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A Prospective Study on Functional Outcome of Distal Tibial Fracture Fixation with Locking Compression Plate Using Minimally Invasive Percutaneous Osteosynthesis Technique

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Abstract

Tibia Fractures Distal make up 5-10% of all fractures in the lower extremities. Because of their intrinsic instability, lack of soft tissue, subcutaneous location and poor bone vascularity, these fractures are still difficult to treat. The use of locking compression plates to treat distal tibia fractures has become more popular recently. Stable plate fixation, preservation of fracture biology and reduction of soft tissue issues are the objectives of this technique. Locking plates can be applied through minimally invasive per cutaneous plate osteosynthesis or open reduction and internal fixation (MIPPO). The present study was a Prospective observational study among 30 patients with distal tibial fractures attending the Department of Orthopaedics at Maharajah's Institute of Medical Sciences during a period of 3 years from June 2020-2023. A written informed consent was taken from all individuals who were eligible for the study as per the inclusion criteria. In our study, the mean age of patients was 49 with a SD of 3.9 years. out of which 68% were male and 32% were female. The mean time of union for fracture was 21.4 weeks with a SD of 2.3 weeks. Functional outcome was measured using the AOFAS score and the mean AOFAS score was 67.4 with a SD of 8.5 at the end of 6 weeks and mean AOFAS score was 76.2 with a SD of 10.3 at the end of 3 months. mean AOFAS score was 83.56 with a SD of 5.36 at the end of 6 months. Under our study out of 30 patients 7 had excellent outcome, 18 had good result, 5 had acceptable result on basis of AOFAS score. MIPPO an effective treatment for distal tibia fractures. It enhances clinical and functional outcomes by reducing ankle stiffness and facilitating early mobilization of ankle movement.

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Key Words

Distal tibia fracture, LCP plate, MIPPO, AOFAS score

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INTRODUCTION

Tibia Fractures Distal make up 5-10% of all fractures in the lower extremities. Because of their intrinsic instability, lack of soft tissue, subcutaneous location, and poor bone vascularity, these fractures are still difficult to treat[1]. While external fixations are typically applied for primary stabilization until soft tissue oedema subsides but delay return to work, intra medullary nails frequently do not offer sufficient stability. The use of locking compression plates to treat distal tibia fractures has become more popular recently[2]. Stable plate fixation, preservation of fracture biology and reduction of soft tissue issues are the objectives of this technique. Locking plates can be applied through minimally invasive per cutaneous plate osteosynthesis or open reduction and internal fixation (MIPPO). Compared to shaft fractures, distal metaphyseal fractures have a greater degree of related soft tissue damage. The fundamental goal of the treatment of distal tibial fractures is

- Restoration of normal or near-normal alignment
- Ensure joint stability
- Articular congruity

Early mobility is made possible by surgical therapy, which also offers soft tissue access and prevents problems brought on by extended immobilization. Because the locking screws' head provides fixed angular stability regardless of friction fit, locking plates possess the biomechanical qualities of both internal and exterior fixations and offer higher holding power[3]. Reducing iatrogenic soft tissue injury and bone vascularity damage while maintaining the osteogenic fracture hematoma is the goal of minimally invasive plate osteosynthesis.

Aims and Objectives:

- To study the clinical features and factors associated with Distal Tibial fracture
- To study the functional outcome of distal tibia fractures treated by MIPPO Technique using the American Orthopaedic Foot and Ankle Society Score

MATERIALS AND METHODS

The present study was a Prospective observational study among 30 patients with distal tibial fractures attending the department of Orthopaedics Maharajah's Institute of Medical Sciences during a period of 3 years from June 2020-2023.A written informed consent was taken from all individuals who were eligible for the study as per the inclusion criteria.

Inclusion Criteria:

- Adults = 18 years
- Extra articular distal tibia fractures (AO OTA A1, A2, A3), partial-articular (AO OTA B1-B2-B3), Intra-articular fractures (AO OTA C1)

Exclusion Criteria:

- Age <18 years
- Intra-articular fractures (AO OTA C2-C3)
- Compound/open fractures
- Pathological fractures

Clinical and Radiological Examination was carried out on all patients in orthopaedic OPD/emergency trauma ward. Ankle AP Lateral and Mortise views were taken to identify the fractures. All the cases were taken for early primarily fixation with locking compression plate.

To treat a distal tibia fracture, an anteromedial approach was taken. An incision of 3-4 cm was made across the medial portion of the tibia, extending proximally over the tibia and beginning 1 cm below and over the medial malleolus centre. With the use of a tunneling device, a subcutaneous tunnel was opened, fracture reduction was accomplished with the aid of fluoroscopic guidance and a temporary plate was placed and secured to the bone using a k-wire. A cortical screw was inserted once the reduction was confirmed and then locking screws were inserted into the shaft and subchondral bone. Prior to inserting all of the distal screws, each patient's syndesmotic stability status was examined by externally rotating the ankle and pulling on the fibula with a hook. Syndesmotic screws were used in the event that syndesmotic instability was detected.

The patient was assessed clinically and functionally using AOFAS (American orthopaedic foot and ankle society) scoring system at follow up of 6 weeks, 3 months and 6 months. Partial and full weight bearing were allowed based on the radiological sign of fracture healing.

AOFAS (American Orthopaedic Foot and ankle society) scoring system[4].

It Has Three Components:

- **Pain Points:** Minimum of 0 and Maximum of 40
- **Function Points:** Minimum of 0 and Maximum of 50
- **Alignment Points:** Minimum of 0 and Maximum of 10
- Total score = Pain points + Functional Points + Alignment Points

Functional Outcome	
AOFAS scale (Functional outcome)	Grade
>89	Excellent
80-89	Good
70-79	Acceptable
<69	Bad

Data Analysis: The data that was collected entered in Microsoft Excel 2019 Spreadsheet and analyzed using IBM SPSS 21.0 version. The data on categorical variables was presented as frequency and percentages and the data of continuous variables was presented as mean and standard deviation. The data was analyzed and interpreted. Charts like bar diagram, pie chart was depicted wherever necessarily.

RESULTS AND DISCUSSIONS

In our study, Total study participants were 30, Details about Age, Gender, side of injury, Mode of injury and Type of fracture and Complications were collected. The mean age of patients was 49 with a SD of 3.9 years. out of which 20(66.7%) were male and 10(33.3%) were females. The majority of study participants had left leg fractures 18(60%) and right leg fractures 12(40%). According to Mode of injury, Road traffic accidents 17(56.7%), H/O fall 13(43.3%). According to Type of Fracture, A1 were 9(30%), A2 were 6(20%), A3 were 11(33.7%), B1 were 3(10%) and B2 were 1(3.3%). Among 30 cases, complications are seen in 7 cases (23.3%) in which 4(13.3%) had a superficial infection which was treated by dressing and antibiotic treatment, 2(6.7%) presented with wound dehiscence/plate exposed for which re-suturing was done and antibiotics were given, 2(6.7%) showed Delayed union.

The mean time of union for fracture was 21.4 weeks with a SD of 2.3 weeks. Functional outcome was measured using the AOFAS score and the mean AOFAS score was 67.4 with a SD of 8.5 at the end of 6 weeks and mean AOFAS score was 76.2 with a SD of 10.3 at the end of 3 months. mean AOFAS score was 83.56with a SD of 5.36 at the end of 6 months. Under our study out of 30 patients 7 had excellent outcome, 18 had good result, 5 had acceptable result on basis of AOFAS score.

Due to the soft tissue damage received at the moment of injury, which has an impact on the long-term clinical outcome, distal tibia fractures are among the most difficult injuries to treat[15]. Achieving anatomic realignment of the joint surface while maintaining sufficient stability to permit early motion is the aim of surgical treatment. Minimal devascularization of soft tissues and bones is used to achieve this, with the goal of reducing treatment-related problems[5,6].

In our study, the mean age of patients was 49 with a SD of 3.9 years. Our study findings were consistent with study done by Illur V[7], mean age of patients was 43 years, similar in a study done by Mauffry C[8], mean age was 46 years, in a study done by HasenbohlerE[2], mean age was 46 years, but mean age was less when compared to our study was found in a study done by Bahari S[9], mean age was 35 years. 20(66.7%)were male and 10(33.3%)were female. Similar findings were found in studies done by Mauffry C[8], Guo JJ[10], male to female ratio is nearly 2 times. Among 30 cases, complications are seen in 7 cases (23.3%) in which 4(13.3%) had a superficial infection which got treated by dressing and antibiotic treatment, 2(6.7%) presented with wound dehiscence/plate exposed for which re-suturing was done and antibiotics were given, 2(6.7%) showed Delayed union.

The mean time of union for fracture was 21.4 weeks with a SD of 2.3 weeks. In a study done by Bahari S[9], mean time of union was 22.4 weeks, similar in a study done by Redfern DJ[11], mean time was 23 weeks. .our study findings were consistent with study done by Illur V[7], mean time of union for fracture was 22 weeks. Functional outcome was measured using the AOFAS score, mean AOFAS score was 83.56with a SD of 5.36 at the end of 6 months. Similarly in a study done by Illur V[7], mean AOFAS score was 83.56. in a study

Fig 1: Mean time for fracture Union

Fig 2: Follow up at 3 months

Fig 3: Follow up at 6 months

Table 1: Frequency distribution of study participants according to Fracture.

Age	Mean	49 years
	SD	3.9 years
Gender	Male	20(66.7%)
	Female	10(33.3%)
Side	Left	18(60%)
	Right	12(40%)
Mode of Injury	RTA	17(56.7%)
	H/O Fall	13(43.3%)
Type of Fracture	A1	9(30%)
	A2	6(20%)
	A3	11(33.7%)
	B1	3(10%)
	B2	1(3.3%)

Table 2: Distribution of study participants according to Complications.

Complications	Frequency	Percentage
No complications	23	76.7
Superficial infections	4	13.3
Wound dehiscence	2	6.7
Delayed Union	2	6.7
Total	30	100

Table 3: Functional Outcome of study participants according to AOFAS score

AOFAS score	Frequency	Percentage
Excellent	7	23.3
Good	18	60
Acceptable	5	16.7
Bad	0	0
Total	30	100

Table 4: Mean AOFAS score of study participants at Follow up

Follow up	mean	SD
6 weeks	67.4	8.5
3 months	76.2	10.3
6 months	83.56	5.3

done by Collinge *et al.,* mean AOFAS score was 85. Under our study out of 30 patients 7 had excellent outcome, 18 had good result, 5 had acceptable result on basis of AOFAS score. In a study done by Saini R[12], 21(70%) had excellent outcome, followed by 8(26.7%) had good outcome and 1(3.3%) had fair outcome. Our study findings were consistent with study done by Illur V[7], out of 20 patients, 14 had good outcome and 4 had fair outcome. Study by Ozkaya U[13], of 22 patients with distal third tibial fractures treated with titanium locking compression plates using MIPO technique, reported a total of 81% of good to excellent outcome assessed using AOFAS Score. Abdulla S[14], reported 80% excellent results with this operative method.

CONCLUSION

MIPPO provides a biological advantage by maintaining the peristyle blood supply, which helps to indirectly reduce distal tibia fractures by restoring length and alignment and lowering the risk of malunion and deformities. This makes MIPPO an effective treatment for distal tibia fractures. It enhances clinical and functional outcomes by reducing ankle stiffness and facilitating early mobilization of ankle movement.

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