

Research Article
Orthopaedics

FUNCTIONAL OUTCOME OF MINIMALLY INVASIVE PLATE OSTEOSYNTHESIS OF PROXIMAL TIBIAL FRACTURES USING LOCKING COMPRESSION PLATES

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Abstract:

Introduction: Aim of surgical treatment of proximal tibial fractures is to restore and preserve normal knee function. Locking compression plate device offers potential bio-mechanical advantages. Treatment of these injuries using Minimally Invasive Plate Osteosynthesis (MIPO) techniques may minimise soft tissue injuries, and damage to vascular integrity of fracture fragments.

Material and methods: The present study was carried out among 30 patients aged more than 20 years with closed proximal tibial fractures, Gustilo-Anderson Type I & 2 proximal tibial fractures, proximal metaphyseal fractures, associated ligamentous injuries and associated upper end fibula fractures. Chi square test was used to test statistically significant difference in proportions and a p value <0.05 was considered significant. SPSS version 21.0 was used for statistical analysis.

Results: Majority of the study participants were in the younger age group and Majority of the study participants were males (76.7%) and most of them (70%) did not have any associated co-morbid conditions. Majority of the study participants (70%) had an 'Excellent' final functional outcome after surgery. Proportion of study participants with 'Excellent' final functional outcome was significantly high among those who are young as compared to elder patients. Also, this association was found to be statistically significant (p value – 0.037).

Conclusion: The surgical management of tibial fractures is challenging, demanding the need to give excellent anatomical reduction, rigid fixation, to maintain axial alignment, to restore articular congruity, facilitate early knee motion, thus achieving optimal knee function and thereby preventing post-traumatic osteoarthritis.

Key words: Functional outcome, Minimally invasive plate osteosynthesis, Proximal tibial fracture, Locking compression plate.

Introduction

Aim of surgical treatment of proximal tibial fractures is to restore and preserve normal knee function, by surgical reconstruction and anatomical restoration of articular surfaces, maintaining mechanical axis, restoring ligamentous stability and preserving a functional pain free range of motion of knee.¹ Locking compression plate device offers potential bio-mechanical advantages over other above mentioned methods by better distribution of forces along the axis of bone. Inserted with minimal soft tissue stripping using Minimally Invasive percutaneous plate osteosynthesis (MIPPO), substantially reducing failure of fixation in osteoporotic bones. Reducing the risk of a secondary loss of intraoperative reduction by locking the screws to the plate, unicortical fixation option, better preservation of blood supply to the bone as in case of low contact locking plates, providing stable fixation by creating a fixed angle construct & angular stability and early mobilisation. Treatment of these injuries by MIPPO may minimise soft tissue injuries, and damage to vascular integrity of fracture fragments. Faster wound healing and minimal skin necrosis has also been noted. Plate fixation has become popular for the treatment of fractures of proximal tibia over the last decade.^{2,3} This technique uses indirect reduction methods and allows stabilisation of distal tibia fractures while preserving the vascularity of the soft tissue.⁴ Coupled with biological advantage of percutaneous insertion has resulted in high union rates. By the locked compression plates we have an added advantage of being able to manipulate and reduce the small and osteoporotic fragments directly.⁵⁻⁷ The present study was carried out with an aim to study

the functional outcome of surgically managed fractures of proximal tibia using locking compression plate.

Material and Methods

The present study was carried out in a tertiary care teaching hospital in Puducherry, South India. The hospital caters to a population of about 10 lakh in and the union territory of Puducherry and the neighbouring districts of Tamil Nadu. The study was undertaken as a prospective observational study. Considering the availability of patients and resources within the time line, the total number of subjects to be studied was taken as 30 based on the previous year admission rates to our hospital. Participants who fulfil the eligibility criteria during the study period from August 2014 to August 2016 were included in the study. A minimum follow-up of six months was done for all the patients who are included in the study. Patients who are of 20 years of age and above presenting to our hospital with closed Proximal tibial fractures, Gustilo-Anderson Type 1 & 2 proximal tibial fractures, Proximal metaphyseal fractures, associated ligamentous injuries and associated upper end fibula fractures were included in the study. Patients with pathological proximal tibial fractures other than osteoporosis, Proximal tibial fractures with neurovascular deficit, Patients managed conservatively for other medical reasons and Patients who are medically not fit for surgery were excluded from the study. On fulfilling all the aforementioned eligibility criteria all the selected patients were subjected to radiographs of the knee joint, CT scan of the knee joint and MRI. Brief procedure: Preoperative investigations were done and treatment of the co-morbidities of the patient was done appropriate

specialists. Antibiotics were used pre-operatively and continued till post-op day two. After aseptic precautions and preparation of the part for surgery, proper size of buttress plate, condylar screws and cortical screws were selected subsequently. Joint instability was assessed for, under anaesthesia, to check for any associated fractures. Following surgery, appropriate functional scoring criteria was employed to assess the functional outcome, with due consideration for time to union, ability to return to previous work and occurrence of complications were assessed at two weeks, four weeks, eight weeks, twelve weeks and twenty four weeks. Post operatively, patients were assessed by the Rasmussens scoring system. MIPPO technique: Under the guidance of image intensifier, fracture reduction was done and submuscular plane created. Buttress plate was inserted over the periosteum and fixed with two k-wires to maintain the position. Using the locking sleeve the screw hole drilled and length measured with an indirect depth gauge. Appropriate size 6.5 mm cannulated cancellous screws were inserted. Distally 4.5 mm cortical screws were inserted through stab incisions and after drilling. Once reduction was stable, thorough wound wash was given and wound closed in layers after achieving haemostasis and sterile compression dressing applied. Informed written consent was obtained from all the study participants before including them in the study. Institute ethical committee approval was sought and obtained before the study was begun. Statistical analysis: Data was entered in MS Excel 2013 and analysed using SPSS version 21.0. Descriptive statistics was depicted in the form of proportion and means with standard deviation. Difference

between proportions was tested by using chi square test. A p value < 0.05 was considered statistically significant.

Results

Majority of the study participants were in the younger age group, 23.3% were in the age group of 18-30 years and 30% were in the age group of 31-40 years. Majority of the study participants were males (76.7%) and most of them (70%) did not have any associated co-morbid conditions. RTA was the mode of injury for most of the study participants (86.7%) (Table 1.)

Majority of the study participants (70%) had an ‘Excellent’ final functional outcome after surgery, while one patient had a poor outcome. (Table 2.)

Proportion of study participants with ‘Excellent’ final functional outcome was significantly high among those who are young as compared to elder patients. Also, this association was found to be statistically significant (p value – 0.037). However no statistically significant association was observed between gender of the participants, presence of co-morbidity and the final functional outcome. (Table 3.)

Table 1. Distribution of study participants based on baseline characteristics (n=30)

Characteristics	Frequency	Percent
Age (in years)		
18-30	7	23.3
31-40	9	30.0
41-50	5	16.7
51-60	5	16.7
61-70	4	13.3
Gender		
Male	23	76.7
Female	7	23.3
Co-morbidity		
Present	9	30.0
Absent	21	70.0
Mode of injury		

Fall	4	13.3
RTA	26	86.7
Type of fracture		
Proximal Metaphysis	7	23.3
Type II (Schatzker)	8	26.7
Type III	1	3.3
Type IV	2	6.7
Type V	7	23.3
Type VI	5	16.7
Total	30	100.0

Table 2. Distribution of study participants based on duration of immobilisation and final outcome after surgery (n=30)

	Frequency	Percent
Duration of Immobilisation		
<5 days	18	60.0
>10 days	9	30.0
>3 weeks	3	10.0
Outcome		
Excellent	21	70.0
Good	6	20.0
Fair	2	6.7
Poor	1	3.3

Table 3. Association between baseline characteristics and final outcome (n=30)

Characteristic	Outcome		Total n (%)	P value*
	Good /Fair/ Poor n (%)	Excellent n (%)		
Age (in years)				
18-30	0 (0.0)	7(100.0)	7(100.0)	0.037
31-40	2(22.2)	7(77.8)	9(100.0)	
41-50	4(80.0)	1(20.0)	5(100.0)	
51-60	1(20.0)	4(80.0)	5(100.0)	
>60	2(50.0)	2(50.0)	4(100.0)	
Gender				
Male	05(21.7)	18(78.3)	23(200.0)	0.073
Female	04(57.1)	03(42.9)	09(100.0)	
Co-morbidity				
Present	04(44.4)	05(55.6)	09(100.0)	0.258
Absent	05(23.8)	16(76.2)	21(100.0)	
Total	09(30.0)	21(70.0)	30(100.0)	

* Chi Square test was applied

Figure 1. Pre-op and Post op radiographs of a study participant.



Intra-op:

Proximal minimal incision



Distal stab incision for screw placement





Post op -sutures



Immediate post-op



6 months post:



1 year post-op



Clinical photos



Flexion



Extension



Sitting Cross legged



Squatting

Immediate Post-op



6 Month Post OP



1 Year Post OP



Clinical photo Squatting



Figure 2:

Pre-op XRAY

LAT

AP



Sitting Crosslegged



Discussion

Proximal tibial fractures are one of the commonest fractures occurring as a result of RTA, fall from height, violence etc. It is sometimes associated with other bony or soft tissue injuries. Any fracture around the joint (especially weight bearing knee joint in the lower limb) is of paramount importance as it would result in significant morbidity and quality of life. Hence the treatment of upper tibial fractures especially those with intra articular extension have become a challenge for the orthopaedic surgeons. In our series majority of the patients were males 70%. This can be attributed to our Indian setup where the female population largely work indoor or in agricultural fields and less prone for injuries. The patients with collateral ligament injuries were managed intraoperatively by suturing when required or POP cast immobilization for 3-4 weeks.⁸⁻¹⁰

The period of immobilization was again individualized depending on the security of rigid fixation and associated ligamentous injuries. The benefits of early knee motion are, to prevent knee stiffness and improved cartilage healing (regeneration). However, these benefit are to be cautiously balanced by risks involved with early mobilisation, including loss of fracture reduction, failure of internal fixation and compromised ligament and soft tissue healing. The poor result was mainly due to the early weight bearing attempted by the patient inspite of the surgeons' advice, leading to implant failure. Following which wound debridement was done and LRS (Limb reconstruction system) was applied. Varus deformity (less than five degree) developed in one patients. However the patient showed good functional results. Pradyumna P et al¹¹ in their

study showed that 82% cases achieved full weight bearing in 23 weeks. Krettek C et al¹² in their study observed that the average time to healing was between 12-20 weeks and there was no delay in healing. These findings were identical to that of the ones observed in the current study. Cheng W et al¹³ in a comparative study of MIPO vs open reduction and internal fixation it was noted that in the ORIF group, ten cases were evaluated as excellent, three as good, one as fair and one as poor (among 15 patients studied) and in the MIPO group, ten cases were excellent and five were rated good. These findings on MIPO group of patients where 66.7% of them had excellent outcome was similar to the present study results where excellent outcome was seen in 70% of the study participants. Also, Oh CW et al¹⁴ in their study also reported that 91.3% of their study patients with Upper tibial fracture and who were treated by MIPO, had Good or Excellent outcome which is similar to the results seen in the present study (90%).

Hazarika S et al¹⁵ studied fractures of the distal Tibia and it was reported in their research work that average time to full weight bearing in the closed fracture group was 18.1 weeks and 19.3 weeks in the open fracture group. MIPPO technique of fixation of tibial intra-articular and proximal metaphyseal fractures is very useful.

Bahari S et al¹⁶ in their work on distal tibial fractures concluded that 89% of the patients felt that they were back to their pre injury status and 95% back to their previous employment status, these results were comparable to the present study results where an excellent and good final functional outcome was seen in 90% of the study participants. These observations of the present study were identical to the

ones noted by various other authors.¹⁷⁻²⁰ Being a simple surgical technique and easy to master. It has a very short learning curve. With lesser soft tissue handling, minimal or no disturbance to the fracture hematoma, thus promoting faster bone healing when compared to the other conventional techniques. Early mobilisation is the major advantage, preventing knee stiffness and shortening the post-op hospital stay. Re-fracture after implant removal is also minimal. Excellent functional outcome is achieved. There is a marginal increase in the exposure to radiation due to the use of Fluoroscopic guidance in fracture reduction and fixation. All the necessary steps were and are needed to be taken to protect the Surgeon, patient and the Operation theatre personal. Relatively lesser sample size could be the possible limitation of the study, however considering the eligible patient load with the hospital during the given study period and the sample required to evaluate surgical procedures, the selected sample size derived the desired outcomes.

Conclusion

The surgical management of tibial fractures is challenging, demanding the need to give excellent anatomical reduction, rigid fixation, to maintain axial alignment, to restore articular congruity, facilitate early knee motion, thus achieving optimal knee function and thereby preventing post-traumatic osteoarthritis.

Percutaneous and minimal fixation methods are more biological, require less surgical time, hospital stay, minimal complications and excellent functional outcome. as a result its of a lesser economic burden to the patient

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