

Prevalence of Distal Tibia Fracture in Adult Population and Its Treatment Outcome – Study of 44 Cases

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Abstract:

Introduction: Fractures of the distal tibia can be challenging to treat because of limited soft tissue, the subcutaneous location and poor vascularity. The goal in expected care is to realign the fracture, realign limb length and early functional recovery. The purpose of this study is to evaluate the effectiveness, functional results and complications following surgical internal fixation of distal tibia fractures with plating techniques.

Objective: To evaluate the functional and radiological outcomes and postoperative complications of surgically treated distal tibia fractures using plate fixation in adult patients.

Methods: A retrospective review was conducted of patients with Distal tibia fractures treated with plating technique. In all 44 patients were enrolled in the study and all were treated with plating technique. Comparative analysis of demographic data, peri-operative & post-operative outcome and complications were carried out.

Results: Total 44 patients were included in the study. Among all patient 26 has 43A, 2 has 43B and rest 16 has 43C type of injury according to AO/OTA classification. Average time to union was found to be around 14 weeks with delayed union noticed in few cases having uncontrolled diabetes mellitus and in elderly patients. According to AOFAS score (86.37%) most of patient fall in good to excellent group.

Conclusions: A good functional result depends on a reasonable anatomical reduction of the articular surface by direct or indirect methods. Fixation of the fibula is recommended whenever possible. Patient with poor skin condition for good function outcome initially, the fibula is fixed, and an external fixator is placed, and after favourable skin condition definitive fixation by plating is done.

Keywords: Pilon fracture, distal tibia fracture, AOFAS score, AO/OTA.

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Introduction

Owing to scarce blood supply and vulnerable location of lower tibia, healing and rehabilitation is difficult. Furthermore, this injury carries significant clinical expertise and utmost care while addressing not only in emergency but also post-surgical period. Primary motto of this fracture of lower leg is to maintain reduction as well as soft tissue coverage. Due to fall from height or sudden ankle movement cause astragalus to impact over distal tibial bone. Consequent order of injury accrues articulocartilaginous breach, severe subcutaneous wounds and deformity. Not only axial but twisting

and forced ankle movements are a part of injury occurrence. [1]

In the advent of state-of-the-art surgical implant technology, locking plates and anatomical lower tibial implants have huge advantage. Open reduction and anatomical fixation by low contact locking plates not only enhances blood supply but also ameliorate stresses generated by this plate. [2,3]

Although locking anatomical designed plates need surgical expertise and excellence, this implant follows the fixation principle of adequate reduction,

alignment of comminuted metaphysioepiphyseal region of lower tibia. This enhances vascularity and expedite union without much disturbing local biology.

Methods

A prospective study was conducted at our institute among 44 adult patients with distal tibia fractures who were treated surgically using plate fixation. Patients aged ≥ 18 years with fractures involving the lower one-third of the tibial metaphysis or metaphyseal-diaphyseal junction and classified as AO/OTA type A, B, or C were included. Both closed and open grade fractures were considered. Patients who did not consent to participate, those aged below 18 years, and patients with associated neurovascular injuries or pathological fractures were excluded. Preoperative assessment included anteroposterior, lateral, and mortise radiographs of the ankle along with full-length radiographs of the tibia and fibula; computed tomography of the ankle was performed when required. Fractures were classified according to the AO/OTA classification. [4,5] Demographic characteristics, fracture pattern and site, duration of hospital stay, and postoperative complications were recorded. Surgical fixation was performed using distal tibial plates. When the soft-tissue condition was favourable, definitive fixation was performed; in patients with an unfavourable soft-tissue envelope, temporary stabilization was achieved using splintage or a spanning external fixator, followed by staged definitive fixation after improvement of the soft-tissue condition. In selected patients with associated fibular fractures, fibular fixation was performed using plating or percutaneous techniques according to the fracture pattern. Postoperatively, patients were mobilized

non-weight-bearing with a walker from the second or third postoperative day, and ankle dorsiflexion and plantar flexion exercises were encouraged. Weight bearing was restricted for approximately 4–6 weeks depending on bone quality and fixation, followed by partial weight bearing when radiographic signs of union were present and full weight bearing usually by 8–10 weeks. Follow-up clinical and radiological assessments were performed at 1, 2, 3, 6 months, and 1 year, with radiographs used to assess fracture union, implant loosening or breakage, and other complications. Functional outcome was assessed using the American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot Scale at 6 months and 1 year.

Results

In our study, youngest patient was 18 years old and oldest patient was 80 years old. Fractures were seen most commonly in the age group of 41–50 years with mean age being around 41 years (Figure 1).

From All patients, 35 were male and 9 were female with ratio of male: female being 3.8:1. In our study, 21 patients were of road traffic accidents and 18 patients had a history of fall from height. And 5 had other form on mode of injury like falling of weight and other reason (Figure 2).

Among the 44 patients, 26 (59.1%) had AO/OTA type 43A fractures, 2 (4.5%) had type 43B fractures, and 16 (36.4%) had type 43C fractures. The most common subtype was 43A3, accounting for 11 (25.0%) cases, followed by 43A1 with 9 (20.4%) cases. No patient had a 43B1 fracture. (Table 1)

Table 1: Distribution of Distal Tibia Fractures According to AO/OTA Classification

AO/OTA	Number of Patients	Percentage of patients
43A1	9	20.4
43A2	6	13.6
43A3	11	25
43B1	0	0
43B2	1	2.3
43B3	1	2.3
43C1	5	11.4
43C2	6	13.6
43C3	5	11.4
Total	44	100%

The average interval between injury and definitive surgery was approximately 4 days. Of the 44 patients, 8 underwent two-stage surgery. In these patients, the average interval between injury and primary surgery was approximately 1 day, while the average interval between injury and definitive surgery was approximately 7 days. The average duration of hospital stay was 9 days. One patient required a prolonged hospital stay of 20 days

because the patient was initially considered medically unfit for surgery due to newly diagnosed coronary heart disease (CHD) and hypertension (HTN). Among the 44 patients, 35 had an associated distal fibula fracture. Of these, 22 patients underwent fibular fixation using percutaneous pins, 6 were treated with a 3.5-mm plate, and 2 were treated with cancellous partially threaded screws.

The most commonly used implant was the distal anatomical plate, which was used in 34 (77.3%) patients. A 1/3rd tubular plate was used in 5 (11.3%) patients, while a T plate was used in 1 (2.3%) patient. Combined fixation with a distal anatomical

plate and T plate was used in 1 (2.3%) patient, whereas a combination of a 1/3rd tubular plate and T plate was used in 3 (6.8%) patients. Overall, 44 patients underwent fixation using these implant configurations. (Table 2)

Table 2: Distribution of Patients According to Implant Used for Distal Tibia Fracture Fixation

Implant Used	Number of patients	Percentage of patients
Distal anatomical plate	34	77.3%
1/3 rd Tubular Plate	5	11.3%
T plate	1	2.3%
Distal anatomical plate +T plate	1	2.3%
1/3 rd Tubular Plate +T plate	3	6.8%
Total	44	100%

The average time to fracture union was approximately 14 weeks. Delayed union was observed in a few patients, particularly those with uncontrolled diabetes mellitus and in elderly patients.

The average time to initiate partial weight bearing was approximately 2 months, while full weight bearing was generally initiated at around 3 months. Weight-bearing progression was delayed in patients with delayed union and in those with complex

fracture patterns. The early postoperative complication observed in our study was wound dehiscence. Four patients developed wound dehiscence, all of whom were managed initially with wound cleaning and regular dressings. One patient required surgical debridement because of a deep infection. The late complications included ankle swelling associated with implant impingement and implant exposure. Six patients developed implant impingement or implant exposure, of whom five underwent implant removal.

Table 3: Functional Outcome According to the AOFAS (American Orthopedic Foot and Ankle Society) Ankle-Hindfoot Scale

Score	Outcome	Number of patients	Percentage of patients
90-100	EXCELLENT	13	29.55%
80-89	GOOD	25	56.82%
60-79	FAIR	6	13.63%
<60	POOR	0	0

The functional outcome was assessed using the American Orthopaedic Foot & Ankle Society (AOFAS) Ankle-Hindfoot Scale. Among the 44 patients, 13 (29.55%) achieved an excellent outcome, while 25 (56.82%) had a good outcome.

Six (13.63%) patients had a fair outcome, and none had a poor outcome. Overall, 38 (86.37%) patients achieved good to excellent functional outcomes. (Table 3)



Fracture site open (fig 1-a)



Anterior plate (fig 1-b)



Suture line (fig 1-c)



Final iitv (fig 1-d)



Medial plat (fig 2-a)



Proximal incision (fig 2-b)



Skin closer (fig 2-c)



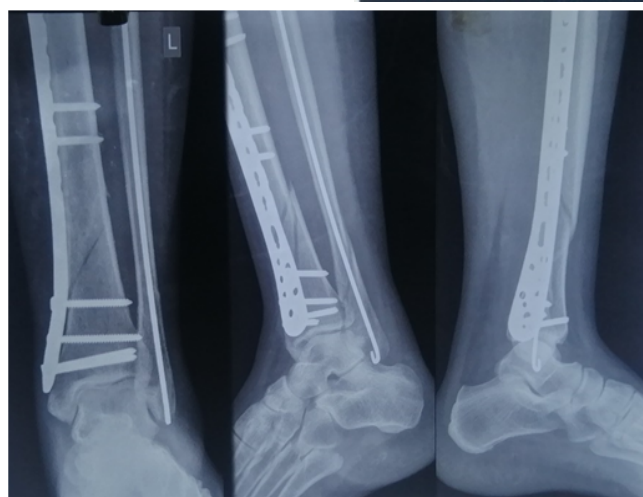
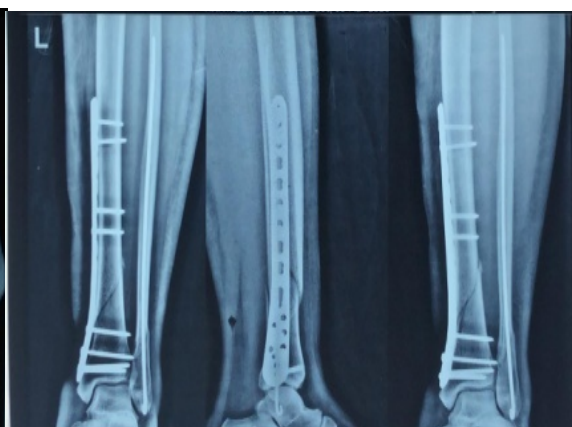
Final iitv (fig 2-d)

Case 1: 39 year old female, history of fall down from stairs having left sided closed displaced tibia and fibula fracture. AO/OTA-43A1.

PRE OPERATIVE X-RAY

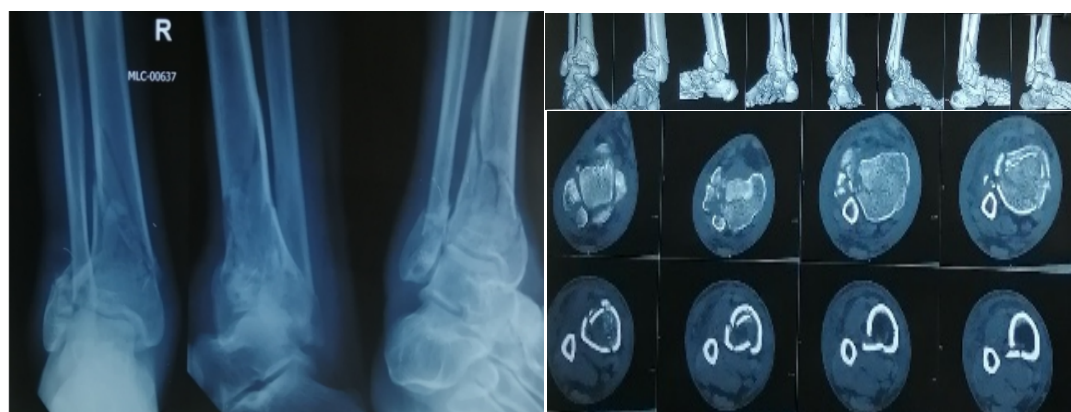


POST OPERATIVE X-RAY



FINAL FOLLOW UP X-RAY

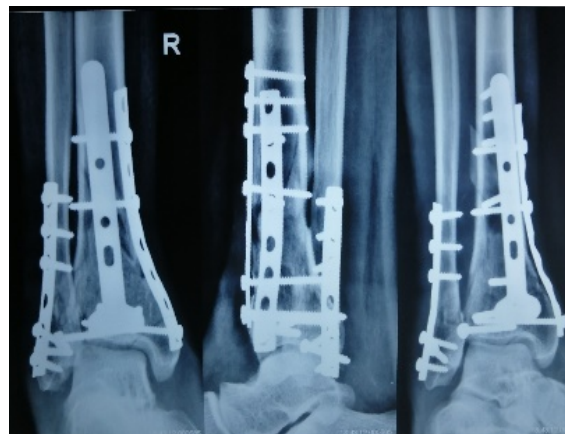
Case 2: 50 year old male, history of fall of heavy weight having right sided closed displaced tibia and fibula fracture. AO/OTA-43C3.



PRE-OPERATIVE X-RAY AND CT SCAN



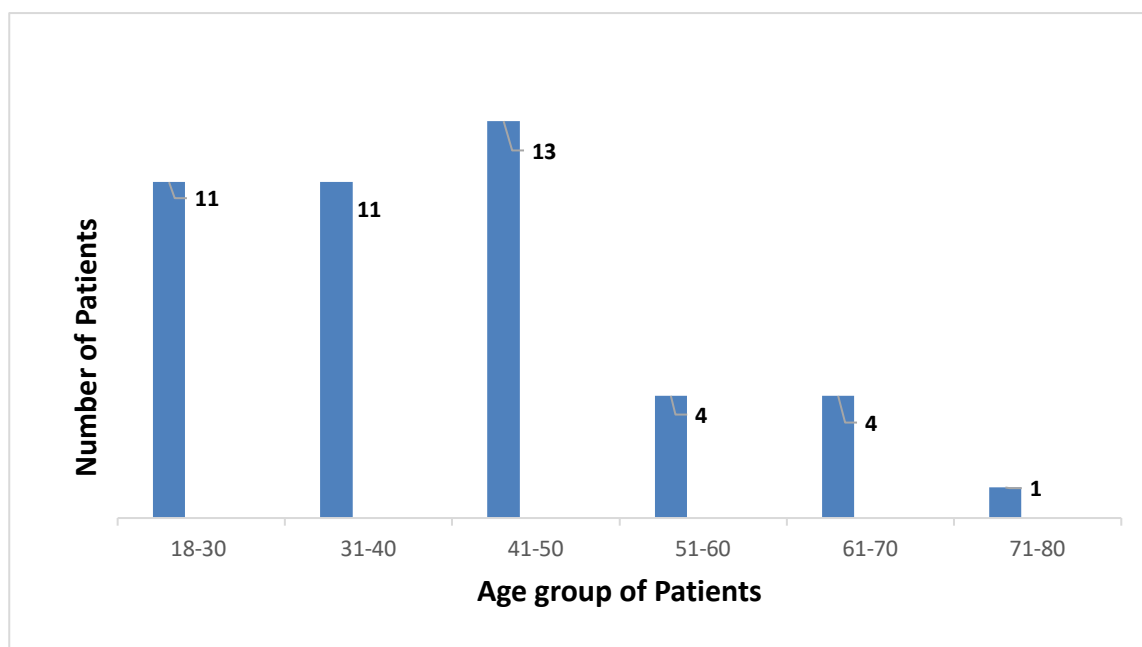
PRIMARY FIXATION AND EXTERNAL FIXATION



FINAL FIXATION

POST OPERATIVE X-RAY

FINAL FOLLOW UP X-RAY

**Figure 1: Age Distribution of Patients with Distal Tibia Fractures**

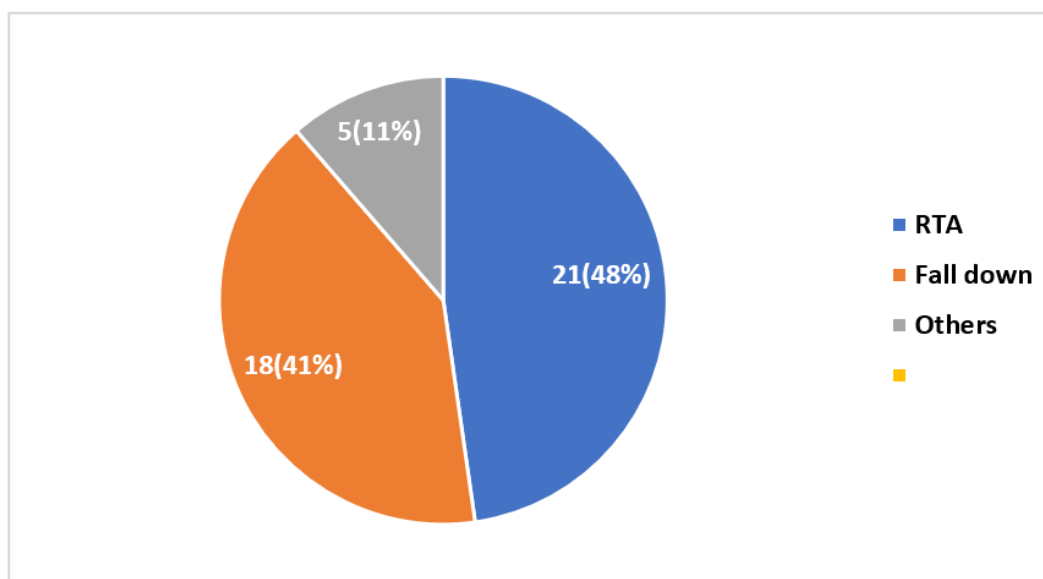


Figure 2: Distribution of Patients According to Mode of Injury

Discussion

In a study evaluating a staged surgical procedure for lower-leg injuries, Helfet et al. performed initial fixation of the lower fibular oblique fracture using open reduction and a 3.5-mm plate, along with application of a damage-control external fixator for the tibial injury. Following adequate improvement of the skin and surrounding soft tissues, definitive reduction and plate fixation of the tibia were performed. Among their 20 patients, 13 were female and 7 were male, with an age range of 25–59 years and a mean age of 43 years. AO/OTA type B and C fractures were observed in 8 patients, while type A fractures were present in 12 patients. The reported ankle range of motion ranged from 0° to 14° of dorsiflexion and 0° to 42° of plantar flexion. [6]

In our series, a damage-control external fixator was used in 8 patients, comprising 7 males and 1 female, with an age range of 23–50 years and a mean age of 36 years. AO/OTA type B and C fractures were observed in 6 patients, while type A fractures were present in 2 patients. The ankle range of motion in our study ranged from 0° to 16° of dorsiflexion and 0° to 43° of plantar flexion. Among these 8 patients, 7 achieved excellent-to-good functional outcomes, while 1 patient had a fair outcome. The fair outcome was observed in an alcoholic patient who was unable to adequately comply with the prescribed limited weight-bearing protocol.

Barei et al. reported that distal tibia fractures associated with fibular fractures represent a severe injury pattern and emphasized the importance of fibular fixation when indicated. [7] Ruedi and Allgower emphasized that restoration of fibular length is important for achieving good functional outcomes and preventing mechanical malalignment. [8–10] In contrast, Bonneville et al. reported that

the necessity of fibular fixation could not be conclusively established, although biomechanical studies demonstrated that fibular fixation may improve the stability of tibial fixation. [11] In our study, 35 of the 44 patients had an associated distal fibular fracture. Of these, 30 patients underwent fibular fixation using plating or nailing according to the fracture pattern, while 5 patients did not require surgical intervention because their fibular fractures were minimally displaced. Radiological union of the fibular fractures was observed within 3 months without major complications.

Bahari et al. reported a mean AOFAS score of 90, with implant failure in 1 patient, infection in 3 patients, and implant impingement requiring implant removal in 3 patients. [12] In our study, the mean AOFAS score was 85.6, with most patients achieving excellent-to-good functional outcomes. This favourable functional outcome was associated with appropriate anatomical reduction and adequate soft-tissue management. In our series, 4 patients developed infection and 6 patients developed implant impingement or implant exposure; 5 of these patients underwent implant removal.

Ronga et al. and Maffulli et al. reported that, among 21 patients, 20 achieved fracture union, while 1 developed non-union. They also reported angular deformity of less than 7° in 3 patients, with no cases of limb-length discrepancy. [13] In our study, all patients achieved fracture union, with a mean time to union of 14 weeks. Delayed union was observed in a few patients, particularly those with uncontrolled diabetes mellitus and elderly patients. No patient developed varus angulation or limb-length discrepancy. In our series, restoration and fixation of the associated fibular fracture may have contributed to maintaining alignment and preventing these complications.

In the present study, 44 patients were evaluated prospectively, compared with 20 patients in the prospective study by Shrestha et al. and 32 patients in the retrospective study by Hasenboehler et al. [14,15] The proportion of open fractures in our study was 22.73% (10 patients), which was lower than that reported by Shrestha et al. (40%) and Hasenboehler et al. (40.6%). Intra-articular fractures were present in 50% of patients in our study, compared with 10% in the study by Shrestha et al. and 37.5% in the study by Hasenboehler et al. [14,15]

The average delay to surgery in our study was 4 days, which was comparable to the 4.45 days reported by Shrestha et al. and shorter than the 6 days reported by Hasenboehler et al. [14,15] The average time to fracture union in our study was 14 weeks, compared with 18.5 weeks in the study by Shrestha et al. and 21.2 weeks in the study by Hasenboehler et al. [14,15] No nonunion was observed in our study, which was similar to the findings of Shrestha et al., who also reported no cases of nonunion. In contrast, Hasenboehler et al. reported nonunion in 2 patients (6%). [14,15]

Overall, our study demonstrated a shorter average time to fracture union and no cases of nonunion, despite a relatively higher proportion of intra-articular fractures. These findings indicate favourable radiological outcomes with plate fixation in our series, although differences in study design, sample size, and fracture characteristics should be considered when comparing these results with previous studies. [14,15]

Conclusion

Plate fixation of distal tibia fractures in adults provided favourable functional and radiological outcomes in our series. Appropriate anatomical reduction, adequate soft-tissue management, and restoration of fibular alignment contributed to satisfactory fracture healing and functional recovery. All patients achieved fracture union, with a mean union time of 14 weeks, while 86.37% achieved good-to-excellent AOFAS functional outcomes. Delayed union was observed in a few elderly patients and those with uncontrolled diabetes mellitus. Although postoperative complications such as wound dehiscence, infection, implant impingement, and implant exposure occurred in some patients, most were successfully managed. In patients with compromised soft-tissue conditions, staged fixation with initial damage-control external fixation followed by definitive fixation after soft-tissue recovery was useful. Overall, careful fracture reduction, appropriate implant selection, fibular fixation when indicated, and early controlled rehabilitation are important for achieving favourable outcomes in distal tibia fractures.

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1. Dr. Harshlaxen Ashvinsinh Rajpardhi and Dr. Paresh H. Karamta

- concepts, design, searching review literatures, data collection, data entry.

2. Dr. Harshal N. Damor

- manuscript writing and formatting, manuscript preparation.

3. Dr. Richenkumar R Shah

- manuscript review, selection of study methodology and data analysis.

4. Dr. Parag M. Tank

-, manuscript review, manuscript editing, overall guidance for conducting study.

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