

Original Article

RANGE OF ANKLE MOVEMENTS AFTER FIXATION WITH PRECONTOURED ANATOMICAL LOCKING PLATE FOR COMMINUTED DISTAL TIBIA FRACTURE

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Objective: To assess the frequency of patients achieving the full range of ankle movements after fixation with pre-contoured locking plate of distal tibia fracture.

Methods: Seventy five patients fulfilling inclusion criteria were included in the study. Patients underwent surgery by a single surgical team. Patients were followed in OPD for 24 weeks and frequency of patients achieving full range of ankle movements was assessed.

Results: The mean age was 37.49 ± 11.062 years, 33 (44%) were male and 42 (56%) female, 33 (44%) patients had left side tibia fracture whereas 42 (56%) patients right side tibia fracture. Minimally invasive fixation was done with pre contoured anatomical distal tibia locking plates. All patients were followed for 24 weeks and range of motion was assessed. Mean ROM was 31.52 ± 10.06 the minimum ROM was 15 and maximum was 50.62 (82.7%) patients had full range of motion. **Conclusion:** Patients presenting with comminuted distal tibia fracture can be effectively managed in terms of full range of ankle movement with precontoured locking plate.

Conclusions: 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.

Keywords: distal tibia fracture, precontoured anatomical plate, range of motion.

Introduction

Distal tibia fractures are complex injuries with a high complication rate.¹ The presence of significant osteoporosis increases the risk for 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 epimetaphyseal block with the diaphysis and to avoid complications.¹ The literature suggests that minimally invasive plating is appropriate management option 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 all 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



Fig-1: X-ray of a fracture involving the articular surface of the Tibia¹⁵

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 exists 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 a larger sample size study will help us to determine the efficacy of distal tibia locking plate in achieving full range of motion at local settings.

Methods

This was a Descriptive case series study, performed at Department of Orthopedic Surgery, Jinnah Hospital, from July 2017 to July 2018. Sample size of 75 cases was calculated with 95% confidence level, 10% margin of error and taking expected percentage of full range of ankle movements i.e. 26% in patients underwent reduction with precontoured locking plate for distal tibial fracture. Non probability, consecutive sampling technique was used. Patients of age 20-70 years of either gender presenting with distal tibia fracture AO type 43C1, 43C2, 43C3 were included in the study. Patients with osteoporosis, osteoarthritis, osteomalacia or positive RA factor (on medical record), multiple fractures or open fracture with infection and debris (on clinical examination), INR>2, Bilateral fracture, Diabetics BSR> 180mg/dl were excluded from study.

Total 75 patients fulfilling the selection criteria were included in this study from emergency of Department of Orthopedic Surgery, Jinnah Hospital, Lahore. An informed consent was obtained. Demographic profile (name, age, gender, anatomical side and contact) was also be obtained. 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 2 weeks. After 24 weeks, frequency of patients achieving full range of ankle movements was assessed by researcher himself. Range of motion comparable to contralateral ankle was considered as full range of motion. All the information was collected through a specially designed proforma. All the data was entered and analyzed through SPSS version 21. The

quantitative variables like age 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 and side of fracture. Chi-square was used to compare stratified groups. P-value<0.05 was considered as significant.

Results

The mean age of the patients in our study was 37.49±11.062 the minimum age was 20 years and maximum was 55 years. **(Table-1)** There were 33 (44%) males and 42 (56%) females in our study. There were 33 (44%) patients in which left anatomical side was involved where as in 42 (56%) patients right side was involved. The mean ROM was 31.52±10.06 the minimum ROM was 15 and maximum was 50. **(Table1)** There were 62(82.7%) patients who had full range of motion whereas there were 13(17.3%) patients without full range of motion.**(Fig-1)** No statistically significant association was seen between age group of patients and full range of ankle movement. i.e. p-value= 0.83. No statistically significant association was seen between gender and full range of ankle movement. i.e. P-value=0.291. No statistically significant association was seen between side involved and full range of ankle movement. i.e. p-value= 0.658

Table-1: Descriptive statistics for full Range of ankle movement.

N(%)	75
Mean	(31.52%)
SD	(10.06%)
Minimum	(15%)
Maximum	(50%)

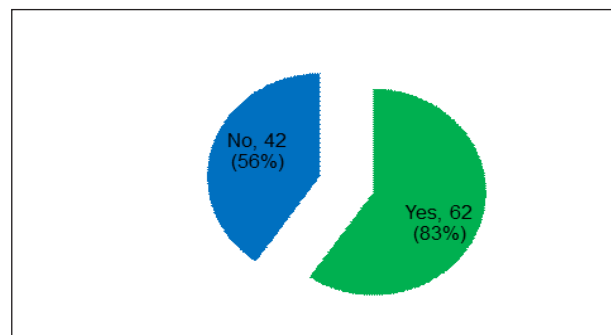


Fig-2: Full range of ankle movement in patients.

Discussion

Treatment for distal tibial fractures ranges from conservative to surgical procedures using external

fixators, intramedullary nailing and internal fixation.^{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.¹² Most of the studies showed good results with open reduction and internal fixation. Few studies with this type of fixation have shown poor results. However the results depend on severity of injury, soft tissue trauma, surgical timing, surgical technique and co-morbidities of the patient.²⁰

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). 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 Results of this study is consistent with the findings reported by Lakhotia D.⁹ However Ronga M in his study showed that full range of ankle movements was achieved in all 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 M and Mohammad MM study did not support the results of this study as in both study full range of ankle movement was quite low as compared to this study. Ronga M: 26% vs. This study: 83% & Mohammad MM: 27% vs. This study: 83%. 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.^{15,19}

Gupta et al., 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.¹⁸ 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.¹⁹

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 nonlocking plates and found that there were no statistically significant differences between locking plates and nonlocking plates for patient-oriented outcomes, adverse events, or complications.^{103, 104} 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.

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