

Midterm Functional Outcome after Operative Management of Midfoot Injuries

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SUMMARY

Background. Injuries of the midfoot are often missed and therefore underestimated. Early diagnosis and treatment are crucial for the final outcome. The primary aim of this study was to assess the pattern and results of early operative management of mid-foot injuries after a midterm follow up.

Material and methods. This study was conducted on 25 patients (19 Males, 6 Females) with mean age of 34.6 years (range 18-60 years) with mid-foot fracture dislocations who were admitted consecutively at our centre from May 2008 through November 2010. 25 patients fulfilling our inclusion criteria with mid-foot fracture dislocations were included in this study. Mechanism of injury, its pattern and results of operative management of midfoot injuries were assessed after acute management of these fractures on urgent basis. Evaluation of results was done by AOFAS Score.

Results. Most common mode of injury was indirect trauma due to fall (n=12) followed by road traffic accident (n=9). Males (n=19) outnumbered females (n=6). The pattern of injuries requiring operative treatment as per our criteria were Lisfranc fracture dislocations (n=22) and navicular fractures (n=3). The mean follow up was 3.2 years and mean AOFAS score at 3.2 years was 78.36, with most patients losing points to pain and decreased recreational function.

Conclusion. The Lisfranc fracture dislocations are the most common injuries around midfoot requiring operative treatment, and we believe that operative treatment considerably improves functional outcome in these injuries.

Key words: lisfranc's fracture, midfoot injury, navicular fractures

BACKGROUND

The mid-foot is defined as the section of foot between and including the Chopart and Lisfranc joints [1]. Among the injuries in the foot region, mid-foot fractures are still problematic in both diagnosis and treatment and result in a high degree of long term morbidity. Mid-foot fractures are uncommon and predominantly occur in motor vehicle accidents. Midfoot fractures, particularly fracture dislocations, affect the function of the entire foot. However, even in these complex foot injuries, an early anatomic (open or closed) reduction and stable fixation can minimize the percentage of long term impairment [1]. Midfoot fractures are particularly not diagnosed during primary examination especially when associated with other injuries [2]. Midfoot fractures, including those involving the Chopart and Lisfranc joints, can be very easy to miss because of their rarity, the lack of obvious radiographic findings in up to 33% of such injuries, and the lack of familiarity with such fractures by many treating physicians [3]. The aim of this consecutive study is to see the pattern of injuries around the midfoot which require operative management and assess their results.

MATERIAL AND METHODS

The study was a consecutive study, conducted on patients with mid-foot injuries who were treated in our hospital from April 2008 through May 2010 after approval by ethical committee of the hospital in accordance with the ethical standards of the 1964 Declaration of Helsinki as revised in 2000. An informed consent was taken from all the patients.

All cases with suspected midfoot injuries were evaluated using anteroposterior, medial oblique and lateral radiographs of foot. Anteroposterior weight bearing and stress views were used in patients suspected of subtle Lisfranc injury. Patients with displaced midfoot fracture dislocations, isolated midfoot injuries with displaced fractures and those fractures which were associated with incongruity of the joints (> 2mm step in the articular surface) were included in this study. Patients who presented >2 weeks after trauma, patients <16 and >65 years old, open type ii and type iii fractures (classified by Gustillo classification), polytrauma patients and undisplaced midfoot fractures were excluded from this study. A total of 25 patients matched our inclusion criteria and were included in our study. Patients with fracture dislocations were operated within 24 hours whereas isolated midfoot fractures were operated within a week. All patients were operated by a standard surgical technique and fixation with K wires was done. Patients were followed up regularly every fortnight for a period of 10 weeks, thereafter monthly up to six months and then every six months for a period of two years and at final follow-up for evaluation for the purpose of this study.

RESULTS

The mean follow-up in our study was 3.2 years (range 2- 4 years). Males (n=19) were affected more than females (n=6) with a ratio of 3.2:1. Most of the patients (17) were in the age group of 16-35 years with the mean age of 34.6 years. The left side (n=14) was affected more than the right side (n=11). The most common modes of injury were indirect trauma



Fig. 1a,b. Preoperative AP radiograph (a) and medial oblique view (b) showing Type C2 Lisfranc fracture dislocation

due to a fall (n=12) followed by road traffic accidents (n=12). Among the cases with road traffic accidents, 50% were pedestrians. There were 22 Lisfranc fracture dislocations (Fig.1a,b) and three navicular fractures (Tab. 1). There was no cuboid or cuneiform fracture in our study which required operative treatment during this period. Among Lisfranc injuries, most (45%, n=10) had type B2 injuries (Myersons classification) while 27% patients (n=6) had subtle Lisfranc injuries (Tab. 2). There were three displaced navicular fractures (12%) in our study. All navicular fractures were type C (as per OTA classification). The most common associated injuries were metatarsal fractures (32% cases) with fractures of the base of third metatarsal (16%) being the commonest. Most patients (n=15, 76%) were treated with open reduction and internal fixation, with K wires used in most patients (Fig. 2a,b), while close reduction and percutaneous pinning was done in

24% cases (n=6). Full weight bearing was allowed at 12-14 weeks in 56% cases (n=14), while in 44% cases, it was done at 9-11 weeks with a mean of 11.7 weeks. All navicular fractures united in our study. There were two (8%) cases of pin-tract infection and two cases of superficial wound infection which responded to antibiotics in our study. There was one case of loss of reduction in our study. The average follow-up was 2-4 years, mean 3.2 years (Figure 3,b). The mean AOFAS-M score was 78.36, with most patients losing points to pain and decreased recreational function. Good to fair results were seen in 88% (Tab. 3) cases and poor results in 2 (8%) cases (as per scale used by Cleber De Jesus et. al.) [2]

DISCUSSION

The midfoot is described as the section of foot between and including the Chopart and Lisfranc joints [1]. Five bones compose the midfoot – the na-

Tab. 1. Pattern of midfoot injuries

S. No.	Type of Injury	No. of Cases	%age
1.	Lisfranc fracture dislocation	22	88
2.	Navicular fractures	3	12
3.	Cuboid fractures	-	-
4.	Cuneiform fractures	-	-

Tab. 2. Types of Lisfranc Fracture Dislocations

S. No.	Type of Fracture	No. of Cases	Percentage
1.	A	3	13.63
2.	B1	-	0.0
3.	B2	10	45.45
4.	C1	2	9.09
5.	C2	1	4.54
6.	Unclassified (Subtle)	6	27.27

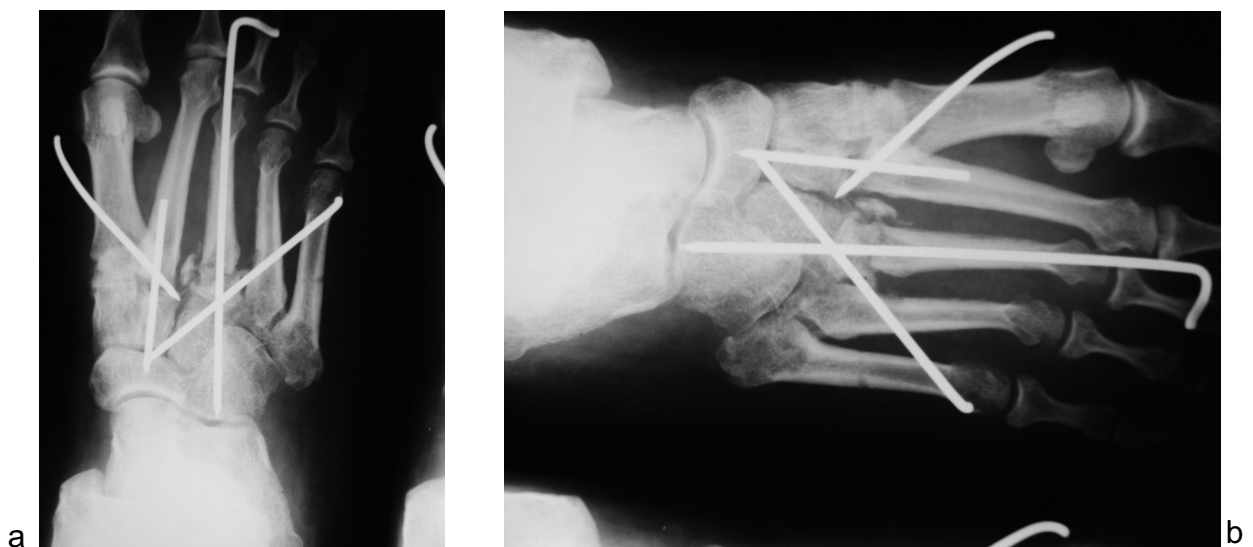


Fig. 2a,b. Anteroposterior (a) and medial oblique radiograph (b) at 8 weeks



Fig. 3a,b. Anteroposterior (a) and lateral radiograph (b) at 2 years of follow-up

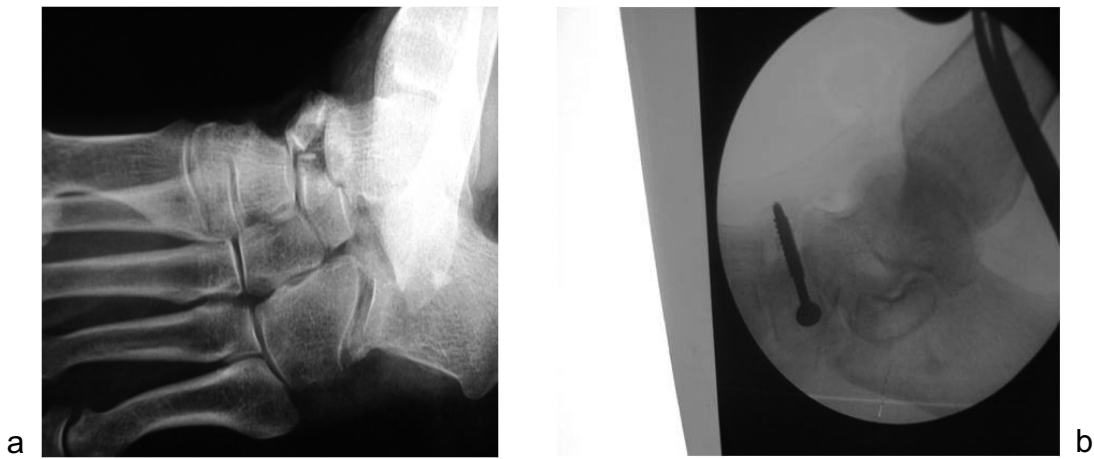


Fig. 4a,b. Navicular fracture before (a) and after (b) fixation

Tab. 3. Results based on AOFAS scoring

Result	Score	No. of patients	Percentage of patients
Excellent	90-100	1	4
Good	80-90	11	44
Fair	70-80	11	44
Poor	<70	2	8

vicular, the cuboid, the medial, the middle and lateral cuneiforms. Despite the presence of many large, broad, flat articular surfaces, this collection of bones is also relatively immobile compared to the rotatory and accommodative functions of the hindfoot and forefoot. One of the functions of the midfoot is to regulate forces on weight bearing and distribute these forces. Midfoot fractures are uncommon and predominantly occur in motor vehicle accidents. Despite significant improvement in automobile safety, the incidence and severity of midfoot fractures has remained the same [4]. Midfoot fractures are frequently not diagnosed during primary examination espe-

cially when associated with other injuries [6,7]. As a result of inadequate treatment, the complication rate is high [8]. Only recognized isolated fractures of the midfoot have an outcome with minimal functional impairment. The fracture dislocation of the Lisfranc joint is the most frequent severe injury of the midfoot, but is still uncommon with incidence of 0.02% to 0.09% of all fractures. Jarde, et. al. estimated that almost 40% of Lisfranc fracture dislocations in polytrauma patients are unrecognized. However, even with accurate diagnosis and early treatment, these injuries can result in chronic disability [9,10]. The aim of surgery is to restore length and alignment

of the midfoot, and therefore maintain the relationship between the hind-, mid- and forefoot. Restoration of the articular surface, maintenance of length of the medial and lateral column and joint congruity should be the aim [11-13]. Conventional means of stabilization include the use of K wires, screws, plates and internal fixation. Placement of plates and screws is difficult due to the limited space available and moreover may lead to loosening and pulling out of the screws resulting in loss of stability and fracture fixation [14]. Temporary bridge plating of the medial column was described in 2003 for comminuted fractures of the navicular but the major disadvantage is that by spanning the joints, movement through the midfoot is restricted to a significant extent [15]. K wire fixation provides a versatile means of achieving reduction and maintaining congruity at joint surface.

In our consecutive study, most patients were in the age group of 16-35 years with a mean of 34.6 years. In Richter et. al., the age group ranged from 10-84 years with mean of 35 years [1]. The mean age in our study was consistent with this study. The males dominated females in our study with a ratio of 3.16:1. In Richter et al., males also outnumbered females with a ratio of 2.78 [1]. The most common mode of injury in our study was indirect trauma due to a fall (48%) followed by road traffic accidents (36%). In Richter et al. study, 72.2% of the cases were due to road traffic accidents and 11.6% were due to falls from height [1]. Our study differed from other studies in the mode of injury. The reason could be that most of our patients belonged to rural areas where road traffic accidents are not so common as in urban areas and open injuries were excluded from our study. The fracture dislocation of the tarsometatarsal joint was the most common midfoot injury in our study (88%) followed by navicular fracture (Fig. 4a,b). In Richter's study, Lisfranc fracture dislocation constituted 31.2% of cases and isolated midfoot injuries were seen in 35.5% of cases [1]. The reason for this difference in our study from other studies could be due to the fact that we included only those patients with midfoot injuries in our study who required operative management and open injuries were excluded from our study. Among the patients with Lisfranc injuries, Type B (classified as per Myerson's modification of Hardcastle et al classification) were the most common injuries (about 45.45%) [16]. In Antonio series, Type B were the most common

tarsometatarsal fracture dislocations [17]. The most frequent associated injuries in the present study were metatarsal fractures in 32% of cases, the commonest being the base of third metatarsal (16%). In Goosens et al. study, metatarsal fractures were associated in 40% of mid-foot injuries [12]. Most patients, in our study (76%), were treated with open reduction and internal fixation, with Kirschner wires used in 60% of cases, Kirschner wires and screws in 12% of cases and screws alone in 4% of cases. Close reduction and percutaneous pinning was done in 24% of cases. In Richter series, close reduction was done in 14.4% of cases and open reduction in 76.1% of cases, in 69% of cases internal fixation was done with Kirschner wires and in 6% of cases internal fixation was done with Kirschner wires and screws [1]. In our study, stitches were removed at 10-14 days and a short leg cast was given. In 80% of cases, a short leg cast was given at 2 weeks while in 20% cases it was delayed due to poor condition of skin in two cases, pin tract infection in one patient and minor wound infection in one patient. The average time of removal of the K wire in our study was 8 weeks while as in Richter et al study, Kirschner wires were removed at 6 weeks [1]. The complications in present study included pin-tract infection in 2 patients, minor wound infection in one patient and loss of reduction in one patient. There was no case of compartment syndrome of the foot in our study. The patients were followed for 2 to 4 years with a mean of 3.2 years and were assessed by AOFAS midfoot score. The majority of our patients [92%] complained of mild occasional pain. 56% of cases could wear conventional fashionable shoes. 52% of cases had no difficulty on uneven surfaces. The mean AOFAS (M) score in our study was 78.36 with most patients losing points to pain and decreased recreational function. In Martinus Richter study, the mean AOFAS score was 71. Our functional score was higher than that study. Good to fair results were seen in 88% of cases in our study and poor results in 12% of cases according to the scale used by De Jesus et al [2].

CONCLUSION

The Lisfranc fracture dislocations are the most common injuries around midfoot requiring operative treatment, and we believe that operative treatment considerably improves functional outcome in these injuries.

REFERENCES

1. Richter M, Wippermann B, Krettek C, Schrott E, Hufner T, Therman H. Fractures and fracture Dislocation of Midfoot; occurrence, causes and long term results.). *Foot & Ankle Int* 2001; 22: 392-8.

2. Pereira CDJ, Espinosa EG. Evaluation of the surgical Treatment of Lisfranc Joint Fracture –Dislocations. Acta Ortop Bras 1992; 16.
3. Wei CJ, Tsai WC, Tiu CM, Wu HT, Chiou HJ, Chang CY. Systematic analysis of missed extremity fractures in emergency radiology. Acta Radiol 2006; 47(7): 710-7.
4. Richter M, Therman H. Fractures of foot and ankle in car drivers and passengers, incidence analysis and long term results. JBJS 1999; suppl I: 81-B.
5. Kitaka A. Clinical rating system of ankle, hindfoot, midfoot, hallux and lesser foot. Foot & ankle int 1994; 15; 349-53.
6. Graziano TA, Sniders D et al. Crush and avulsion injuries of foot, their evaluation and management. J Foot surg 1984; 23: 445-50.
7. Mawhinney IN, McCoy GF. The crushed foot. J R Coll Surg Edinb 1995; 40: 138-9.
8. ZivI, Moosheiff R, et al. Crush injuries of the foot with compartment syndrome. immediate one stage management. Foot & Ankle 1989; 9: 185-9.
9. Jarde O, Gaffuri JG, et al. Fractures of the Navicular bone, apropos of 48 cases. Ann Chir 1993; 47: 32-5.
10. Kaplan JD, Karlin JM, et al. Lisfranc fracture dislocation – A review of literature and case report. J Am Podiatr Med Assoc 1991; 81: 531-9.
11. Richter M, Wippermann B, Krettek C, et al. Fractures and fracture dislocations of the midfoot: occurrence, causes and long-term results. Foot Ankle Int 2001; 22: 392–8.
12. Sangeozan BJ, Benirschke SK, Mosca V, et al. Displaced intra-articular fractures of the tarsal navicular. J Bone Joint Surg Am 1989; 71: 1504–10.
13. Pinney SJ, Sangeozan BJ. Fractures of the tarsal bones. Orthop Clin North Am 2001; 32: 21–33.
14. Smith RW, Ziran BH, Anglen JO, Stahel PF. Locking plates: tips and tricks. J Bone Joint Surg Am 2007; 89: 2298–307.
15. Schildhauer TA, Nork SE, Sangeozan BJ. Temporary bridge plating of the medial column in severe midfoot injuries. J Orthop Trauma 2003; 17: 513–20.
16. Myerson M, Fisher R, Burgess A. Dislocation of the tarsometatarsal joints; end results correlated with pathology and treatment. Foot & Ankle 1986; 6: 225.
17. Enriquez Gastro JA, Lopez Volero A. Lisfranc Fracture Dislocation Epidemiological study and Results at the General Hospital Mexico. Acta Ortopedica Mexicana 2005; 19 (Suppl 1): 38-41.
18. Goosens MN, Stoop DE. Lisfranc fracture-dislocations; etiology, radiology, and results of treatment; A review of 20 cases. Clinical Orthopaedics and Related Research 1983; 176: 2-305.

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