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Original Research Article

Analysis on the functional results of distal tibial fractures in adults treated with distal tibial medial locking plates

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ABSTRACT

Background: Even today, distal tibial fractures provide a substantial challenge to the majority of surgeons because they account for only 1–10% of lower extremity fractures and have severe consequences. Despite improvements in both non-operative and surgical therapy, distal tibia fractures are still a contentious topic. The goal of a distal tibia fracture is early functional recovery and realignment of the fracture and limb length.

Materials and Methods: This research was carried out at the Jhalawar Medical College Hospital's Orthopaedics Department. Adult patients who met the inclusion criteria and had 15 occurrences of distal tibial fractures treated with a distal tibial medial locking plate. Patients were assessed clinically and radiologically with the relevant X-rays at each follow-up.

Results: At the ending of the follow-up period, patients were evaluated using the "Ovadia and Beals" scoring method, which incorporates both an objective and subjective assessment of the patients. An average of 18 weeks passed before all the fractures healed. One delayed union had a radiological callus development indication that was present for 22 weeks. Six patients (40%) with fractures healed in 16 weeks, six patients (40%) with fractures healed in 18 weeks, two patients (13%) with fractures healed in 20 weeks, and one patient (7%) with fractures healed in 22 weeks. In this study, 60% of the patients (9 patients) had outstanding outcomes, while 13% of the patients (2 patients) had poor results based on objective criteria, and 54% of the patients (8 patients) had excellent results, but 13% of the patients (2 patients) had terrible results based on subjective criteria.

Conclusion: Through the use of locking compression plates and MIPPO methods, the distal tibia fractures have obtained close reduction. These fractures have been successfully stabilised as a result of this approach. It does allow for early mobility and offers sufficient stability. Because it makes it easier to preserve the blood supply to the fragment and anatomically reduce the fracture, the close reduction aids in quick union.

1. Introduction

Due to the minimal soft tissue, subcutaneous position, fragile vascularity, and proximity to the ankle joint, distal tibia fractures can be very difficult to treat.[1,2] The difficulty in treating distal tibia end fractures is demonstrated by an orthopaedist from the first half of the 20th century who thought that the fractures were too severe and complicated to be amenable to surgical reconstruction.[3]

Even today, distal tibial fractures provide a substantial challenge to the majority of surgeons due to their low prevalence (1–10%) and high complication rates.[4] Axial loading from the talus's forceful impact with the lower end of the tibia is the mechanism of damage.[5] Axial force on the distal tibia controls soft tissue injuries,

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metaphyseal communition, articular surface damage, and joint impaction.[6,7] Although the injury process may be complicated, vertical compression is the main force. The position of the foot at the time of contact determines where the articular part of the fracture is located.

Despite improvements in both non-operative and surgical therapy, distal tibia fractures are still a contentious topic. Realigning the fracture, adjusting limb length, and promoting early functional recovery are the goals in distal tibia fractures.[8,9]

Conservative treatment with the insertion of a cast results in extended immobilisation, which causes ankle and knee stiffness and lowers the patient's quality of life.[10] The development of fracture care saw the introduction of locking compression plates as a resolution where lengthy bed rest is avoided and return to work is successfully helpful.

For the past ten years, difficult fractures of the lower leg, particularly those of the distal tibia, have been successfully treated with fracture reduction employing plating. This procedure aims to apply stable plate fixation while preserving fracture biology and reducing soft tissue issues.[11–13] Using a locking plate to treat complicated fractures of the distal section of the tibia has become more popular recently.[14,15] It comprises of plate and screw systems with screws locked at a fixed angle in the plate. Because the plate does not need to be strongly placed against the bone to stabilize the fracture, screw locking reduces the amount of plate and bone contact.[16,17]

The management of these difficult fractures remains elusive despite breakthroughs in the recognition, understanding, and treatment of soft tissue injury as well as in the widespread use of computed tomography scanning and advances in implant design that include locking plate technology.[18]

2. Aims and Objective

This study's goal is to evaluate the effectiveness of Distal Tibial Medial Locking Plate in the management of distal tibial fractures in adults, with a focus on procedural challenges and side effects and analyse the functional outcomes, radiological outcomes, and numerous comorbidities related to the distal medial tibial plate in distal tibial fractures in adults, as well as to identify the demographics (age and sex distribution) of distal tibial fractures in adults.

3. Materials and Methods

15 cases of distal tibial fractures of adult reported to the department, who fulfilled the inclusion criteria treated with distal medial tibial plate after permission from ethical committee were included in the study.

3.1. Inclusion criteria

1. Distal tibial fractures
2. 18 -70 yrs. age group
3. Close fractures
4. Grade I open fractures as per gustilo-andersons classification

3.2. Exclusion criteria

1. Patients less than 18 years of age and more than 70 years of age.
2. Open Grade II or Grade III distal tibial fractures as per gustilo-andersons classification
3. Comminuted and segmental fractures.
4. Metabolic bone disorders or pathological fractures.
5. Underlying neuromuscular disorder.
6. Patients unfit for surgery.
7. Patient not willing to give consent.

3.2.1. Preoperative evaluation

When patients first came at the emergency room, they underwent an airway, breathing, circulation, disability, and exposure (ABCDE) evaluation. If necessary, resuscitative actions were taken, such as the administration of IV fluids, continuous oxygen inhalation, splinting of the fracture with an above-knee plaster, and monitoring for unfavourable side effects such fat embolism and hypotension.

According to gustilo-classification, Anderson's Grade I open fractures were properly cleaned, and where needed, antibiotics, analgesics, and blood transfusions were administered. A thorough history of the patient's age, sex, mode of injury, and accompanying disease was obtained. A knee and ankle X-ray, as well as AP and lateral views, were taken on the affected leg. Investigations of the blood were routine.

3.3. Operative procedure

The treatment was carried out under spinal anaesthesia in a sterile environment on a radiolucent operating table. Every patient underwent distal medial tibial plate surgery using the MIPPO technique. At the level of the medial malleolus, a vertical or curved incision measuring 2 cm was performed. The great saphenous vein and saphenous nerve were protected with care. The fracture hematoma was not disturbed during the creation of the subcutaneous plane. The plate was introduced after making a tunnel retrograde, and a little counter incision was made proximally to line the plate on the tibia optimally. The plate was then fastened with percutaneous screws by stab incisions under the direction of an image intensifier. Using the same incision, distal segment screws are inserted. In other instances, closed reduction employing K-wire/Rush nails/4mm CC screws was used to treat fibula fractures initially.

Fig. 1: Positon of the limb showing incision with plate insertion technique

3.4. Post operative care and rehabilitation

It was evaluated for immediate post-operative sequel include vascular injury, compartment syndrome, neurological damage, and fat embolism. Following surgery, an intravenous antibiotic treatment was maintained for 5 days. Oral antibiotics were suggested for a further 5 days. At the tenth or twelfth post-operative day, sutures or staples were removed. On the first post-operative day, active quadriceps activities were resumed along with active ankle and toe motions and knee mobilization as far as the patient is comfortable and pain-free.

The patients were required to use a walker or crutches to ambulate starting on the third post-operative day without placing any weight on the operated leg. Initial follow-up was done on a 4 weekly basis for the first three months, then 6 weekly for the next six (4 weeks, 8 weeks, 12 weeks, 18 weeks, 24 weeks). Based on clinical and radiological results, patients were evaluated.

Each postoperative visit included an evaluation of the lateral and anterior follow-up radiographs. Based on the radiographic and consolidation of the fractures, partial and full weight-bearing were permitted. When there was periosteal bridging callus at the fracture site in at least three cortices in the anteroposterior and lateral views, the fracture was deemed to be unified. Also taken into account were trabeculations that crossed the fracture site.

These radiographs were examined for shortening over the fracture site and coronal and sagittal plane misalignment. Documented patient discomfort or swelling levels as well as differences in the range of motion at the knee, ankle, and limb. All surgical, post-operative, and unanticipated problems as well as further procedures were recorded.

4. Results

13 (87%) of the 15 individuals were closed fractures, while 2 (13%) involved open GA-I fractures. According to Rudie and Allgower's classification of fractures of the distal tibia, of the 15 cases examined, 7 (46 percent) were categorised as having an A1 fracture pattern, 5 (34 percent) as having an A2 fracture pattern, and 3 (20 percent) as having a B1 fracture pattern.

An average of 18 weeks passed before all the fractures healed. One delayed union had a radiological callus development indication that was present for 22 weeks.

Table 1: Duration of union fracture

Duration (in weeks)	No. of patients	Percentage
16	6	40%
18	6	40%
20	2	13%
22	1	7%
Total	15	100%

Six patients' (40%) fractures healed in 16 weeks, six patients' (40%) fractures healed in 18 weeks, two patients' (13%) fractures healed in 20 weeks, and one patient's (7%) fracture healed in 22 weeks.

In this study 60% cases (9 patients) showed excellent results while 13% cases (2 patient) showed poor results as per objective criteria (Ovadia and Beals).

Table 2: Results as per objective criteria

Results	No. of cases	Percentage
Excellent	9	60%
Good	3	20%
Fair	1	7%
Poor	2	13%

In this study 54% cases (8 patients) showed excellent results while 13% cases (2 patients) showed poor results as per subjective criteria (Ovadia and Beals).

Table 3: Results as per subjective criteria

Results	No. of cases	Percentage
Excellent	8	54%
Good	3	20%
Fair	2	13%
Poor	2	13%

5. Discussion

One of the fractures that is hardest to adequately treat is a fracture of the distal tibia. Long-term clinical outcomes are influenced by the condition of the soft tissues and the level of comminution at the time of injury. Operative therapy aims to reshape the joint surface anatomically while

Table 4: Fracture pattern percentage

Study	Al	A2	A3	Bl	B2	B3	CI	C2	C3
Cory collinge et al [19]	9	9	10	-	-	-	16	32	24
Andrew Grose et al [20]	5	5	7	2	4	6	6	12	64
Heather A Vallier et al [21]	31	-	-	21	-	-	44	-	-
Our study	46	34	-	20	-	-	-	-	-

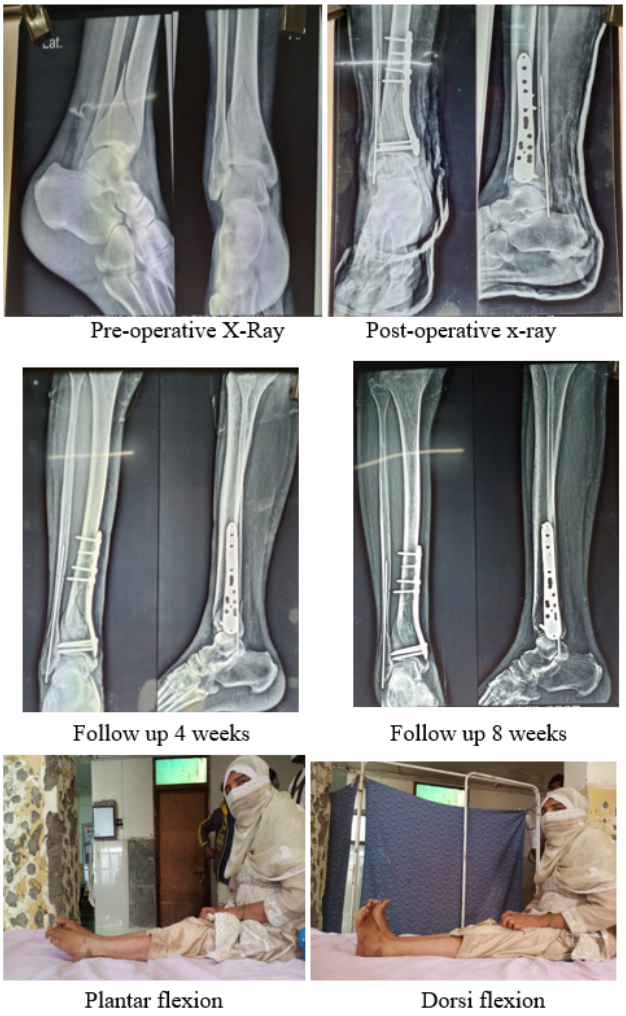

Fig. 2: Case 1

Fig. 3: Case 2

maintaining sufficient stability to permit early motion. In order to lessen treatment-related problems, this should be done using methods that reduce osseous and soft tissue devascularization.

5.1. Fracture patterns

Because our main objective in the present study was to investigate distal metaphyseal fractures, it was unable to compare it to other investigations (without intra articular extension). The segmental and comminuted fractures had also been disregarded. However, research by Cory Collinge et al. revealed C1 to be 16 percent, C2 to be 32 percent, and C3 to be 24 percent. Additionally, Andrew Grose and colleagues suffered fractures of types 2% B1, 4% B2, 6% B3, 6% C1, 12% C2, and 64% C3. Additionally, fractures accounted for 31% A, 21% B, and 44% C in Heather A. Vallier et al. Due to the selection criteria being based on the study's objectives, we had a larger percentage of type A fractures.

5.2. Duration of fracture union

In numerous investigations carried out using various techniques, the average time for fracture union was 16-28 weeks. Our study's average time for a fracture to heal-18

weeks was comparable to trials using locking compression plates. Abid Mushtaq et al. and Cory Collinge et al. reported average fracture union times of 22 weeks and 21 weeks, respectively.

Table 5:

Study	Method	Average fracture union
Cory collinge et al [19]	MIPPO	21 weeks
Abidmushtaq et al [22]	MIPPO	22 weeks
Im GI, et al [23]	ORIF	20 weeks
Hazarika et al [24]	MIPPO	19.3 weeks
Our study	MIPPO	18 weeks

6. Conclusion

Anatomical reduction is obtained and the fracture hematoma is not significantly disrupted with close reduction and internal fixation with locking compression plates. Because intramedullary nails frequently do not provide enough stability and external fixators are typically applied for primary stabilization and until soft tissue edema gets better and delays the return to work with fixators, it is effective in extra articular fractures that occur within 5 cm of the joint. Due to modern anatomically designed locking compression plates for the distal end tibia fractures, it is easy, quick, and straightforward to apply and has a shorter surgery time in extra articular fractures and intra articular fractures.

7. Source of Funding

None.

8. Conflict of Interest

None.

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