520, 2006.
- Stavlas P, Roberts CS, Xypnitos FN, Giannoudis PV. The role of reduction and internal fixation of Lisfranc fracture-dislocations: a systemic review of literature. Int Orthop 34: 1083-91, 2010.
- Sheibani-Rad S, Coetzee JC, Giveans MR, DiGiovanni C. Arthrodesis Versus ORIF for Lisfranc Fractures. Orthopedics 35: 868-873, 2012.
- VanPelt MD, Athey A, Yao J, Ennin K, Kassem L, Mulligan E, Lalli T, Liu G. Is Routine Hardware Removal Following Open Reduction Internal Fixation of Tarsometatarsal Joint Fracture/Dislocation Necessary? J Foot Ankle Surg 58:226-230, 2019.