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Original Research Article

To Evaluate the Functional Outcome of Treating Displaced Proximal Tibia Fractures using Plate Osteosynthesis

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Abstract

Aim: To evaluate the functional result of treating displaced proximal tibia fractures using plate osteosynthesis.

Materials and Methods: This retrospectively study was done in the Department of Orthopaedics, SKMCH, Muzaffarpur, Bihar, India for 7 months. 30 patients involving proximal tibia fracture managed using LCP 20 patients with minimally invasive plate osteosynthesis, (MIPPO) technique and 10 patients with Open reduction and internal fixation (ORIF) technique. Total 30 patients were involved in this study with inclusion criteria of age more than 18 years and patients having closed intra articular and extra articular fractures of proximal tibia. Patients which were excluded was age less than 18 years, open fractures (any grade) and pathological fractures. Patient placed in supine and under Spinal anesthesia, and Pneumatic tourniquet was applied after exsanguinations and time noted. Painting and draping was done. Through anterolateral approach, intraarticular fractures were exposed and reduced anatomically, whereas extraarticular fractures were treated through MIPPO technique.

Results: In 67% 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. In 90% of the cases open reduction and internal fixation (ORIF) technique was used. The average time for proximal tibia fracture union was 16 weeks (range from 12-24 weeks). In majority of the cases, around 33.33% had union of proximal tibia fracture by 16th weeks, 30% had fracture union by 18th week. 10% had fracture union by 20th and 22nd week, 6.67% had fracture union by 14th and 24th week and 3.33% had fracture union by 12th week. (table 1) Infection occurred in 7% of cases at the post-operative site. Approximately 20% of the cases developed knee joint stiffness. Out of 30 Cases, according to Ramussen score 66% had an excellent functional outcome, 14% had good functional outcome, 16.67 had fair functional outcome and 3.33% had poor functional outcome.

Conclusion: Locking compression plate system acts as a good biological fixation for proximal tibia fractures even in complex fracture situations. MIPPO technique offers short duration of procedure, less blood loss, less soft tissue injury excellent, early wound healing and faster and better functional outcome than ORIF in patients with proximal tibia fracture. However, MIPPO demands more learning curve.

Keywords: Tibia plateau, osteosynthesis, locking compression plate (LCP), ORIF, MIPPO

Introduction

Displaced proximal tibia fractures are a significant orthopaedic challenge, often resulting from high-energy trauma such as motor vehicle accidents or falls from height. These fractures can lead to substantial morbidity due to their complexity and the essential role of the proximal tibia in weight-bearing and knee function. Effective treatment aims to restore the anatomical alignment and stability of the fracture while minimizing complications and ensuring early mobilization. Plate osteosynthesis has emerged as a prominent surgical technique in managing displaced proximal tibia fractures, providing the necessary stability and allowing for precise anatomical reconstruction. Proximal tibia fractures represent a spectrum of injuries ranging from simple lateral plateau fractures to complex bicondylar fractures involving the metaphysis and diaphysis. [1] These fractures are more prevalent in younger individuals due to high-energy trauma and in the elderly population due to low-energy mechanisms such as falls, attributed to osteoporotic bone quality The incidence of these fractures is

increasing, paralleling the rise in traffic accidents and the aging population. Plate osteosynthesis is indicated in displaced proximal tibia fractures to achieve stable fixation, allow early joint mobilization, and reduce the risk of post-traumatic arthritis. [2] Indications for surgery include significant displacement, articular incongruity, and fractures with associated ligamentous injuries. In cases of open fractures, timely debridement and stabilization are critical to prevent infection and facilitate soft tissue healing. The surgical approach for plate osteosynthesis of proximal tibia fractures varies depending on the fracture pattern and soft tissue condition. The anterolateral approach is frequently utilized for lateral plateau fractures, providing excellent visualization and access for fracture reduction and fixation. For medial and bicondylar fractures, a combination of medial and lateral approaches or minimally invasive techniques may be employed to minimize soft tissue disruption and promote healing. Locking plates have revolutionized the management of these fractures by providing angular stability and preserving periosteal blood supply. These plates act as an internal fixator, distributing forces across the fracture site and enhancing construct stability, especially in osteoporotic bone . The use of locking screws allows for stable fixation even in comminuted fractures, reducing the risk of secondary displacement. The success of plate osteosynthesis in proximal tibia fractures is measured by the restoration of joint function, alignment, and the absence of complications. Studies have demonstrated favourable outcomes with high rates of fracture union and functional recovery. [3] However, complications such as infection, non-union, and malalignment remain concerns, particularly in complex fractures and high-energy injuries. Infection is a significant complication, with rates varying from 1% to 10% in closed fractures and higher in open fractures. Early recognition and management are essential to prevent chronic osteomyelitis and joint stiffness. Non-union and malunion are other complications that can impair function and lead to secondary procedures. Proper surgical technique, including accurate reduction and stable fixation, is crucial in minimizing these risks. [4] Recent advances in surgical techniques and implant technology have improved the management of displaced proximal tibia fractures. Minimally invasive plate osteosynthesis (MIPO) techniques have gained popularity due to their potential to reduce soft tissue complications and promote faster recovery. The use of biologics, such as bone morphogenetic proteins (BMPs) and autologous bone grafts, has shown promise in enhancing fracture healing, particularly in challenging cases with bone loss or delayed union. [5,6] Displaced proximal tibia fractures pose a significant challenge to orthopaedic surgeons due to their complexity and the critical role of the proximal tibia in knee function. Plate osteosynthesis remains a cornerstone in the management of these fractures, offering stable fixation and facilitating early mobilization. Advances in surgical techniques and implant technology continue to enhance outcomes, but complications such as infection and non-union persist. Ongoing research and innovation are essential to further improve the management of these fractures and optimize patient outcomes. [7,8]

Materials and Methods

This retrospectively study was done in the Department of Orthopaedics, SKMCH, Muzaffarpur, Bihar, India for 7 months. 30 patients involving proximal tibia fracture managed using LCP 20 patients with minimally invasive plate osteosynthesis, (MIPPO) technique and 10 patients with Open reduction and internal fixation (ORIF) technique. Total 30 patients were involved in this study with inclusion criteria of age more than 18 years and patients having closed intra articular and extra articular fractures of proximal tibia.

Patients which were excluded was age less than 18 years, open fractures (any grade) and pathological fractures. Patient placed in supine and under Spinal anesthesia, and Pneumatic tourniquet was applied after exsanguinations and time noted. Painting and draping was done. Through anterolateral approach, intraarticular fractures were exposed and reduced anatomically, whereas extraarticular fractures were treated through MIPPO technique. After achieving reduction, appropriately sized plate was taken and fracture was stabilized using cortical and locking screws. Cortical screws were put before putting locking screws. The average time taken for surgery in case of MIPPO technique was 50 minutes (range, 40-60 minutes) and 75 minutes (range, 60-90 minutes) in case of open reduction and internal fixation. The major intra-operative problems encountered were in case of comminuted fractures that were tried to reduce by MIPPO technique and later converted to open reduction after unsuccessful attempts. Tourniquet was released and hemostasis secured. Wound closed leaving suction drain in situ. Postoperatively, the patients were mobilized after removal of drains, for 2-5 days the range of motion allowed was 0-20 degree, from the 5th day the range of motion was gradually allowed to be increased to 90 degree or more. After suture removal on 12-14th day if no complications, full range of movement was allowed. An immediate postoperative x-ray was also done. Intravenous antibiotics were given for 48 hours in case of closed fractures and more as required in case of open fractures. Analgesics were given till adequate pain relief was obtained. The patients were advised quadriceps exercises, early active knee mobilization and non-weight bearing crutch walking, on discharge. In case of comminuted fractures with unstable fixation, external support

was given in the form of slab and mobilization was started after confirming the healing process clinically and radiologically. After suture removal, follow up was done at 6 weeks during which patient were clinically evaluated and an x-ray was taken to look for signs of fracture union and loss of reduction if any. (Fig. no 2) The second follow up was done at 3 months during which one more x-ray was done and a clinical evaluation of union done. Based on the clinical and radiological signs of union patients were allowed partial weight bearing and gradually progressed to full weight bearing. Partial weight bearing was delayed until 6-8 weeks and full weight bearing allowed after 12-16 weeks if fracture union seen. The patients were then followed up at 6 months during which time the anatomic and functional evaluation was done.

Results

In our study a total of 30 patients with proximal tibial fracture were studied after meeting the inclusion criteria. In our study majority of the patients around 66% belonged to the 20 to 40 years age group followed by 20% in more than 40 years age group. A total of 14% were belonged to the age group of less than 20 years. Fractures were classified based on Schatzker's Classification [7]. Type VI tibial fracture was the most common fracture seen in 23.33% of the cases. Followed by Type IV and Type I fracture which were seen in 20% of the cases each. Type V Fracture was seen in 16.67%, Type II fracture was seen in 13.33% of the cases and Type III fracture was seen in 6.67%. In 67% 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. In 90% of the cases open reduction and internal fixation (ORIF) technique was used. The average time for proximal tibia fracture union was 16 weeks (range from 12-24 weeks). In majority of the cases, around 33.33% had union of proximal tibia fracture by 16th weeks, 30% had fracture union by 18th week. 10% had fracture union by 20th and 22nd week, 6.67% had fracture union by 14th and 24th week and 3.33% had fracture union by 12th week. (table 1) 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. Approximately 20% of the cases developed knee joint stiffness. (table 2) Out of 30 Cases, according to Ramussen score 66% had an excellent functional outcome, 14% had good functional outcome, 16.67 had fair functional outcome and 3.33% had poor functional outcome. (Acc. To table 3)

Table 1: Time of union

Duration in weeks	No. of patients	Results
12	1	3.33%
14	2	6.67%
16	10	33.33%
18	9	30%
20	3	10%
22	3	10%
24	2	6.67%

Table 2: Complications

Complications	No. of patients	Results
None	22	73%
Knee stiffness	6	20%
Implant failure	0	0%
Non union	0	0%
Infections	2	7%
Total	30	100%

Table 3: Functional outcome and Ramussen score

Clinical results	No. of patients	Results
Excellent	20	66%
Good	4	14%
Fair	5	16.67%
Poor	1	3.33%
Total	30	100%

Discussion

Tibial plateau fractures are one of the commonest intra articular fractures that usually occur as a result of road traffic accident, fall from height, violence etc. For many years, treating proximal tibial fractures has been the subject of much controversy regarding both the indications for surgical intervention and the specific type of intervention to be employed. Especially in intra-articular fractures, inadequate treatment may result in joint instability and deformity coupled with a restricted range of motion. [8, 9]

Open reduction and rigid internal fixation, according to the principles of Association for Osteosynthesis/Association for the Study of Internal Fixation (AO/ASIF), has been the treatment of choice for decades. This treatment modality has yielded satisfactory short- and long-term results in many series. Recently, locking plates, or internal fixators, have been designed to allow for less plate to bone contact without compromising stability. The screw holes are modified to allow the screw to "lock" into the plate, thus converting a plate/screw construction into a fixed-angle device with multiple points of fixation. [10] This design allows for minimal vascular damage to the periosteum. Moreover, locking plates can be particularly effective in treating osteoporotic bones. [11] In our study, we have used Schatzker classification [7] for the proximal tibial plateau fractures type I to VI with the incidence of type-I (20%), type-II (13.33%), type-III (6.67%), type-IV (20%), type - V(16.67%) and type-VI (23.33%). In Girish H V and co-workers' study [12] , Schatzker type I and II dominated the total fractures making 50%, with type V and VI having 18.8% and 12.5% involvement, respectively. Similarly, Rademakers et al. [13] reported that 64% of patients sustained a lateral condyle fracture (Schatzker type I and II). In MRI analysis of 103 patients, Gardner et al. [14] reported that the most frequent fracture pattern was a lateral plateau split-depression (Schatzker type II). Barei et al. [15] showed that the average time interval from injury to definitive surgical treatment was nine days. Manidakis et al. [16] showed that the average time interval from injury to definitive surgical treatment was three days.

In our study of proximal tibia plateau fracture, mean union time was 16 weeks which is comparable to Manidakis et al. [16] which showed that average time of union was 13 weeks and Jain et al. [17] which showed a series of 34 cases having mean union time of 17.6 weeks. The most frequently used approach was lateral approach with incidence of 67.92% and the most frequently used implant was lateral anatomical plate (proximal tibial locking plate) which was used in 62.26% of the patients with or without cannulated cancellous screw. In the series by, Pasa et al. [18] out of 114 patients with proximal tibial fractures he fixed the fracture with cannulated cancellous screw and washer in 25, and a buttress plate in 27 patients. In the series by Vasanad et al. [12] showed that 46.8% of the patients needed ORIF with buttress plate along with cannulated cancellous screw. In our study, we achieved 66% excellent result and 14% good result with our standard surgical care using periarticular proximal tibia plating and allowing mobilization of the knee. Vasanad et al. [12] had 44% excellent result and 44% good results (overall 88% acceptable results) (Table No.3). Kugelman et al. [19] showed in their study that out of 279 tibial plateau fractures 10 patients (3.6%) sustained a deep infection. Six patients (2.2%) developed a superficial infection. One patient (0.4%) presented with early implant failure. Two patients (0.7%) developed a fracture non-union. Eight patients (2.9%) developed a venous thromboembolism. Seventeen patients (6.2%) went on to re operation for symptomatic implant removal. Nine patients (3.3%) underwent a lysis of adhesions procedure.

Vasanad et al. [12] also showed knee stiffness in three patients, mal-union in two patients, infection and wound dehiscence in three patients, extensor lag in one patient and loss of reduction in one patient. Our study also showed superficial infection in (7%) patients which were controlled by antibiotics and dressing. Knee stiffness was developed in (20%) of patients.

Conclusion

Locking compression plate system acts as a good biological fixation for proximal tibia fractures even in complex fracture situations. MIPPO technique offers short duration of procedure, less blood loss, less soft tissue injury excellent, early wound healing and faster and better functional outcome than ORIF in patients with proximal tibia fracture. However, MIPPO demands more learning curve.

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