Functional and Radiological Outcome of Minimal Invasive Plate Osteosynthesis for Fractures of Tibia

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ABSTRACT

Objective: To determine the outcome of closed proximal and distal tibia fractures managed by minimal invasive plate osteosynthesis (MIPO).

Material and Methods: This descriptive study of 18 patients was conducted from June 2013 to May 2014. In this study all patients with AO type 42B1-3, 42C1-3 and 43A1-3 of adult age and either sex were included, while patients with open fracture, poly trauma patient and patients with associated neurovascular injuries were excluded. Functional outcome of the procedure was measured in terms of Range of motion (ROM) and fracture healing time.

Results: Total of 18 patients was included of which 13 were male and 5 were female. Age ranged from 22 to 57 years. In more than 90% of the patients the functional outcome of the procedure was excellent. There was one complication and there was no mortality in the series.

Conclusion: MIPO is a very effective procedure for the treatment of proximal and distal tibial fractures. It is effective irrespective of the age of the patient and mode of injury.

Key words: Minimal Invasive Plate Osteosynthesis (MIPO), Tibial Fracture, and Functional outcome.

INTRODUCTION

Tibia fractures are serious injuries due to high energy trauma, soft tissue destruction is mostly general and open fractures, compartment syndromes, and vascular damages are associated usually.[1,2] Plating with open reduction usually presents difficulties, such as infectivity and soft tissue destruction. It is also well known that intramedullary nails and percutaneous external fixation producing less infection risks and cause no more soft tissue damage as compared with conventional compression plating techniques.[3-6] Nonetheless, intramedullary nails and external fixators can be associated with higher risks of mal or non-union.

An alternative technique for tibial fractures is Minimal invasive plate osteosynthesis (MIPO) using a locking plate.[7-10] This MIPO technique can preserve the periosteal blood supply and offers a clear biological advantage over conventional Plating, due to reduction of iatrogenic damage of surrounding soft tissues. The aim of this study was to determine the outcome in terms of range of movement and fracture healing of MIPO for tibial fractures.

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MATERIAL & METHODS

This descriptive study was conducted from June 2013 to May 2014. Preoperative planning was done which included careful study of the x-rays, considering intraoperative reduction techniques and choice of implants, was done.

Type A (extra articular) fractures were reduced by ligamentotaxis alone with indirect manipulation and all other fractures were reduced by indirect means under image intensifier. Through a small distal incision the plate was glide in submuscular plane over the periostium and bone for the fractures involving the distal tibia while a small incision proximally was given for fractures involving the proximal tibia. The shape of the implant serves as a reduction tool. A precontoured or properly contoured plate while using Dynamic Compression Plate or Locking Compression Plate applied according to a preoperative radiographic assessment. Temporary fixation was performed with K-wires through the screw holes (or inserted drill sleeves) to check the final plate position before the first screw was inserted. Once accurate restoration of length, alignment and rotation have been achieved, provisional stabilization of the plate was performed with a single conventional “positioning” screw inserted through the plate. Reduction was finalized by pulling the distal

segment against the plate with a non-locking screw or other instrument (eg, push-pull device). Then further proximal and distal screws were inserted. The number and position of the screws inserted was dependent on the individual fracture pattern and bone quality. Wounds were closed and antiseptic dressing was done.

The patients were followed up after every four weeks and the rate of healing was assessed clinically as well as radiologically.

Table 1 : Union Scale Score

Features	**Score**			
	0	**1**	**2**	**3**
Mobility	Frank mobility in both planes	Restricted mobility in both planes	Minimum mobility in one plane	No mobility at all
Tenderness	Present	Absent	_	_
Radiological Features	No callus at all	Minimum en sheathing callus	Good en sheathing callus or internal callus with bridging of at least two cortex	Good internal callus with bridging of all four cortex

Outcome was evaluated by using Knee Society clinical rating scores,[11] where excellent means 85-100; good, 70-84; fair, 60-69; and poor < 60. The analysis was conducted using SPSS ver. 17.

RESULTS

A total of eighteen patients with tibia fracture were managed by using the MIPO technique with the follow up period of about 6 months. There were 13 male and 5 female of overall mean age of 40.50 years ± 11.84, with an age range of 22-57 years. The mechanism of injury was trauma in all the patients. There was no comorbidity in 16 patients while diabetes mellitus and hypertension and diabetes mellitus was found in 1 patient each. Majority of the patients, 10 (55.6%), were harboring distal tibial diaphysis type of fracture, while 6 (33.3%) were having proximal tibial metaphysis and 2 (11.1%) was having distal tibial metaphysis fracture.

Figure 1:

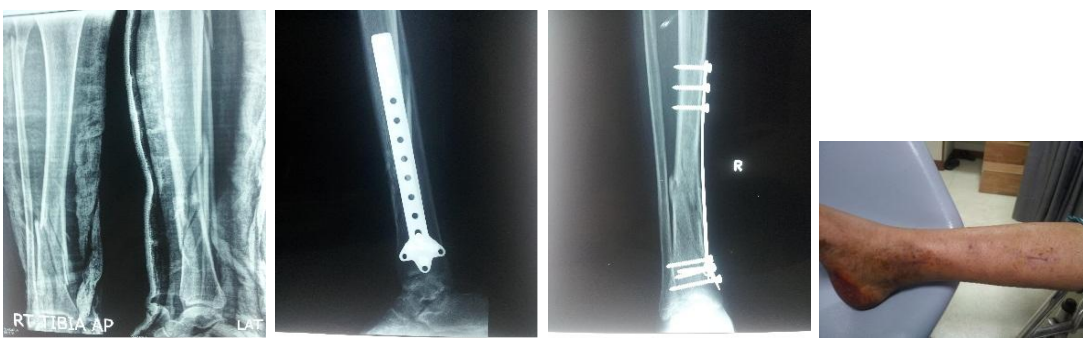

Figure 2:

Table 2: Fracture Healing Time In Months

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3.0	4	22.2	22.2	22.2
	3.5	5	27.8	27.8	50.0
	4.0	4	22.2	22.2	72.2
	4.5	2	11.1	11.1	83.3
	5.0	1	5.6	5.6	88.9
	6.0	2	11.1	11.1	100.0
	Total	18	100.0	100.0	

Fracture healing was succeeded by 17 (94.44%) of 18 patients at an total average of 3.9 months (range = 3-6 months) (Table 2). There was 1 case of non-union, which may be due to the co-morbid condition, which the patient was having. Functional outcome were excellent in 14 (77.7%) patients and good in 3 (16.66%). Some of the pre-operative and post-operative pictures are shown in Figure 1 & 2.

DISCUSSION

In open reduction, the fracture site can be approached easily. However, disruption of blood supply to the site of fracture cannot be avoided, non-union and infection occur with high incidence. The deep infection rate has been reported from 11% to 80%, and most authors also reporting rates of 18% or more.[4,12] Problems associated with open reduction and internal fixation with plating have replaced the use of external fixators.[6, 13-14]

The use of intramedullary nails as a treatment for tibial shaft fractures have also been advocated.[5, 15-16] The intramedullary nailing in proximal and distal tibia fractures with a short segment also presents an additional challenge for higher incidences of mal-reduction resulting in non-union have been reported.[17-19] Nailing is contraindicated for fractures with intra-articular involvement. Minimally invasive technique can be performed without further stripping of the already damaged soft tissue envelope, and providing the load-sharing device with superior stiffness and stability. Due to the development of MIPO, the popularity of locking plates for the treatment of these complex fractures has significantly increased, because they do not require large incisions or soft tissue damage, and also minimizing failures because of infection and non-union. The effectiveness of the MIPO procedure in terms of ROM and fracture healing time is somewhat comparable with the international literature[4, 12, 16-19] but a slight difference is there which might be due to the fact that it is our initial experience.

CONCLUSION

We concluded that MIPO is a very effective procedure for the treatment of proximal and distal tibial fractures. It is effective irrespective of the age of the patient and mode of injury.

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