Scholars Journal of Applied Medical Sciences (SJAMS)
Abbreviated Key Title: Sch. J. App. Med. Sci.
ISSN 2320-6691 (Online)
ISSN 2347-954X (Print)

A Unit of Scholars Academic and Scientific Society, India
www.saspublishers.com

Orthopedics

A Study of Minimally Invasive Plate Osteosynthesis for the Treatment of Distal Tibial Fractures

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Original Research Article

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Article History
Received: 04.05.2018
Accepted: 15.05.2018
Published: 30.05.2018

DOI:
10.36347/sjams.2018.v06i05.051

Abstract: Distal tibial fractures are very common in orthopedic clinics; they are difficult to deal with and sometimes require operative treatments. Fixation with locking compression plate by minimally invasive percutaneous plate osteosynthesis technique is an alternative treatment available. The aim of the present study was to find out the results of MIPO and its clinical outcomes. This prospective study was done in Rajiv Gandhi Institute of Medical Sciences [RIMS], Adilabad from the period of October 2013 to January 2016. 25 patients were treated with minimally invasive plate osteosynthesis [MIPO]. Patients were examined clinically and radiologically at periodical intervals 4-6 weeks for a period ranging from 6 - 40 weeks. Inclusion criteria were closed and open fractures in adults of distal tibial bone. Exclusion criteria were pathological fractures, polytrauma, crush injuries. The number of the male was 15 (60%) and the female was 10 (40%) according to AO classification Type A =15, Type B=8, Type C=2. Right side tibial involvement was seen in 17 (68%) and the left side was in 8 (32%). Average age 43.08 yrs, an average duration of hospital days was 13.6 days and average time to Radiological union was 11.04 weeks. The results were n=9 (36%), good results were in n=7 (28%) and fair results were n=4 (16%), Poor n=5 (20%). The patients reached full weight bearing after an average of 3.6 months. The average range of motion flexion/extension 17°/34° patient was able to walk without restrictions. The minimally invasive plate osteosynthesis using locking compression plate is a good and an effective technique for the treatment of fractures of the distal tibia. It has advantages like early rehabilitation, mobilization and reduced postoperative pain. It provides good stability with pre-contoured plates and improves the outcomes particularly in elderly patients. It has overall lower incidences of complications and excellent clinical outcomes.
Keywords: Minimally Invasive Plate Osteosynthesis [MIPO], Distal tibial fractures.

INTRODUCTION

The distal tibial fractures present several challenges. The location is close to the ankle joint and there is relatively thin soft tissue coverage as compared to the rest of the tibial bone. The distal tibial fractures usually occur as a result of high energy trauma such as Road Traffic Accidents, falls etc. They comprise 1% of the lower limb fractures and 5-10% of tibial fractures [1-3]. These fractures are often comminuted and unstable. They may be present with or without intra-articular extension. If injury to articular surface of the distal tibia occurs, it is in varying degrees with fragments of the articular surface being driven proximally into the metaphysis of the tibia by the impact [4] and is most of the times these fractures considered difficult injuries to treat due to soft tissue involvement [5]. Because of its complexity and nature of injury the optimal treatment of these kinds of fractures is controversial. Non-operative treatment is technically demanding and sometimes associated with joint stiffness in 40% of cases as well as shortening and rotational malunion in more than 30% of treated cases [6, 7]. In recent years Minimally Invasive Plate Osteosynthesis [MIPO] has become the preferred technique when operative treatment of distal tibial fractures is required. Some authors have claimed that results of Minimally Invasive Plate Osteosynthesis [MIPO] are comparable or superior to the results of open anatomic reduction and internal fixation [8]. The AO distal tibia locking plate applied percutaneously by adhering to minimally invasive percutaneous plate osteosynthesis technique was developed by AO group to address the soft tissue problems associated with the open reduction and internal fixation. The minimally invasive plate osteosynthesis [MIPO] involves small skin incisions, minimal surgical dissection, and gentle soft tissue retractions followed by indirect fracture reduction and minimal hardware application like screws insertion with stab incision and avoidance of excess screw placements. This technique is reported to

have minimal periosteal disturbances, faster callus and best possible option as it permits adequate fixation in a biological manner [5]. MIPO aims to achieve correct limb length and axial and rotational alignment of the main fragments with minimal damage at the fracture site [9]. However the disadvantage is the surgeons have to rely on C-arm intensifiers during the reduction and maintenance because the fractures are not visible to the naked eye during minimally invasive plate osteosynthesis causing an increased risk of radiation exposure [10]. The distal tibia receives circulation from extra-osseous anastomosis of branches of anterior and posterior tibial arteries which enter the tibia through its medial surface. Open plating usually causes greater disruption of blood supply of metaphyseal region than the percutaneously applied plates [11, 12]. MIPO, therefore, have higher rates of union and lower postoperative complications as compared to traditional approach [13-15] With this background we in the present study tried to evaluate the outcomes of treatment of distal tibial fractures with MIPO in both male and female patients reporting to RIMS hospital, Adilabad.

MATERIALS AND METHODS

This prospective study was done in Department of Orthopedics, Rajiv Gandhi Institute of Medical Sciences and Hospital [RIMS], Adilabad from the period of October 2013 to January 2016. Institutional Ethical committee permission 25 patients were treated with Minimally Invasive Plate Osteosynthesis [MIPO]. Patients with lower distal tibial fractures were chosen that who were unsuitable for locked intramedullary rod fixation due to the location of fractures. The fractures were classified according to Muller‘s AO classification system [16] According to AO classification Type A =15, Type B=8, Type C=2. Inclusion criteria were closed and open fractures in adults of distal tibial bone. Exclusion criteria were pathological fractures, polytrauma, crush injuries. Patients were operated on as soon as the swelling subsided on the same day. Patients in whom gross swelling was present they were splinted and leg elevated till the swelling subsided and wrinkles appeared over the ankle joint. In cases of open injuries, the wounds were debrided initially and fixation was performed as they healed in the third week. The same surgeon performed all the surgeries and a standardized technique was used. The patients were placed in supine position with the limb elevated for the proper anteroposterior view. Fibula length was restored first by osteosynthesis plate followed by reconstruction of the distal tibia. A 3-4 cms oblique incision from the proximal-lateral to distal-medial in the anteromedial surface of the leg was performed. The bony segment is distracted and a tunnel subcutaneously was created and the plate is inserted through it the plate is fixed temporarily with wire. Fracture reduction followed by proximal plate fixation using 12 mm stab incision, centered between two holes. Two screws were inserted through the single incision while retracting the skin proximally for proximal screw placement and distally for distal screw placement only the required numbers of screws were utilized to ensure the stability of the implants. No screw was placed at the fracture level. Postoperatively POP above the knee was applied for one week. Sutures were removed after 2 weeks. Active and passive knee exercises and ankle range of motion exercises were encouraged. Partial weight bearing with crutches was allowed for the first 6 weeks then gradually increased to full weight bearing. Patients were assessed clinically and radiologically at monthly intervals until radiological healing and three months thereafter up to 18 months. Bone union was defined as the presence of callus bridging on radiographs.

RESULTS

25 cases of distal tibial fractures were treated with minimally invasive plate osteosynthesis [MIPO]. The Average period of follow up of patients was 18 months. The Male patients were 15 (60%) and the female patients were 10 (40%) the average age of the patients was 43.08 yrs. The common cause of fractures was RTA in 15 (60%) of cases followed by Fall from height FFH in 8 (32%) of cases and 1 (4%) each was sports-related injury and direct hit case shown in table 1.The fractures were classified according to AO classification to AO classification Type A =15, Type B=8, Type C=2. Right side tibial involvement was seen in 17 (68%) and the left side was in 8 (32%). the average duration of hospital days was 13.6 days and average time to Radiological union was 11.04 weeks. One case had developed the superficial infection that was managed adequately with IV antibiotics. Patients were examined clinically and radiologically at periodical intervals 4-6 weeks for a period ranging from 6 - 40 weeks.

Table-1: showing the clinical profile of the patients involved in the study

Sex/Age in years	Side	Cause	AO fracture type	Open	Hospital Stay days	Time to Radiological Union
M/37	Left	RTA	43-A1	NO	12	10
F/45	left	FFH	43-A2	NO	14	12
M/55	Right	RTA	43-B2	I	13	13
M/28	Right	SPORTS RELATED	43-A2	NO	14	10
M/40	Right	FFH	43-A2	NO	12	11
F/58	Right	FFH	43-B1	NO	14	15
F/32	Left	RTA	43-B2	NO	20	14
M/60	Right	FFH	43-B1	I	21	11
M/71	Right	DIRECT HIT	43-A2	NO	16	10
M/42	Left	RTA	43-B2	NO	15	17
M/39	Right	FFH	43-B1	NO	14	8
M/25	Right	RTA	43-A1	NO	10	13
M/36	Right	RTA	43-A2	NO	10	11
F/29	Left	RTA	43-A1	NO	15	9
F/21`	Left	FFH	43-A2	NO	12	16
F/49	Right	RTA	43-B2	I	13	10
M/57	Right	RTA	43-B2	NO	14	11
F/71	Right	RTA	43-A2	NO	12	11
M/55	left	RTA	43-C1	NO	11	16
M/60	Right	FFH	43-A2	NO	12	14
F/39	Right	RTA	43-A1	NO	13	13
F/27	Right	RTA	43-C1	NO	14	15
F/37	Right	RTA	43-A2	I	15	14
M/29	Right	FFH	43-A1	NO	14	12
M/35	Left	RTA	43-A2	NO	10	11

Clinical outcomes were evaluated as per Teeny Wiss clinical assessment criteria [17] based on 100 points system [27 of A study of] The results were n=9 (36%), good results were in n=7 (28%) and fair results were n=4 (16%), Poor n=5 (20%) given in table 2. The patients reached full weight bearing after an average of 3.6 months. The average range of motion flexion/extension 17°/34° patient was able to walk without restrictions.

Table-2: Clinical results graded as excellent, good, fair or poor as per Teeny Wiss criteria [17]

Rating	points	Results/percentage
Excellent	(>92 points)	9 (36%)
Good	(87-92 points)	7 (28%)
Fair	(65 - 86 points)	6 (24 %)
Poor	(<65 points)	3 (12%)

DISCUSSION

Fractures of the tibia are complex due to their location and often difficult to treat and are associated with soft tissue injuries. The state of soft tissue injuries and degree of communication affect the long-term clinical results [5]. Failing to attend the soft tissue injuries may lead result in wound dehiscence especially when the soft tissue injuries are significant and bridging external fixation is advantageous for skeletal and soft tissue stabilization [18]. MIPO was initially developed for subtrochanteric and distal femoral fractures [15] and subsequently modified for fractures of the femoral shaft and proximal and distal tibia [14, 19]. The minimally invasive techniques are based on the principles of limited exposure, indirect reduction methods and limited contact between bone and implant to achieve fracture reduction. In a study by S Bahari *et al.* [20] using minimally invasive plate osteosynthesis for tibial plateau fractures had 20% of the patients developed superficial or deep infections despite acceptable outcomes? In our study, we did not have serious superficial or deep infections. Only one patient had the superficial infection it was adequately managed by IV antibiotics. In our study, we found good and excellent results in 16 (64%) and fair results in 6 (24%) of cases. In a study by Hasnain Raza *et al.* [21] using MIPO for tibial plateau fractures found an acceptable anatomic reduction in 93% of the patients and other

studies reporting 91-100% [14, 22] In our study we had an acceptable anatomic reduction in 88% of cases only 12% had a poor result. S Bahari *et al*. [20] had found acceptable alignment and angulation in all the cases and they found the mean time of union was 22.4 weeks. In our study, the average time to union was 23.5 weeks. In our study, we found the mean interval for the radiological union was 12.3 weeks and one study by Rajesh Bhatia *et al*. [5] found the mean interval of the radiological union to be in 18 weeks. In a study by Pramod Devkata *et al.* [23] showing the outcomes of minimally invasive plate osteosynthesis MIPO for distal tibial fractures found mean hospital stay was 16 days. In the present study, we found the mean duration of hospitalization was for 13.6 days. They had also found anatomical union in 51 out of 53 cases. We had an anatomical union in 22 of 25 cases. The MIPO is sometimes criticized for not achieving anatomical reduction as an open method. However, literature is not clear regarding an acceptable method of reduction in the fractures of the distal tibia. An ideal method required for treatment of distal tibial fractures should ensure stability, anatomical repositioning, and lesser soft tissue dissections. The minimally invasive plate osteosynthesis [MIPO] appear to be close to it.

CONCLUSION

The minimally invasive plate osteosynthesis [MIPO] using locking compression plate is a good and an effective technique for the treatment of fractures of the distal tibia. It has advantages like early rehabilitation, mobilization and reduced postoperative pain. It provides good stability with pre-contoured plates and improves the outcomes particularly in elderly patients. It has overall lower incidences of complications and excellent clinical outcomes.

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