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A prospective study to evaluate the postoperative functional outcome of distal tibia fractures managed with locking compression plating

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Abstract
Introduction: Fractures of the distal tibia remains as one of the most threatening therapeutic challenges to an orthopedician particularly due to the associated soft tissue injury. Limited soft tissue coverage and development of edema immediately after the fracture augments complication status. The spectrum of treatment extends from conservative management to open reduction and internal fixation of which MIPO (Minimally Invasive Plate Osteosynthesis) technique is the most recent advancement.
Aim: To assess the functional outcome of distal tibia fractures managed with locking compression plate using American orthopaedic society foot and ankle scoring and to assess the relationship between type of fracture, mode of injury and associated co morbidities in final functional outcome.
Materials and Methods: Unicentric, prospective, observational study was conducted with 49 patients selected for the management of distal tibia fracture using Locking Compression Plate and followed up in the OPD after 6 weeks, 12 weeks, 6 months and 12 months during the period of June 2017- June 2019. The average age of the study group was 43.82 years with 71.4% males and 28.6% female patients. 36.7% of the cases were type 1 fracture and 32.7% of the cases were type 2 fracture and 30.6% of cases were type 3 fracture (AO). 38.8% of the cases had diabetes mellitus, 24.5% of the cases had hypertension.
Results: Age had a significant statistical relation with final functional outcome. It was noted that as the age increases there was a higher occurrence of bad or acceptable outcome compared to younger age groups ($p = 0.042$). There was a statistically significant association between the fracture type and final functional outcome. Excellent or good functional outcome occur more in Type A and B when compared to Type C where there are more occurrence of bad or acceptable outcome ($p = 0.011$). It was also noted that bad/ acceptable outcome was Significantly lower in patients without diabetes compared to cases with diabetes.
Conclusion: Distal tibia fractures are challenging fractures for fixation. It is imperative to attain good reduction of the fragments, respect the surrounding soft tissue cover, Stable fixation, control of co morbidities, proper rehabilitation and physiotherapy to obtain an excellent functional outcome among the patients. Locking compression plating for distal tibia is an adequate, advantageous and attractive option for fixation of distal tibia fractures.

Keywords: distal tibia fracture, ORIF, MIPO, AOFAS score

Introduction
Management of fractures of the distal tibia has always been a challenge to orthopedic surgeons owing to its peculiar anatomy.
This peculiarity may be attributed to many reasons but the most important feature that contributes is the accompanying soft tissue injury. The fracture, its pattern and key management principles were understood after Reudi published an article in 1968. Since then, a lot of development has occurred on treating these kinds of fractures, most of them evolved due to better understanding of the soft tissue anatomy. It was understood that better restoration of the osseous anatomy without considering the already compromised soft tissue can cause serious impact on the functional outcome of these kind of fractures. The spectrum of management extends from conservative management to open reduction and internal fixation of which MIPO (Minimally Invasive Plate Osteosynthesis) technique is the most recent advancement. Reudi initially advocated immediate fixation for tibial plafond fractures but now many centers consider staged procedures for fixation of distal tibial fractures where surgery is deferred to at least 8-10 days until soft tissue swelling has reduced. In this context, my study aims at evaluating the functional outcome of distal tibial fractures that are managed with a locking compression plate.

Materials and Methods
A unicentric prospective observational study was conducted during the period of June 2017 to June 2019. All patients who satisfied the selection criteria underwent Open reduction and internal fixation using locking

compression plate and was followed up in the OPD after 6 weeks, 12 weeks, 6 months and 12 months post-surgery. Patients with closed distal tibia fractures and aged more than 18 years and willing for surgery and follow up were selected and patients with open fractures, pathological fractures, fractures more than 3 weeks old and patients with neurovascular deficits were excluded from study. Patients underwent surgical management after evaluation of soft tissue status and reduction of edema. Fracture was fixed with locking compression plating technique. Most of the patients had undergone internal fixation by MIPO (Minimally invasive plate osteosynthesis) technique in order to prevent soft tissue damage and to minimize post-operative complications. Below knee slab was applied and limb was kept elevated post operatively. Patients were started on intravenous antibiotics, analgesics and anti-inflammatory medications. A single dose of antibiotic injection was given about 30 minutes prior to operation. Patients are usually discharged at the 3rd post-operative day. At discharge, patients are advised to keep limb elevated, strict non-weight bearing mobilization, and active movements of toes. On post-op day 1, active toe movements, static quadriceps strengthening exercises and non-weight bearing mobilization was started which was continued up to 6 weeks depending on the radiographic evaluation and fracture stability. Later on, partial weight bearing was started. Full weight bearing was started after 3 months ensuing radiographic evaluation.

Outcome Measures

The postoperative outcome was measured by Ankle-Hind foot Scale (100 Points Total) at 6 weeks, 12 weeks, 6 months, and 1-year intervals after surgery

Results and Outcome

Patient demographics

In our study, 26.5% of the cases belong to the age group up to 30 years and 38.8% of the cases belong to the group 31-50 years. 34.7% cases aged more than 50 years. The average age was 43.82 years with standard deviation 14.86. The minimum and maximum age was 22 and 74 years respectively.

71.4% of the cases were males and 28.6% of the cases were females. The average age of male patients was 40.54 years with standard deviation of 12.48. The minimum and maximum age of male patients was 22 and 68 years respectively. The average age of female patients was 52.00 years with standard deviation of 17.55. The minimum and maximum age of female patients was 22 and 74 years respectively.

Distribution of co morbidities

Among 49 cases taken for our study, 38.8% of the cases have diabetes mellitus and 61.2% of the cases have no diabetes mellitus. 24.5% of the cases have hypertension whereas 75.5% of the cases have no hypertension.

Distribution of Functional Outcome

In our study, almost 24.5% of the cases have excellent functional outcome and 38.8% of the cases have good functional outcome. Around 24.5% of the cases have acceptable functional outcome and 12.2% of the cases have bad functional outcome.

Relationship between Functional Outcome and Age

Here the p-value (0.042) is less than significance level 0.05; the relationship between functional outcome and age is significant. Excellent/good functional outcome is significantly higher in cases with age up to 30 years (92.3%) and 31-50 years (68.4%) compared to the cases with age more than 50 years (35.3%).

Relationship between Functional Outcome and Type of Fracture

Here the p-value (0.011) is less than the significance level 0.05; the relationship between functional outcome and type of fracture is significant. Excellent/good functional outcome is significantly higher in type 1 (88.9%) and type 2 (68.8%) compared to type 3 (26.7%).

Relationship between Functional Outcome and Diabetes Mellitus

Here the p-value (0.015) is less than significance level 0.05; the relationship between functional outcome and diabetes mellitus is significant. Excellent/good functional outcome is significantly higher in cases without diabetes mellitus (80.0%) compared to the cases with diabetes mellitus (36.8%). Further, acceptable/bad functional outcome is significantly lower in cases without diabetes mellitus (20.0%) compared to the cases with diabetes mellitus (63.2%).

Table 1: Distribution of age

Age (Years)	Frequency	Percent
Up to 30	13	26.5%
31 - 50	19	38.8%
Above 50	17	34.7%

Fig 1: Plates, Screws, Screw Drivers Etc For Distal Tibia Fracture

Fig 2: Marking Incision Site and Medial Malleolus

Fig 3: Selecting Plate of Appropriate Size and Checking Under Fluroscopic Guidance

Fig 4: Using A Drill Sleeve; Plate Is Passed Through The Subperiosteal Tunnel

Fig 5: After Application of All Screws

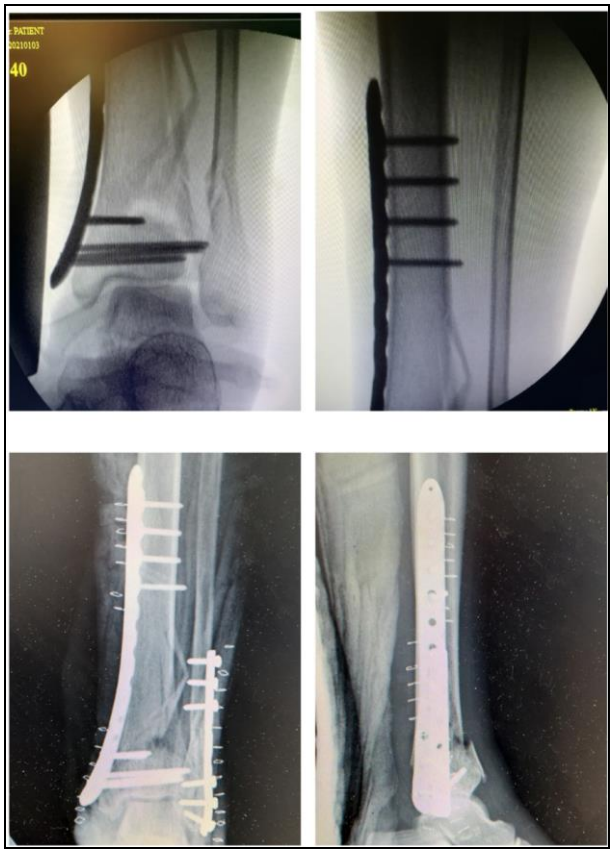

Fig 6: Final Fluroscopic Appearence and Immediate Post Op Radiograph

Table 2: Distribution of type of fracture

Type of Fracture	Frequency	Percent
Type 1	18	36.7%
Type 2	16	32.7%
Type 3	15	30.6%

Table 3: Distribution of Diabetes mellitus

Diabetes Mellitus	Frequency	Percent
Yes	19	38.8%
No	30	61.2%

Table 4: Distribution of functional outcome

Functional Outcome	Frequency	Percent
Excellent	12	24.5%
Good	19	38.8%
Acceptable	12	24.5%
Bad	6	12.2%

Table 5: Relationship between Functional Outcome and Age

Age (Years)	Functional Outcome				Total	p - value
	Excellent	Good	Acceptable	Bad		
Up to 30	6 (46.2%)	6 (46.2%)	1 (7.7%)	0 (0.0%)	13	0.042
31 - 50	4 (21.1%)	9 (47.4%)	5 (26.3%)	1 (5.3%)	19	
Above 50	2 (11.8%)	4 (23.5%)	6 (35.3%)	5 (29.4%)	17	
Total	12 (24.5%)	19 (38.8%)	12 (24.5%)	6 (12.2%)	49	

Table 6: Relationship between Functional Outcome and Type of Fracture

Type of Fracture	Functional Outcome				Total	p - value
	Excellent	Good	Acceptable	Bad		
Type 1	7 (38.9%)	9 (50.0%)	2 (11.1%)	0 (0.0%)	18	0.011
Type 2	3 (18.8%)	8 (50.0%)	4 (25.0%)	1 (6.3%)	16	
Type 3	2 (13.3%)	2 (13.3%)	6 (40.0%)	5 (33.3%)	15	
Total	12 (24.5%)	19 (38.8%)	12 (24.5%)	6 (12.2%)	49	

Table 7: Relationship between Functional Outcome and Diabetes Mellitus

Diabetes Mellitus	Functional Outcome				Total	p - value
	Excellent	Good	Acceptable	Bad		
Yes	2 (10.5%)	5 (26.3%)	7 (36.8%)	5 (26.3%)	19	0.015
No	10 (33.3%)	14 (46.7%)	5 (16.7%)	1 (3.3%)	30	
Total	12 (24.5%)	19 (38.8%)	12 (24.5%)	6 (12.2%)	49	

Discussion

Fractures of distal tibia are a treatment dilemma to the orthopaedic surgeon, with little consensus on optimal management, fractures pose a great difficulty to orthopaedic surgeons. The proximity to the ankle joint and the soft tissue cover in the distal aspect of the leg being sparse and can lead to complications if not given importance at the time of fixation.

Failing to appreciate the soft tissue condition will invariably complicate the injury with infection, wound dehiscence or non-union.

The results of operative treatment are dependent on the severity of the initial injury and the quality and stability of the reduction. The mechanism of injury, the status of the soft tissues and the degree of comminution affect the long-term clinical result.

However, the most important factor is to achieve stable fixation and to allow early range of motion without unnecessary osseous and soft tissue devascularisation.

In our study 49 cases of pilon fractures of distal tibia, were treated by locking compression plate and were followed for a period of one year. The purpose of this study was to evaluate the end result of treatment or the functional outcome in these patients.

Majority of the cases sustained fractures from road traffic accidents (26 cases). Most of the injuries were the result of high energy trauma. A similar mode of high-velocity injury leading to distal tibia fractures was also noted by Ronga et al, collinge & Protzman, Dickson et al, Pollak et al.

It is a well-documented fact that the incidence of uncontrolled Diabetes will negatively influence the soft tissue healing and lead to surgical wound complications. For example, Kline et al's paper on Early Complications following the Operative Treatment of Pilon Fractures with and without Diabetes opined that diabetes mellitus has a negative impact on wound healing. Hypertension had no statistical significance in final functional outcome. Among 49 cases taken for the study, around 38.8% of the cases had diabetes mellitus and 61.2% of the cases did not have diabetes mellitus. It was also noted that there is a statistical significance between diabetes mellitus and functional outcome ($p = 0.015$), which means that acceptable/bad functional outcome is significantly higher in patients with diabetes mellitus.

All patients who were considered for the study were initially categorized into 3 groups according to AO distal tibia fracture classification. Among the population there were 18 patients with Type A, 16 with type B and 15 with type C. Khoury et al noted that good functional outcome was achieved especially in Type A and B fractures using minimally invasive plate osteosynthesis but in most of the cases of Type C fractures open reduction maneuvers were done to achieve a stable and anatomical reduction [31].

Considering functional outcome, Type C fractures had a comparatively lower functional outcome score than Type A or B fractures. Van den Berg et al also noted that complex fractures of distal tibia are associated with poor functional outcome. In our study there were 15 cases of type C fracture (30.6%). It was noted that patients who sustained type C fractures had more occurrences of bad or acceptable outcome when compared to type A or B fractures. There was a statistically significant relation between type of fracture and the functional outcome ($p=0.011$) which means that as the severity of fracture increases from type A to C there is higher occurrence of bad or acceptable outcome.

Limitations of Our Study

The number of cases included in the study was only 49, which is a major limitation. We recommend studies on a larger scale for shedding more light into this fracture which is a therapeutic dilemma for any orthopedic surgeon.

AOFAS scoring system has its own limitation that it is subjective. A newer objective method needs to be developed which is easily available and accurate. Body mass index of the patient, preoperative muscle power can also influence the functional outcome of the patient. The age of the patient might influence the adverse effects studied.

Conclusion

Distal tibia fractures are challenging fractures for fixation. It is imperative to attain good reduction of the fragments, respect the surrounding soft tissue cover, Stable fixation, proper rehabilitation and physiotherapy to obtain an excellent functional outcome among the patients.

Locking compression plating for distal tibia is an adequate, advantageous and attractive option for fixation of distal tibia fractures

Advantages

- ORIF provided the opportunity for anatomical reduction of the fracture fragments.
- MIPO technique ensures minimal soft tissue damage.
- Lesser occurrence of complications.
- Periosteum is not stripped, keeping intact the precious blood supply.
- Less chance for implant removal due to skin irritation.
- Provides excellent to good functional outcome.
- Stable fixation can allow early ROM and rehabilitation will be speedier.

References

1. Dickson KF, Montgomery S, Field J. High energy plafond fractures treated by a spanning external fixator initially and followed by a second stage open reduction internal fixation of the articular surface—preliminary report. Injury,2001:32:92-98.
2. 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-A(10):1893-900.
3. Collinge C, Protzman R. Outcomes of minimally invasive plate osteosynthesis for metaphyseal distal tibia fractures. J Orthop Trauma,2010:24(1):24-29.
4. 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.
5. Kline AJ, Gruen GS, Pape HC, Tarkin IS, Irrgang JJ, Wukich DK. Early Complications Following the Operative Treatment of Pilon Fractures with and without Diabetes. Foot Ankle Int,2009:30(11):1042-7.
6. Khoury A, Liebergall M, London E, Mosheiff R. Percutaneous plating of distal tibial fractures. Foot Ankle Int,2002:23(9):818-824
7. Van den Berg J, Monteban P, Roobroeck M, Smeets B, Nijs S, Hoekstra H. Functional outcome and general health status after treatment of AO type 43 distal tibial fractures. Injury,2016:47(7):1519-24.
8. Viberg B, Kleven S, Hamborg-Petersen E, Skov O. Complications and functional outcome after fixation of distal tibia fractures with locking plate – A multicentre study. Injury,2016:47(7):1514-8.

9. McFerran MA, Smith SW, Boulas HJ, Schwartz HS. Complications encountered in the treatment of pilon fractures. J Orthop Trauma,1992:6(2):195-200.
10. Rüedi T, Matter P, Allgöwer M. [Intra-articular fractures of the distal tibial end]. Helv Chir Acta,1968:35(5):556-82.
11. Michelson J, Moskovitz P, Labropoulos P. The nomenclature for intra-articular vertical impact fractures of the tibial plafond: pilon versus pilon. Foot Ankle Int,2004:25(3):149-150.
12. Pugh KJ, Wolinsky PR, McAndrew MP, Johnson KD. Tibial pilon fractures: a comparison of treatment methods. J Trauma,1999:47(5):937-41.