Original research article

A Prospective Study on the Surgical Management of Closed Lisfranc Injury by Various Modalities

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Abstract

Introduction: The Lisfranc injuries are the injuries of one or more metatarsals that are displaced with respect to the tarsus. The incidence of such injuries is rare as compared to other fractures. However, they carry a high risk of morbidity and economic implications. We in the current study tried to evaluate different treatment modalities for Lisfranc injuries reporting to our Hospital.
Methods: This cross-sectional study was conducted in the Department of Orthopedics Mahatma Gandhi Memorial Hospital, Kakatiya medical college, Warangal. The sample size of n=60 patients presented with Lisfranc injury was treated by using K-wires, screws, and plates.
Results: A total of n=60 cases were included and studied during the period. The cases were equally K-wire 33.33%, Screw 33.33% cases, and plate fixation in 33.33% cases. The functional outcomes of the study revealed Excellent outcomes in 46.67% of cases out of which plate fixations achieve better outcomes. Poor outcomes were more commonly noted in the K-wire fixations and no case of poor outcome was noted in the plate fixations.
Conclusion: Percutaneous screw fixation is an effective and relatively simple method of treating TMT trauma specially Myerson type B (partial incongruous) injuries and fracture-dislocation. In our study, we found that both K wire and screw fixation were adequate in allowing an acceptable anatomical reduction until the healing occurred although the overall outcome by dorsal plate was better with lesser complications
Keywords: Lisfranc injuries, K-wire fixation, Screw fixation, Plate fixation, Complications

Introduction

Lisfranc injuries refer to a spectrum of injuries ranging from a stable, partial sprain to a grossly displaced and unstable fracture or fracture-dislocation of the midfoot. Ironically, the injury is named after Jaques Lisfranc de Saint-Martin, a French army field surgeon, who described a traumatic amputation through the midfoot. [1] Tarsometatarsal (TMT) joint complex injuries are occasional, with incidence about 0.2% to 0.8% of all fractures. [2, 3] The Incidence of midfoot sprains or subtle Lisfranc disruption is much higher. [4-6] Up

to 20% of these injuries are missed on the initial clinical examination. [6] Mechanism of injury can be either direct (high energy blunt trauma), or indirect by an axial or rotational force applied to a plantarflexed foot. [2, 6] High-energy injuries, such as motor vehicle accidents, are more common (58%) than low-energy injuries, falls from height (48%). [7] There are two main mechanisms of injury: either due to indirect forces (bending and twisting to the midfoot) or due to direct forces (crush injuries). Lisfranc injuries are 2–4 times more common in males, which could be due to higher participation in risk activities involving high-speed injuries. [8] Precise identification and optimal management of these injuries are crucial as they often lead to degenerative arthritis, chronic instability, pain, and disability. Unstable midfoot trauma can be a challenging diagnosis. A complete clinical examination including bilateral anteroposterior (AP) and true lateral weight-bearing (WB) as well as oblique X rays are required to evaluate the midfoot trauma. [9] In subtle Lisfranc dislocation non-weight bearing (NWB) X rays may be normal. Plantar ecchymosis, tenderness over the TMT area, pain on abduction stress of the forefoot indicate a possible Lisfranc injury. [6, 9] Bilateral weight-bearing (WB) AP and lateral radiographs, as well as 30° oblique views, are required to evaluate if there is any TMT joint disruption. [6, 9] The treatment options vary from closed reduction or closed reduction and percutaneous pinning is simple dislocations to open reduction and temporary screw fixation, screw fixation combined with external fixation, and primary arthrodesis in severe fracture-dislocations. [11-15] Reduction is not sufficient to achieve an anatomical reduction in the majority of LFD because of interposed soft tissue and small bony fragments from fractures of the base of the metatarsals. However, a correct anatomical reduction can be critical for optimal outcomes, and this can best be achieved with open reduction and internal fixation. The current study aimed to study the effectiveness of various surgical modalities in closed Lisfranc injury in achieving anatomical reduction and stability of fixation.

Material and Methods

This cross-sectional study was conducted in the Department of Orthopedics Mahatma Gandhi Memorial Hospital, Kakatiya medical college, Warangal from August 2018 and August 2020, in the Sample size of n=60 patients presented with Lisfranc injury were treated by using K-wires, screws, and plates.

Inclusion criteria

1. Age more than 18 years
2. Male and female patients
3. Closed displaced fractures

Exclusion criteria

1. Patient with neurological injuries
2. Patient with associated compartment syndrome
3. Patient with associated complex regional pain syndrome
4. The patient who is medically unfit for surgery
5. Patient in whom injury exceed six weeks
6. Gustilo Anderson 1, 2, 3, A, B and C
7. Patient with non-displaced ligamentous injuries with or without small plantar avulsion of the metatarsal

All patients were admitted, and a careful history was elicited from the patient or

attendants to reveal the mechanism of the injury and the severity of the trauma, site of the incident, circumstances about which the injury occurred, premorbid medical history, and preinjury functional status. The patients were then assessed clinically to evaluate their general condition and the vital signs were recorded. The involved extremity was examined for swelling, deformity, abnormal mobility, discoloration, skin integrity, neurological and vascular compromise, and signs or symptoms of compartment syndrome. Medical consultation was sought expeditiously for geriatric patients. General surgeon consultation was sought to evaluate all high-energy accident victims to rule out polytrauma. Routine investigations done were hemoglobin percentage, bleeding time, clotting time, random blood sugar, blood urea, serum creatinine, serum electrolytes, HIV and HbsAg, Blood grouping and cross matching, ECG, Chest X-Ray, Urine for macroscopy, sugar, albumin, and microscopy. Other investigations like 2D Echo were done. The patient was then taken up for surgery after investigations and as soon as the patient was medically fit for surgery. The interval between the injury and the definitive operation ranged from several hours to ten days (mean 3 days). Any delay in the surgery was usually attributable to multiple trauma or poor medical condition of the patient. All fractures were treated with IV antibiotics. A pre-anesthetic check-up was done and preparations of the required part window shaving were done before surgery. Spinal anesthesia was used for all cases. The cases were treated with K-wire fixations or Screw fixation or Plate fixations as per standard protocol depending on the case. Postoperatively IV fluids and antibiotics were infused as appropriate. Analgesics and Serratiopeptidase were given. Wounds were inspected on the 3rd day and sutures were removed on the 12th postoperative day on average. Rehabilitation protocol was implemented. Follow-up was done at 1, 2, and 6 months after discharge till the fracture was united.

Results

A total of n=60 cases were included and studied during the period. The cases were equally K-wire n=20(33.33%), Screw n=20(33.33%) cases, and plate fixation in n=20(33.33%) cases. In the study n=44(73.33%) were males and n=16(26.67%) were females. The mean age was 29.5 years which indicates that most of the cases occurred in the younger age group details depicted in table 1.

Table 1: Demographic profile of the cases included in the study

Age group (in years)	*Male*	*Female*	*Total*	*Percentage*
21 – 30	11	7	18	30.0
31 – 40	10	4	14	23.3
41 – 50	8	2	10	16.6
51 – 60	9	1	10	16.6
>60	6	2	8	13.3
Total	44	16	60	100

The assessment of mechanisms of injuries of the cases included in the study revealed n=34(56.67%) cases were due to Road Traffic accidents and n=26(43.33%) cases were due to accidental falls. Based on the laterality of the foot involved n=36(60%), were the right-side injuries, and n=24(40%) cases were with left-side injuries. K–Wire fixation

took time between 30 to 60 minutes which was lowest when compared to fixation by plating in which the duration was > 90 minutes in most cases (table 2).

Table 2: Duration of Surgery (In Minutes) Vs Mode of Fixation

Duration of surgery (minutes)	*Frequency*	*K-wire*	*Screw*	*Plate*
30 – 60	32	20 (100%)	8 (40%)	4 (20%)
60 – 90	16	0	10 (50%)	6 (30%)
>90	12	0	2 (10%)	10 (50%)
Total	60	20 (100%)	20 (100%)	20 (100%)

Out of the n=60 cases, n=20(33.33%) cases were found with complications post-operatively out of which the most common complications were bleeding and pain. Loss of reduction in n=4 cases out of n=20 cases of K-Wire fixation was found, and the same complication was not recorded in the screw fixation cases and plate fixation cases indicating K-wires has the disadvantage of loss of reduction easily. Out of the total n=20 complications n=10 therefore half the number of complications occurred in K-wire fixations alone the details have been depicted in Table 3.

Table 3: Post-Operative Complications Vs Mode of Fixation

Complication vs mode of fixation	*Frequency*	*K-wire*	*Screw*	*Plate*
Bleeding	2	0	0	2
Pain	4	2	2	0
Superficial infection	4	2	0	2
Post-operative edema	6	2	2	2
Vascular complication	0	0	0	0
Pulmonary embolism	0	0	0	0
Loss of reduction	4	4	0	0
Total	20(33.33)	10(16.67%)	4(6.67%)	6 (10%)

The time for radiological union in the cases of our study were ranging from 16 to 18 weeks in all the cases of fixations. The late complications were recorded as infections in n=3 cases followed by degenerative osteoarthritis. The functional outcomes of the study revealed Excellent outcomes in 46.67% of cases out of which plate fixations achieve better outcomes. Poor outcomes were more commonly noted in the K-wire fixations and no case of poor outcome was noted in the plate fixations cases the details have been depicted in table 4. Partial weight-bearing was started in 6 weeks in 30% of cases and 7 weeks in 33.3% of cases of the study. Full weight-bearing was started in 12 and 13 weeks in 30% of cases respectively.

Table 4: Functional Outcome of Cases in the study

Functional Outcome	K wire	Screw	Plate	Total (%)
Excellent	8	9	11	28 (46.67)
Good	6	8	8	22 (36.67)
Fair	2	1	1	4 (6.67)
Poor	4	2	0	6 (10.0)

Discussion

Dislocated fractures of the Lisfranc joint are unusual injuries of the foot is unusual and approximately 30% of such injuries go undiagnosed. which may lead to chronic pain and osteoarthrosis and deformities. Road traffic accidents are the commonest cause of such injuries in approximately 40% of cases. [16] Shapiro et al concluded that lateral compression test and axial stability test between 1st and 2nd meta-tarsals are positive when there is rupture of Lisfranc ligament. [17] The mean age group of involved cases in the current study was 29.5 years. In similar studies by Miswan MF et al., [18] had a mean age was 30 years which agrees with the results of the current study Sobardo MF et al., [19] reported cases of Lisfranc injuries with a mean age of 35.5 years. In this study 73.33% of cases were males and 26.67% were females. In epidemiological terms, the Lisfranc injures are 75% common in males. [18] The 56.67% of Lisfranc injury cases were due to Road Traffic accidents and 43.33% of cases were due to accidental falls. Sobardo MF et al., [19] in their study found motor vehicle accidents for 69% of total trauma mechanisms with auto accidents slightly more common than motorcycle accidents. They also attributed the higher percentage because their hospital is a referral hospital for trauma care. The study of fracture type based on Hardcastle & Myerson Classification type A fractures were found in 20% cases, type B in 53.33% cases, and type C in 26.67% cases. [20] Miswan MF et al., [18] in their study reported 11.76% type A fractures, 55.88% type B fractures, and 32.35% type C fractures. In the current study, we treated n=12 cases with closed reduction and K wire fixations and n=8 cases with open reduction and K wire fixation. The screw and plate cases of n=20 each were open reductions. Out of n=12 cases of closed reduction with K wire fixation in this study, we found complications in n= 4 cases with loss of reduction. N=2 cases each were with post-operative pain, superficial infection, and edema. The total incidence of complications in K wire fixations was in 50% of patients. Screw placements produced the least complications in this study (Table 3). Out of n=60 cases of this study, 46.67% of all the treated cases in three categories were will excellent functional outcomes. 36.67% had good functional outcomes and 10% had poor functional outcomes (table 4). Sun Hun J et al., [21] in their study of treating Lisfranc injuries by dorsal plate fixation versus screw fixation found Excellent functional outcomes in plate fixation as compared to screw fixation. We in the current study also found higher numbers of cases with Excellent results with dorsal plate fixation as compared to the other two methods. In a biomechanical study comparing the osteosynthesis with trans-articular screws and dorsal plates, it was confirmed that two methods had similar efficacy in reducing and resisting the TMT joint to displacement on weight-bearing. [22] Fixation with screws offers a rapid recovery of activities and a low incidence of secondary displacement compared with the technique of bone fixation with K-wires. [23] K-wires are easy to insert and remove but have shown up to 32% secondary displacement or suboptimal reduction. [24] Thus, they are reserved only for injuries of the lateral column (fourth and fifth metatarsals).

Conclusion

It is important to distinguish sophisticated Lisfranc injuries from Lisfranc dislocations as treatment protocols are different in each type of injury. Dorsal bridge plate has also been used in patients with fracture-dislocation which provided rigid stabilization without

injury to the articular surface, implant failure, loss of reduction. Open reduction and internal fixation are desirable in unstable injuries. Conservative treatment is unsatisfactory in severe fracture-dislocations, open reduction with screw or k-wire fixation is the treatment of choice in severe Lisfranc fracture-dislocation. Excellent results can be achieved with percutaneous fixations provided reductions are accurate irrespective of the type of injury. Percutaneous screw fixation is an effective and relatively simple method of treating TMT trauma specially Myerson type B (partial incongruous) injuries and fracture-dislocation. In our study, we found that both K wire and screw fixation were adequate in allowing an acceptable anatomical reduction until the healing occurred although the overall outcome by dorsal plate was better with lesser complications.

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