Section: Orthopaedics

Original Article

ISSN (0): 2347-3398; ISSN (P): 2277-7253

Surgical Management of Proximal Tibial Fracture with Plate Osteosynthesis

Khaja Adil Ahmed[1], Mir Zia Ur Rahman Ali[2]

[1]Associate Professor, Department of Orthopaedics, Bhaskar Medical College, Yenkapally, Moinabad, Rangareddy, Telangana, India, [2]Orthopaedic Surgeon, Yashoda Super speciality Hospital, Malakpet, Hyderabad, Telangana, India.

Abstract

Background: The majority of proximal tibia fractures are caused by articular extension and can occur as a result of high-speed collisions or falls from considerable heights, when fractures are caused by indirect shear pressures and direct axial compression, respectively. Due to the poor resistance of subchondral bone to axially directed stresses, Depression fractures are relatively common in the elderly with osteopenic bones. Objectives: To study functional outcome of proximal tibia fractures managed by plate osteosynthesis **Subjects and Methods:** There were 30 patients with proximal tibial fractures scheduled for surgery. Using a study proforma, a detailed history was obtained, with real emphasis paid to the mechanism of injury. Baseline investigations are included in evaluations. The history and physical examination were used to examine other associated symptoms. Six weeks following surgery, the first follow-up appointment was scheduled. Patients were followed up on every 4-6 weeks until radiographic evidence of fracture union was observed. **Results:** Out of 30 Cases, Male predominance was seen with 80% and females were 20%. The male : female ratio was 4:1. In 90% of the cases Open reduction and internal fixation (ORIF) technique was used. In 10% of the cases Minimally invasive percutaneous plate osteosynthesis (MIPPO) technique was used The average time for proximal tibia fracture union was 18 weeks (range from 18-24 weeks). 67% had an excellent clinical outcome, 20% had good clinical outcome, 7% each had fair and poor clinical outcome. **Conclusion:** The best technique to treat a proximal tibial fracture is to balance soft-tissue treatment with fracture reduction and alignment. At midterm follow-up, there was no significant difference in the functional outcome of these fractures between single plating and dual plating.

Keywords: Proximal tibia, plate osteosynthesis, ORIF, MIPPO.

Corresponding Author: Dr. Mir Zia Ur Rahman Ali, Orthopaedic Surgeon, Yashoda Super speciality Hospital, Malakpet, Hyderabad, Telangana, India. Email: drmirziaurrehman@gmail.com

Received: January 2020
Accepted: March 2020

Introduction

The knee joint is a complicated synovial joint that regulates the centre of body mass and posture, and it requires a wide range of motion in three dimensions as well as the ability to withstand considerable stress. It's needed for daily activities including standing, walking, and stair climbing, as well as running, leaping, kicking, and changing directions.[1] For both range of motion and stability, the interplay of the articular surfaces, passive stabilisers, and muscles that traverse the joint is vital.[2]

The majority of proximal tibia fractures are produced by articular extension and can happen as a result of high-speed accidents or falls from great heights, respectively, when fractures are generated by indirect shear forces and direct axial compression.[3] Due to the poor resistance of subchondral bone to axially directed stresses, Depression fractures are relatively common in the elderly with osteopenic bones.[4]

Until recently, conservative treatments had not yet superseded internal fixation as the primary therapeutic choice. While it emphasises early mobilisation and decreased morbidity, soft tissue problems are not addressed.[5]

The main goals of surgical therapy for proximal tibial fractures are to restore articular congruity and mechanical axisto and re-establish ligamentous stability; all of these can lead to a fully functional, pain-free knee with a fair range of motion.[6]

The process of repairing a bone is known as osteosynthesis. It is a surgical procedure in which bone pieces are fused together by screws, plates, nails, or wires to repair bone fractures.[7] The aforementioned fixes the broken bone and allows it to knit solidly in the correct position.

Osteosynthesis or internal bone fixation are not used to treat all types of bone fractures. Osteosynthesis is best suited for open bone fractures with concomitant skin or soft tissue injury. It is also the preferred method of treatment for bone fractures with multiple fragments, leg fractures, and osteoporosis-related bone fractures.[8]

The articular congruency, complex ligamentous stability, and complex biomechanics of knee weight bearing position are important reasons why orthopaedic surgeons are concerned about tibial plateau fractures.[9]

The treatment of proximal tibial plateau fractures is still evolving. The rate of wound infection and wound dehiscence is significantly higher in open reduction and internal fixation techniques (ORIF) than in other techniques.[10]

Screw osteosynthesis, plate osteosynthesis, external fixation devices, tension band osteosynthesis, intramedullary pin osteosynthesis, Kirschner wire fixation, and dynamic hip screws are all used.[11] Nowadays, titanium is the most commonly used material.

Plate osteosynthesis is a surgical procedure that uses a plate to repair broken bone fragments. The broken bone is exposed and a suitable plate is screwed over the fracture line by the surgeon. This is secured to all of the fragments with bone screws. During the process, the broken parts are securely connected to one another.

Open reduction and internal fixation (ORIF) techniques allow for the restoration of joint congruency.

Other treatment options, such as plate fixation using a minimally invasive technique (MIPPO) and hybrid external fixation, have also been posited.[12]

The development of locking compression plates has enabled the use of the MIPPO technique for single column tibial plateau fractures, with improved soft tissue healing management.

Subjects and Methods

Type of Study: Prospective study.
Place of study: Department of Orthopedics.
Duration: 1 year.

Inclusion Criteria:

- Proximal tibia fractures with no prominent osteoarthritis.
- Closed fractures
- Managed with ORIF with plate osteosynthesis

Exclusion Criteria

- Patients with Osteoarthritis
- Deformity of knee due to other causes
- Open fractures
- Proximal tibia fractures managed by other techniques

Sample size: 30 patients

There were 30 patients with proximal tibial fractures scheduled for surgery. Using a study proforma, a detailed history was obtained, with real emphasis paid to the mechanism of injury. Baseline investigations are included in evaluations. The history and physical examination were used to examine other associated symptoms. Six weeks following surgery, the first follow-up appointment was scheduled. Patients were followed up on every 4-6 weeks until radiographic evidence of fracture union was observed.

Ethical Approval: The consent was obtained from the Institutional Ethics Committee prior to the commencement of the study.

Statistical analysis:

The SPSS software was used for statistical analysis. The data was presented in the form of tables and graphs. A p-value of 0.005 was considered statistically significant.

Results

A total of 30 patients with proximal tibial fracture were studied after meeting the inclusion criteria.

Table 1: Distribution based on Gender and age group

Gender	Frequency	Percentage
Male	24	80%
Female	6	20%
Age group (years)		
<20	1	3.33%
21-30	10	33.33%
31-40	5	16.66%
41-50	9	30.00%
51-60	5	16.66%
Total	30	100

Male predominance was seen with 80% and females were 20%. The male: female ratio was 4:1. Majority of the patients around 33% belonged to the 21 to 30 yrs age group followed by 30% in 41 to 50 yrs age group. A total of 16.66% each belonged to the age group of 31 to 40 and 51 to 60 yrs. and only 3% belonged to <20 yrs age group. The mean age was 38.33 + 11.41 yrs.

Table 2: Distribution based on laterality, type of fracture and method of reduction and fixation

Laterality	Frequency	Percentage
Right	17	56.66%
Left	13	43.33%
Total	30	100%
Type of fracture		
Lateral split	1	3.33%
Split with depression	9	30.00%
Central depression	0	0
Medial condyle Fracture	3	10.00%
Bicondylar Fracture	9	30.00%
Metaphysiodiaphseal disassociation	8	26.66%
Method of reduction		
ORIF	27	90%
MIPPO	3	30%

In majority of the cases, around 57% had right tibial fractures and the rest 43% had left tibial fractures.

Fractures were classified based on Schatzker's Classification. Type II and type V tibial fracture were the most common fractures seen in 30% of the cases each. Followed by Type VI fracture which was seen in 27% of the cases, Type IV Fracture was seen in 10% and Type I fracture was seen in 3% of the cases.

Table 3: Distribution based on Side of surgical approach and principle of fixation

Side	Frequency	Percentage
Anterolateral	22	73.33%
Posteromedial	5	16.66%
Combined	3	10%
Principle		
Compression	22	73.33%
Bridging	5	16.66%
Combined	3	10%

In 90% of the cases Open reduction and internal fixation

(ORIF) technique was used. In 10% of the cases Minimally invasive percutaneous plate osteosynthesis (MIPPO) technique was used which in terms of duration of procedure and soft tissue injuries were less compared to ORIF. Wound healing with MIPPO was also better and faster.
Anterolateral approach was used in 73 % of the cases with lateral tibial plateau displacement fractures and soft tissue injuries on the medial side of the proximal tibial region. A posteromedial medial approach was used in 17% of cases with medial tibial plateau displacement fractures. A combined approach was used in 10% of the cases with unreducible schatzker type V.
In the majority of cases, around compression type was used for 73 % of the cases in which both rigid and buttress effect were needed. Bridging type of fixation was used in 17% of cases where the fracture extended into the metaphyseal region. In 10% of the cases, a combined type of fixation was used. This fixation is requisite for articular reconstruction and protects against collapsing fracture reduction in the postoperative period.

Table 4: Distribution based on fracture union and complications

Fracture union (in weeks)	Frequency	Percentage
16	10	33.33%
18	8	26.66%
20	5	16.66%
22	4	13.33%
24	3	10%
Complications		
Knee joint stiffness	2	6.66%
Implant failure	1	3.33%
Varus deformity	1	3.33%
Infection	2	6.66%

The average time for proximal tibia fracture union was 18 weeks (range from 18-24 weeks). In majority of the cases, around 33% had union of proximal tibia fracture by 16th weeks, 27% had fracture union by 18th week. 17% had fracture union by 20^{th} week, 13% had fracture union by 22^{nd} week and 10% had fracture union by 24^{th} week.

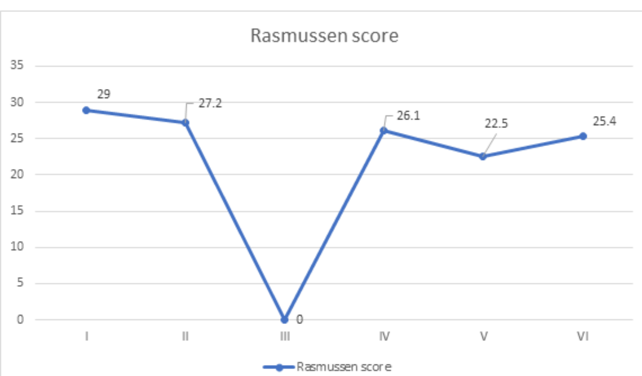

Figure 1: Distribution based on Type of fracture with Rasmussen score

Deep infection occurred in 7% of cases at the post-operative site. As a result, the plate was removed, the patient was given intravenous antibiotics, and an above-knee pop cast was applied. At 26 weeks, the fracture was eventually united.
Varus deformity developed in 3% of cases as a result of post-operative medial condyle collapse. Due to a lack of post-operative mobilisation, approximately 7% of the cases developed knee joint stiffness.

Table 5: Distribution based on Clinical results outcome and ramussen score

Clinical results	Frequency	percentage
Excellent	20	66.66%
Good	6	20%
Fair	2	6.66%
Poor	2	6.66%

Out of 30 Cases, 67% had an excellent clinical outcome, 20% had good clinical outcome, 7% each had fair and poor clinical outcome.

Discussion

The most prevalent kind of complicated fracture is proximal tibial fractures, which account for around 1.2 % of all fractures.[13] They have a deleterious influence on knee function and stability, which leads to a high rate of morbidity.[14] High-velocity traumas generate these fractures, which are often associated with significant comminution and soft-tissue injury.[15]
Patients with high-intensity intra-articular tibial plateau fractures suffer severe injuries and have a poor prognosis, with wound dehiscence and extensive communition leading in malalignment. They're also associated with a slew of significant early and late complications.[16]
With a prompt diagnosis, full preoperative assessment of the bone and soft tissue injuries, adequate soft tissue monitoring and resuscitation, anatomic reduction, and stable fixation, early joint mobilisation and favourable clinical outcomes can be achieved.[17]
Internal plate fixation that is stable and does not damage the soft-tissue envelope is exceedingly difficult to perform, with only fair outcomes in 20% to 50% of these fractures.[18]
In this research, there were no late complications like loss of reduction or misalignment with unilateral plating for type V and type VI fractures. The functional result is similar to the previous two studies with dual plating at the midterm follow-up. Plate osteosynthesis is a superior method with lesser complications since this study group is small and less invasive.
Based on the solid internal fixation, the time of immobilisation was tailored. Early knee mobility has been shown to reduce knee stiffness, enhance cartilage repair (regeneration), and promote callus development and remodelling. In this study, the average period of follow-up was 6 months. As a result, a five- to ten-year follow-up period would probably be considered more significant. This study solely evaluated the functional outcome of proximal tibial plateau fractures; we did not evaluate the radiological outcome.
The fracture pattern, bone quality, and intraoperative reduction should all influence the procedure/implant of

choice.
Thus, when paired with attentive intraoperative soft tissue treatment and active patient engagement in the rehabilitation programme, the proximal Tibial locking plate is a useful device for stabilising proximal tibial fractures.
Eventually, a locking compression plate is an excellent bone stabilisation device, even in cases of soft tissue injuries. The plate osteosynthesis technique is presumed to decrease surgical incisions by decreasing soft tissue stripping in order to produce a robust fracture reduction while still taking into account post-traumatic soft tissue damage. The benefit has increased and complications have decreased since the Plate osteosynthesis approach produces minimum surgical damage to surrounding soft tissue and the healing process biologically.

Conclusion

Tibial plates are effective for repairing intra-articular extension fractures, especially when the soft tissue environment in the proximal tibia allows for dissection. Long plates that span the whole fracture length offer enough support for fracture union and soft tissue healing. Balance soft-tissue treatment with fracture reduction and alignment is the best way to treat a proximal tibial fracture.
There was no significant difference in the functional result of these fractures between single plating and dual plating at the midterm follow-up.

References

1. Bedi A, Le TT, Karunakar MA. Surgical treatment of nonarticular distal tibia fractures. JAAOS-Journal of the American Academy of Orthopaedic Surgeons. 2006 Jul 1;14(7):406-16.
2. Himanshu.H,Prasad.MB,Verma.AK, Minimally Invasive Percutaneous Plate Osteosynthesis(Mippo) A Technique for Treatment of Distal Tibia Fractures,eISSN:2279-0853,p-ISSN:227-0861.Volume 15,Issue 12 Ver.1(December,2016), PP 31-38.
3. Collinge.C,Kuper.M et al, minimally invasive plating of high-energy metaphyseal distal tibia fractures,JOrthop Trauma 2007;21:355-361
4. David P Barei,Rockwood and Green’s, Fracture in adults, 8th edition,vol-2,2473-2540
5. Kundu.A.K et al, outcome of minimally invasive plate osteosynthesis technique with locking compression plate in distal tibial fracture management, Indian journal of orthopaedics surgery 2015;1(3):138-145
6. Paluvadi.S.V et al, management of fracture of the distal third tibia by minimally invasive plate osteosynthesis- a prospective series of 50patients,journal of clinical orthopaedics and trauma 5 2014,129-136
7. Dhakar.A et al, minimally invasive plate osteosynthesis with locking plates for distal tibia fractures,JCDR,2016Mar,vol-10(3):RC01-RC04
8. Ali,SKI et al, evaluation of the functional outcome in distal tibia fractures managed by MIPPO technique using distal tibia locking plate,IJOS;2017;3(2):441-444
9. Patel.YC et al, outcome of minimally invasive plate osteosynthesis(MIPO) technique in distal tibial fracture,IJOS;2017;3(3):10-14 10.
10. Bahari.S et al,minimally invasive percutaneous plate fixation of distal tibia fractures,Acta orthop.Belg.,2007,73,635-640 11.
11. Mustaq.A et al,“Distal Tibia Fracture Fixation With LCP using MIPO” : European Journal of Trauma and Emergency Surgery Vol: 35, No. 2, April,2009 12.
12. Netter, Frank H 2011 .Atlas of Student Anatomy. 5th ed. [Philadelphia, PA]: Saunders. 13.
13. Drake, Richard; Vogl,A.Wayne. Grays Anatomy for Students E-Book. London: Churchill Livingstone. 14.
14. Egol KA, Kubiak EN, Fulkerson E, Kummer FJ, Koval KJ. Biomechanics of locked plates and screws. Journal of orthopaedic trauma. 2004 Sep 1;18(8):488-93. 17.
15. Egol KA, Wolinsky P, Koval KJ. Open reduction and internal fixation of tibial pilon fractures. Foot and ankle clinics. 2000 Dec;5(4):873-85. 18.
16. Etter C. Operative long term result of tibial pilon fractures treated with open reduction and internal fixation Orthop Trauma 1991;189:1191-1997.
17. Frigg R. Development of the locking compression plate. Injury. 2003 Nov;34:B6- 10
18. Blauth M, Bastian L, Krettek C, Knop C, Evans S. Surgical options for the treatment of severe tibial pilon fractures: a study of three techniques. Journal of orthopaedic trauma. 2001 Mar 1;15(3):153-60. 23.

How to cite this article: Ahmed KA, Ali MZUR. Management of Phalanges of Hand. Asian J. Med. Res. 2020;9(1):OR1-OR4.
DOI: dx.doi.org/10.21276/ajmr.2020.9.1.OR1

Source of Support: Nil, **Conflict of Interest:** None declared.