

ORIGINAL RESEARCH

Assessment of clinical and functional outcome of anterolateral tibial plating in the management of tibial Pilon fractures

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ABSTRACT

Background: A Pilon fracture is a distal tibial metaphyseal fracture that involves the ankle joint. The present study was conducted to assess clinical and functional outcome of anterolateral tibial plating in the management of tibial Pilon fractures. **Materials & Methods:** 20 cases of tibial Pilon fracture treated with anterolateral distal tibia locking compression plate were studied. Fibular fixation approach used was (posterolateral/lateral) and type of implant used was intramedullary/extramedullary. **Results:** Out of 20 patients, males were 14 and females were 6. 5 patients (25%) had fall as the mode of injury and the remaining 15 patients (75%) had road side accident as the mode of injury. Severity of injury was trivial in 2, mild velocity in 8 and high velocity in 10 patients. Right side was involved in 11 and left in 9 patients. 16 patients had no and 4 patients had other long bones involvement. In 4 patients, head injury was present. Only 4 patients (20%) had bone grafting along with anterolateral tibial locking compression plating and no bone graft was placed in 16 patients (80%). The difference was significant ($P < 0.05$). The mean interval between injury and definitive surgery was 12.4 days, duration of surgery was 83.2 minutes and the mean overall Kaikkonen ankle score was 74.50. 13 patients (65%) were categorized as type I fracture and 7 patients (35%) were type II according to Gustillo Anderson grading. **Conclusion:** The use of 3.5 mm anterolateral plate in the management of distal tibia fractures has been found to be a safe and effective implant with good clinical and functional outcome especially in cases where the medial skin is specifically bruised.

Key words: Pilon fracture, tibia, Gustillo Anderson grading

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INTRODUCTION

A Pilon fracture is a distal tibial metaphyseal fracture that involves the ankle joint. Etienne Destot, who was a French Radiologist, first adopted the French word for pestle (Pilon) to describe this fracture in 1911. This is different from tibial plafond fractures that only involve the horizontal weight-bearing surface of the tibia. Fractures are considered Pilon fractures only if these tibial plafond fractures extend into the supra-malleolar region of the distal tibia. Pilon fractures may also involve metaphyseal extension and can have associated fibular fractures.¹ The tibial Pilon anatomically comprises the distal end of the tibia including the articular surface.² Its proximal limit is found approximately 8-10 cm from the ankle articular surface, where the triangular section of the tibial diaphysis, with its anterior crest, changes direction forming the metaphysis. The three-dimensional configuration of this region appears to be designed to increase the area of the articular surface, reducing the

stress on the ankle joint. Pilon fractures can be partial (a part of the metaphysis is in continuity with the diaphysis) and complete.³ Tibial Pilon fractures are challenging to treat, as they are typically intra-articular and associated with extensive soft tissue damage.⁴ Patients involved in high-energy trauma should be treated according to advanced trauma life support guidelines because they may have associated life- or limb-threatening injuries. The inability to sustain the weight of the body is particularly indicative.⁵ The factors which play a role in management are degree of fracture displacement, extent of soft tissue injury, degree of comminution, neurovascular injuries, severity of joint involvement, osteoporosis and associated ipsilateral fractures (e.g., patella, tibial plateau, talus). The main goal of fracture treatment is to obtain a stable, aligned, mobile and painless joint to reduce posttraumatic osteoarthritis.⁶ The present study was conducted to assess clinical and functional outcome of anterolateral tibial plating in the

management of tibial Pilon fractures.

MATERIALS & METHODS

The present study comprised of 20 cases of tibial Pilon fracture treated with anterolateral distal tibia locking compression plate in Orthopaedics Department in Guru Nanak Dev Hospital, attached Govt. Medical College, Amritsar between June 2019 to June 2021, after taking permission from Institutional Ethical Committee. During this period patient of tibial pilon fracture were treated by 3.5 mm anterolateral distal tibia locking compression plate after taking informed consent. In all patients, examination of the injured ankle was carried out. Examination of the ipsilateral knee joint to rule out associated injuries and also distal tibiofibular syndesmotic joint was necessary. In high velocity trauma with poor skin condition, external fixator was applied as per "span-scan-plan" protocol. After clinical examination patient was

subjected to radiological evaluation for confirmation. CT scan was performed as it is helpful in documenting articular surface involvement, fracture comminution and osteochondral lesion of the talus. Definitive fixation of tibia was carried out as per soft tissue condition which took approximately 10-14 days. Fibular fixation approach (posterolateral/lateral) and type of implant used was intramedullary/extramedullary. In 10 cases, fibula fixation was performed at first stage. Gustillo-Anderson type I and II were considered in our study. Even if the wound was healed, still it was preferred to put the plate on the anterolateral surface, due to the precarious blood supply on the medial surface and to address the anterolateral chaput fragment. The final results were evaluated and correlated according to KAIKKONEN ankle score. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

CASE



PRE OP X-RAY



POST OP X-RAY



PLATE APPLICATION



POST OP 6 MONTHS FOLLOW UP



POST OP WOUND STATUS AND RANGE OF MOVEMENTS

RESULTS**Table: I Distribution of patients**

Total- 20		
Gender	Males	Females
Number	14	6

Table: I shows that out of 20 patients, males were 14 and females were 6.

Table: II Assessment of parameters

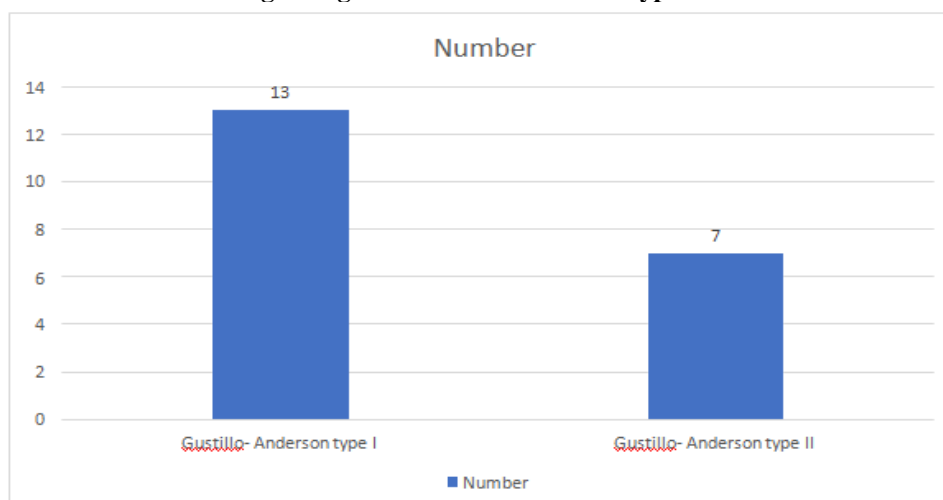
Parameters	Variables	Number	P value
Mode of injury	Fall	5	0.02
	RSA	15	
	Total	20	
Severity of injury	Trivial	2	0.04
	Mild velocity	8	
	High velocity	10	
Side	Right	11	0.97
	Left	9	
Long bones involvement	No Involvement	16	0.01
	Long bone involved	4	
Head injury	Absent	16	0.01
	Present	4	
Bone grafting	Bone graft not placed	16	0.01
	Bone graft placed	4	

Table: II shows that 5 patients (25%) had fall as the mode of injury and the remaining 15 patients (75%) had road side accident as the mode of injury. Severity of injury was trivial in 2, mild velocity in 8 and high velocity in 10 patients. Right side was involved in 11 and left in 9 patients. 16 patients had no while 4 patients had long bones involvement. In 4 patients, head injury was present. Only 4 patients (20%) had bone grafting along with anterolateral tibial locking compression plating and no bone graft was placed in 16 patients (80%). The difference was significant ($P < 0.05$).

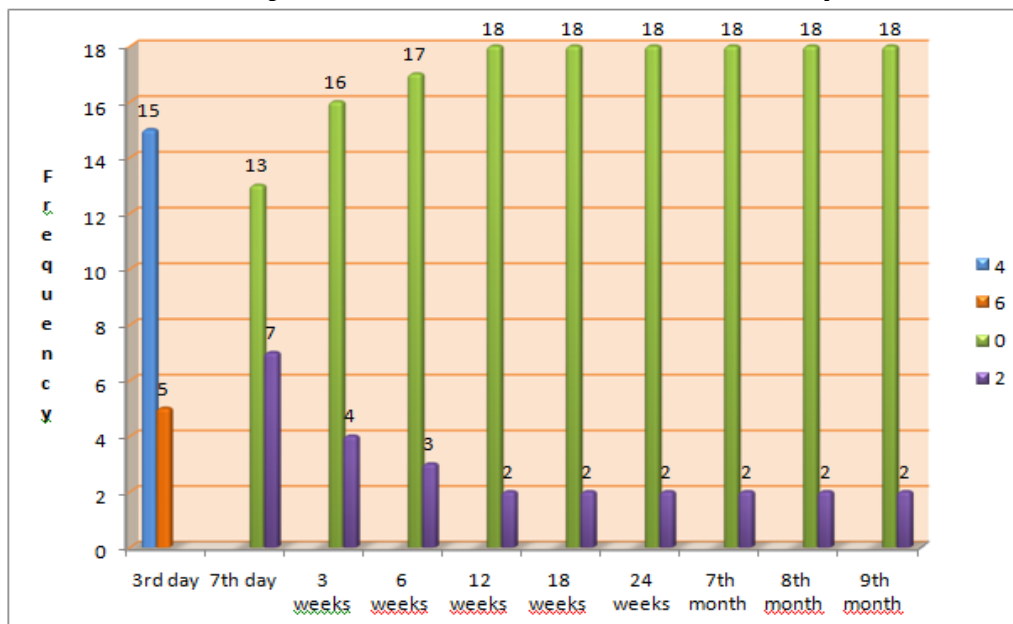
Table: III Operative parameters

Parameters	Mean	SD
Mean interval between injury and definitive surgery in days	12.4	3.2
Duration of surgery (mins)	83.2	7.6
Overall Kaikkonen ankle score	74.5	9.2

The mean interval between injury and definitive surgery was 12.4 days, duration of surgery was 83.2 minutes and the mean overall Kaikkonen ankle score was 74.50.

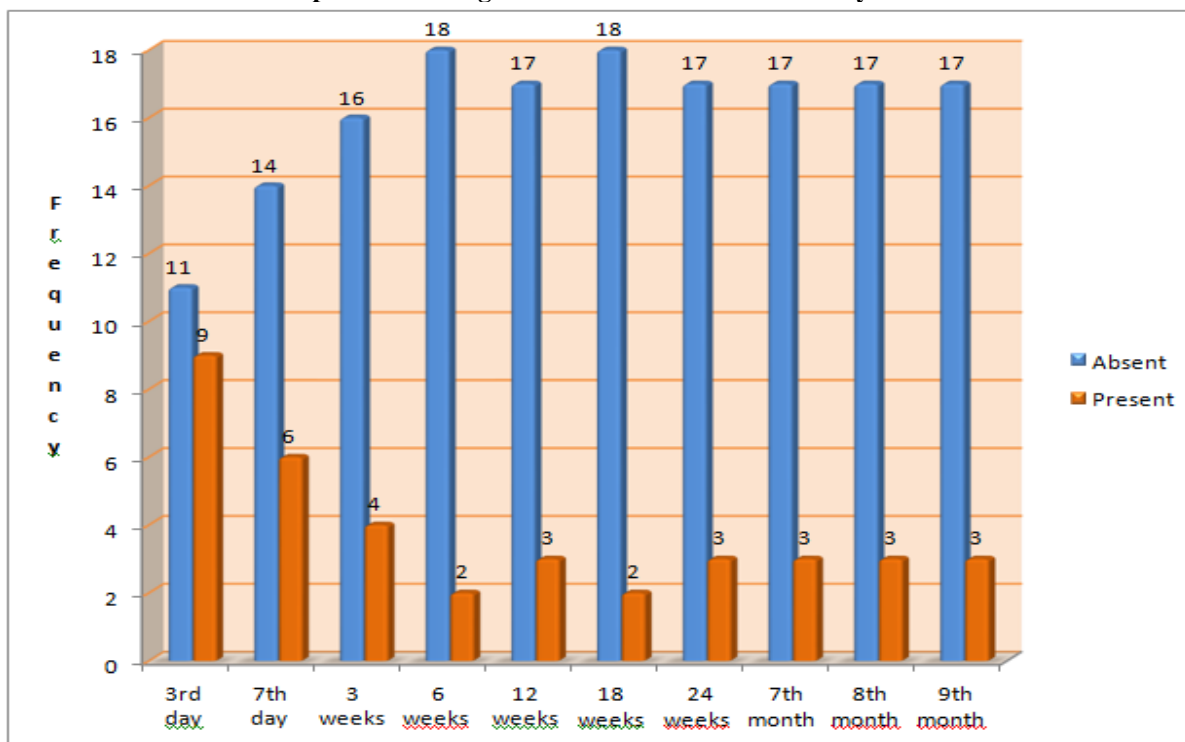
Graph I: Frequency distribution of study population on the basis of Gustillo Anderson type I fracture grading and Gustillo- Anderson type II

Graph: I shows that 13 patients (65%) were categorized as type 1 fracture and 7 patients (35%) were categorized as type 2 fracture according to Gustillo Anderson grading.

Graph II: Pain score at different intervals of the study

Graph II shows that 15 patients (75%) had pain score of 4 (uncomfortable, troublesome pain) and 5 patients (25%) had pain score of 6 (distressing, miserable pain) at 3rd post-op day. However, at the 7th post op day 13 patients (65%) had no pain and only 7 patients (35%) had mild pain. At 3 weeks only 4 patients (20%) out of 20 had mild pain, and the remaining 16 patients had no pain. Further at 6 weeks, mild pain

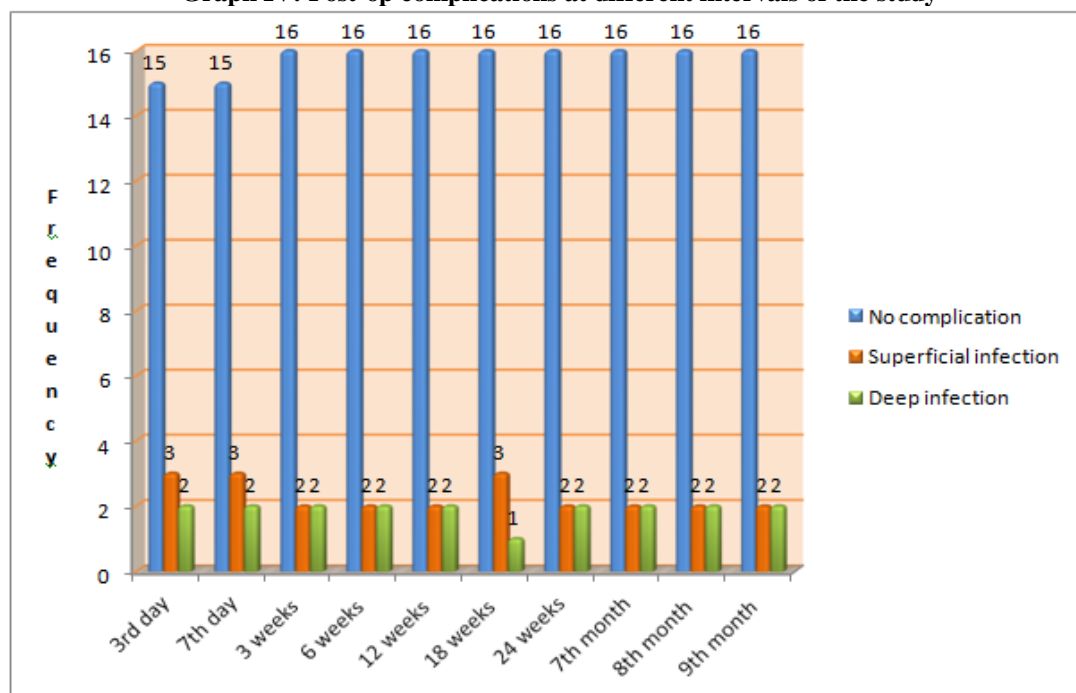
was observed in only 3 patients (15%) and 17 patients had no pain. At 12 weeks, only 2 patients (10%) had mild pain, while 18 patients presented no pain. There was no change in the observations on VAS pain score from 12 weeks to 9 months when the VAS was assessed at interval of 18 weeks, 24 weeks, 7th month, 8th month and 9 months.

Graph III: Swelling at different intervals of the study

Graph: III shows that 11 patients (55%) had no post-op swelling and 9 patients (45%) had swelling at 3rd post-op day. However, at the 7th post op day, swelling subsided in 3 more patients resulting in 14 patients (70%) with no swelling and only 6 patients (30%) had swelling. At 3 weeks only 4 patients (20%) out of 20 had post-op swelling, and the remaining 16 patients (80%) had no swelling. Further at 6 weeks, swelling was observed in only 2 patients (10%) and 18 patients (90%) had no swelling. At 12 weeks, swelling was

observed in only 3 patients (15%) and 17 patients (85%) had no swelling. At 18 weeks, only 2 patients (10%) had swelling, while 18 patients (90%) presented no swelling. At 24 weeks, swelling was observed in only 3 patients (15%) and 17 patients (85%) had no swelling. There was no change in the post-op swelling observed from 24 weeks to 9 months when swelling was checked at interval of 7th month, 8th month and 9 months.

Graph IV: Post-op complications at different intervals of the study



Graph: IV shows that 3 patients (15%) had superficial infection and 2 patients (10%) had deep infection. Similar results observed at 7th day also. At 3 weeks, 16 patients (80%) did not have any post-op complications, while 2 patients (10%) had superficial infection and 2 patients (10%) had deep infection. Similar results observed at 6 weeks and 12 weeks also. At 18 weeks, 16 patients (80%) did not have any post-op complications, while 3 patients (15%) had superficial infection and 1 patient (5%) had deep infection. At 24 weeks, 16 patients (80%) did not have any post-op complications, while 2 patients (10%) had superficial infection and 2 patients (10%) had deep infection. There was no change in observations from 24 weeks to 9 months when checked at interval of 7th month, 8th month and 9th months.

DISCUSSION

Distal tibia fractures result from low energy torsional or high energy axial-loading mechanisms. High energy fractures are commonly associated with severe soft tissue injury, comminution of metaphyseal and articular fracture fragments of tibial plafond and comminuted distal fibula fractures.⁷

Tibial Pilon fractures account for <10% of lower

extremity fractures and occur in adults owing to fall from height or from road traffic accidents. The optimal treatment for these fractures remains controversial. This is due to the associated significant soft tissue injury and precarious vascular supply of distal tibia.⁸ The treatment of distal tibia fractures can be challenging because of its subcutaneous location, poor vascularity and limited soft tissue. The main factor in treating these injuries is to estimate the degree of associated soft tissue injury. Definitive fixation is advisable and proceeded only when the soft tissue injury heals. The present study was conducted to assess clinical and functional outcome of anterolateral tibial plating in the management of tibial Pilon fractures.⁹ If the fracture is in the valgus, then it is also preferred to put the plate on antero-lateral surface to maintain length, axial alignment and rotation. In soft tissue injury with some level of compounding, despite wound healing, it is always dicey to put plate on medial side due to precarious blood supply and it is always safe to put on antero-lateral surface. We found that out of 20 patients, males were 14 and females were 6. 5 patients (25%) had fall as the mode of injury and the remaining 15 patients (75%) had road side accident as the mode of injury. Severity of injury was

trivial in 2, mild velocity in 8 and high velocity in 10 patients. Right side was involved in 11 and left in 9 patients. 16 patients had no and 4 patients had long bones involvement. In 4 patients, head injury was present. only 4 patients (20%) had bone grafting along with anterolateral tibial locking compression plating and no bone graft was placed in 16 patients (80%). Bedi A et al¹⁰ concluded that percutaneous plating with indirect reduction achieves effective stabilization of distal tibia fractures without extensile exposure and preserves the vascularity of the soft tissue envelope. We found that the mean interval between injury and definitive surgery was 12.4 days, duration of surgery was 83.2 minutes and the mean overall Kaikkonen ankle score was 74.50. 13 patients (65%) were categorized as type 1 fracture and 7 patients (35%) were type 2 according to Gustillo Anderson grading. Locking compression plating (LCP) is the most widely used implant for tibial Pilon fractures at present. It can be performed by minimally invasive technique or standard open reduction and internal fixation methods. These are anatomically contoured to the bone surface to which it is applied. For Pilon fracture the gold standard was medial LCP, a low-profile plate placed through medial approach. The low-profile nature tends to address the problem of bulky implant used in standard AO plating techniques. Medial plating using LCP on the subcutaneous medial border of distal tibia still resulted in a significant rate of wound dehiscence and deep infection, although at a lower rate compared to standard AO plates.¹¹ We observed that At 12 weeks, swelling was observed in only 3 patients (15%) and 17 patients (85%) had no swelling. At 18 weeks, only 2 patients (10%) had swelling, while 18 patients (90%) presented no swelling. At 24 weeks, swelling was observed in only 3 patients (15%) and 17 patients (85%) had no swelling. There was no change in the post-op swelling observed from 24 weeks to 9 months when swelling was checked at interval of 7th month, 8th month and 9 months. At 18 weeks, 16 patients (80%) did not have any post-op complications, while 3 patients (15%) had superficial infection and 1 patient (5%) had deep infection. At 24 weeks, 16 patients (80%) did not have any post-op complications, while 2 patients (10%) had superficial infection and 2 patients (10%) had deep infection. There was no change in observations from 24 weeks to 9 months when checked at interval of 7th month, 8th month and 9th months. Grose A et al¹² reported 2 deep infections and 2 wound-healing complications in a series of 44 fractures treated using a more direct lateral approach just anterior to the fibula. In addition, they reported 4 non-unions (9%) in fractures treated with both nonlocked and locked pre-contoured anterolateral plates.

The limitation the study is small sample size.

CONCLUSION

Authors found that distal tibia fractures are usually associated with soft tissue problems and early internal fixation is usually fraught with considerable complications. So, distal tibia fractures should be treated either as a two staged procedure and allowing the soft tissue to normalise or a single staged surgery especially if it is a low energy trauma. However, in any case due consideration has to be given to the traumatised soft tissue in such injuries. In our study, use of 3.5 mm anterolateral plate in the management of distal tibia fractures has been found to be a safe and effective implant with good clinical and functional outcome especially in cases where the medial skin is specifically bruised.

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