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Functional outcome of osteosynthesis of distal tibia fractures by anterolateral approach

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Abstract
Background: *The distal tibial fracture management is challenging. Soft tissue damage, decreased vascularity and intra-articular extension of fractures compound its management.*
Material and methods:*This prospective study enrolled patients with fracture to the distal tibia (both intra and extra-articular). The study included patients aged > 18 years and both genders. The operative procedure included fixation with the 3.5 mm anterolateral distal tibia locking compression plate*
Results:*Of the 25 patients enrolled, 19 (76%) were males.The mean age of the participants was 49.2 ± 8.94 years, ranging from 30-60 years. The road traffic accidents was the main cause of injury.14 (56%) cases had type B fracture of AO classification. Grade O was the commonest 13 (52%) Tscherne soft tissue injury. The mean hospital stay was 2.8 ± 1.7 days (range 2-5 days). The full weight-bearing time was 12.4 ± 2.16 weeks (range 10-20 weeks) and the time to union of fracture was 16.0 ± 3.16 weeks (range 12-22 weeks). The mean AOFAS score was 82.98 ± 7.24, with 16 (64%) of patients having good AOFAS scores of 80-89.*
Conclusions:*Thesingle stage anterolateral plating was successful in distal tibial fractures. It allows proper exposure of lateral malleolus and distal tibia. The functional and radiological scores were excellent in majority of patients.*
Key Words: *AOFAS score; Anterolateral platting**;** Distal Tibial fracture*

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I. Introduction

The distal one-third of tibial fractures with or without articular involvement can be difficult to manage[1, 2]. Metaphyseal reduction and restoration of articular alignment without soft tissue complications are always challenging[3]. A variety of treatment methods have been suggested for these injuries, including conservative treatment, external fixation with or without internal fixation, intramedullary nailing, plate fixation (medial or anterolateral) and minimally invasive plate osteosynthesis (MIPO). But none of these techniques is without complications. Conservative treatment may result in malunion if the fracture extends to the articular surfaces. External fixation and intramedullary nailing have fewer soft tissue complications but have higher rates of malunion4. Intramedullary nailing has got limitations with far distal fractures and with fractures extending to the joint line[4]. Plate osteosynthesis has local soft-tissue complications including wound dehiscence and infection.

The best treatment for distal tibial fractures still remains controversial. Surgical fixation can be difficult in the distal one-third of the tibia. Fracture pattern, soft tissue injury and bone quality influence the selection of fixation technique. Several surgical methods have been described including external fixation, Intramedullary nailing and plate fixation[5, 6].

The anterolateral approach avoids dissection over the tenuous soft tissue envelope of the distal tibia. This approach otherwise allows excellent access to the vast majority of the tibial plafond, particularly the lateral, posterior, and central aspects. The exposure exploits the fracture involving the anterolateral (Chaput) fragment, which, after the exposure is performed, is manipulated and typically externally rotated on the anterior tibiofibular ligament to allow access to the posterior and central aspects of the plafond. The anterolateral approach offers excellent visualization of the tibial articular surface as far as the medial malleolus while avoiding dissection of the anteromedial tibial face. It is well suited for an accurate articular reduction, as well as sub-muscular and subcutaneous plate applications spanning metaphyseal comminution. However, access to the medial ankle joint is poor, and proximal extension is limited. In the above context, the current study aimed to evaluate the functional outcome of osteosynthesis of distal tibia fractures by an anterolateral approach.

II. Material And Methods

This study was conducted at the Postgraduate Department of Orthopaedics, Government hospital for Bone and Joint Srinagar from the year, 2018 to the year 2021. The present prospective study enrolled patients with fracture to the distal tibia (both intra and extra-articular). Patients aged > 18 years, both genders with closed fractures of the distal third of tibia both intra articular as well as extra-articular. Patients with pathological fractures or associated fractures of the same limb were excluded from the study.

Preoperative

Evaluation of patients with injury to distal leg region was initiated with history, clinical examination, radiographs (AP and Lateral view of ankle with leg and knee with leg), CT scan and blood investigations. History included name, age, gender, occupation, side of involvement and comorbidity. Furthermore, the time of occurrence of trauma, mechanism of trauma and any treatment received was recorded.

Clinical Examination

Apart from the general physical examination, the local examination included a description of external wounds, swelling, tenderness, deformity, abnormal mobility, crepitus and loss of transmitted movements. A combination of tenderness, swelling, or ecchymosis over the bone, joint, or ligament suggests an injury. Any open wounds, bruises, or blisters were noted around the ankle along with neurovascular status. Periodic monitoring of capillary refill time of extremity was noted. Examination of the ipsilateral knee joint to rule out associated injuries and calcaneum, and the distal tibiofibular syndesmotic joint was performed.

The affected limb was elevated over a Cramer wire splint. Cold sponging and anti-inflammatory medications were given to improve the condition of soft tissues and to decrease the swelling of the affected limb. AP and Lateral view radiographs preferably without Cramer wire were taken. Patients diagnosed with intra-articular fractures were subjected to a CT scan of the affected ankle.

Pre-anesthetic checkup (PAC) was done before surgery. Pre-operatively patients were started on intravenous antibiotics prophylaxis one hour before surgery. The antibiotics that were used included cephalosporin (cefuroxime) and aminoglycoside.

Operative procedure

After regional anesthesia and above knee tourniquet patient was positioned supine on a radiolucent table. The leg was elevated on a padded rest with a moderately flexed knee after the limb is painted from groin to foot. Initially, the fibula fixation was performed to restore length and achieve an indirect reduction of tibia fracture

The operative procedure included fixation with the 3.5 mm anterolateral distal tibia locking compression plate. The technical innovation of locking screws provides the ability to create a fixed-angle construct. The anterolateral approach was adopted; a longitudinal incision centered at the ankle joint, parallel to the fourth metatarsal distally, and between the tibia and fibula proximally. The proximal extension of the incision ended seven centimeters above the joint. Distally the incision can be extended to the level of the talonavicular joint, allowing exposure to the talar neck. Further, to avoid compromising skin vascularity, decrease tension across the incisions, and minimize soft tissue complications, a skin bridge of 7cms apart was made between two incisions.

The reduction was obtained with multiple Kirschner wires and was checked under an image intensifier. The application of an external fixator or a distractor may facilitate visualization and reduction of the joint sometimes. A lateral distractor was placed from the talar neck to the mid-tibia (from lateral to medial) to maximize joint visualization by distracting and plantar-flexing the talus.

The plate was slid sub-muscularly along the lateral tibial cortex, beneath the anterior compartment muscles and neurovascular bundle. Special care was taken to protect the superficial peroneal nerve, which typically crosses under the incision proximal to the ankle joint. Articular fragment and main fracture fragments were identified, reduced and fixed with temporary k-wires. The order of reduction of articular fragments was posterolateral à Posteromedial à central à anterior à anterolateral. The distal row of screws was set just proximal to the joint. Fixation of the proximal portion of the plate was performed percutaneously through a separate stab incision. Tourniquet was removed, hemostasis was achieved wound was closed. Immediate postoperatively i/v antibiotics were started (cefuroxime and amikacin). The distal neurovascular status (DNVS) was checked.

Follow up

The patients were followed at 2 weeks, 6 weeks and then monthly up to 6months with a final follow up at 9 months. The functional outcome of the study patients was carried out as per AOFAS scoring system. This scale consists of subjective and objective variables classified into three major categories (Pain 40 points;

function 50 points and alignment 10 points)[7, 8]**.** Radiological outcome was assessed by Nicola Maffuli Grading[9].

Ethics

The institutional review board of Bone and joints hospital approved the research protocol vide no 2437 dated 2018. The procedures involved in this study were in accordance with the ethical standards of the responsible committee on human experimentation (institutional or regional) and with the Helsinki Declaration of 1975 that was revised in 2013.

Consent

The consent was ensured from each participant involved in this study. The purpose of the study and procedure was explained to each participant in the local language. Confidentiality of data was explained and ensured. The participation in the study was voluntary. The participants signed the consent form in the presence of two witnesses.

Statistical Methods

The recorded data was compiled and entered in a spread sheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). Continuous variables were expressed as Mean±SD and categorical variables were summarized as frequencies and percentages.

III. Results

In total, 25 patients were recruited; of these, 19 (76%) were males and 6 (24%) were females. The age ranged from 30-60 years with a mean age of 49.2 ± 8.94 years. The majority 14 (56%) and 17 (68%) of patients had road traffic accidents as the main cause of injury and right-sided involvement respectively. The type B of AO classification of fracture comprised 14 (56%). 23 (92%) had fractured fibula. Grade O was the commonest 13 (52%) Tscherne soft tissue injury (Table 1).

Table 1: Baseline characteristics of the study population (n=25).

Characteristic	Number (n)	Percent (%)
Gender		
Male	19	76
Female	6	24
Age (in years)		
30-39	3	12
40-49	10	40
50-59	7	28
≥ 60	5	20
Mode of injury		
RTA	14	56
Fall	11	44
Side of involvement		
Right side	17	68
Left side	8	32
AO classification		
Type A	1	4
Type B	14	56
Type C	10	40
Presence of fracture fibula		
Yes	23	92
No	2	8
Tscherne classification		

Grade 0	13	52
Grade I	9	36
Grade II	3	12
Grade III	0	0

The surgery time ranged from 75 to 120 minutes with a mean of 96.1 ± 11.94 minutes. The mean duration of hospital stay was 2.8 ± 1.7 days (range 2-5 days). Ankle stiffness 4 (16%) was the frequent complication followed by superficial infection in 3 (12%) of patients. The time to full weight-bearing was 12.4 ± 2.16 weeks (range 10-20 weeks) and the time to union of fracture was 16.0 ± 3.16 weeks (range 12-22 weeks). The mean AOFAS score was 82.98 ± 7.24, with 16 (64%) of patients having good AOFAS scores of 80-89 (Table 2).

Table 2: Surgical and the functional outcome of the study population (n=25).

Characteristic	Number (n)	Percent (%)
Duration of Surgery (Minutes)		
75-90	4	16
90-105	16	64
105-120	5	20
Hospital stay (Days)		
2 Days	13	52
3 Days	6	24
4 Days	3	12
5 Days	3	12
Postoperative complications		
Superficial infection	3	12
Neuropraxia	2	8
Skin necrosis	3	12
Ankle stiffness	4	16
Palpable implant	1	4
Malunion	0	0
Non union	0	0
Time to full weight bearing (Weeks)		
10 Weeks	5	20
12 Weeks	14	56
14 Weeks	4	16
≥ 16 Weeks	2	8
Time to union		
12 Weeks	7	28
14 Weeks	3	12
16 Weeks	8	32
18 Weeks	4	16
≥ 20 Weeks	3	12
Functional outcome scores (AOFAS)		
Excellent (90-100)	5	20
Good (80-89)	16	64
Acceptable (70-79)	3	12
Bad (< 70)	1	4
Radiological outcome of study participants (Nicola Maffuli Grade)		
Excellent	16	64
Good	9	36
Fair	0	0
Poor	0	0

IV. Discussion

The current study included a total of 25 patients. The peak incidence of tibial fractures in our study was in 40-49 years age group with male predominance (76%). Our study runs in conformity with earlier studies conducted by Lakhotia D et al.;[10]Kosalaramant P et al.;[11] andVerma R et al.;[12] that have observed the mean age of distal tibial fractures at 42.8, 45.4 and 39.4 years respectively and more prevalent among males. This could be attributed to male dominance in physical activities compared to females. Road traffic accidents are the leading cause of morbidity, over 1.35 million deaths occur annually around the globe with India topping the list. This finding is reflected in our study where 56% of the study participants had road traffic accident (RTA) as the mode of injury[13]. This finding is consistent with earlier studies conducted by Lakhotia D et al. (71% RTA)[10] and Verma R et al. (62% RTA)[12]. The majority of fractures in our study population were AO type B (56%) followed by AO type C which was comparable withother studies (Lakhotia D et al. ,Verma R et al and Mehta S et al76)[10, 14]. The mean duration of radiological union in our study was 15. 4 weeks. The results

differ from an earlier study conducted by Kosalaramant P et al[11] that observed 21.4 weeks but consistent with results of Lakhotia D et al.[10] , and Verma R et al[12].

The American Orthopaedic Foot and Ankle Society Score in the current study was excellent in 20%, good in 64%, acceptable in 12% and 4% cases had bad functional results with a Mean + SD 82.98 + 7.242. The functional AOFAS scores were consistent with earlier studies conducted by Gulabi D et al. (2016)[15] (mean AOFAS score of (78.33) and Kosalaramant P et al. (2017)[11] (mean AOFAS score of (79.16).

V. Conclusion

Distal tibial fracture can be successfully treated by single stage anterolateral plating allowing proper exposure of lateral malleolus and distal tibia, considering a proper surgical timing, respect to soft tissue handling and understanding the fracture completely before surgery. Placement of pre-contoured plate in the region well covered with soft tissue will minimize the risk of problems associated with surgical wound healing.

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