

Treatment of proximal tibia fractures with locking compression plate: a prospective study

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Abstract

Background and Objectives: Incidence of fracture of the proximal tibia is increasing regularly due to road traffic accident. Because of the involvement of the knee joint, restoration of articular congruity and stability is of prime importance to achieve this surgical treatment is best option. There are various implants used for surgery like percutaneous cancellous screw, conventional buttress plate, locking compression plate. The new generation locking plates developed over regular buttress plates for better outcome. So our aim is to study functional outcome, range of movements of the knee, duration for union and complications using locking compression plate in the proximal tibial fractures.

Methods: We studied 50 patients involving proximal tibial fracture in prospective manner. Among them 48 patients operated with ORIF and 2 patients with MIPPO technique.

Results: All patients were followed up till complete union of the fracture. Average follow up period was 16 to 24 weeks. Those patients in whom fracture was fixed in a biological manner using minimal invasive technique results in early union compared to patients treated by open reduction techniques.

We used IKDC score (International knee documentation committee) for the evaluation of clinical results. We had total 3 complications include 2 knee joint stiffness and 1 varus deformity at 6 month follow up. There were no cases of implant failure or implant related complication in our study.

Conclusion: The patient sample approximately reflected the regular trauma patients encountered at our setup, fracture treated with bridge plating and combined principle of conventional and internal fixation (bridge plating) healed rapidly by secondary fracture union and hence achieving strong union across the fracture at a much earlier time compared to LCP as conventional plate. The MIPPO type of reduction and fixation was less time consuming, less soft tissue injury so preserve the bone blood supply subsequently helps in healing of both soft tissue and bone faster.

Keywords: Locking compression plate; interal fixator; bridge plating; MIPO.

Introduction

Proximal tibial fractures are subdivided into extra articular and intra articular. Intra articular fractures significantly alter the anatomy of the knee joint and as a result deformity can occur and early arthritic changes occur and increased morbidity due to changes in load transmission. Direct bending force causes extra-articular fracture of proximal tibia. Most of the proximal tibial fractures occur as a result of vehicle accidents¹ and fall from heights producing high axial loads with associated varus or valgus forces and indirect shearing type of injuries². The principal of surgical treatment in proximal tibial fractures is to reduce the lost articular anatomy as much as possible and start early mobilization, also obtain the normal mechanical axis and ligamentous stability³.

There are various modalities to treat proximal tibial fracture are conservative method with cast application. Operative methods like closed reduction percutaneous fixation with cancellous screws, open reduction and internal fixation with conventional or locking compression plate and external fixation.

Conventional plates are rigid and cause thinning and atrophy of the underlying bone and also secondary displacement can occur due to improper fixation and incidence of refracture is

also common due to thinning of the bone⁴. Time for union of the fracture may also be longer and can go for non union also due to stripping of the periosteum and soft tissue trauma resulting in reduced blood supply to underlying bones.

After the advent of locking compression plates which are technically more superior to conventional plating system, fixation have been more stable and more useful in comminuted and complicated cases and in osteoporotic fractures^{5,6}. We have conducted a prospective study on the use of locking compression plating system in the proximal tibial fractures.

Our objective is to analyze the functional outcome, range of movements of the knee time duration for union and complications following the use of locking compression plating system in the proximal tibial fractures.

Material & Method

Our study is prospective conducted in our institute from November 2017 to December 2019. Total number of patients included in the study were 50.

Proximal tibial fractures extra articular and intra articular with age above 18 years were included in the study. After admitting, patients were evaluated for any other fractures elsewhere and also for any other medical co morbidities. After x rays were taken, fracture was classified according to AO classification system and surgery was planned accordingly. Computed tomographic scans were obtained whenever articular involvement was there.

Temporary immobilization was done with above knee slab whenever the surgery was delayed. After thorough pre op evaluation, patients were taken up for surgery.

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Figure 1: Pre OP X ray



Figure 2: 3 months follow up x-ray



Figure 3: Clinical Photograph

Patients who had huge swelling and impending compartment syndrome were given strict limb elevation and were waited for surgery till the subsidence of swelling.

Operative technique

All the surgeries were done after suitable anaesthesia with patient in supine position under the C-arm guidance. The approach was anterolateral. In both cases open reduction and internal fixation or where minimally invasive surgeries were performed.

In locking compression plating, screw head gets locked in the threads in the screw holes of the plate. Direction of the drilling should be guided by the drill sleeves and it should not change.

Post operative protocol

The patients were mobilized 48 hours after surgery once the operative pain subsided. Static quadriceps and knee range of motion exercises were started with Continuous Passive Motion and knee flexion was gradually increased to 90°. Sutures were removed on 14th post operative day.

All patients were follow up at 2 weeks for suture removal, 6 weeks, 3 months and 6 months.

On each follow up we were assess patient clinically for union, knee range of motion, any deformities and X rays were taken for union and implant position.

Results will be evaluated with respect to the frequency of side of injury, frequency of type of fracture, frequency of method of treatment, clinical results, radiological results and IKDC (International Knee Documentation Committee) score.

Results

The study was prospective conducted in our institute from November 2017 to December 2019. Total number of patients included in the study were 50 which was having closed proximal tibial fracture.

In our study, maximum patients having proximal tibial fracture i.e. 44% were in 51 to 60 years age group while 38% were 41 to 50 years old (Table no.1). Male preponderance with female to male ratio of 1: 2.6, because majority of working population in Indian set up are males.

Road traffic accidents were the most common cause for majority of the fractures i.e 76%.

When the cases were categorized as per AO classification system (Table No.2), most of the cases in our study were B3 and C2 type 26% and 24% respectively, which are generally a result of high energy injuries.

Open reduction and internal fixation was performed in 48 cases and 2 cases were operated by minimally invasive plate fixation techniques (MIPPO). The duration of surgical procedure and amount of soft tissue damage in minimal

Table 1: Age group of patients having proximal Tibial fracture		
Age group (years)	Frequency	Percent
21 to 30	4	8
31 to 40	3	6
41 to 50	19	38
51 to 60	22	44
61 to 70	2	4
Total	50	100

Table 2: Type of proximal Tibial fracture in patients		
Type Of Fracture	Frequency	Percent
A1	0	0
A2	6	12
A3	2	4
B1	4	8
B2	8	16
B3	13	26
C2	12	24
C3	5	10
Total	50	100

invasive technique is less when compared to that in open reduction surgeries. Healing of the tissues also occurs in a rapid rate in minimally invasive surgeries.

In 10 patients, locking compression plate was used in a compression mode, in 18 patients it was used in a bridging fashion whenever severe comminution and osteoporosis was noted in the metaphyseal region. In 22 patients both compression and bridging method of fixation were used.

Bone grafting was needed in 38% patients while 62% patients did not need bone graft.

None of the patients had neurovascular injury. After management, pain was noted in 32% patient at time of discharge, 22% had pain at 1 month which reduced to 2% at 3 months follow-up. Swelling was in 24% patients and 2% patients had superficial wound infection at time of discharge only. In one patient varus deformity was observed at 3rd month imaging studies. IKDC subjective Knee evaluation score was within 37 to 60 with mean of 53.1 at 3 months follow-up. At 6 months the IKDC subjective Knee evaluation was within 40 to 67 with mean of 58.6

After 6 months follow-up examination, it was found that passive flexion ROM of affected side was within 90 to 135 degrees with mean of 121.7 degrees. The active flexion ROM at knee joint was within 90 to 130 degrees with 116.4 degrees mean after 6 months of proximal tibial fracture management. There was normal passive and active flexion ROM on the normal side knee joint. We have two patients of knee stiffness at 6 months follow up recovered after physiotherapy.

There were no cases of implant failures such as breaking of screws, breaking of plates in our case series.

There was statistically no significant ($p > 0.05$) difference of pain, swelling in different AO Type of Fracture at time of discharge.

Discussion

Proximal tibial fractures are one of the most common fracture and involve the most important weight bearing joint of the body. Proximal tibial fractures are increasing everyday due to increasing road traffic accident rate. There is evolution of newer treatment plans and newer implants for the proximal tibial fractures.

Being a major weight bearing joint of the body, management of these fractures is of prime importance, since it results in significant disability and alters quality of life. To overcome this difficulties and to early restoration of strength of bone and function of knee joint with minimal injury to soft tissue they developed locking plates and minimal invasive techniques.

We studied the functional outcome in a total of 50 patients treated surgically with locking compression plate. Patients were analyzed in parameters of age and sex, side of the fracture, AO type of fracture, type of surgery and fixation, and complications following surgery.

Most of the fractures occurred between the age 51 to 60 years i.e. 44%, while 38% were 41 to 50 years old. There was male preponderance with male to female ratio of 2.6:1. (Table 1)

In our study, proximal tibial fractures occurred due to road traffic accident fall in 74% while 26% had fall from height.

The Schatzker classification and AO/OTA Fracture and Dislocation Classification, are commonly used. In this study, we used AO classification. In this series we studied 50 cases. Out of them most of the patients fall into AO type B3 and type C2. (Table No. 2)

In our study, we waited on an average 5 to 7 days for the swelling to subside. Skin wrinkling indicating regression of oedema is a good clinical indicator that it is safe to perform open reduction and internal fixation (ORIF) 7.

We operated all the cases with locking compression plate through anterolateral approach.

In our series we used minimal invasive technique for reduction and fixation in 2 patients (4%), in which both duration of procedure and soft tissue injuries are less compare to open reduction technique, wound healing also better and faster compare to open reduction technique but it demands more surgical techniques.

we used combined principle of fixation in 22 patients and achieved good articular reconstruction and protection from collapse during post operative period. We used bridging type of principle of fixation in 18 patients in metaphyseal comminution fractures. We used compression type principle of fixation in 10 patients where both rigid fixation and buttress effect were needed. But we had 1 case of varus collapse at 3 months follow up because of early weight bearing by the patient (Image 1).

In our study after care involve monitoring for compartment syndrome and neurovascular status especially in the first 48 hours after surgery. Superficial infection was present in 4% patients at the time of discharge treated with oral, topical antibiotics and daily dressing, none of the patients had neurovascular injury in initial 48 hours in our study.

Isometric quadriceps exercises were started as early as possible after surgery. We had 2 cases of knee stiffness at 3 month and 6 month follow up treated with physiotherapy.

In our study IKDC subjective Knee evaluation score was within 37 to 60 with mean of 53.1 at 3 months follow-up. At 6 months the IKDC subjective Knee evaluation was within 40 to 67 with mean of 58.6.

Conclusions

Locking compression plate results have been good with excellent restoration of knee stability, range of movement and minimal soft tissue complication. The LCP incorporates the advantages of minimally invasive techniques with fixed angle device.

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