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Range of ankle movements after reduction with precontoured locking plate for distal tibial fracture

Muhammad Sajid[1], Muhammad Adeel-Ur-Rehman[1], Asad Ali[1], Tahseen Riaz[1], Muhammad Mansoor Hafeez[2], Sobiya Alyas, Qurban Ali[2] and *Arif Malik[2]

[1.] Orthopedics Unit 1, Jinnah Hospital, Lahore-Pakistan
[2.] Institute of Molecular Biology and Biotechnology, University of Lahore, Lahore-Pakistan
Corresponding Author: arifuaf@yahoo.com

Abstract: Background: Distal tibia fractures are complex injuries with a high complication rate. The presence of significant osteoporosis increases the risk for compound or more complex fractures associated with higher morbidity and mortality. More severe tibia fractures stem from high-energy trauma, most often motor vehicle collisions. Fractures of the distal tibia can be challenging to treat because of the limited soft tissue, the subcutaneous location, and poor vascularity. The best treatment remains controversial. **Objective:** To determine the frequency of patients achieving full range of ankle movements after reduction with precontoured locking plate for distal tibial fracture. **Methodology:** It is a descriptive case series. Total 75 patients fulfilling the selection criteria were included in this study after the approval of ethical committee of Jinnah Hospital Lahore. An informed consent was obtained. Then patients underwent surgery by a single surgical team under general anesthesia. Then patients were shifted in post-surgical wards and discharged from their wards on very next day. Then patients were followed-up in OPD for 24 week after surgery on every second week. After 24 weeks, range of ankle movements was assessed. All the information was collected through a specially designed proforma. **Results:** The mean range of motion (ROM) was 31.52±10.06. In this study full range of ankle movement was seen in 62(83%) of patients. However no statistically significant association was seen for full range of ankle movement with age of patients (p-value=0.831), gender (p-value=0.291), side involved (p-value=0.658) and BMI of patients (p-value=0.825). **Conclusion:** Results of this study demonstrate that patients presenting with distal tibia fracture can be effectively managed in terms of full range of ankle movement with precontoured locking plate. However further long-term studies are needed to compare other relevant outcomes with this treatment modality.

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Keywords: Range of ankle movements, precontoured locking plate, distal tibial fracture

Introduction

Distal tibia fractures are complex injuries with a high complication rate [1]. The presence of significant osteoporosis increases the risk for compound or more complex fractures associated with higher morbidity and mortality [2]. More severe tibia fractures stem from high-energy trauma, most often motor vehicle collisions [3, 4]. Fractures of the distal tibia can be challenging to treat because of the limited soft tissue, the subcutaneous location, and poor vascularity. The best treatment remains controversial [5, 6]. The goal of orthopaedic surgeons is to restore the tibial anatomy, to fix the epi-metaphyseal block with the diaphysis and to avoid complications.1The literature suggests that minimally invasive plating is appropriate management options for these fractures, but further studies are required [6, 7]. The management of distal tibial fracture involves open reduction and internal fixation (ORIF) of the associated fibular fracture when present, followed by minimally plate osteosynthesis of the tibia utilizing precontoured tubular plates and percutaneously placed cortical screws. This minimally invasive technique for treatment of distal tibial fractures proves to be a feasible and worthwhile method of stabilization while avoiding the severe complications associated with the more standard methods of internal or external fixation of those fractures.8 In a study it has been noticed that full range of ankle movements was achieved in all 100% cases after 6 months (n=38) [9]. But another study has showed that full range of ankle movements was achieved in all 26% cases after 6 months (n=19) [5]. One more study supported the evidence and also showed that full range of ankle movements was achieved in 27% cases after 6 months (n=26) [10]. Rationale of this study was to assess the frequency of patients achieving the full range of ankle movements after reduction with precontoured locking plate for

distal tibial fracture. It has been observed in literature that locking plate can be more successful in achieving full range of ankle movements. But controversy exits in literature which showed that it is only 26-27% patients, full range of ankle movements can be achieved. So, we are unable to implement the use of precontoured locking plate for management of distal tibial fracture in adults. But previous studies were conducted on small sample size. So we want to conduct this study with large sample size to confirm whether it is a successful method to implement in future in local setting. This will improve our practice and implementation of precontoured locking plate to manage these type of fracture in future.

Material & Methods

Total 75 patients (n=75) fulfilling the selection criteria were included in this study from emergency of Department of Orthopedic Surgery, Jinnah Hospital, Lahore after the approval of research ethical committee of the institute. An informed consent was obtained. Demographic data (name, age, gender, anatomical side and contact) noted. Then patients underwent surgery by a single surgical team under general anesthesia. Then patients were shifted in post-surgical ward and then discharged from their ward on very next day. Then patients were followed-up in OPD for 24 week after surgery on every second week. After 24 weeks, frequency of patients achieving full range of ankle movements was assessed by researcher himself (as per operational definitions). All the information was collected through a specially designed proforma.

Inclusion Criteria

Patients of age 20-70 years of either gender presenting with distal tibia fracture (as per operational definition)

Exclusion Criteria

1. Patients with osteroporosis, osteoarthritis, osteomalacia or positive RA factor
2. Communited fractures, multiple fractures or open fracture with infection and debris
3. INR>2
4. Bilateral fracture
5. Diabetics BSR > 180mg/dl

Data Analysis

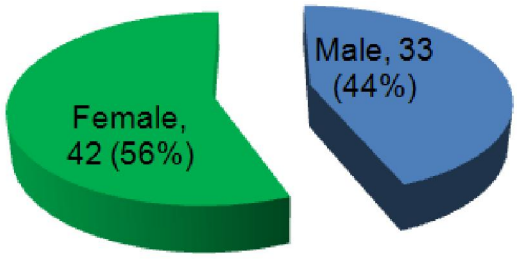
All the data was entered and analyzed through SPSS version 21. The quantitative variables like age, BMI and range of movement were presented as mean & standard deviation. The qualitative variable like gender, anatomical side and full ROM were presented as frequency and percentage. Data was stratified for age, gender, BMI and side of fracture. Chi-square was used to compare stratified groups. P-value<0.05 was considered as significant.

Result

Table-1: Descriptive Statistics for AGE, BMI and ROM

	n	Mean	SD	Minimum	Maximum
AGE	75	37.49	11.06	20	55
BMI	75	24.92	2.85	20.00	29.85
Full range of ankle movement	75	31.52	10.06	15	50

Graph-1: Gender distribution of patients



Graph-2: Full Range of ankle movement in Patients

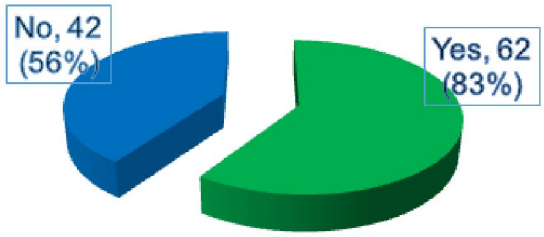


Table-2: Anatomical Side Involved

Anatomical side	Frequency (percentage)
Left	33(44%)
Right	42(56%)
Total	**75**

The mean age, BMI and ROM of the patients in our study was 37.49±11.062, 24.92±2.85 and 31.52±10.06 respectively. The minimum age, BMI and ROM was 20, 20 and 15 and maximum was 55, 29.85 and 50 respectively (Table 1). There were 33 (44%) patients in which left anatomical side was

involved where as in 42 (56%) patients right side was involved (Table 2) There were 33(44%) males and 42 (56%) females in our study (Graph 1). There were 62(82.7%) patients who had full range of motion whereas there were 13 (17.3%) patients without full range of motion (Graph 2). No statistically significant association was seen between age group and gender of patients with full range of ankle movement (p=0.831, 0.291 respectively). Similarly no statistically significant association was seen between anatomical side involved and BMI with full range of ankle movement (p=0.658, 0.825 respectively). (Table 3)

Table-3: Comparison of success of different variables

		Full range of ankle movement		Total	p-value
		Yes	No		
BMI	Normal	19(30.6%)	3(23.1%)	***22***	**0.825**
	Overweight	32(51.6%)	7(53.8%)	***29***	
	Obese	11(17.7%)	3(23.1%)	***14***	
SIDE OF FRACTURE	Left	28(45.2%)	5(38.5%)	***33***	**0.658**
	Right	34(54.8%)	8(61.5%)	***42***	
GENDER	Male	29(46.8%)	4(30.8%)	***33***	**0.291**
	Female	33(53.2%)	9(69.2%)	***42***	
AGE	20-30	20(32.3%)	5(38.5%)	***25***	**0.831**
	31-40	12(19.4%)	3(23.1%)	***15***	
	41-50	19(30.6%)	4(30.8%)	***23***	
	>50	11(17.7%)	1(7.7%)	***12***	

Discussion

Treatment for distal tibial fractures ranges from conservative to surgical procedures using external fixators, intramedullary nailing and internalfixation [11, 12]. All methods of fixation have merits and demerits and hence there is no consensus for superiority of one method over the other for these types of fractures. Soft tissue healing is of paramount importance along with bone healing in distal tibial fractures for a successful outcome [13, 14]. Minimally invasive plating techniques reduce surgical soft tissue injury and maintain a more biologically favorable environment for fracture healing [15]. Most of the studies showed good results with open reduction and internal fixation [16]. Few studies with this type of fixation have shown poor results [17, 18]. However the results depend on severity of injury, soft tissue trauma, surgical timing, surgical technique and co-morbidities of the patient.12 In current study full range of ankle movement was seen in 62(83%) of patients. However no statistically significant association was seen for full range of ankle movement with age of patients (p-value=0.831), gender (p-value=0.291), side involved (p-value=0.658) and BMI of patients (p-value=0.825). Lakhotia D from Indian in his study reported that full range of ankle movements was achieved in all 100% cases after 6 months (n=38).9 However Ronga M in his study showed that full range of ankle movements was achieved in 26% cases after 6 months (n=19) [5]. However Mohammad MM supported the evidence and also showed that full range of ankle movements was achieved in all 27% cases after 6 months (n=26) [10]. However Ronga and Mohammad study did not support the results of this study as in both studies full range of ankle movement was quite low as compared to this study. It has been proposed that the reduced plate-to-bone compression afforded by locking plates serves to protect the viability of the bone by maintaining microvascular circulation within the cortex and its investing tissues. Screw locking minimizes the compressive forces exerted by the plate on the bone because the plate does not need to be tightly pressed against the bone to stabilize the fracture [19-21]. Gupta *et al*., [22] found that open reduction and internal fixation in distal tibial fractures jeopardises fracture fragment vascularity and often results in soft tissue complications. Minimally invasive osteosynthesis, if possible, offers the best possible option as it permits adequate fixation in a biological manner. Seventy-nine consecutive adult patients with distal tibial fractures, treated with locking plates, were retrospectively reviewed. The 4.5-mm limited-contact locking compression plate was used in 33 fractures, the metaphyseal locking plate in 27 fractures and the distal medial tibial locking plate in the remaining 20 fractures. Fibula fixation was performed in the majority of comminuted fractures (n = 41) to maintain the second column of the ankle so as to achieve indirect reduction and to prevent collapse of the fracture. There were two cases of delayed

wound breakdown in fractures fixed with the 4.5-mm locking plate. Five patients required primary bone grafting and three patients required secondary bone grafting. All cases of delayed union (n = 7) and nonunion (n = 3) were observed in cases where plates were used in bridge mode. Minimally invasive plate osteosynthesis with locking plate was observed to be a reliable method of stabilization for these fractures. Peri-operative docking of fracture ends may be a good option in severely impacted fractures with gap. The precontoured distal medial tibial locking plate was observed to be a better tolerated implant in comparison to the 4.5-mm locking plate or metaphyseal locking plate with respect to complications of soft tissues, bone healing and functional outcome, though its contour needs to be modified [22]. The distal end of the precontoured locking compression plate is anatomically contoured to the distal medial tibia, thus preventing primary displacement of the fracture caused by inexact contouring of a normal plate; it allows a better distribution of the angular and axial loading around the plate, and also, the distal end allows placement of up to nine locking screws that provide stability where satisfactory bone purchase is difficult [21]. The clinical importance of these advantages, however, is still debatable. Several studies had investigated the differences between fractures fixed by locking plates and those fixed by non-locking plates and found that there were no statistically significant differences between locking plates and non-locking plates for patient-oriented outcomes, adverse events, or complications [23, 24]. With careful attention to surgical timing, respect for soft tissue handling and using a minimally invasive technique, incisions may be placed less than 7 cm apart depending on the needs of the fracture pattern. Revision surgery for implant removal due to implant prominence can be avoided with anterolateral plating.

Conclusion

Results of this study demonstrate that patients presenting with distal tibia fracture can be effectively managed in terms of full range of ankle movement with precontoured locking plate. However further long-term studies are needed to compare other relevant outcomes with this treatment modality.

References

1. Joveniaux P, Ohl X, Harisboure A, Berrichi A, Labatut L, Simon P, et al. Distal tibia fractures: management and complications of 101 cases. Int Orthop 2010;34(4):583-8.
2. Clement N, Beauchamp N, Duckworth A, McQueen M. The outcome of tibial diaphyseal fractures in the elderly. Bone Joint J 2013;95(9):1255-62.
3. Chua W, Murphy D, Siow W, Kagda F, Thambiah J. Epidemiological analysis of outcomes in 323 open tibial diaphyseal fractures: a nine-year experience. Singapore Med J 2012;53(6):385-9.
4. Madadi F, Farahmandi MV, Eajazi A, Besheli LD, Madadi F, Lari MN. Epidemiology of adult tibial shaft fractures: a 7-year study in a major referral orthopedic center in Iran. Med Sci Monitor Basic Res 2010;16(5): CR217-CR21.
5. Ronga M, Longo UG, Maffulli N. Minimally invasive locked plating of distal tibia fractures is safe and effective. Clin Orthop Relat Res 2010;468(4):975-82.
6. Babis G, Kontovazenitis P, Evangelopoulos D, Tsailas P, Nikolopoulos K, Soucacos P. Distal tibial fractures treated with hybrid external fixation. Injury 2010;41(3):253-8.
7. Newman SDS, Mauffrey CPC, Krikler S. Distal metadiaphyseal tibial fractures. Injury 2011;42(10):975-84.
8. Mahajan N. Minimally invasive techniques in distal tibial fractures. Jk Science 2008(2):78-80.
9. Lakhotia D, Sharma G, Khatri K, Kumar GK, Sharma V, Farooque K. Minimally invasive osteosynthesis of distal tibial fractures using anterolateral locking plate: evaluation of results and complications. Chinese J Traumatol 2016;19(1):39-44.
10. Mohammad MM, Hafez KMAH, Abdelkader AA, Mohamed EGK. Short-term results for the management of distal tibial fractures by minimally invasive locked plating. Egypt Orthop J 2014;49(4):314.
11. Leonard M, Magill P, Khayyat G. Minimally-invasive treatment of high velocity intra-articular fractures of the distal tibia. International orthopaedics 2009;33(4):1149-53.
12. Vallier HA, Cureton BA, Patterson BM. Randomized, prospective comparison of plate versus intramedullary nail fixation for distal tibia shaft fractures. Journal of orthopaedic trauma 2011;25(12):736-41.
13. Lau T, Leung F, Chan C, Chow S. Wound complication of minimally invasive plate osteosynthesis in distal tibia fractures. International orthopaedics 2008;32(5):697.
14. Grose A, Gardner MJ, Hettrich C, Fishman F, Lorich DG, Asprinio DE, et al. Open reduction and internal fixation of tibial pilon fractures using a lateral approach. Journal of orthopaedic trauma 2007;21(8):530-7.

15. Farouk O, Krettek C, Miclau T, Schandelmaier P, Guy P, Tscherne H. Minimally invasive plate osteosynthesis and vascularity: preliminary results of a cadaver injection study. Injury 1997;28: A7-A12.
16. Pollak AN, McCarthy ML, Bess RS, Agel J, Swiontkowski MF. Outcomes after treatment of high-energy tibial plafond fractures. J Bone Joint Surg Am 2003;85(10):1893-900.
17. McFerran MA, Smith SW, Boulas HJ, Schwartz HS. Complications encountered in the treatment of pilon fractures. Journal of orthopaedic trauma 1992;6(2):195-200.
18. Helfet DL, Koval K, Pappas J, Sanders RW, DiPasquale T. Intraarticular" pilon" fracture of the tibia. Clinical orthopaedics and related research 1994;298:221-8.
19. Pallister I, Iorwerth A. Indirect reduction using a simple quadrilateral frame in the application of distal tibial LCP—technical tips. Injury 2005;36(9):1138-42.
20. Kubiak EN, Fulkerson E, Strauss E, Egol KA. The evolution of locked plates. The Journal of Bone & Joint Surgery 2006;88(suppl 4):189-200.
21. Frigg R. Development of the locking compression plate. Injury 2003;34:6-10.
22. Gupta RK, Rohilla RK, Sangwan K, Singh V, Walia S. Locking plate fixation in distal metaphyseal tibial fractures: series of 79 patients. International orthopaedics 2010;34(8):1285-90.
23. Ozkaya U, Parmaksizoglu AS, Gul M, Sokucu S, Kabukcuoglu Y. Minimally invasive treatment of distal tibial fractures with locking and non-locking plates. Foot & ankle international 2009;30(12):1161-7.
24. Ahmad MA, Sivaraman A, Zia A, Rai A, Patel AD. Percutaneous locking plates for fractures of the distal tibia: our experience and a review of the literature. Journal of Trauma and Acute Care Surgery 2012;72(2): E81-E7.

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