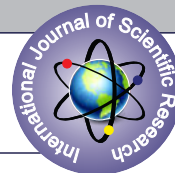


SURGICAL MANAGEMENT OF EXTRA-ARTICULAR PROXIMAL TIBIA FRACTURE USING MINIMALLY INVASIVE TECHNIQUE WITH LOCKING COMPRESSION PLATE: AN OBSERVATIONAL STUDY



Orthopaedics

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ABSTRACT

Methods: This study evaluated the outcome of 23 patients with total 24 proximal tibia fractures, treated with Minimally Invasive Plate Osteosynthesis using LCP from 13 March 2020 – 30 September 2021 at MMIMSR, Mullana.

Results: There were 17 males and 6 females, with mean age of 51 years. RTA was the most common cause of trauma (65%). Most common fracture type as per AO classification was 41-A3.1 (41.7%). The average injury to surgery interval was 2.1 ± 1.4 days. The mean duration of surgery was 98.91 ± 16.5 minutes. Average follow-up period was 20.5 weeks. Union was seen in duration of 12 ± 3.9 weeks. Full weight bearing was achieved by 12.9 ± 4.5 weeks. American Knee Society Score is subdivided into knee score and function score. At 6 months follow-up, the mean Knee Score was 86.7 ± 11.5 and the mean Functional Score was 88.1 ± 13.2 . The mean range of motion at $108.5^\circ \pm 16.8^\circ$ at 6 months. There was 1 instance of superficial infection, 3 instances of knee stiffness and 1 instance of non-union.

Conclusion: MIPPO technique for management of extraarticular proximal tibia fractures using LCP leads to excellent clinical and functional outcome.

KEYWORDS

INTRODUCTION

The proximal tibia is vulnerable to injury due to its subcutaneous surface and lack of soft tissue coverage. Plating techniques have evolved with major focus on blood supply to the fracture site, which utilize conventional approaches with limited incisions above and below the fracture.

AIMS AND OBJECTIVES

To observe the outcome of surgical management of extra articular proximal tibia fractures using minimally invasive technique with locking compression plate.

MATERIAL AND METHODS

The study was conducted in the Department of Orthopedics, Maharishi Markandeshwar Institute of Medical Sciences and Research from 13 March 2020 – 30 September 2021 on 23 patients with 24 fractures of proximal tibia.

INCLUSION CRITERIA

- Patients aged 20 years and above with recent (<2 weeks) history of trauma

EXCLUSION CRITERIA

- Intra-articular fractures.
- Associated lower limb injury.
- Pathological fractures.

SURGICAL TECHNIQUE

- Under spinal anesthesia, patient placed on radiolucent table. Tourniquet applied. Painting and draping done.
- Indirect reduction of fracture done under C-arm.
- Site of placement of the plate, medially or laterally, determined by the fracture pattern, was planned prior to surgery, and approach used accordingly.
- Inverted L-shaped longitudinal skin incision made 3-4 cm proximal to the fracture site and a subcutaneous tunnel created using periosteal elevator.
- Flap was raised in full-thickness, along with subcutaneous fat, fascia and retinaculum, made such so that the implant doesn't lie directly underneath skin.

- An LCP of appropriate length which involves 6 to 8 cortices in the metaphysis and 8 to 10 in the diaphysis was slid in and provisionally positioned with two K-wires.
- Separate small incisions made for inserting locking screws (Figure 1) Using a drill guide used, screw hole drilled, measured with depth gauge. 6.5 mm locking cancellous screws were inserted.
- Complete screw tightening by hand using the torque-limiting screwdriver. (Figure 2)
- After confirming hemostasis, wound wash given, closure done in layers. Aseptic dressing done and knee brace applied.
- Regular aseptic dressings done on POD 2, 4 and 9. Sutures removed on POD 14.



Figure 1 Separate Minimal Incisions for Insertion of Locking Screws in the Diaphysis

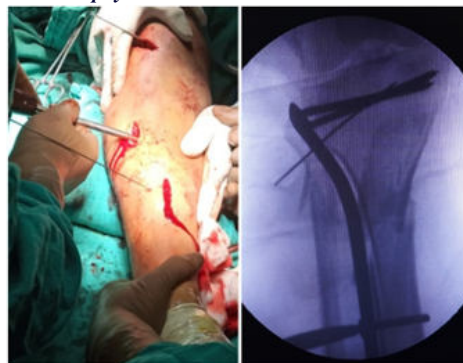


Figure 2 Locking Screws Inserted, Fixing the Plate in Bridging Mode

REHABILITATION PROTOCOL

Patients were started on continuous passive motion of operated knee with isometric quadriceps-strengthening exercises on POD 2. Following suture removal, active flexion-extension of knee with full range of motion encouraged. During the first 3 weeks, toe-touch partial weight bearing was done, progressed to full weight bearing after 3 to 6 weeks, as tolerated.

FUNCTIONAL AND RADIOLOGICAL ASSESMENT

Patient follow-up done regularly at 6 weeks, 3 months and 6 months, till completion of union. If no signs of union till 6 months, it was termed as non-union. The functional outcome of surgical intervention was evaluated using the following scores:

- American Knee Society Score (AKSS)
- Visual Analogue Score (VAS)

STATISTICAL ANALYSIS

Data collected in the first follow-up and the final follow-up was entered into Microsoft excel datasheet and analysed statistically. The mean, standard deviation and range were calculated for continuous quantitative variables to measure the dispersion of data. The qualitative and categorical data was represented as frequencies and proportions. The quantitative data was compared using student's t-test. A p-value of less than 0.05 was considered significant.

RESULTS

1) PATIENT CHARACTERISTICS

23 patients with 24 fractures of proximal tibia were enrolled on the basis of inclusion and exclusion criteria. 17 were male and 6 were female. The mean age of the study population was 51.1 ± 11.1 years (range 27 years to 69 years). Road Traffic Accidents (RTA) was found to be the cause of trauma in 65% cases, followed by fall with 29%. There was one case of assault, who had bilateral involvement.

2) FRACTURE CHARACTERISTICS

Majority of the fracture belonged to AO type 41-A3 extra-articular multifragmentary, metaphyseal fractures, accounting for 66% of the cases. Simple extra-articular metaphyseal fractures, 41-A2, including oblique and spiral fractures seen in 8 cases and accounted for 33% of the cases.

3) TIME DURATION

The average injury to surgery time interval was 2.1 ± 1.4 days. In one patient, surgery was delayed for 6 days to allow swelling to subside. The mean duration of surgery was 98.91 ± 16.5 minutes. Patients were followed up on a monthly basis, for average duration of 20.5 weeks (range 16–24)

4) OUTCOME EVALUATION

- Average VAS at presentation was 7.7 ± 1.3 , which improved to 1.4 ± 1.2 at 6 months.
- The average time for union of fractures was 12 ± 3.9 weeks.
- The mean duration by which full weight bearing was achieved was 12.9 ± 4.5 weeks (range: 12–24 weeks).
- The objective knee score at 6 months showed 75% patients had excellent grade, while 12.5% patients had good score. 1 patient had a fair score and 1 patient scored poor. The Subjective knee score at 6 months showed 20 patients had excellent scores, 3 had good while 1 had poor score. At the follow-up at 6 months the mean Objective Knee Score was 86.7 ± 11.5 and the mean Subjective Functional Score was 88.1 ± 13.2 .
- The mean range of motion at 6 weeks was $94.6^\circ \pm 14.7^\circ$, which increased to $108.5^\circ \pm 16.8^\circ$ at 6 months.
- 1 patient developed superficial infection, which resolved on oral antibiotics. There were 3 instances of knee stiffness. There was one instance of non-union at 6 months follow up.

Case Illustration : 49yr Male; H/O RTA



Figure 3 a) Pre-op xray b) Immediate Post op Xray c) Follow up Xray at 6 months

DISCUSSION

Surgical management of proximal tibia fractures is challenging, with possible complications of infection, loss of fixation and non-union. The proximity of the fracture to the knee joint can lead to joint stiffness. Hence for a successful outcome, it is imperative to achieve anatomical reduction, stable fixation, without soft tissue insult, followed by watchful early rehabilitation. MIPPO plating helps tackle the aforementioned challenges.

On reviewing the existing literature, the average age of the patients in most of the studies belonged to age group: 31 to 49 years. Road traffic accident was found to be the major cause of trauma in most studies, as observed by the present study.

Table 1 Comparison of results among various studies

Study	Scores	Average union time (weeks)	Results	Range of Motion
Boldin et al (2006)	Hospital for Special Surgery (HSS) Score, Knee Society Score	11	The mean HSS was 88, knee score averaged at 91, average functional score was 93.	Average range of flexion was 130°
Kim et al (2012)	Knee Society Score	13.7	Functional results excellent in 23 (76.7%) patients and good in 7 (24.3%). Mean Knee Society score at final follow-up was 89 (range, 75 to 95)	17 cases had normal range of motion.
Gupta et al (2016)	SJ Lam Criteria	17	18 patients (60%) had excellent results, 10 patients (33%) had good results and 2 patients (7%) had fair result.	Average range of flexion was 100°
Chintawar et al (2016)	Rasmussen Clinical and Radiological Scoring	15	The average Rasmussens clinical score was 23.53 and average radiological score was 14.3. As per the clinical score, good result in 26 (81.4 %) patients, poor result in 1 (3.1 %) patient. As per radiological score good results in 26 (81.3 %) patients and in 1 (3.1 %) patient, poor result seen.	The average range of knee flexion was 136.25°
Asimuddin et al (2017)	Rasmussen Clinical and Radiological Scoring	19	Excellent results achieved in 10 fractures (47.6%), good in 8 fractures (38.1%), fair in 2 fractures (9.6 %) while poor result in one fracture (4.7 %).	An average knee range of motion of $0-121^\circ$ was achieved.
Current Study	Visual Analogue Score, American Knee Society Score	12	Objective knee score: 18 (75%) excellent, 3 (12.5%) good, 2 (8.3%) fair and 1 (4.2%) poor. Subjective functional score: 20 (83.33%) excellent, 3 (12.5%) good, 1 (4.2%) poor. At 6 months, Mean Objective Knee Score was 86.7 ± 11.5 and the mean Subjective Functional Score was 88.1 ± 13.2	The mean range of motion was $108.5^\circ \pm 16.8^\circ$ at 6 months.

The average time for union of fractures was 12 ± 3.9 weeks. This was comparable to studies by Boldin et al, Kim et al and Chintawar et al. Studies done by Gupta et al and Asimuddin et al report average time of union as 17 weeks and 19 weeks, respectively.

The mean range of motion was $108.5^\circ \pm 16.8^\circ$ at 6 months. This was

comparable with the result obtained by Gupta et al in 2016. Studies done by Boldin et al, Chintawar et al and Asimuddin et al showed a higher range of flexion on comparing with existing study.

A 56yr female developed non-union with medial collapse leading to varus deformity. The patient was advised revision surgery, but refused. The proximal tibia is predominantly cancellous and theoretically, non-union should be a rare complication. However, because it is one of the components of weight-bearing, there is increased risk of collapse of fracture on premature weight-bearing.

1 patient had developed superficial infection, which resolved on oral antibiotics. The low rate of infection can be attributed to the injury to surgery time interval, to allow swelling to subside. Low infection rate can also be attributed to use of minimal incisions.

Table 2 Comparison of complications among various studies

Study	Complications
Boldin et al (2006)	1 case of compartment syndrome with incomplete peroneal nerve palsy . 2 patients had hardware irritation.
Kim et al (2012)	3 patients developed superficial while 5 developed deep infections.
Gupta et al (2016)	One superficial infection. One patient developed a nonunion.
Chintawar et al (2016)	2 cases of superficial infection, 1 deep infection, 4 cases of implant failure
Asimuddin et al (2017)	2 knee stiffness, 1 post-operative loss of reduction, 1 infection, 1 varus Deformity, 1 knee instability.
Current Study	1 case of superficial infection, 3 instances of knee stiffness, 1 case of non-union

CONCLUSION

The results of the present study show promising outcomes which are comparable to the previously reported results in literature. The Proximal Tibia Locking Compression Plate (LCP) is a stable and safe implant for the management of extraarticular fractures of the proximal tibia and Minimally Invasive Percutaneous Plate Osteosynthesis (MIPPO) is tissue-friendly, Hence, by adopting the principles of biological fixation, the management of extra-articular fractures of the proximal tibia with MIPPO using LCP has satisfactory outcomes with minimal complications.

REFERENCES

1. Boldin C, Fankhauser F, Hofer HP, Szyzkowitz R. Three-year results of proximal tibia fractures treated with the LISS. Clin Orthop Relat Res. 2006;(445):222-229. doi:10.1097/01.blo.0000203467.58431.a0
2. 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):313-320. doi:10.4055/cios.2012.4.4.313
3. Gupta P, Tiwari A, Thora A, Gandhi JK, Jog VP. Minimally invasive plate osteosynthesis (MIPO) for proximal and distal fractures of the tibia: A biological approach. Malaysian Orthop J. 2016;10(1):29-37. doi:10.5704/MOJ.1603.006
4. Chintawar G, Deshpande S, Khan SM, et al. Evaluation of Outcome of Proximal Tibia Fractures managed with MIPPO. Indian J Orthop Surg. 2016;2(2):156. doi:10.5958/2395-1362.2016.00032.3
5. Asimuddin DM, Kulkarni DM. A clinical study of minimally invasive percutaneous plate osteosynthesis of proximal tibial fractures using locking compression plate. Int J Orthop Sci. 2017;3(1k):740-746. doi:10.22271/ortho.2017.v3.i1k.109