International Journal of Research in Orthopaedics
Sharma A et al. Int J Res Orthop. 2023 Jan;9(1):88-92
http://www.ijoro.org

DOI: https://dx.doi.org/10.18203/issn.2455-4510.IntJResOrthop20223304

Original Research Article

Clinical outcome of proximal tibia plates in extra-articular proximal tibia fractures: a retrospective study

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Received: 28 November 2022
Accepted: 12 December 2022

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ABSTRACT

Background: Tibial fractures, which account for 2.2% of all intra-articular fractures, are frequent. These fractures are prevalent in two age groups: younger patients experience higher-energy fractures, whereas elderly patients experience lower-energy fractures as a result of osteopenia. These injuries are linked to a higher frequency of complications such as non-union, infection, mobility limitation, and post-traumatic arthritis in the younger population. The study's primary objective was to assess the results of proximal tibial fracture treated with a locking plate.
Methods: Thirty patients with proximal tibia fractures are included in this retrospective clinical study. They are all treated with a tibia plate system made by Kaulmed private limited in Sonipat, Haryana, India. Thirty patients consisting of 18 males and 12 females, with average age of 42 years. Fractures categorized based on AO classification and type of soft tissue injury. Patients assessed clinically, radiologically, functionally using VAS, post-op radiographs and ROM.
Results: All 30 cases that were chosen were monitored for 6 months. The average time for fracture union was 21 weeks, with a range of 18 to 24 weeks. No delayed union and non-union was observed. Infection, valgus, Knee stiffness were the complication that was observed. Two patients complained about the mild pain on the post-operative visit. Acceptable knee ROM of angle >120° was achieved and all patients were satisfied at their last visit based on parameters of pain, ADLs, aesthetics and full weight bearing.
Conclusions: Excellent results were achieved in the surgical treatment of proximal tibia fractures by MIPO (minimal invasive plate osteosynthesis) and ORIF (Open reduction and internal fixation) using proximal tibia plate technique. Optimum knee function is achieved with reduction, rigid fixation to restore articular fragments, and early mobility. preventing osteoarthritis following trauma.

Keywords: Proximal tibia fracture, Locking plate, Tibia plate system, MIPO, ORIF

INTRODUCTION

Due to a rise in auto accidents and sports-related injuries, knee joint-which is complicated-is now one that is most frequently damaged. With 2.2% of all fractures being tibial plateau fractures, these are frequent intra-articular fractures.[1] Fractures are frequent in 2 age groups: younger patients experience higher-energy fractures, whereas older patients experience lower-energy fractures as result of osteopenia.[2] Injuries linked to higher frequency of complications as non-union, infection, mobility limitation and post traumatic arthritis in younger population.[3]

Each form of fracture has a unique morphology, a unique response to therapy, and other unique characteristics. The severity of fracture varies from simple non-displaced fractures to highly comminuted fractures with accompanying soft tissue injury and neuromuscular damage. Apart from tibial plateau, meniscal tear and ligament injuries should also be evaluated.[4] The different indications are managed using cast, surgical method that includes implants and external fixators. The choice of treatment depends on the severity and type of fracture.[5] The doctor's experience is also a factor for post-op results.

The ORIF and MIPO are surgical techniques are some of implant fixation techniques that provide better clinical outcomes in case of complex proximal tibia fracture.[6,7] Therefore, orthopaedic surgeons have advanced from conservative treatment to the internal fixation of fractures as the first choice of treatment in case of proximal tibia fractures. Conservative treatment can be result stiffness in the knee, non-union, and malunion. Surgical techniques use implants that are locking compression plates for optimal clinical results, fracture union, and patient outcomes. In this clinical study, the post-operative results are assessed retrospectively by addressing improvements using VAS, radiographs and ROM in the follow-up visit after proximal tibia plate surgery.

Tibia plate system

The tibia plate system consists of both dynamic compression plates and locking plates. The locking plates are often used because of the locking screw and plate provide stable construct the provide stability to the fractures.[8] The plates also feature compression holes which provide compression when a non-locking screw is inserted through them. The locking plates construct are also available in axial and poly-axial constructs. Both are fixed angle constructs. The main difference between such plates is that in fixed angle locking, the locking screw can be implant only in nominal angle whereas in multi-axial construct, the screw can be fixation the cone angle on 15° which in result provide better result as this construct allows fixation of many fractures that are not treatable through standard compression plates.[9]

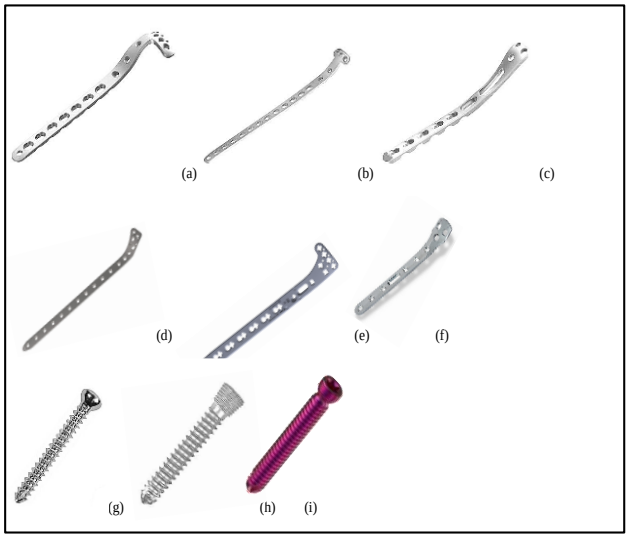

Figure 1 (A-I): Tibia plate system-3.5 mm KL-4 proximal tibia plate or 4.5/5.0 mm KL-5 proximal tibia plate, 3.5 mm KL-4 medial proximal tibia plate or 4.5/5.0 mm KL-5 medial proximal tibia plate, 3.5 mm KL-4 posterior medial proximal tibia plate, 5.0 mm KL-7 proximal lateral tibia plate, 3.5 mm KL-11 variangle proximal tibia plate (small and large bend), 4.5 mm KT-3 proximal tibia medial plate, non-locking screw, locking screw and variable angle locking screw.

The fixed angle constructs avoids implant translation or loosening as this allows for less precise contouring of plates, as fixation depends on the plate-screw construct rather than the friction between plate bone interface, in the case of compression plates.

The following images show the plates that are used in this study that includes locking plates. Different plates system includes LISS (less invasive stabilization system) plates, variable angle locking and non-locking plates (Figure 1).

METHODS

Data were gathered from 30 patients who were treated with a tibia plate system during this retrospective study, which took place at Jawahar Lal Nehru hospital, Mauritius from September 2021 to July 2022. The data collected from the hospital includes age, gender, fracture type, aetiology of injuries and post-operative visits. The study is approved by the institutional ethics committee.

Inclusion criteria

Male or female participants who were at least 18 years old and had recently suffered a proximal tibia fracture due to an injury between 12 and 72 hours before pre-operative investigation were included in the research. The patients included in the study have suffered from the fractures that are amendable from the proximal tibia plates. The patient with at-least three follow-up visit in the period of one year.

Exclusion criteria

Patient age greater than 75 years; compounded fracture; proximal tibia fracture along with fracture in other limbs, pathological fracture; subjects who had problems with alcohol abuse, those who were detained or were in the process of being detained, those who had an infection at the site of the operation, patients who had any active local infections, those who had an allergy to the metal, and patients who had problems with neuromuscular diseases were also excluded from this study.

Treatment

The patients with traumatic cases of proximal tibia fracture were assessed whether open reduction needs to be performed after preliminary treatment. The assessment was based on the radiograph taken during emergency treatment. The patients who required open reduction were then admitted and planned for surgery.

The surgery was performed based on the AO principles of fracture management that includes Anatomic reduction followed by stable fixation, Early, active mobilization and preservation of blood supply. The surgery was carried out using a tibiaplates made of titanium alloy (Ti-6Al-4V) or Stainless steel (316LRM) manufactured by Kaulmed Private Limited in Sonipat, Haryana, India. A splint was applied after the surgery to prevent the motion and any

load at surgical site. It was taken off after the confirmation of bone union. The mobilization was achieved after removal of splint. After removal of sutures, physiotherapy exercise started for early recovery and motion, which was done for a period of 25-30 days. Partial weight bearing also started after completion of physiotherapy.

Statistical analysis

All statistical analyses will be performed using Minitab. Results are reported as means ± standard deviations for continuous variables and as number (%) for nominal variables. The endpoints are summarized using descriptive statistics (Mean, Median standard deviation, minimum, maximum). For a normal distribution, parametric tests will be applied; otherwise equivalent non-parametric tests will be applied for analysis. For normally distributed data, intra group at various follow-up using Paired-t-test using the statistical software. P≤ 0.05 to be considered as statistically significant.

RESULTS

The surgery from tibia plate fixation includes 18 males and 12 females with mean age of 42 years (Table 1). In adults the primary cause of proximal tibia accidents includes vehicle accidents, fall from heigh and sport injury whereas in elderly (age>60) the primary cause includes low energy trauma that includes fall different activities (Table 2). As per the AO classification the patients have 41A, 41B and 41C type of fractures. The patients suffered from both closed and open fractures. Open fracture are categorized based on Gustilo-Anderson I, II and III (Table 3). There were 25 isolated fractures and 5 compound fractures which were managed separately. In this study, the 19 patients sustained injury on the right side and 11 on left side.

At each follow up, radiological evaluation was performed to assess the bone union progress. The meantime taken for full bone union was 21 weeks with a range of 18-24 weeks. No patient had delayed union and non-union. Post-ope complication includes infection (5 patients) which were managed through orally, knee stiffness (3 patients) and valgus deformity (1 patient) (Table 4). The clinical assessment includes knee ROM and pain evaluation using VAS score. The acceptable Knee ROM of >125° was achieved by 25 patients. At last visit 28 patients showed no pain whereas 2 patients showed mild pain (Figure 2). No complication related to implant was observed and all the patients evaluated shows satisfactory results based on parameters of pain reduction, full weight bearing, aesthetics and ADLs (Activities of daily living) (Table 5).

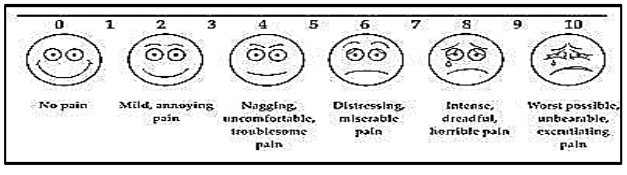

Figure 2: VAS score.

Table 1: Demographic data.

Demographics	Percentage (%)
Sample size	30 (100)
Mean age (years)	42
Range (years)	Youngest: 23
	Oldest: 68
Male	18 (60)
Female	12 (40)
Adults	22 (73.33)
Elderly	8 (26.67)

Table 2: Aetiology.

Fracture cause	Percentage (%)
Adults	
Motor vehicle accidents	16 (72.7)
Slip and fall	4 (16.7)
Other (sports, etc.)	1 (10.6)
Elderly	
Motor vehicle accidents	1 (12.5)
Slip and fall	7 (87.5)

Table 3: Injury description.

AO fracture type	N
41 A2-A3	23
41 B1-B3	2
41 C1-C3	5
Soft tissue injury	
Gustilo-Anderson I	16
Gustilo-Anderson II	10
Gustilo-Anderson III	4

Table 4: Post-operative complication.

Complication	Percentage (%)
Infection	5 (16.7)
Knee stiffness	3 (10)
Valgus	1 (3.3)
Normal	21 (70)

Table 5: Patient satisfaction.

Parameters	Percentage (%)
No pain	30 (100)
Full weight bearing	28 (93.3)
Aesthetics	24 (80)
ADLs	30 (100)

DISCUSSION

The objective of this article is to show the radiological and clinical outcome of locking proximal tibia plate in the management and stabilization of complex proximal tibia fractures. The proximal tibia fractures due to high energy trauma often accompanied by soft tissue injury. Such injuries are imperative to proper management. Open fracture of proximal tibia should be treated emergency

wound healing process along with the use of external fixator.[10] Such fractures are managed in stages with second stage is the use of MIPO technique to stabilize the fracture after the wound healed. The use of MIPO techniques in management of proximal tibia fracture shows that it provides optimum results of rapid healing, minimization of soft-tissue injury, loss of function and prevention of non-union and mal-union.[11,12]

The present study shows the treatment of proximal tibia fracture using proximal tibia plates which were designed and manufactured by Kaulmed private limited, India. The plates used in this are indicated for the intra-articular and extra-articular fractures of proximal tibia. In this study, medial, lateral, posterolateral plates for proximal tibia are used for different indications of split-type fractures of the lateral tibial plateau, lateral split fracture with associated depression, pure central depression fractures, split or depression fractures of the medial plateau, bicondylar combination of lateral wedge and depression fractures and fractures with associated shaft fractures. It was observed that use of these plates provide bride in comminuted fracture which result in better healing.[13,14]

Although in present study, ROM and pain were observed as major clinical outcome for which data shows good result in pain reduction in less duration and achieved set criteria for ROM. No major complication of non-union, mal-unions and deep infection were observed, although some cases were reported with infections which was managed through medication and delayed bone union no major complication that may required re-surgery. Knee stiffness complaint was observed post-operatively but disappeared at last visit. Valgus deformity was observed in one patient.

Limitation of present study is sample size, retrospective design and no statistical significance considered data analysis. Only descriptive data with mean, range and frequency is shown. These limitations can be avoided using different study design with large sample size.

CONCLUSION

The incidence of proximal tibial fracture are increasing and require optimum treatment as it involve mobilization and QoL issues. The fractures with accompanying soft tissue have a high risk of infection. Anatomic reduction, accurate axial and articular alignment with rigid fixation should be the objective of the treatment to achieve a stable and functional knee joint. The MIPO technique using proximal locking tibia plate. These plates are designed for minimal invasive surgery leads to less soft tissues dissection thereby faster mobilization occur with less chances of infection and stiffness lead to excellent functional outcome of the knee joint.

ACKNOWLEDGEMENTS

The author would like to thanks to the clinicians, doctors and hospital staff for supporting and allowing us to conduct the study. The author(s) also thankful to Kaulmed private. Limited for providing the opportunity to participate in the study.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

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Cite this article as: Sharma A, Jain A, Luthra G. Clinical outcome of proximal tibia plates in extra-articular proximal tibia fractures: a retrospective study. Int J Res Orthop 2023;9:88-92.