

7 A STUDY OF DISTAL TIBIA FRACTURES TREATED WITH DISTAL TIBIA PLATE WITH OPEN REDUCTION AND MIPPO TECHNIQUE

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ABSTARCT

Background: Fractures of the distal tibia can be challenging to treat because of the limited soft tissue, the subcutaneous location, and poor vascularity. There is a considerable debate regarding the best method for treating distal tibial fractures. In present study we have treated various distal tibial fractures with distal tibia plate either by open reduction and internal fixation or using MIPPO technique. **Materials and methods:** All the patients were evaluated clinically with AOFAS Score and radiologically at 4 weekly intervals for up to 6 months. **Results:** Mean time to union was 17.5 weeks. All fractures united with acceptable alignment and angulation. Two cases of superficial infection were noted, with two cases of joint stiffness. Mean AOFAS score was 90 at a 6 months follow-up. We report satisfactory outcomes with the use of the distal tibia locking plate in treatment of distal tibial fractures. There were only 4 cases with fair results and none of the case had poor result.

Conclusion: At the end of our study we conclude that proximal tibia plate with either open or MIPPO technique is treatment of choice for various distal tibia fractures.

keywords: pilon fracture, MIPPO-minimally invasive percutaneous plate osteosynthesis, distal locking tibia plate, American Orthopaedic Foot and Ankle Score (AOFAS)

Introduction

The management of Distal tibia fractures has always remain controversial for orthopaedic surgeons. Not only are these fractures relatively common, but they are often difficult to treat.^{1,2} The subcutaneous location of the anteromedial surface of the tibia means that severe bone and soft tissue injury is not infrequent, and there is a high incidence of open fractures compared with other long bones.^{3,4} There is a considerable debate regarding the best method for treating distal tibial fractures. In the past close reduction and casting followed by functional bracing were the prime modalities for treating the open and close tibial fractures. Frequent soakage in cast, inaccessibility of dressing, breakage of cast, knee and ankle stiffness and high chances of delayed and non-union produced discouraging results leading to a wave of new methods to treat these fractures effectively.⁵ These complications also place a considerable strain on the health services of our country.

Some surgeons treat the fracture based on fracture pattern and level of the fracture, mostly on external fixation if soft tissue injury is found, whereas others use predominately plate fixation and some prefer nailing techniques.⁶ The interest in internal fixation has centered on the use of AO plates which have been well documented by Thunold and Roksendoahl in late part of twentieth century.

AO plate was extremely useful for closed fractures. Many surgeons have treated open fractures by immediate wound debridement, rigid fixation by plate and some sort of soft tissue coverage.⁷ The indications of plating were preformed and restricted. Its use in high velocity comminuted fracture and segmental fractures were questionable. Open reduction, drainage of fracture hematoma, poor soft tissue coverage because of subcutaneous location of tibia have decreased

its popularity among orthopaedic surgeons around the globe. Indirect reduction was introduced in the 1988 by Mast et al. and others. It was an attempt to decrease surgical dissection by relying on ligamentotaxis, blind repositioning of fragments, reduction aids such as the distracter and other methods to maintain soft tissue integrity and preserve bony perfusion.⁸

In the 1990s, Krettek et al. popularized MINIMALLY INVASIVE PERCUTANEOUS PLATES OSTEOSYNTHESIS TECHNIQUES using conventional implants placed through small incisions and submuscular (subcutaneous) tunnels. With MIPPO method rate of delayed union and infection rate is come down.⁹

Aims and objectives

- To study the short term results of distal tibia fractures fixed with distal tibia plate with open reduction or MIPPO techniques
- To study the factors affecting the results of surgery
- To compare this results with those in literature

Materials and methods

This study was carried out at Orthopaedic clinics of Shree Sayajirao Gaekwad Hospital. The study was approved by Ethical committee of our University and informed consent was taken from patients. All patients were informed and explained about the injury and their treatment plan.

Study design: Retrospective Observational Study.

Sample size: Based on feasibility criteria

Study population: Patients admitted in wards in the Department of Orthopaedics, Medical College and S.S.G. Hospital, Vadodara.

Investigations: X ray

Period of Data Collection: March'2015 to february'2016.

Outcome parameters: 4 weekly assessment of all operated patients clinically by lysholm knee score and radiologically for up to 6 months.

CRITERIA FOR PATIENT SELECTION

Inclusion Criteria:

1. Adults above age of 18yrs
2. The fractures of the distal tibia with or without intra-articular extension (including lower third fractures of tibia)
3. Closed fractures, fractures with Open grade-I and II wounds were also included.

Exclusion Criteria:

- Pathological fractures
- Open grade III fractures
- Fractures in children
- Old neglected fractures
- Old fractures with implant failure

➤ Pregnant females

preoperative assessment:

Anteroposterior and lateral radiographs of the leg with ankle joint were taken to determine the fracture pattern and classifying the fractures according to the AO classification for preoperative planning.¹⁰ The patients were stabilized and local soft tissue condition assessed pre-operatively, else the surgery was deferred till the wrinkle sign appeared. . Temporary immobilization was given by above knee posterior plaster splint. Patient was admitted and calcaneal pin was given in all cases under general anaesthesia and primary debridement and suturing was performed in open fractures.

Surgical technique

Surgery was performed on plain radiolucent table. The affected limb was scrubbed and prepared with savlon. Painting and draping was done under aseptic and antiseptic conditions. Again the reduction was checked in image intensifier and incision was put depending on the fracture and size of implant used. Incisions were anticipated and planned. We used MIPPO technique if close reduction can be achieved and checked under image intensifier. For minimally invasive plate insertion, small incision of 3-4 cm length either vertical or horizontal placed distal to the fracture over the medial aspect of tibia to access the medial malleolus.¹¹ An extraperiosteal, subcutaneous tunnel is created and precontoured locking compression plate for the tibia is then inserted along the tunnel. The plate can be slid under IITV image control in A-P and Lateral views. Drill guide can be used as handle for percutaneous insertion into one of the distal combi holes.

The locking screw didn't provide interfragmentary compression; therefore, any desired compression was achieved with standard lag screws. The articular fractures was reduced and compressed prior to fixation of the distal tibial plate with locking screws.¹²

If a combination of cortex and locking screws had been used, the cortex screw had been first inserted to pull the plate to the bone.

PROXIMALLY: The stab incisions are kept directly over the holes of the plate.

Antero-medial approach is used for Open Reduction and Internal fixation with Distal tibia plate.^{2,10} Incision length is decided according to the level of fracture and length of plate to be fixed. Incise the subcutaneous tissues and deep fascia for adequate exposure of the fracture.

manually reduce the fracture with bone holding or pointed clamps, apply k wire to temporary fix it. Then distal tibia plate of sufficient length was chosen so that at least 3 screws can be applied proximal to the fracture of tibia. These plates are precontoured and cortical screws can be applied to flush the plate to the bone.

Patients were followed up clinically and radiologically in the outpatient clinic at monthly intervals till 6 months. Suture removal was done at 2 weeks. Progressive weight bearing was allowed according to the callus formation assess in follow up radiographs. Full weight bearing was permitted only after clinico-radiological evidence of union. Union was defined as bridging of three of the four cortices and disappearance of the fracture line on the plain radiographs for a patient who was able to bear full weight.^{1,2} Fracture in the process of union but not united at six months was considered as delayed union. At the end of six months, functional outcome score was analysed using the AOFAS score.

Observations and results:

- **Age and sex:** There were 40 patients in our study. With mean age was 41.5 years. There were 30 males and 10 females in our study.
- **Average hospital stay:** Average injury surgery interval was 1.2 weeks(9 days). Average hospital stay was 2.1 weeks(15 days).
- **Mode of injury:** There were 50%(20) patients with injury due to RTA, 27.5%(11) patients were injured due to fall from height, 7.5%(3) had injury due to assault and 15%(6) patients were injured due to fall of weight.

- **Fracture classification**

Fracture pattern		Patients	Percentage (%)
A	A1	10	25
	A2	8	20
	A3	6	15
B	B1	0	0
	B2	5	12.5
	B3	5	12.5

C	C1	4	10
	C2	2	5
	C3	0	0
Total		40	100

- **associated injury:** 18(45%) of our patients had associated fibula fracture. 6 of our patients had head or chest injuries.

- **injury surgery interval**

Interval	Patients	Percentage (%)
< 1 week	24	60
1 - 2 week	12	30
2 - 4 week	4	10
4 - 6 week	0	0
Total	40	100

- Most patients 24(60%) were operated within first week of trauma.
- Delay in the surgery in other patients occurred due to various factors - associated head or chest injury, local site edema or blisters or other medical conditions.

- **Method:** 16 patients were operated with open reduction and internal fixation while 24 patients were candidates for MIPPO technique.
- **TYPE OF PLATE**

Type	Patients	Percentage (%)
Distal Tibial Metaphyseal locking plate	22	55
Clover leaf plate	2	5
Anatomical distal tibia locking plate	16	40
Total	40	100

Type of plate selection varied according to bone stock, degree of comminuation, level of fracture and age of patients.

- **Time taken for union**

Time in week	Patients	Percentage (%)
12 to 18	20	50
18 to 24	20	50
24 to 30	-	-
Total	40	100

20 (50%) fracture were united between 12 - 18 weeks.

Average time of union 18.65 weeks.

- **Complication**

Complication	Patients	Percentage (%)
Non union	0	0
Implant failure	0	0
Implant loosening	0	0
Joint stiffness (Ankle)	2	5
Infection	1	2.5
Limping	2	5

- **Type of fracture with results**

Type		Excellent	Good	Fair	Poor	No. of Patients
A	A1	10	0	0	0	10
	A2	8	0	0	0	8
	A3	6	0	0	0	6
B	B1	0	0	0	0	0
	B2	4	1	0	0	5
	B3	4	0	1	0	5
C	C1	0	2	2	0	4
	C2	0	1	1	0	2
	C3	0	0	0	0	0
		32	4	4	0	40

All type A fracture pattern had excellent result most probably due to articular surface of ankle joint was not involved.

3(75%) out 4 fair result were fall in Type C AO/OTA classification.

- **Final functional outcome(AOFAS score)**

RESULT	Patients	Percentage(%)
Excellent	32	80
Good	4	10
Fair	4	10
Poor	0	0
Total	40	100

- **Statistics of method of surgery with results**

Method	No. of patients	Mean of AOFAS score	Standard deviation	t value (paired t test)	P value
Open	16	90.68	6.43		
MIPPO	24	91.87	5.58		
Total	40			0.54	0.59

*statistically not significant at $p < 0.01$

There is no significant difference in the results whether we use open reduction or MIPPO technique.

Discussion

We have also compared this study with international study Wang Cheng, Ying li & Wang Manyi Traumatology department, Peking University. Clinical Medical College, Beijing Jishvitan Hospital, Beijing, China.¹³

which shows comparable results.

Parameter	Our study	Wang cheng study(30 cases)
Mean age	41.5 years	39.3 years
Sex		
Male	75%	60%
female	25%%	40%
Type of fracture		

A	60%	53.3%
B	25%	20%
C	15%	26.6%
Type of plate used		
Distal tibia metaphyseal	55%	AO-distal tibia locking plate in all cases
Clover leaf plate	5%	
Anatomical distal tibia plate	40	
Average time taken for union	17.5 weeks	17.93 weeks
Implant failure	0	1 case
Results		
Excellent	80%	66.66%
Good	10%	26.66%
Fair	10%	3.33%
poor	0	3.33%

With the introduction of locking plates, many limitations of conventional plating have been overcome. The angle stable locking screws allow secure fixation of the opposite condyle with a single plate thus avoiding extensive soft tissue dissection. Contact area between plate and bone is minimal thus preserving blood supply of bone.¹⁴

Our study also shows that there is no significant difference in results between MIPPO or open reduction technique. We had 26(65%) patients with associated injury, out of which ipsilateral lower limb injury comprise maximum 8(20%) number of patients. Thus the average injury surgery interval in the study was 1.2 weeks(9 days). While average hospital stay was 2.1 weeks(15 days). We have achieved 100% fracture union rate in our study.

There was only one case of early post operative infection, which was healed with antibiotics at final follow up.

The average time taken for union in our study was 17.5 weeks.

Most of our patients had no restriction of knee range of movement, 36(90%).

Most of our patient, 36(90%), can squat and sit crossed leg with ease and can walk without limp and support.

It gives advantage to achieve good articular congruity in intra articular fractures which gives excellent ankle range of movement.^{15,16}

By MIPPO distal tibia plate in severe comminuted fractures, biology of fracture site remain unchanged so, good healing of fracture occurs in minimal time.¹⁷

Complication like pin tract infection seen with external fixation, ilizarov fixator¹⁸ and unstable reduction seen with tibia interlock nail or ender's nail in distal tibia fractures not seen with use of this plate.

Conclusion

Thus, it is concluded from the study that open reduction & MIPPO distal tibia plating is an excellent mode of treatment for fractures of distal tibia, which consistently gives long term good results.

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