IJPSR (2022), Volume 13, Issue 12 (Research Article)

INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH

Received on 06 April 2022; received in revised form, 16 May 2022; accepted, 03 June 2022; published 01 December 2022

EVALUATION OF FUNCTIONAL OUTCOME OF MINIMALLY INVASIVE PLATE OSTEOSYNTHESIS (MIPO) IN PROXIMAL TIBIA FRACTURES

P. Krishna Sandeep, M. S. Deiv Ramkumar, Alagurswamy Ravi, Arun Kumar and Dr. Yeshwanth Subash*

Department of Orthopaedics, Saveetha Medical College and Hospital, Thandalam, Chennai - 602105, Tamil Nadu, India.

Keywords:

Proximal tibia, MIPO, Soft tissue, Sanders score

Correspondence to Author:
Dr. Yeshwanth Subash

Professor,
Department of Orthopaedics,
Saveetha Medical College and Hospital, Thandalam, Chennai - 602105, Tamil Nadu, India.

E-mail: djyesh@rediffmail.com

ABSTRACT: Introduction: Proximal tibia is a weight-bearing area, and treating these fractures is challenging. Various treatment options will be closed reduction and casting, Open reduction and internal fixation with plate osteosynthesis, and minimally invasive plate osteosynthesis (MIPO). The advantage of MIPO in this type of fracture is that it requires only minimal exposure for stable fixation and will give a better quality of life with less complications. The study aimed to assess the functional outcome of MIPO in treating the proximal tibia fractures. **Materials and Methods:** A prospective study of 30 patients was conducted in patients treated with the MIPO technique for closed proximal tibia fracture. Sanders score was assessed for functional outcome in 6th month. **Results:** The mean age of the patients was 43.16 years. Lateral column MIPO alone was done in 22 patients and Dual column MIPO was done in 8 patients. The mean time to union of fracture was 12.16 weeks ranging from 11 to 18 weeks. Sanders score at 6th month showed excellent results in 18 cases, good results in 8, fair results in 3 and poor results in 1 case (Type II fracture). **Conclusion:** MIPO is a good technique for treating proximal tibia fractures as it provides good functional results like early fracture union, minimal blood loss, early wound healing, less chances of infection and early mobilization with better quality of life. However, it has its own limitations.

INTRODUCTION: Proximal Tibia is the weight-bearing area, and these fractures, if not treated properly, these fractures lead to functional impairment due to the intra-articular nature of these fractures [1]. The most common mode of injury for these fractures are Road traffic accidents and falls from heights [2]. The main goal in treating these fractures will be to attain early fracture union in the correct anatomical position with a good range of knee movement and functional outcomes.

QUICK RESPONSE CODE

DOI: 10.13040/IJPSR.0975-8232.13(12).4979-84

This article can be accessed online on www.ijpsr.com

DOI link: http://dx.doi.org/10.13040/IJPSR.0975-8232.13(12).4979-84

There are various classifications for the proximal tibia fractures like Schatzker and A.O. Most commonly used is the Schatzker classification, which comprises 6 types [3]. Various treatment options will be closed reduction and casting, Open reduction and internal fixation with plate osteosynthesis, and minimally invasive plate osteosynthesis (MIPO). Each of them has its advantages and disadvantages [4].

Non-operative treatment in comminuted fractures may lead to complications like Malunion, Prolonged immobilization, Joint stiffness, and post-traumatic arthritis. In contrast, Open reduction internal fixation (ORIF) with plate osteosynthesis may lead to complications like Non-union, Delayed union, Implant infection, and failure [5].

The important factor one should remember while treating this type of fracture will be proper management of overlying soft tissue, especially in the anteromedial side, as there is only skin and subcutaneous tissue. Therefore MIPO has gained importance in treating these types of fractures as it needs minimal exposure without disturbing the major part of the blood supply to the bone and soft tissue. The principles of MIPO include providing relative stability with indirect closed reduction and extraperiosteal dissection [6]. The study aimed to assess the functional outcome following MIPO using the sanders scoring system.

MATERIALS AND METHODS: A prospective study of 30 patients was conducted in patients treated with the MIPO technique for closed proximal tibia fracture and presented to our Medical College and Hospital between June 2020 and June 2021. Ethical committee approval obtained SMC/IEC/2020/11/75. Patients with age >18 years and acute closed fractures of proximal tibia, both extra-articular and intra-articular fractures, were included in the study.

Open fractures, fractures with neurovascular injury, pathological fractures, and patients who were not willing to give consent and follow-up were excluded from the study. All routine investigations were done, and an x-ray of the affected tibia and knee AP and lateral views were taken. In intra-articular fractures, a CT-scan of the affected knee was taken to know the extent, size, location, and articular depression. They were classified using Schatzker classification, which comprises 6 types **Fig. 1.**

FIG. 1: SCHATZKERS TIBIAL PLATEAU CLASSIFICATION

All the patients were initially stabilized with splints, the application of ice packs, and limb elevation. All the cases were treated by direct, definitive management, staged procedures were not included in the study. Timing for taking up the patient to surgery was based on skin condition and was delayed in patients having severe swelling and blisters. After obtaining anaesthesia fitness, patients were planned for the surgery. Under spinal anaesthesia, the patient in a supine position on the radiolucent table parts was painted with betadine and draped. The reduction was done by giving traction and using point reduction forceps, checked in c-armand temporarily fixed using K-wires from lateral side to medial side. For centrally depressed fractures, a window was created in the subchondral metaphyseal region, and elevation of the fragment was done using a Hofmann retractor and fixed temporarily with K-wires. In some patients, separate cannulated and cancellous screws were also applied to fix both the condyles together and maintain the articular surface. For lateral column plating through anterolateral approach, skin incision was given, soft tissue dissection was performed, and a tunnel was created sub muscularly using Cobbs elevator. A distal skin incision was done lateral and parallel to the tibial crest. After fracture reduction was performed and reduction of length, rotation, and a valgus-varus correction were achieved, a percutaneous lateral locking compression plate was passed from proximal to distal part through the tunnel. Plate length should be selected to give a minimum of 3 good bi-cortical screw purchases distal to the fracture. The fracture was fixed with a plate using cortical and locking holes. An additional medial

column plating in certain fractures is also performed using MIPO if needed. After fixation of fracture, stability of the knee joint should be checked. A wound is closed in layers. All the patients were given IV Antibiotics pre-operatively and Post operatively for 5 days followed by oral antibiotics for 5 days. Patients were started on active knee range of movement exercises, Hamstring and quadriceps strengthening exercises and non-weight bearing walking following the day of surgery. The wound was inspected on Post operative day 2 and 5, and suture removal was done on 12th day. Partial weight-bearing walking was started after 8 weeks, and full weight-bearing walking was started after 12 weeks when there is lack of tenderness over the fracture site, absence of pain on weight-bearing and radiologically bridging of 3 out of 4 cortex was noted in 2 views. All the patients were followed up for 6 months and were assessed for sanders functional score, which contains 40 points. Statistical analysis was performed using SPSS 11 software. A p-value of <0.05 was found to be statistically significant.

RESULTS: In this study, 30 patients diagnosed with proximal tibia fracture and treated with the MIPO technique were included. All the patients were followed up for 6 months. The mean age of the patients was 43.16 years ranging from 21 to 60 years **Fig. 2**. There were 21 males (70%) and 9 females (30%), indicating males got most affected than females **Fig. 3.**

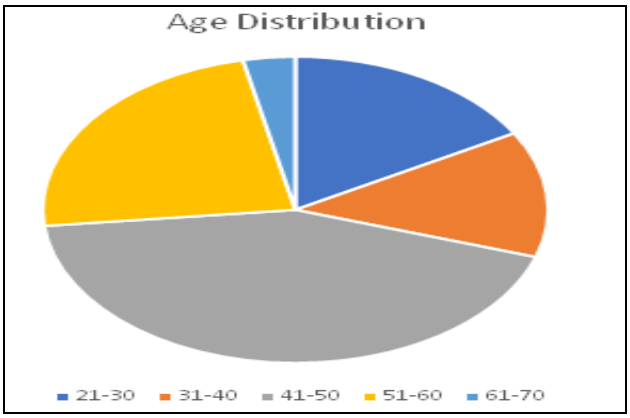

FIG. 2: AGE DISTRIBUTION

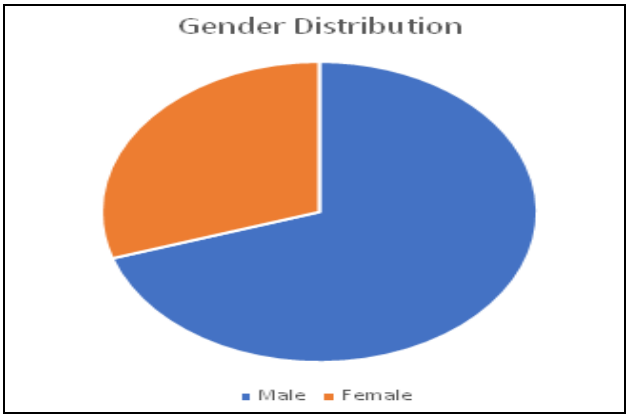

FIG. 3: GENDER DISTRIBUTION

The right tibia was fractured in 17 patients (56.7%), and the left tibia was fractured in 13 patients (43.7%). The most common mode of injury was road traffic accidents (RTA), injuring 21 patients (70%), followed by falls from height (FFH) in 6 patients (20%), followed by workplace injury (WPI) in 3 patients (10%) **Fig. 4.** According to Schatzkers classification of proximal tibia fractures, 14 patients (46.6%) sustained type I fracture, 6 patients (20%) sustained type II, 4 patients (13.3%) sustained type III, 2 patients (6.6%) sustained type IV, 3 patients (10%) sustained type V and 1 patient (3.3%) sustained type VI fracture indicating Type I is more common followed by Type II **Fig. 5.**

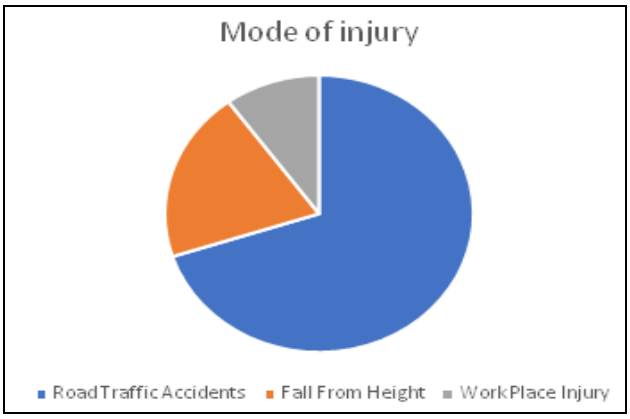

FIG. 4: MODE OF INJURY

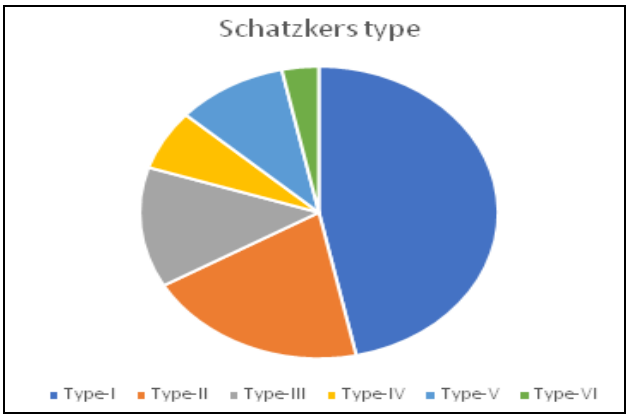

FIG. 5: SCHATZKERS TYP

The mean time for surgery from the trauma was 6 days ranging from 3 days to 10 days. All the cases were treated by direct, definitive management, staged procedures were not included in the study. Fracture elevation was done before fixing with a plate in 12 patients. In 6 patients, 2 cc screws (4mm) were used to fix the condyles.

Lateral column MIPO alone was done in 22 patients, and Dual column MIPO was done in 8 patients. Bone grafting/Bone substitutes were not used in any of the patients. The mean surgical time was 84.6mins ranging from 72 to 112 min. The mean blood loss was 300ml ranging from 250 to 400ml. The mean time to union of fracture was 12.16 weeks ranging from 11 to 18 weeks. The average duration of hospital stay was 12 days. The average range of movement (ROM) at the end of 6^{th} month was 110 º, ranging between 90 to 130 º. Extension lag of > 10 ºnoted in one case, which was tolerated well.

Early post-op complications like superficial wound infection and wound gaping were noted in 2 cases (1-type VI fracture and 1 -type V fracture) which got settled in 1 week after doing regular dressings and giving IV antibiotics.

Late post-op complications like fracture collapse were noted in 1 patient (Type-II) in post-op 2^{nd} month X-ray, but the patient was symptomatically fine without any pain and Arthritic changes; the patient was tolerating well with good ROM. Complications like non-union, malunion, knee stiffness, implant failure, screw backout, skin necrosis, and Compartment syndrome were not noted in any of the patients. Functional outcome was assessed using sanders score at the end of 6 months, which showed excellent results in 18 cases, good results in 8, fair results in 3 and poor results in 1 case (Type II fracture). None of the patients were lost to follow-up **Table 1.**

TABLE 1: PATIENTS DEMOGRAPHICS AND DATA

Sl. no.	Age	Gender	Side	Mode of injury	Schatzker type	Surgical time (mins)	Blood loss (Ml)	Time of union (weeks)	Sanders score (at 6 months)
1	24	M	R	RTA	I	92	400	14	40
2	46	M	R	RTA	I	78	250	11	40
3	40	M	R	RTA	II	80	280	12	38
4	32	M	L	FFH	II	95	310	12	34
5	60	F	L	WPI	V	100	270	14	24
6	44	M	R	RTA	IV	110	320	12	36
7	50	F	L	FFH	V	98	350	12	38
8	48	M	R	RTA	III	79	300	11	40
9	21	F	L	RTA	I	80	270	12	40
10	66	M	R	RTA	III	80	340	18	34
11	44	M	R	WPI	I	90	380	12	40
12	58	F	R	RTA	VI	112	450	14	35
13	42	M	L	RTA	I	76	270	11	40
14	29	M	R	RTA	I	82	280	11	40
15	38	M	L	RTA	II	80	300	12	24
16	45	F	L	FFH	III	85	370	12	34
17	29	M	R	FFH	IV	80	360	12	38
18	33	M	L	RTA	I	72	290	11	40
19	48	M	R	RTA	I	88	340	14	34
20	54	F	L	RTA	III	80	300	11	34
21	60	M	R	RTA	V	100	380	12	30
22	45	M	R	RTA	I	90	300	14	40
23	42	F	L	RTA	I	83	350	12	36
24	50	M	L	FFH	I	87	270	11	34
25	26	M	L	RTA	II	76	340	11	40
26	43	F	R	RTA	I	78	280	11	34
27	47	F	R	FFH	I	107	340	12	36
28	52	M	R	RTA	II	93	400	12	14
29	48	M	R	WPI	II	87	310	11	20
30	31	M	L	RTA	I	80	280	11	40

M-male, F-female, R-right, L-left, RTA-road traffic accident, FFH-fall from height, WPI-work place injury.

DISCUSSION: Proximal tibia fractures in most cases, are high energy injuries, resulting in skeletal injuries, ligament injuries, and multisystem dysfunction. Without proper intervention and management, these injuries will lead to poor outcomes like instability, loss of motion, post-traumatic arthritis, wound breakdown, and infection[7]. Open reduction and internal fixation for this type of complex intra-articular fractures have high chances for soft tissue complications like infection and skin necrosis [8]. For complex intra-articular fractures, closed reduction and casting have high chances for non-union, malunion, depression, loss of range of movement, immobilization, and stiffness [9].

In view of these complications MIPO technique is an attractive technique for treating the proximal tibia fractures. The use of locking plates for the proximal tibia fractures using MIPO significantly increases these days. Anatomically pre-contoured locking plates are available for lateral and medial side plating. Bicondylar fracture fixation is still controversial. A single lateral column locking plate alone can be used, or dual column plating that medialcolumn plating can also be done along with the lateral column plating to stabilize the fracture. Studies have supported both types of management [10, 11].

Dual column plating requires two separate incisions, which will have a high risk for soft tissue injury and periosteal injury. Our study observed that 70% of the patients had sustained injury due to RTA, indicating the most common mode of injury. Most of the fractures in the study had comminuted intra-articular fractures and were taken up for surgery within 1 week time as studies have shown that delayed intervention will have difficulty in reduction of the fracture, with the average duration of hospital stay being 12 days[12,13].

In almost 60% of cases, fracture united by 12 weeks, with the average union time being 12.16weeks. Lateral column MIPO alone was done in 22 patients, and Dual column MIPO was done in 8 patients. All the proximal tibia fractures had a good reduction, and the plate location was good. Complications like superficial wound infection and wound gaping were noted in 2 cases, and fracture collapse was noted in 1 patient. No other major complications were noted in the study. Partial weight-bearing walking was started after 8 weeks, and full weight-bearing walking was started after 12 weeks [14, 15]. Sanders functional outcome score at the end of 6 months showed excellent results in 18 cases (60%), good results in 8 (26.6%), fair results in 3 (10%), and poor results were seen in 1 case (3.3%), indicating good success rate has been noted due to use of MIPO technique for treating proximal tibia fractures without disturbing the fracture hematoma. A study done by Vora J et al. in evaluating functional outcomes for proximal tibia fractures using MIPO technique showed that 63.3% of cases had excellent results, 20% showed good results, 13.3 % showed fair results, and 3.33% showed poor results [16].

A study done by Abdel-Rahman Mansour Alkoum on the outcome of MIPO in the management of proximal tibia fractures showed 58.3% excellent results, 33.3% good results, and 8.3% fair results [17]. Our study also showed similar results to those mentioned above in evaluating the functional outcome. Limitations of the study are small sample size, short follow-up period, and there is no comparative group; hence difficult to assess. Surgical procedure also requires a learning curve to provide good functional results.

CONCLUSION: MIPO is a good technique for treating proximal tibia fractures with minimal dissection of soft tissue, Fracture hematoma preservation, and also provides good functional results like early fracture union, minimal blood loss, early wound healing, less chances of infection, and early mobilization with better quality of life. However, it has its limitations.

ACKNOWLEDGEMENT: None

CONFLICTS OF INTEREST: None to declare

REFERENCES:

1. Rudran B, Little C, Wiik A and Logishetty K: Tibial Plateau Fracture: Anatomy, Diagnosis and Management. Br J Hosp Med (Lond) 2020; 81(10): 1–9.
2. Xie X, Zhan Y, Wang Y, Lucas JF, Zhang Y and Luo C: Comparative Analysis of Mechanism-Associated 3-Dimensional Tibial Plateau Fracture Patterns. J Bone Joint Surg Am 2020; 102(5): 410–8.
3. Soni A and Kansay R: Comment on: Patient-related outcomes after proximal tibial fractures. Int Orthop 2019; 43(6): 1537.

4. Canton G, Santolini F, Stella M, Moretti A, Surace MF and Murena L: Strategies to minimize soft tissues and septic complications in staged management of high-energy proximal tibia fractures. Eur J Orthop Surg Traumatol 2020; 30(4): 671–80.
5. Kerschbaum M, Tyczka M, Klute L, Heller MT, Koch M and Popp D: The Tibial Plateau Map: Fracture Line Morphology of Intra-Articular Proximal Tibial Fractures. Biomed Res Int 2021; 2021: 9920189.
6. Vendeuvre T and Gayet LÉ: Percutaneoustreatment of tibial plateau fractures. Orthop Traumatol Surg Res 2021; 107(1): 102753.
7. Aymen F, Youcef O, Aymen S, Issam A and Abderrazek A: Triplane fracture of the proximal tibia: a case report and literature review. Pan Afr Med J 2019; 33: 40.
8. Pulley BR and Gardner MJ: Bridge Plating of Proximal Tibial Metaphyseal Fracture by Limited Open Technique. J Orthop Trauma 2019; 33 1: 34–5.
9. Wright DJ, Etiz B and Scolaro JA: Combined plate and nail fixation of bicondylar tibial plateau fractures. Injury 2021; 52(10): 3104–10.
10. Ren C, Li M, Sun L, Li Z, Xu Y and Lu Y: Comparison of intramedullary nailing fixation and percutaneous locked plating fixation for the treatment of proximal tibial fractures: A meta-analysis. J OrthopSurg (Hong Kong). 2021; 29(2): 23094990211024396.
11. Peng C, Ren G, Dou M, Yuan B and Wu D: Minimally invasive plate osteosynthesis for complex comminuted bone fractures in the Fraser's type II floating knee: a case report. Eur J Med Res 2022; 27(1): 31.
12. Kim JW, Oh CW, Jung WJ, Kim JS. Minimally invasive plate osteosynthesis for open fractures of the proximal tibia. Clin Orthop Surg 2012; 4(4): 313–20.
13. Wajnsztejn A, Pires RES, Dos Santos ALG, Labronici PJ, Fernandes HJA and Ferretti M: Minimally invasive posteromedial percutaneous plate osteosynthesis for diaphyseal tibial fractures: technique description. Injury 2017; 48(4): 6–9.
14. Kim JW, Oh CW, Oh JK, Kyung HS, Park KH and Kim HJ: Staged minimally invasive plate osteosynthesis of proximal tibial fractures with acute compartment syndrome. Injury 2017; 48(6): 1190–3.
15. Wasky PR, Beltran MJ. Extreme Nailing or Less Invasive Plating of Lower Extremity Periarticular Fractures. Orthop Clin North Am 2021; 52(2): 111–21.
16. Vora J, Shah J and Vala G: Functional outcome of minimally invasive plate osteosynthesis (MIPO) in proximal tibial fractures. Surgical Review Int J Surg Trauma Orthoped 2020; 6(2): 110-120.
17. Mohamed Abd Allah El-Soufy, Amr Mohamed Ahmed El-Adawy, Mohamed Khaled Saleh and Abdel-Rahman Mansour AlKoum: Outcome of Minimally Invasive Locked Plate in Management of Proximal Tibial Fracture. The Egyptian J of Hospital Medicine 2020; 80(2): 876-82.

How to cite this article:
Sandeep PK, Ramkumar MSV, Ravi A and Kumar A: Evaluation of functional outcome of minimally invasive plate Osteosynthesis (MIPO) in proximal tibia fractures. Int J Pharm Sci & Res 2022; 13(12): 4979-84. doi: 10.13040/IJPSR.0975-8232.13(12).4979-84.