

Functional Outcome of Proximal Tibia Fractures Treated With Locking Compression Plate by MIPPO Technique and Its Association with Complications

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Abstract

Introduction: Increased incidence of road traffic accidents, natural disasters, and industrial accidents claim most of human mortality and morbidity. These injuries commonly involve long bones, especially the tibia due to its subcutaneous location. Tibial diaphyseal fractures are the most common, followed by proximal tibial fractures. The treatment of proximal tibial fractures changed dramatically in 1969 following the study by Reudi and Ailgower (1) where 75% patients after internal fixation of tibia fractures were pain free and had good functional outcome at 4 years follow up. The following widespread use of internal fixation led to an increase in major complications like malunions (42%), superficial infections (20%), nonunion (18%), and osteomyelitis (17%). This led to a search for newer techniques which led to lesser soft tissue damage and yielded better results. Amongst these techniques was biological minimally invasive percutaneous plate osteosynthesis (MIPPO). In the 1990's Krettek et al popularized the Minimally Invasive Percutaneous Plate Osteosynthesis (MIPPO) technique in which conventional plates were placed through a small incision and slid through a subcutaneous tunnel. Biologically friendly plating and minimally invasive plating continues to remain popular today. This study compares MIPPO in proximal tibia fractures, in terms of functional outcome, union rate and time and the various complications associated with each group.

Method & Material: The present study was conducted in the Department of Orthopaedics. This study included 32 patients with the fracture proximal tibia of the patients and age of patient ranging from 20 to 75 years. All the patients with proximal tibia fractures were included in the study.

Result: A total of 32 patients of proximal tibial fractures were treated with minimally invasive percutaneous plate osteosynthesis technique. There were 29 male and female patient, with maximum patients in the age group of 31 to 40 years. Road traffic accident evolved as most common mode of injury. Fractures were classified according to AO classification. C1 type of fracture seen in 8 (25 %) patients and A2 type in 7 (21.9%) patients. Rasmussen's clinical and radiological scoring system was used for final evaluation of the results.

Conclusion: Minimally invasive percutaneous plate Osteosynthesis is better technique, and should be considered as primary option for the surgical treatment of the proximal tibia fractures. Clinical outcome of MIPPO technique are favourable and comparable to world literature in terms of fracture union, early mobilization and functional outcome. MIPPO technique preserve the soft tissues around the fracture site hence healing of the fracture is early. For the same reason MIPPO can be a treatment option for the grade I compound fractures. MIPPO technique can be successfully used for the simple or grade I compound fracture of proximal tibia.

Keywords: Tibia, Minimal Invasive Plate Osteosynthesis, Clinical, Functional, Radiological.

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Introduction

Increased incidence of road traffic accidents, natural disasters, and industrial accidents claim most of human mortality and morbidity. These injuries commonly involve long bones, especially the tibia due to its subcutaneous location. Tibial

diaphyseal fractures are the most common, followed by proximal tibial fractures. The treatment of proximal tibial fractures changed dramatically in 1969 following the study by Reudi and Ailgower [1] where 75% patients after internal

fixation of tibia fractures were pain free and had good functional outcome at 4 years follow up. The following widespread use of internal fixation led to an increase in major complications like malunions (42%), superficial infections (20%), non-union (18%), and osteomyelitis (17%). This led to a search for newer techniques which led to lesser soft tissue damage and yielded better results. Amongst these techniques was biological minimally invasive percutaneous plate osteosynthesis (MIPPO).

The subcutaneous location of the proximal tibia, its poor blood supply and sparse muscle cover anteriorly leads to complications such as delayed union, non-union, infection and wound dehiscence, which can be challenging to tackle as a surgeon.

As these fractures are notorious to reduce, align, and stabilize, several modalities of treatment were advocated in the past. One of the most common methods used to be closed reduction and casting, followed by functional bracing. However, discouraging results led to the trend of External fixator application, which dramatically improved short term results. The long term complications, however, like pin tract infections, frame failure, mal-union, non-union, compartment syndrome, and the necessity of secondary procedures diverted many surgeons away from the external fixator route. In the late twentieth century ring fixator was invented by Prof. Gavril

A. Ilizarov, which proved to be very useful in treating these fractures. However, they had their own problems like high learning curve, pin tract infection, knee stiffness etc. To achieve union many procedures are recommended such as closed reduction and cast, open reduction and internal fixation, intramedullary nailing, hybrid or ring external fixation

In the 1990's Krettek et al. popularized the Minimally Invasive Percutaneous Plate Osteosynthesis (MIPPO) technique in which conventional plates were placed through a small incision and slid through a subcutaneous tunnel. Biologically friendly plating and minimally invasive plating continues to remain popular today.

IM Nailing frequently results in misalignment, malunion and pain in the knee. While tibial plating provides the benefit of anatomic reduction, it is associated with the risk of wound dehiscence and infection because of the relative lack of soft tissue cover. This study compares MIPPO in proximal tibia fractures, in terms of functional outcome, union rate and time and the various complications associated with each group

Method & Material

The present study was conducted in the Department of Orthopaedics. This study included 32 patients

with the fracture proximal tibia of the patients and age of patient ranging from 20 to 75 years. All the patients with proximal tibia fractures were included in the study.

Inclusion criteria

1. Patients with closed articular proximal tibia fractures with age of more than 18 years.
2. Both male and female patients.

The exclusion criteria

1. Fracture associated with knee dislocation
2. Pathological fractures
3. More than 6 weeks Old untreated fractures
4. No other associated lower limb fracture
5. Age more than 80 years

Results

Out of 32 patients, the eldest patient in our study was 75 year old whereas youngest patient was 20 year old. The mean age of all patients was 42.31±14.35 year. However, 53.2% of our patients were from 31-50 age group. The male gender was predominantly (91%) forming the sample size where as 9% females in the sample size. 27 patients had fracture due to road traffic accident, 1 had due to fall from height, 1 due to assault and 3 patients due to slip and fall. 2 patients had associated femur fracture and 30 patients did not have any associated injury. 31 fractures were simple (closed) fracture and 1 was Compound Grade 1. There were 7 patients with 41A2, 6 with 41A3, 3 with 41B1, 1 with 41B2, 1 with 31B3, 8 with 41C1, 4 with 41C2, and 2 with 41C3 type of Fractures respectively. AO type A was in 13 patients whereas B and C type fracture were in seen in 5 and 14 patients respectively. Out of all type C1, A2 and A3 were the most common type of fracture in (65%) patients. 8 patients were managed with fixation with lateral buttress plating, 12 patients with fixation with medial buttress plate, 6 with medial plate with lateral canulated cancellous screw, 1 with lateral buttress plate with medial canulated cancellous screw, and 5 with medial and lateral buttress plating. 62.6% of patients were managed with Buttress plating, 9.4% of patients were managed with L plate and 28.1% of patients were managed with T – plate. 22 patients were managed with locking plate and 10 patients were managed with non – locking plate. There are disadvantages of these locking plate are costly, removal of plate is difficult, Plate cannot be contoured according to special need Locking head screws gives false feeling of the hold, Lag effect cannot be given, in proximal tibial locking plates the peroneal nerve is at risk when used through the lateral approach. 2 Patients had superficial infection and 1 had deep infection. Rasmussen clinical and radiological scores were used to express the result at the end of last follow up which is basically based in functional

improvement and radiological parameters. Good results were observed in 26 patients whereas 5 had excellent, 1 showed fair and 1 showed poor result. Rassmussen clinical and radiological criteria was calculated and plotted over chart with rassmussen clinical minimum and maximum score 14 and 24 respectively with standard deviation of 2.699, and rassmussen radiological minimum and maximum score 12 and 18 respectively with standard deviation of 1.897. There were 2 cases of implant related problems. Screw back out was seen in 1 patient. Screw back out with loosening of hardware seen in another patient. The patient with loosening of implant also had deep infection. In the present

study, the range of knee flexion was 100 to 146 degrees, with a mean flexion of 136 degrees. Out of 32 patient 31 patient had no extension lag only 1 patient had extension lag more than 10 degree who had showed poor compliance to pain and physiotherapy Other than infection other complication included, delayed union(2) varus deformity(1), post traumatic arthritis in 2 patients. No complications like Compartment syndrome, DVT, Iatrogenic foot drop and avascular necrosis. Out of 32 patients 12 patient had radiological union at 12 weeks with average time for union was 15 weeks. Majority of our patients 75% started started walking in 18-20 weeks.



Figure 1:



Figure 2:



Figure 3:

Discussion

Opinions are still divided regarding the appropriate management of the proximal tibial fractures. All the techniques have their merits and demerits. Minimally invasive plate osteosynthesis technique (MIPPO) in the management of properly selected proximal tibial fractures has an upper hand over other methods. In the present study 32 patients were treated with MIPPO technique for proximal tibial fractures.

Out of 32 patients 29 (90.6%) were male and 3 (9.4%) were female. According to the epidemiological study by Kretekk et al [1] and Koval et al [2] there was male preponderance. The eldest patient in our study was 75 year old and the youngest was 20 year old. The mean age was 41.3 years. Maximum numbers of patients were from the age group between 31 and 40 years. As this age group is the mostly male from this age given were mostly the earning member of the society and engaged in outdoor occupation e.g., driver, labour, farmer etc., and hence are more vulnerable to road traffic accidents.

According to Joon-woo kim et al [3] out of 30 patients of proximal tibia fractures the mean age was 44.4 years in the range of 24- 69 years. The mode of injury was road traffic accidents in 27(84.4 %) cases followed by slip and fall in 3 (9.4%) and fall from height in 1 (3.1%) cases and a case (3.12%) of direct injury (assault). Monappa et al [4] also described in their study of 49 tibia fracture 41 were due to road traffic accidents and 6 were due to fall from height Most of our patient had type A 13 patients, type B were 5 and 14 patients in type C fracture, out of which 96.9% (31) were closed and 3.1%(1) was of compound grade I. These are similar to studies by Oh et al [5] who observed in 23 fractures, there were 13 type A, 5 were type B and 5 type C out of 23 fractures. There were four open fractures (grade I- 3, grade III A-1 case). In our study we have included open fractures only up to grade 1 as higher grade of open fractures are associated with increased chances of deep infections and subsequent implant failure.

Radiographic classifications of the fractures have been hallmark of the injury severity assessment. Fractures of the same group are similar in mechanism of injury and require similar approach in their treatment and also behave similar in prognosis. The AO classification is unique as it classifies fracture in such a way that they organize fractures in the ascending order of the severity. Types A generally are less severe than Type B, and Type C fractures have greatest severity. This system has been followed by most of the investigators. G thiruvengita Prasad et al [6] used Schatzker type of classification in their 43 patients. In our study all of the patients have used stainless steel T and L

buttress plates in all 32 patients for the surgery. Nithyananth et al [7] using T-plate or L-plate minimally invasive percutaneous plating of tibial plateau fracture found good result. This study describes the use of non-angled stable implants for MIPPO of proximal tibial fractures through only on the medial side. All five patients had excellent result and concluded that the use of buttress plates for MIPPO of selected proximal tibial fractures can result in outcomes comparable to angled stabled implants. Kankate et [8] al also used T and L buttress plates for the MIPPO. We have used proximal tibial locking plates in 22 (68.8%) of patients.

The main advantages we observed of locking compression plates for proximal tibial are that the plate can be used in patients with diminished bone quality and better angular stability. Gonzalez et al [9] also described that plate can be used with severe soft tissue damage as the plates are considered to preserve the periosteal blood supply and so reduced need for bone grafting. In addition to the medially inserted percutaneous screws and plate, in 15/32 cases we have used additional 6.5 mm cc screw from lateral side to fix the lateral condylar fragment. According to Sirkin et al [10], once the anatomic reduction of the articular surface has been verified, percutaneous screw placement acts as an adjunct to percutaneous plate. A lag screw and washer is placed at the apex of the condylar fracture to provide a buttressing effect and prevent axial displacement of the condyle. The menisci were not visualized. No meniscal or ligamentous injuries were treated operatively in our study. None of the patient in our study appeared to have symptoms related to the residual abnormalities of the meniscus, and none had subsequent operation for the meniscal injury. According to Marsh et al [11] meniscal injury is uncommon after simple condylar fracture. Moore et al [12] found no difference in laxity between the injured and the non-injured knees of 208 patients at least 1 year after the fracture. The average time for union was 15 weeks (range of 12-20 weeks), although 12/32 patients had radiological union at 12 weeks. Raiturker and Salunkhe [13] had a union in a range of 16-20 weeks, Singh et al [14] had union at 21 weeks and Ha et al [15] had union at 13.7 weeks. In present study we observed delayed union was observed in 1 patient, who had metaphyseal comminution and was of grade I compound injury. In this case PRP (platelet rich plasma) injections were given up to 6 months after the surgery for bony healing.

The fracture united eventually. None patient required bone grafting. Also there was no case of non-union. In the series of Collinge et al [16] bone grafting was carried out in 6 patients, 4 of which had a significant bone loss, which most likely

would have delayed healing regardless of the implant or technique used. In the present study, the range of knee flexion was 100 to 146 degrees, with a mean flexion of 136 degrees which is comparable with the other studies by Krettek et al [1], Kankate et al [8], and Ha et al [15] in which they observed 136, >130 and 136 degrees of knee flexion respectively at final follow up. In our study average extension lag (range -0 to -10 degrees) was -2.3 degrees which is comparable with other studies by Krettek et al [1], Kankate et al [8]. We analysed our results at the last follow up using the parameters of post-operative resumption of function and radiological findings. The results were assessed as per the Rasmussen's clinical and radiological scores [17].

Out of 32 patients, 2 (6.25%) had excellent, 26 (81.25%) good, 3 (9.37%) fair and 1 (3.12%) poor clinical score. Rasmussen's Radiological Scores in present study were 5 (15.6%) excellent, 26 (81.3%) good, and 1 (3.12%) poor. The Rasmussen's clinical score was between the ranges of 14 to 24, with mean score of 20.06. Rasmussen's radiological score was in the range of 12 to [18]. The mean radiological score was 14.88. Our results were comparable with the study of Lee et al [18]. Other investigators who got results with different other scoring systems are given in the table no D3. According to Tilley et al [19] outcome scoring is vital in the accurate evaluation of interventions around the knee.

The most commonly used scoring systems quoted in the literature include the WOMAC, the Hospital for Special Surgery (HSS) knee score, knee society scores, Rasmussen and Iowa scores. The Rasmussen and Iowa scores address fractures around the knee specifically. The Rasmussen score, described in 1973 assesses subjective complaints of pain and walking capacity and clinical signs of knee extension, range of movement and stability.

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