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Original Research Article

Prospective Study to Evaluate the Functional Outcome in Patients with Distal Tibia Fractures Undergoing Locking Compression Plate Fixation Using Minimal Invasive 'MIPPO' Technique.

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Abstract:

Aim and Objectives: To study the functional outcome of distal tibia fractures in patients treated by Minimal Invasive Percutaneous Plate Osteosynthesis (MIPPO) technique with distal tibia locking compression plate.

Materials and Method: This study had a Prospective Clinical study design conducted at Govt. R. D. B. P. Jaipuria Hospital attached with RUHS College of Medical Sciences, Jaipur, Rajasthan. Total of 30 patients with Closed, open fracture type 1 (Gustilo and Anderson Classification) fracture of distal tibia with or without intra-articular extension were included in the study. The final result was evaluated using Tornetto et al scores.

Results: Mean time to union was 12.93 ± 4.8 weeks, 14 of the patients showed union at 12 weeks follow-up. Normal union was seen in 83.33% subjects, delayed union in 13.33% and non-union was noted in 1 (3.33%) patient. Most common complications seen were joint stiffness (10%), valgus deformity (6.67%) and infection (10%). Excellent outcome was seen in 53.33%, good outcome in 30%, fair outcome in 13.33% and poor outcome in 1 (3.33%) subject.

Conclusion: The present study concludes that minimally invasive plate osteosynthesis (MIPPO) using LCP is a safer modality for treating distal tibial fractures without significant intra-articular comminution because it promotes rapid functional recovery, good fracture healing, and prevents serious skin problems.

Keywords: Distal Tibia Fractures, Minimal Invasive, Locking Plate, MIPPO.

Introduction

Road traffic accidents are a major pandemic in the modern world, as they account for the majority of human mortality and illness. Distal tibial fractures are one of the most complicated injuries around the ankle joint, accounting for around 7% of all tibial fractures. [1] Due to the subcutaneous position, lack of blood flow, and lack of soft tissue coverage, distal tibia fractures, including tibial pilon fractures, present a significant challenge to the surgeon. These already complicated injuries are made even more complicated by the involvement of the ankle joint and the susceptibility of the surrounding soft tissues. [2] Various procedures can be used to treat these fractures. With different outcomes, small wire fixators [3,4] and open reduction and plating [5] have been utilised. Along with the bone reconstruction, soft-tissue handling has been demonstrated to play an important part in the management. [6] Stable fractures with minor shortening can be treated nonsurgically, however shortening of the affected leg, malunion, limited range of motion, and early ankle osteoarthritis have all been described after treatment of these fractures, particularly pilon fractures. [7]

Conventional open reduction and internal fixation of such fractures resulted in extensive soft tissue dissection and periosteal damage, affecting the blood supply, which may be linked with high rates of infection, delayed union, and nonunion. [8-10] External fixation of distal tibial fractures has also been linked to a high rate of pin site infection and loosening in up to 50% of cases, as well as malunion rates of up to 45 percent. [11] For fractures of the distal third tibia, minimally invasive percutaneous plate osteosynthesis (MIPPO) and interlocking nailing are the favoured treatments in modern orthopaedic practise. The intramedullary nail avoids substantial soft tissue dissection while sparing the extraosseous blood supply. [12] However, proximal and distal shaft fractures might be difficult to control with an

intramedullary device, which increases the likelihood of misalignment. [13]

The acceptance of intramedullary nailing as a treatment for distal tibia fractures has been hampered by worries about reduction/loss of reduction, improper fixation in fractures with articular extension, anterior knee pain [14] and hardware failure. MIPPO (minimal invasive percutaneous plate osteosynthesis) can address a number of difficulties associated with intramedullary nailing while combining all of the biological advantages of closed reduction and fixation. [15] For fracture fixation, locking compression plating (LCP) provides angular stability. The plate's anatomical form minimize fracture malalignment and ensures proper angular and axial weight distribution. [16] Locked screws keep the plate from pressing against the bone and don't interfere with periosteal circulation. [17] Present study aims to evaluate functional outcome of distal tibia fractures fixed with locking compression plate using minimal invasive MIPPO technique.

Materials and Method

Present study has prospective clinical study design, where 30 distal tibia fracture cases operated with MIPPO technique were prospectively studied for 6 months to determine the functional outcome. This study was conducted at Govt. R. D. B. P. Jaipuria Hospital attached with RUHS College of Medical Sciences, Jaipur, Rajasthan. The sample size of study was calculated at a 95% confidence interval and 10% relative allowable error using the formula for the sample size for estimation of a single sample proportion. The sample size was calculated to be a minimum of 16 patients, which was enhanced to 30 patients. This study included closed and open fracture type 1 (Gustilo and Anderson Classification) fracture of distal fracture with or without intraarticular extension. The study excluded Open fractures i.e. type 2, type 3 (Gustilo and Anderson Classification), fractures associated with delayed knee mobility and ankle mobility, Compartment syndrome / poor local skin conditions, AO type C3 fracture (articular comminution) and Pathological fracture.

Regular Follow up was done on the 2nd, 6th, 8th, 12th, 16th, 20th, 24th post-op week. At each follow - up visit, the patient will be evaluated clinically and radiologically. Following points are considered at each out- patient clinic visit: Pain, Range of motion, Alignment and Radiological union. The final result was evaluated using Tornetto et al scores for evaluation of ankle joint.

Surgical Technique

Using preoperative X-rays, first calculate the length of the plate.

Preliminary Reduction: An external fixator or distractor that is placed properly can be a highly beneficial tool for reduction. Plate Insertion: With the use of a distractor or external fixation, the tibia's length and rotation are indirectly maintained. Plate application successfully rectified the angulation. After proximal tunneling with a blunt instrument, the plate was introduced through a medial oblique incision. Plate is located on the anteromedial side of the tibia and supra malleolar level, to avoid the plate irritating soft tissue. A small incision of 2 to 3 cm above the fracture zone helps in implant positioning. Plate Fixation:

Before inserting a screw, temporary fixation can be achieved with k wires. Once the plate is in its proper location, reduction is seen and checked under IITV vision in both Antero-posterior and lateral views and then tighten the plate to the bone by manually compressing it or by inserting a regular screw in one of the distal plate holes. Then, you can use a head screw in instead of the conventional screw. Insertion of the proximal and distal screws is complete. Require 6-8 screws for the metaphysis and 4 -5 for the diaphysis. The number of screws needed to stabilize an osteoporotic fracture increased on both sides. Screws with locking heads enhance fixation in an osteoporotic bone. There are pre-contoured distal tibia plates available, however without a specially made plate, the distal purchase might be hampered. Locking head screws are more stable distally for osteoporosis and distal tibia fracture. Wound Closure: by using subcutaneous vicryl and ethilon 2-0 skin suture to close the incision site.

Results

The most common cause of distal tibia fractures was found to be road traffic accident (83.33%), while fall from height was the cause in 16.67% patients. Intra-articular fracture was found among 53.33%, while extra-articular fracture was seen in 46.67% cases. Close fracture was the most common type seen (73.33%) subjects followed by grade 1 fracture (26.67%).

Most of the patients were within one week of injury (46.7%). Majority (46.7%) of the patients showed union at 12 weeks follow-up with the mean time to union was 12.93 ± 4.8 weeks. The normal union was seen in 83.33% subjects, delayed union in 13.33% and non-union was noted in 1 (3.33%) patient. Most common complication seen were joint stiffness (10%), infection (10%), valgus deformity (6.67%).

Excellent outcome was seen in 53.33%, fair outcome in 13.33% and poor outcome in 1 (3.33%) subject based on the tornetta et al scoring system.

Table 1

		N	Percentage
The time between injury and surgery	Within 1 day	9	30.0%
	Within 1 week	14	46.7%
	1-2 week	7	23.3%
Time taken for union	8 weeks	8	26.7%
	12 weeks	14	46.7%
	16 weeks	2	6.7%
	20 weeks	1	3.3%
	24 weeks	4	13.3%
Type of union	Union	25	83.3%
	Delayed union	4	13.3%
	Non-union	1	3.3%
Complications	Joint stiffness	3	10.0%
	Valgus deformity	2	6.7%
	Infection	3	10.0%

Table 2: Showing Final outcome

Final outcome	N	Percentage
Excellent	16	53.3%
Good	9	30.0%
Fair	4	13.3%
Poor	1	3.3%

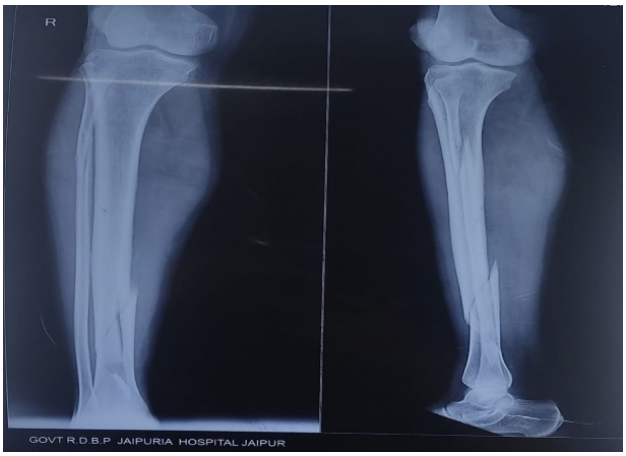

Figure 1: Pre Operative X RAY

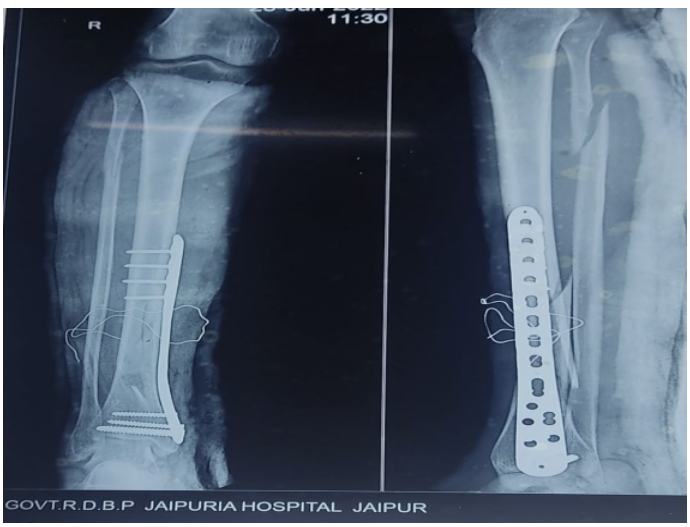

Figure 2: POST Operative X RAY- Immediate

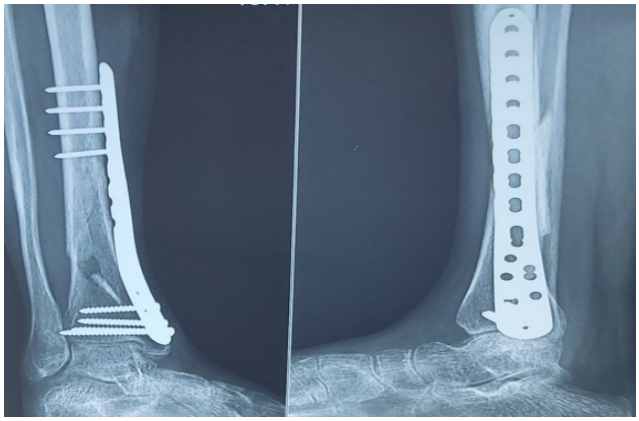

Figure 3: POST-Operative X-RAY -24 WEEKS

Figure 4: Intra-operative pics of plating

Statistical Analysis: SPSS version 25.0 analyzed the Excel data when it was loaded. Quantitative (numerical variables) data was given as mean and standard deviation, whereas qualitative (categorical variables) data was provided as frequency and percentage. The student t-test was used to compare the two groups' mean values, while the chi-square test analyzed their frequency differences. If p0.05, it was statistically significant.

Discussion

The most common cause of fracture was a road traffic accident (83.33%), while fall from height was the cause in 16.67% patients. Mehmet Atif Erol Aksekili.[18] similarly observed that road traffic accident was the common cause. Mar'éi et al. [19] also observed that road traffic was the leading cause (72.2%), followed by falls from height (27.2%). Basak et al [20] also found that road traffic accidents or automotive accidents are the most common source of injury. Choubisa et al. [21] also observed road traffic accidents to be the prime causes of injury. The close fracture was the most common type (73.33%) subjects, followed by Compound type 1 fracture (26.67%). Most of the patients were operated within one week of injury (46.67%). Mario Ronga et al also observed that the average duration between trauma and surgery was 6.5±4.3 days (range: 5–14 days). Shrestha D et al. [22] found that the average time between injury and operation was 4.45 days (range 1-10 days). Mar'éi et al. [19] observed that the amount of time before surgery was 3.0±1.2 days, with a minimum of 1 day and a maximum of 7 days. Basak et al.[20] found that the majority 83.33 percent of cases were operated within one to seven days.

14 of the patients showed union in the 12th week of follow-up. 8 (26.67%) patients had union at the 8th week of follow-up, 2 (6.67%) at 16 weeks, 1(3.33%) at 20 weeks, while 4 (13.33%) at 24 weeks follow up and 1 patient showed nonunion. The mean time to union, was 12.93 ± 4.8 weeks. Shrestha D et al. [22] found that except for one case of delayed union, which was treated with percutaneous bone marrow injection, all fractures were united in an average of 18.5 weeks (range 14-28 weeks). Aksekili et al. [18] observed that the mean duration of the union was 20.7 (range: 16 to 28) weeks and 17.96 (range: 10 to 36) weeks, respectively among open and closed fractures. Rakesh Sharma et al. [23] observed that except for two cases of non-union, all fractures healed in an average of 19.13 weeks (range: 16-24 weeks). The

duration of the union was observed to be 19.53±.318 weeks by *Mar'éi et al*. [19] *Choubisa et al*. [21] found that union took an average of 16.4 weeks.

Figure 5: Post-operative ROM (Range of Movement) pics of patient's Ankle Joint.

The normal union was seen in 25 (83.33%) subjects, delayed union in 4 (13.33%) and non-union was noted in 1 (3.33%) patient. The most common complications seen were joint stiffness 3 (10%), valgus deformity 2 (6.67%) and infection 3 (10%). Choubisa et al. [21] found that there had been one patient each who developed nonunion, deep infection, and valgus malalignment. On functional assessment, Excellent outcome was seen in 16 (53.33%), good outcome in 9 (30%), the fair outcome in 4 (13.33%) and poor outcome in 1 (3.33%) subjects. S M Teeny et al. [24] however found that there were 15 excellent and good (25%) results, 15 fair (25%) results, and 30 poor results (50 percent). Most of the other studies observed excellent functional outcomes among more than about 70% of patients. Like, J T Watson et al. [25] found that 75 percent of patients treated with open plating had satisfactory or excellent results.

Akhtar et al. [26] observed that 71.92% patients had great outcomes, 14.03% had good results, 8.77% had fair and 5.26% had poor results. Hasan Ali Qanaw et al. [27] observed that eleven patients (61.1%) scored excellent, four patients (22.2%) scored good, two patients (11.1%) scored fair, and one patient (5.55%) scored low.

Conclusion

The present study concludes that minimally invasive plate osteosynthesis using LCP is a safer

modality for treating distal tibial fractures without significant intra-articular comminution because it promotes rapid functional recovery, good fracture healing, and prevents serious skin problems. Early surgical fixation and early joint mobilization following surgery both appear to have significantly improved the patient's functional outcome, according to observations. However, more research is needed to gain a better understanding of injury patterns and functional outcome like MIPPO. A step in that direction is made by this study.

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