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Delayed Medial Locking Compression Plating for Tibial Pilon Fractures – A Prospective Observational Study

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ABSTRACT

Background: The management of tibial pilon fractures have always been perplexing. Due to the equivocal results of external fixation and early internal fixation, a better understanding of the need for healthy soft tissue coverage, some surgeons began waiting for soft tissue injuries to heal before proceeding with internal fixation. The objective of our study was to evaluate the functional outcome and factors associated with good functional outcome in patients undergoing delayed medial locking compression plating for tibial pilon fractures. **Materials and methods:** A prospective observational study was done for50 patients with tibial pilon fracture, for whom delayed medial locking compression plating was done. Data collected using a structured proforma and evaluation of results done at one year by AOFAS ankle hindfoot score. **Results**: The mean age of the patients was 39.26(21-66) and among them 58% had right side affected., 42 had left side effected ,38% had excellent functional outcome and 48% had good functional outcome at the end of 12 months. Best functional outcome was obtained in Ruedi Allgower type 1 fractures. Wound related infections were noted in 6% cases who had significantly poor functional outcome. Mean days of delay for surgery was 13.69±5.4. **Conclusion**: The condition of soft tissue is equally important as the fracture pattern in determining the functional outcome of the patient. Complex fractures are associated with poor functional outcomes. Diabetes and old age are associated with poor functional outcome. Delayed medial locking compression plating greatly improves the functional outcome in tibial Pilon fractures.

Keywords*: Tibial Pilon Fracture, Medial locking plate, AOFAS ankle hindfoot score; Ruedi Allgower classification*

INTRODUCTION

One of the major challenges for orthopaedic traumatologists remains distal tibial fractures, which are complicated by several factors, especially associated soft tissue injuries [1]. Pilon fractures, which involve the weight-bearing distal tibial articular surface, were first described by French radiologist Destot [2] .A Pilon fracture describes the talus acting like a hammer, striking and damaging the tibial plafond [3]. Ruedi's groundbreaking work in 1968 provided a clearer understanding of these injuries by detailing their characteristics, treatment guidelines, and introducing a classification system [3].Despite numerous documented treatment strategies, there remains significant debate over the best approach, compounded by a lack of long-term outcome data from randomized comparative studies. Surgeons must strike a balance between the soft tissue's tolerance for injury and the need to restore the articular surface through proper reduction before fixation.

Studies concluded that higher infection rates were linked to immediate fracture fixation in a compromised soft tissue environment[4].The introduction of external fixators has notably reduced the infection rates that were once prevalent due to severe soft tissue injuries, complex surgical approaches, and bulky implants.Aggarwal et al reported on the outcomes of using a hybrid approach combining internal and external fixation for high-energy pilon fractures [5,]. This method involved

open reduction, screw stabilization of the articular surface, and external fixation extending across the ankle to primarily stabilize the distal metaphyseal fracture until union occurred [6]. However, the use of external fixation introduced new challenges, including higher rates of non-union and malunion, lower clinical scores, and delayed return to function. Later studies highlighted significant issues such as tendon damage, pin-tract infections, and neurovascular damage from tensioned wire fixators [7-9]. Due to the equivocal results of external fixation and a better understanding of the need for healthy soft tissue coverage, some surgeons began waiting for soft tissue injuries to heal before proceeding with internal fixation [10-15]. Theyrecommended waiting 7 to 10 days before definitive fixation, allowing the skin and soft tissues to heal.They advised using closed reduction, plaster splint immobilization, skeletal traction, or external fixation to support the limb until soft tissue healing occurred[16.17].The aim of present study was to evaluate the functional outcome and factors associated with good functional outcome in patients undergoing delayed medial locking compression plating for tibial pilon fractures.

MATERIALS AND METHODS

A prospective observational study was done at Government Medical college, Thiruvananthapuram after obtaining institutional ethics committee clearance. All consecutive patients above 18 years with pilon fractures who gave informed consent were included in the study. The exclusion criteria were patients with polytrauma or head injury and those not willing to give consent. There were 50 patients in the study. Patientswere admitted and immobilized with plaster of Paris slab or external fixator. Once edema subsides, they were posted for open reduction and internal fixation. A pretested questionnaire were given to them on admission to assess the study variables. Post operatively, they were called upon for evaluation of functional outcome at 12 months and assessed with AOFAS ankle hindfoot score.

Surgical procedure

Once the soft tissue condition improves, the patientswere scheduled for definitive fixation. All procedures were performed under spinal anesthesia. The medial approach is the preferred approach. If a concomitant fibular fracture is present, fibular fixation is done first. Depending on the fracture pattern, either a MIPPO procedure or direct visualization of the plafond is performed, followed by reduction of the fragments and fixationwith medial locking compression plate [Fig 1]. A below-knee slab is applied for immobilization for 6-8 weeks [Fig 2]. Wight bearing was allowed as tolerated after plaster removal.

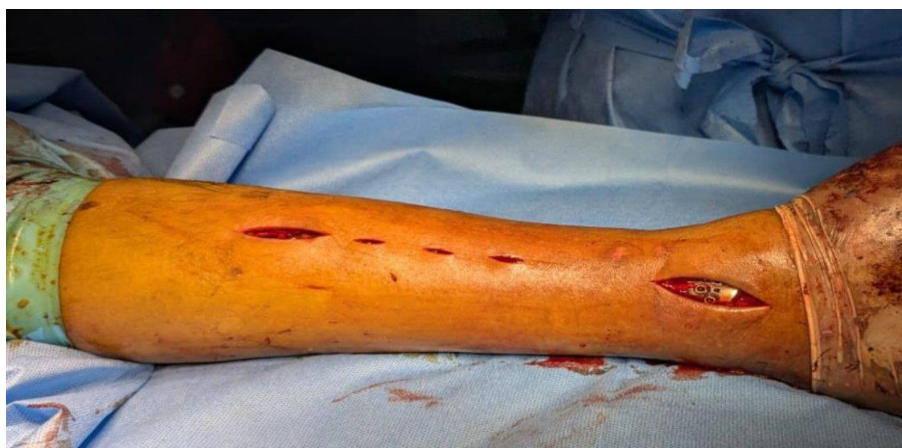

Fig 1: Medial plating of tibia

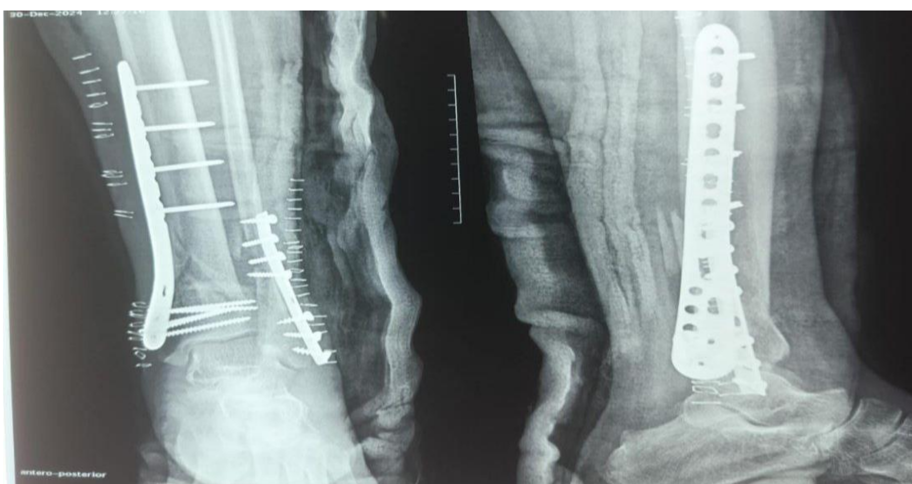

Fig 2: Post-op Xray

Statistical analysis

Data entered into excel sheets and analysed using Statistical Package for Social Science(SPSS) software version 27 (IBM Corp; Chicago, USA).Quantitative variables were expressed as mean and standard deviation and qualitative variables as proportions. Association of quantitative variables determined using t-test and qualitative variables using chi-square test.P<0.05 was considered significant.

RESULTS

The mean age of 50 patients was 39.26±12.92 (21- 66) years [Table 1]. 26 patients (52%) were less than 40 years. There were 62% males and 38% females [Table 2]. In our study 30% had injury due to fall from height, 60% were due to road traffic accident, 30% due to fall from height [Table 3]. 36% had ruediallgower type 1 fracture, 44% type 2 and 20% had type 3 fracture [Table 4]. Right side was injured in 58% of cases [Table 5]. 20% were diabetic[Table 6]. Mean delay for fixation was 13.60 ± 5.44 days [Fig 3].

Table 1: Age group affected

Frequency		Percent
20-40 years	26	52.0
40-60 years	20	40.0
>60 years	4	8.0

Table 2: Sex of patients

Sex of the patient		
	N	%
female	19	38%
male	31	62%

Table 3: Mode of trauma

Mechanism of injury		
	N	%
Fall from height	15	30 %
Road traffic accident	30	60 %
Slip and fall	5	10 %

Table 4: Ruedi Allgower classification of fracture

Ruedi Allgower type of fracture		
	N	%
type 1	18	36%
type 2	22	44%
type 3	10	20%

Table 5: Side affected

Affected side		
	N	%
Left	21	42%
Right	29	58%

Table 6: Diabetic status of the cases

Diabetic status of the patient		
	N	%
Not diabetic	40	80.0%
Diabetic	10	20.0%

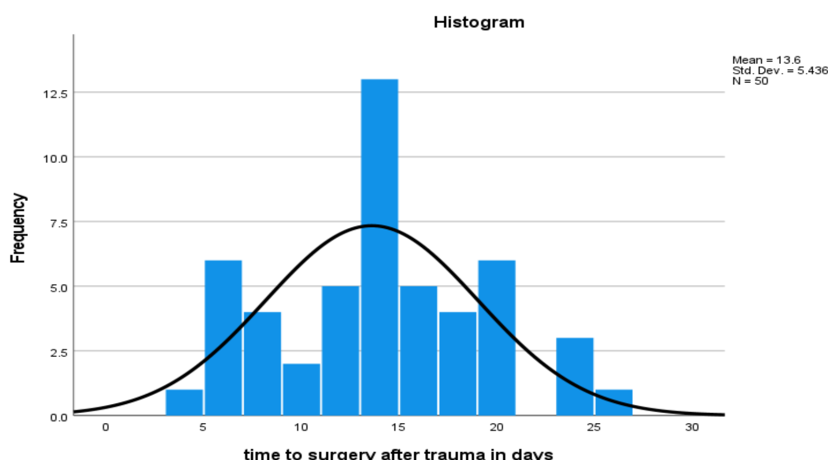

Fig 3: Histogram showing time to surgery after trauma

Table 7: Post operative AOFAS score at 12 months post op

Post op AOFAS ankle hindfoot score at 12 months follow up		
	N	%
Poor	1	2%
Fair	6	12%
Good	24	48%
Excellent	19	38%

AOFAS ankle hind foot score at12 months after surgery revealed excellent functional outcome in 19 out of 50 (38%) , 48% had good functional outcome, 12% had fair and 2% had poor functional outcome. 86% (n=43) had excellent to good functional outcome [Table 7].100% of type 1 ruediAllgower fractures had good and above functional outcome, 86.4% of type 2 ruediAllgower fractures had good and above functional outcome and only 60% of type 3 fractures had good and above functional outcome (p value=0.004 by fisher exact test). 40% of diabetic patients had below good functional outcome. Among non-diabetic patients 92.5 % had good and above functional outcome (p-value=0.003by fisher exact test).6% of patients had post operative wound infection of which 100% had below good functional outcome while only 8.5% of patients without infection had below good functional outcome (p-value=0.001 by fisher exact test). 85.1% of patients of 18-40 years had good and above functional outcome, 84.2% of patients of 40-60 years had the same and 75% of patients above 60 years had good or above functional outcome ((p-value=0.159). Males had a mean AOFAS ankle hindfoot score of 87.70±7.70 and females 88.52±6.78 (p-value=0.706).

DISCUSSION

The mean age of 50 patients was 39.26±12.92 (21- 66) years. 26 patients were less than 40 years. The age distribution is similar to the study by Alcian baris et al (mean age of 45±14.9 years) [18].There was a male preponderance of 68% in our study which was comparable to 68.3% in his study. Their study attributes 70 % of the injuries to road traffic accidents and in our study 60%.Dhanasekaran et al reported10% wound healing complications in a study among 30patients, while we had 6% surgical site infection [19].Study by Laik jk et al showed excellent AOFAS ankle hindfoot score in 50% cases and good in 40% cases [20].Leonard et al. showed excellent AOFAS scores (83%) of patients with high energy pilon fractures following MIPO locking plating method [21]. In our study38% had excellent functional outcome and 48% had good functional outcome.

A study by Philip A McCann et al had a mean delay of 13.45 days till the patient was fit for surgery and in our study it was 13.6±5.4 days [22]. 100% of type 1 Ruedi Allgower fractures had good and above functional outcome, 86.4% of type 2 fractures had good and above functional outcome and only 60% of type 3 fractures had good and above functional outcome and the finding was statistically significant (p-value=0.004), indicating that complex fractures are associated with poor functional outcomes.

In a study conducted by Alican baris et al,in diabetic patients the AOFAS score was significantly lower (p=0.022) compared to non-diabetics [18]. In our study non-diabetic patients had statistically significant better functional outcome of 92.5% when compared to diabetic patients (p=0.03).6% of patients had post operative wound infection and all of them had below good functional outcome while only 8.5% of patients without infection had below good functional outcome (p-value=0.001) and is statistically significant.

85.1% of patients of 18-40 years had good and above functional outcome, 84.2% of patients of 40-60 years had the same and 75% of patients above 60 years had good or above functional outcome ((p-value=0.159), indicating that functional

outcome deteriorates in elderly. Functional outcomes were comparable in males and females. Systematic review by Sourougeon et al; concluded that 87.33% achieved 'excellent to good' results, while86% had excellent to good functional outcome in the present study [23].

Surgical treatment should be delayed until the soft tissues have healed and the swelling has begun to decrease. This usually requires a period of 7 to 14 days.Present study has shown that delayed surgery for tibial pilon fractures prevented postoperative soft tissue problems.Even while the evidence is encouraging, further research with larger sample sizes and longer follow-up periods are required.

CONCLUSION

Pilon fracture is caused by high energy trauma to the ankle and is most commonly seen in road traffic accidents. The condition of soft tissue is equally important as the fracture pattern in determining the functional outcome of the patient. Complex fractures are associated with poor functional outcomes. Diabetes and old age are associated with poor functional outcome.Delayed medial locking compression plating greatly improves the functional outcome in tibial Pilon fractures.

Conflicts of interest: Nil
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