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## A prospective study of cases of proximal tibial fractures using locking compression plating

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### Abstract

Standard open reduction and internal fixation techniques have been successful in restoring osseous alignment for proximal tibial fractures; however, surgical morbidity, especially soft tissue infection and wound necrosis, has been reported frequently. For this reason, several investigators have proposed minimally invasive methods of fracture reduction. To our knowledge, there have been no studies to assess the functional outcome of these fractures. During study period 30 patients were treated for proximal tibial fractures treated by open reduction and internal fixation with buttress plate and LCP. Out of which 8 cases lost for follow up. In the present study there were 26 proximal metaphyseal fractures managed plate osteosynthesis. All the fractures united at an average of 13 weeks. There were 4 excellent, 16 good and 2 fair, 1 poor results. There were 1 patients with superficial infections which healed with regular dressings, no patients (5%) with knee stiffness, 2 patients with knee pain, no patients with delayed union, 1 patient with non union. Plating offers a good treatment option for difficult proximal tibial fractures, because plateosteosynthesis provide improved healing rates, restoration of the articular surface, and decreased complications.

**Keywords:** Proximal tibia fracture, LCP, plateosteosynthesis

### Introduction

The proximal tibial fractures involve various fracture configurations. The tibial plateau fractures comprises mainly Lateral condyle, Medial condyle and Bi condylar. Most of these involve articular surface of the tibia, which form part of a major weight bearing joint of axial skeleton of the human body<sup>[1]</sup>.

Demographically, majority of the patients are young adults with robust health. The majority of the injuries are due to, road traffic accidents. These fractures occur due to a combination of axial loading and varus or valgus force applied leading to articular depression.

- High speed two wheeler riding
- Bumper injuries due to direct trauma.

The high energy trauma results in diverse group of injuries, with various degree of severity<sup>[2]</sup>.

- Ranging from simple injuries with predictably excellent results after non operative treatment.
- Complex fracture patterns that challenge even the most experienced surgeons, and many times results are not very satisfactory.
- Often these high velocity injuries are associated with
- Various degree of soft tissue injuries and
- Many fractures are associated with limb threatening neuro vascular injuries, like acute compartment syndrome.

For the diagnosis of these various intra articular injuries encompassing tibial plateau needs high resolution imaging studies including

- High quality digital radiography.
- 3-D C.T Studies.
- MRI Imaging

These imaging studies are required to assess the type of fracture, involvement of

- Articular surface
- Stable or unstable and
- Involvement of supporting soft tissue structures of joint.

This will help the treating surgeon to select the best treatment options.

The twentieth century, has seen a lot of changes in medical field especially in orthopaedic trauma. A better understanding of the bio mechanics, quality of implants, principles of internal fixation, soft tissue care, role of antibiotics and aseptis have all contributed to the radical change in the surgical treatment. Thus treatment concepts are based on restoring or preserving limb alignment will leads to satisfactory results for patients, where as poor alignment, will result in less satisfactory outcomes. Thus we have advanced from conservative approach to best result oriented surgical management of these fractures as accepted mode of treatment<sup>[3]</sup>.

We have come across the high velocity proximal tibial fractures more frequently necessitating plate osteosynthesis with specific indications. The results of this type of treatment obtained was assessed and relevant conclusions drawn.

Proximal tibial fractures are the most common bone injuries that occur during road traffic accidents (High velocity injuries). This is mainly due to its

- Sub cutaneous nature at almost all levels of the leg.
- Soft tissue, muscle coverage, is scanty over antero medial aspect of leg.
- Thus injuring forces can not be absorbed or dissipated so that fractures can be prevented<sup>[4]</sup>.

### Methodology

This study of surgical management of proximal tibial fractures was conducted in the Department of orthopaedics. Clearance was obtained from hospital ethical committee.

During this period 30 patients were treated for proximal tibial fractures were treated by open reduction and internal fixation with buttress plate and LCP. Out of which<sup>[4]</sup> cases lost for follow up.

All the required data was collected from the patients during their stay in the hospital, during follow up at regular intervals and from the medical records.

### Surgical Technique Plate Osteosynthesis

1. Prior to the surgery, the patient & close relatives were counselled
  - Regarding the type of anaesthesia & type of surgery and possible outcome of the surgery
  - Informed & written consent was taken
2. Medical evaluation of the patient and necessary treatment was instituted in certain patients where it was necessary.
3. Then the patient was evaluated any risk factors any type of anaesthesia by anaesthetists.
4. All the patients were kept nil orally for 8-10 hrs before surgery.
5. All the patients were given head & body bath, the hole limb to be operated was thoroughly cleaned including the back & private parts.
6. Inj. tetanous taxoid was given along with xylocaine test dose.
7. Adequate compatible blood (whole blood/packed cells) was arranged.
8. The required implanted in assorted sizes and instrumentation set was kept ready in each case.

### Instruments and implants used in proximal tibial fractures

The various instruments required are

1. Reduction clamps (pointed) for reducing the fracture site.
2. Periosteum elevator : for elevation of periosteum
3. Screw drivers for 4.5mm cortical screws 4mm and 6.5mm cancellous screws (hexagonal drivers preferred).
4. Hand drill, power drill.
5. Drill bit of 3.2mm for drilling the bone
6. Tap of different sizes ie., 4.5mm and 6.5mm tap.

### Follow up

- Patients were followed up at 4 - 6weekly, 8-10wks, 12-16wks intervals until fracture union and at once at the end of 1 year. 6 months and 1year there after.
- Periodic follow up of the patient was done at OPD days.

A thorough clinical assessment was made regarding the symptoms of pain, discomfort, walking ability, movement of joint, any bony tenderness, any abnormal mobility at fracture site presenting/disappearing and associated pain, any shortening of the limb.

Any complications like infection, stiffness of joint, muscular wasting etc and recorded in detailed in patient proforma sheet.

Then followed radiological assessment comparing with previous x-rays.

The fracture was said to united when there was bridging callus at the fracture site at least in three cortices in the anteroposterior and lateral views. Trabeculations extending across the fracture site was also taken into consideration.

The scoring system used in this study was Modified Insall Knee Soscity Scoring System

### Results

In the present study there were 19 proximal metaphyseal fractures managed by external fixators. All the fractures united at an average of 16.5weeks. There were 1 excellent, 9 good, 6 fair results and 3 poor results. There were 6 patients with pin tract infections which healed with regular dressings, 2 patients with knee stiffness, knee pain in 2 patients, 2 patients with delayed union, 2 patients with non union and 1 patient with wire breakage. 23 proximal metaphyseal fractures managed plate osteosynthesis. All the fractures were united at an average of 13 weeks. There were 4 excellent, 16 good and 2 fair, 1 poor results. There was 1 patient with superficial infection which healed with regular dressings. There were no patients with knee stiffness, 2 patients with knee pain, no patients with delayed union, 1 patient with non union.

**Table 1:** Baseline characteristics

	Mean	SD	Min - Max
Duration between surgery and Trauma	4.53	2.06	1 - 10
PWB (In Weeks)	6.0	1.36	4 - 6
FWB (in Weeks)	12.12	1.66	8 - 16
ROM Knee Degree	126.15	8.87	90 - 135
Union (In Weeks)	14.92	2.95	12 - 28
Follow up (In Months)	17.46	2.00	14-22
Knee	73.92	7.52	56-92

**Table 2:** Type of surgery

	Number of Cases	Percentage
MIPPO	13	50%
ORIF	13	50%
Total	26	

**Table 3:** Plate used

	Number of Cases	Percentage
Dual buttress plate	3	11.54%
Dual LCP	6	23.08%
Single Buttress plate	7	26.92%
Single LCP	10	38.46%
Total	26	

**Table 4:** Complications

	Number of Cases	Percentage
Infection	1	3.85%
Knee Pain	3	11.54%
Non Union	1	3.85%
No	20	76.92%
Total	26	

**Table 5:** Result

	Number of Cases	Percentage
Excellent	4	15.38%
Good	18	69.23%
Fair	3	11.54%
Poor	1	3.85%
Total	26	

## Discussion

The average time for fracture union in various studies conducted using various was 13-25 weeks. Our study had an average fracture union of 14 weeks which were comparable with studies conducted using the hybrid external fixator. (Barbieri *et al.* had an average fracture union of 14 weeks and Gaudinez *et al.* had an average of 13 weeks for the proximal tibia. Where as for the proximal tibia, Kumar *et al.* 48 had an average of 24.7 weeks) The study conducted by Gaudinez *et al.* in the management of communitied tibial plateau fractures by hybrid external fixation, which were include 93% were high velocity injuries. They had 4 (22%) pin tract infections and 3 (17%) varus malalignment.5 Kumar *et al.* in a study o group of patients, had an incidence of 3 (5%) malunions and 4 (7%) osteomyelitis. All patients in this series had pin tract infection at some time during the course of treatment<sup>[6]</sup>.

Rademakers *et al.* in their study of 202 tibial plateau fractures treated by ORIF, had the following complications. 11 patients (5.4%) developed a deep wound infection within the first 2 weeks after treatment. In 8 patients (4.0%), a malunion of the fracture developed. One of the common complications encountered in surgical group of patients was infection. The rate of infection was 16.3%. All the infections were superficial infection and healed with time<sup>[7]</sup>.

Jensen *et al.* reported a 22% incidence of osteoarthritis in their study of 109 fractures of all varieties followed up over an average period of 6 years. They attributed this high percentage to meniscectomy done at the time of surgery<sup>[8]</sup>.

Rasmussen reported 17% incidence of post traumatic osteoarthritis. They observed that arthritis was more frequent with bicondylar fractures, varus deformity and unstable knees in extension.

In the present study of exfix, there were 6 patients with pin tract infections which healed with regular dressings, 2 patients with knee stiffness, knee pain in 2 patients, 2 patients with delayed union, 2 patient with non union and 1 patient<sup>[9]</sup>.

In the present study of plate osteosynthesis, there were 1 patient with superficial infections which healed with regular dressings, no patients with knee stiffness, 2 patients with knee pain, no patients with delayed union, 1 patient with non union.

Gaudinez *et al.* based their study on the scale by Ovadia and Beals with 64% patients having good to excellent objective results, and 71% patients had good to excellent objective results, complications included superficial pin tract infections in 3 patients<sup>[5]</sup>.

Zeman *et al.* in their study of periarticular fractures of the tibia treated with hybrid external fixators obtained 5 excellent (26%), 6 very good (32%), 5 satisfactory (26%) and 3 poor results (16%)<sup>[10]</sup>.

Aggarwal *et al.* in their study of hybrid external fixation of high energy peri articular fractures of the tibia had results that were good to excellent in 30 (86%), fair in 2 (6%) and poor in 3 (8%)<sup>[11]</sup>.

Stannard *et al.* studied 34 tibial plateau fractures treated by LISS. All of the fractures healed without additional surgical intervention or bone grafting. The average time to radiographic callus was 6.1 weeks, and the average time to complete union was 15.6 weeks. The articular step-off average was 0.8 mm, with a range of 0 to 5 mm. The postoperative alignment demonstrated 2 patients (6%) with a malunion. There were 2(6%) superficial wound infections and no cases of deep infection or osteomyelitis<sup>[12]</sup>.

Stamer *et al.* studied 22 patients with Schatzker type VI tibial plateau fractures were treated with a hybrid ring external fixator. 8 patients were treated with limited open reduction and internal fixation before application of the frame. 14 patients had percutaneous cannulated screw fixation to stabilize the articular surface without opening the fracture site. Average time to healing was 4.4 months. 4 flexion contractures (18%) of 5-15degrees. Complications consisted of 3 deep wound infections (14%), 1 deep venous thrombosis (DVT) (5%), 1 malunion (5%), and 1(5%) pin tract infection. There were 13 excellent (59%), 3 good (13%), 1 fair (5%), and 6 poor results (23%)<sup>[13]</sup>.

In the present study there were 19 proximal metaphyseal fractures managed by external fixators. All the fractures united at an average of 14.4 weeks. There were 1 excellent, 9 good, 6 fair results and 3 poor results. There were 6 patients with pin tract infections which healed with regular dressings, 2 patients with knee stiffness, knee pain in 2 patients, 2 patients with delayed union, 2 patient with non-union and 1 patient with wire breakage.

In the present study there were 23 proximal metaphyseal fractures managed plate osteosynthesis. All the fractures united at an average of 13 weeks. There were 4 excellent, 16 good and 2 fair, 1 poor results. There were 1 patient with superficial infections which healed with regular dressings, no patients with knee stiffness, 2 patients with knee pain, no patients with delayed union, 1 patient with non union.

## Conclusion

Our study demonstrates improved outcomes in the locked plating group based on several variables evaluated. The 12% higher union rate at 6 months is superior to that of the external fixation group. The average time to union was superior in the plating group (13.5 VS 16 weeks), although the overall nonunion rates at latest follow-up were similar. The improved healing rate may potentially be related to the fixation characteristics of the locking plates, increased use of bone grafting, and/or a more adequate reduction. It should be noted that the overall union rate of 90% is supported by numerous studies in the literature that report union rates of 94% to 100% with plating.

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