

A Functional Outcome Assessment of Distal Tibial Fractures Stabilized Using a Distal Tibial Locking Plate

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Abstract:

Background: After the femur, the tibia is the largest long bone in the skeleton. The tibia's shaft is triangular in form and has enlarged ends. From the smaller distal end, a powerful medial malleolus protrudes distally. The tibia is now the long bone in the body that fractures most frequently. Tibial plafond/pilon fractures, which are serious wounds, are frequently used to characterize distal tibia fractures. In the current study, locking compression plates for the distal tibia in lower tibial fractures that were treated with open reduction internal fixation and a minimally invasive plate osteosynthesis approach are being evaluated.

Methods: Patients with distal tibial fractures who attended the outpatient department (OPD) or emergency OPD at Patna Medical College and Hospital, Patna, Bihar between October 2020 and March 2021 were the subject of a prospective and retrospective study. The inclusion and exclusion criteria for the patients treated with locking compression plates using minimally invasive plate osteosynthesis (MIPO) or open reduction internal fixation (ORIF) are examined. Epi-info software was applied to collect and assess all of the data.

Results: Out of 52 patients, 48.4% underwent open reduction internal fixation with outstanding results, while 28.6% underwent surgery using the MIPO approach. The p value, which is 0.352, is not significant. 40.4% of patients had excellent outcomes overall. In our study, 1.9% of patients with type B and C fractures and 32.6% of patients with AO/OTA type A fractures obtained outstanding scores. This is explained by increased comminution and ankle joint involvement. 40.4% of patients scored excellent overall. The P value, which is 0.863, is not significant.

Conclusions: We observed excellent/ good functional outcome in 65.3% of patients.

Keywords: Functional outcome, MIPO, Tibia.

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Introduction

The tibia, after the femur, is the second-largest long bone in the skeleton. The first tibia's shaft has expanded ends and a triangular cross-section; the smaller distal end has a robust medial malleolus that extends distally from it. [1] At the moment, the tibia is the long bone in the body that is fractured most frequently. [2] Tibial distal fractures are serious wounds known as tibial plafond/pilon fractures. With a predominance of men, the average age is about 37 years. [2] Less than 1% of lower extremity fractures are lower tibial fractures, which account for 7 to 10% of all tibial fractures. [3]

There are several surgical treatment options that have been tested thus far, including closed intramedullary nailing, open reduction and internal fixation (ORIF) with traditional plate osteosynthesis, and external fixation. However, none of them had a favorable functional outcome and all had a significant rate of complications. The patient's quality of life was negatively impacted by

the conservative therapy of applying a cast to the ankle and knee. Although anatomical reduction is not possible due to the distal tibia's hourglass form, closed intramedullary interlocking nailing of distal tibia fracture can be a good alternative. However, this causes rotational and angular malalignment. A temporary stabilizing device or in cases of serious soft tissue injury, external fixation is advised. The disadvantages of external fixation include joint stiffness, mal-reduction, and pin tract infection. [4]

All types of lower tibial fractures are treated at the orthopaedic department of the Patna Medical College and Hospital in Patna, Bihar. These patients are evaluated clinically and radiologically, and various fixation techniques, such as locking compression plates, are used to manage them. In order to assess the functional outcome of lower tibial fractures treated with open reduction internal fixation and minimally invasive plate osteosynthesis procedures, the current study used

Tenny Wiss scoring and locking compression plates.

Material and Methods

The prospective group consisted of 28 patients who underwent open reduction internal fixation (ORIF) or minimally invasive plate osteosynthesis (MIPO) for the fixation of distal tibial fractures with locked compression plates between October 2020 and March 2021 at Patna Medical College and Hospital, Patna, Bihar. Patients above 18 years, simple lower third tibial fractures, intraarticular/periarticular lower third fractures and Gustillo Anderson grade I, II and upto IIIA open fractures were included in this study and patient less than 18 years, Gustillo Anderson grade IIIB and above open fractures, associated vascular injuries, pathological fractures, tibial fractures associated with ankle dislocation and talus fractures and associated tibial condyle fracture of same side were excluded in this study.

24 patients who had operations performed before October 2020 are considered retrospective cases. They were contacted for follow-up in the outpatient department (OPD) when the Medical Record Department was able to locate their records. Case sheets and X-rays are used to acquire the necessary data. Clinical and radiological evaluations are done on these patients' data. In the event that it is not already in the records, further information is obtained directly from patients during follow-up by personal questioning. Antero-posterior and lateral images of the ankle joint were taken on an X-ray of each patient's leg. Patients are examined for an electrocardiogram (ECG), a complete hemogram, fasting blood sugar, and renal function tests like urea and creatinine.

Above-knee slabs for splintage have been used as pre-operative treatment. The limb is elevated using a Böhler Braun splint or two cushions. Patients

have been encouraged to move their toes and perform quadriceps exercises for 15 minutes per hour while awake. If any blisters develop, they are either aspirated or left untreated. If blisters erupt, patients are given oral antibiotics. Prior to surgery, patients and their support personnel received thorough explanations of the procedure, its restrictions, and potential risks, including infections, skin necrosis, implant exposure, implant failure, anesthetic issues, and stiffness.

The patient's relative and they have given their informed consent for the procedure. Patients who are deemed fit have surgery. The preoperative and postoperative periods are used to examine patients.

All the fractures will be classified as per: AO/OTA and Rüedi-Allgöwer classification.

Results

Out of total 52 patients, majority of patients were in age group 26-55 years (80.7%). The youngest patient was 25 years old and the oldest was 75 years. Female patients predominated and comprised 59.7% of the total number of patients. Male to female ratio was 2:3. Out of 52 patients in our study, 12 had open fractures. Patients who had open fractures underwent additional categorization using the Gustillo Anderson system. 8 out of 12 instances had type 3A injuries, which were primarily related to fracture comminution rather than skin disease. 21 instances were operated on using the minimally invasive plate osteosynthesis approach, and 31 cases were performed using open reduction and internal fixation.

MIPO

Out of 52 patients, 48.4% underwent open reduction internal fixation and had outstanding results, while 28.6% underwent MIPO procedure. The p value, which is 0.352, is not significant. 40.4% of patients had excellent outcomes overall.

Table 1: Distribution of patients according to age and sex

| Age (in years) | Prospective | | Retrospective | |
|----------------|-------------|--------------|---------------|--------------|
| | Male N (%) | Female N (%) | Male N (%) | Female N (%) |
| 15-25 | 1(9.09%) | 0(0.00) | 0(0.00) | 2(14.29%) |
| 26-35 | 2(18.18%) | 4(23.53%) | 4(40.00%) | 3(21.43%) |
| 36-45 | 2(18.18%) | 5(29.41%) | 4(40.00%) | 3(21.43%) |
| 46-55 | 3(27.27%) | 7(41.18%) | 1(10.00%) | 4(28.57%) |
| 56-65 | 2(18.18%) | 1(5.88%) | 1(10.00%) | 1(7.14%) |
| 66-75 | 1(9.09%) | 0(0.00) | 0(0.00) | 1(7.14%) |
| Total | 11 | 17 | 10 | 4 |

Table 2: Distribution of patients based on Gustillo Anderson classification having open fractures

| Fracture type | | Patients (%) |
|-----------------|--------|--------------|
| Open Fractures | | 12 |
| | Type 1 | 4(7.7%) |
| | Type 2 | 0(0.00) |
| | Type 3 | 8(15.4%) |
| Closed (others) | | 40(75.0%) |
| | Total | 52(100.0%) |

Table 3: Distribution of patients according to operative technique used

| Operative technique | Prospective Group N(%) | Retrospective Group N(%) | Total N(%) |
|----------------------------|-------------------------------|---------------------------------|-------------------|
| Open | 15(53.57%) | 16(66.67%) | 31(59.62%) |
| MIPO | 13(46.43%) | 8(33.33%) | 21(40.38%) |
| Total | 28 | 24 | 52(100.0%) |

Table 4: Distribution of patients according to used technique and outcome based on Tenny Wiss Scoring

| Operative technique | Excellent N (%) | Good N(%) | Fair N(%) | Total |
|----------------------------|------------------------|------------------|------------------|--------------|
| Open reduction | 15(48.4%) | 7(22.6%) | 9(29.0%) | 31 |
| MIPO | 6(28.6%) | 6(28.6%) | 9(42.9%) | 21 |
| Total | 21 | 13 | 18 | 52 |

Table 5: Distribution of patients according to functional outcome as per Tenny Wiss scoring in prospective and retrospective group

| | Excellent N (%) | Good N(%) | Fair N(%) | Total |
|---------------|------------------------|------------------|------------------|--------------|
| Prospective | 7(25.0%) | 8(28.6%) | 13(46.4%) | 28 |
| Retrospective | 14(58.3%) | 5(20.8%) | 5(20.8%) | 24 |
| Total | 21(40.4%) | 13(25.0%) | 18(34.6%) | 52 |

Table 6: Distribution of patients according to AO/OTA classification and Tenny Wiss scoring

| Fracture type AO/OTA | Excellent N (%) | Good N(%) | Fair N (%) | Total |
|-----------------------------|------------------------|------------------|-------------------|--------------|
| A1 | 9(42.9%) | 4(30.8%) | 5(27.8%) | 18(34.6%) |
| A2 | 2(9.5%) | 2(15.4%) | 3(16.7%) | 7(13.5%) |
| A3 | 6(28.6%) | 5(38.5%) | 4(22.2%) | 15(28.8%) |
| B1 | 0(0%) | 0(0%) | 0(0%) | 0(0%) |
| B2 | 1(4.8%) | 1(7.7%) | 2(11.1%) | 4(7.7%) |
| B3 | 1(4.8%) | 0(0%) | 2(11.1%) | 3(5.8%) |
| C2 | 1(4.8%) | 0(0%) | 2(11.1%) | 3(5.8%) |
| C3 | 1(4.8%) | 1(7.7%) | 0(0%) | 2(3.8%) |
| Total | 21 | 13 | 18 | 52 |

In our study, 58% of retrospective patients, 25% of prospective patients, and 25% of patients in both groups all received outstanding scores. The p value is 0.043, which is noteworthy.

In our analysis, type A AO/OTA fractures accounted for 32.6% of good scores, while types B and C only had 1.9%. This is explained by increased comminution and ankle joint involvement. 40.4% of patients scored excellent overall. The P value, which is 0.863, is not significant.

Discussion

One of the more challenging fractures to treat is a distal tibial fracture at the metaphysis-diaphysis junction with or without intra-articular extension. In comparison to the triangular diaphysis, which has a thicker cortex, the distal tibia has a circular cross-sectional area. [5]

Since the tibia is subcutaneous in that area and roughly two-thirds of the blood supply comes from periosteum, open reduction internal fixation with traditional plates is not a good option. With ORIF with plating, reports of nonunion, delayed union and infection vary from 8.3 to 35% and 8.3 to 25%, respectively. [6,7] A physiologically friendly and stable fixing treatment for a distal dia-metaphyseal tibia fracture is now possible thanks to the

invention of the MIPO with LCP technique, which protects the extra osseous blood supply and respects osteogenic fracture hematoma.

An orthopedic surgeon faces a therapy conundrum when treating a distal tibia fracture. While concurrently conserving the integrity of the soft tissue envelope, it is necessary to achieve and maintain an anatomic reduction of the joint surface. If the low-energy traumas that caused these fractures did not seriously harm the lower leg's soft tissue envelope. Instead of high-speed trauma, major soft tissue injury is caused by past falls or roadside accidents.

In our study we had achieved excellent/ good functional outcome in 65.3% patients. Study by Kapukaya et al had achieved excellent or good clinical results in 58%, fair in 21% and poor in 21% of patients. [8] In a group of 42 patients with distal tibia fractures, Bourne et al. found that 86% of those with the Reudi Allgower type 1 fracture pattern and 80% and 44% of those with the type 2 and type 3 pilon fracture patterns, respectively, who had open reduction and internal fixation to accomplish anatomical reduction, had good or satisfactory results. [9]

The study has unmistakably shown that type 1 and type 2 fractures are amenable to anatomic open reduction, stable internal fixation, and early

movement, resulting in satisfactory results in more than 80% of patients, while type 3 fractures are amenable to poor results because of intra articular involvement and comminution of fracture fragments.

Conclusion

We found that 65.3% of patients had excellent or satisfactory functional outcomes. The retrospective group has superior functional outcomes, which is directly related to the fact that outcomes get better with time, according to the study.

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