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Functional outcome of tibial condylar fractures (Schatzker type V, VI) managed surgically with mippo technique

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Abstract

Introduction: Fractures involving proximal tibia & extending into the knee joint, are known as tibial plateau fractures. They comprise of 1% of all fractures and 8% of the fractures in elderly. Lateral condyle fractures are most common (55-70%). Medial condyle fractures (10 to 23%), bicondylar fractures (10-30%). Most common mechanism of injury is direct axial compression, with a valgus or varus moment and indirect shear forces.

AIM: This study was conducted to observe the functional outcome of surgical management in schatzker type V, VI tibial plateau fractures with proximal locking compression plate.

Materials and Methods: 30 cases of Schatzker type V and VI Tibial plateau fractures were taken up for this prospective study. Patients were followed up for a minimum period of 6 months. First follow up was at 6th week, and second follow up was done at 3 months. Both radiological and clinical evaluation was done at both the times. The anatomic and functional evaluation was done using the modified Rasmussen clinical and radiological criteria.

Results: In our study, we found that most cases were between 5th-6th decade. Males were affected more than females (80% & 20%). Majority of the patients showed involvement of right tibia (21/30), as compared to left (9/30). RTA was the most common mode of injury, accounting to 77% of the cases followed by self-fall-23%.

Conclusion: MIPPO (minimally invasive percutaneous plate osteosynthesis) technique minimizes the size of the surgical incision and avoids soft tissue injury, in turn reducing post-operative complications, leading to better wound healing.

Keywords: Mippo technique, tibial condylar, plateau fractures

Introduction

The fractures which involve proximal tibia and extend into the knee joint, are known as tibial plateau fractures. Proximal tibia is involved in body weight transmission through knee joint. Any injury to this area causes functional impairment and instability of knee joint ^[1].

Tibial condylar fractures result from direct axial compressive or indirect coronal forces, and are known to be one of the commonest intra-articular fractures. They comprise of 1% of all fractures and 8% of the fractures in elderly. Among these, lateral condyle fractures are most common (55-70%). Isolated medial condyle fractures are seen in 10 to 23%, while bicondylar fractures are seen in 10-30% of cases ^[1].

Majority of tibial plateau fractures are caused road traffic accidents; however, fall, sports injury or other less violent trauma can also cause these fractures ^[2]. Most common mechanism of injury is direct axial compression, with a valgus (more common) or varus moment and indirect shear forces, resulting from a high speed velocity accidents ^[3].

Complex fractures of the tibia are difficult to reduce, align and stabilize and constitute significant bony and soft-tissue injuries within and around the knee joint ^[4]. They are prone to develop wound complications as well as infections. The surgical treatment aims to restore congruent articular surfaces of tibial condyles maintaining the mechanical axis and restore ligamentous stability. This will achieve functional painless and good range of motion in knee joint ^[5]. This study was conducted to observe the functional outcome of surgical management in schatzker type V, VI tibial plateau fractures with proximal locking compression plate.

We also assessed possible post-operative complications, duration of union time in TWO sub types of fractures and post-operative knee function with Modified Rasmussen criteria.

Materials and methodology source of data

The study was conducted in the Department of Orthopaedics, Kempegowda institute of medical science and research centre, Bangalore. All patients visiting the outpatient department and emergency department of the hospital were considered. Patients diagnosed with Schatzker type V and VI Tibial plateau fractures who were operated during the time period of October 2016 - 2018 were included in the study. Patients were followed upto 15 months. Only post traumatic fractures were included while pathological fractures were excluded.

Sample size

30 cases of Schatzker type V and VI Tibial plateau fractures were taken up for the study at Kempegowda institute of medical science and research centre

Study period

October 2016 – October 2018

Study Method

Prospective study

Method of collecting data

All cases presenting to the outpatient and emergency department fulfilling the below mentioned criteria were recruited for the study.

Inclusion criteria

- Patients above 18 years of either sex
- Closed tibial plateau fractures
- Radiological diagnosis of fractures with classification including Schatzker’s classification V & VI
- Patients who give consent
- Open fractures up to Gustilo Anderson class I and II

Exclusion criteria

1. Patients below 18 years
2. Schatzker classification I, II,III and IV fractures
3. Patients medically unfit for surgery
4. Concomitant associated fractures in the same limb and upper extremities
5. Patients with pathological proximal tibial fractures
6. Fractures with compartment syndrome or impaired circulation

Patients subjected to surgery were followed up at regular intervals with clinical and radiological evaluation. Assessment was done based on a Performa containing all necessary information.

Surgical procedure

The patient is anesthetized and placed in supine position with a small sand bag under the gluteal region. A tourniquet is applied over proximal thigh and inflated. The limb is draped and surgical area is sterilised.

An anterolateral or posteromedial incision was made and deep dissection was carried out. Full thickness flaps were raised consisting of subcutaneous fat up to the fascia. Submeniscal arthrotomy was carried out preserving the meniscus, to visualise the articular surface. Reduction was done and fixed

with k-wires provisionally, under C-arm guidance. Locking plate or buttress plate was placed and 6.5 mm cancellous screws were applied. Cortical screws were applied in the diaphysis.

Postoperative care

Patient’s vitals were monitored. Patient was advised foot end elevation overnight and suction drain was measured regularly. Splints were removed and mobilisation was done from 4th post-operative day. Non-weight bearing mobilisation was done for 6 to 8 weeks depending on the fracture pattern. Later, the patient was advised partial weight bearing after confirmation of fracture reunion. Suture removal was done on 11th day post operatively. Patients were discharged after giving crutch training and were made ambulatory without weight bearing. Full weight bearing was allowed depending on the progress and fracture healing pattern.

Follow up

The patients were followed up for a minimum period of 6 months. First follow up was at 6th week, and second follow up was done at 3 months. Both radiological and clinical evaluation was done at both the times. The anatomic and functional evaluation was done using the modified Rasmussen clinical and radiological criteria.

Results

This was a prospective study to observe the functional outcome of surgical management in schatzker type V, VI tibial plateau fractures with proximal locking compression plate. The study included cases of Tibial plateau fractures presenting to the emergency and outpatient department at Kempegowda institute of medical science and research center, Bangalore from October 2016 to May 2018.

Analysis was done in terms of functional outcome of postoperative knee range of movement after union, time for fracture union, early and late post-operative complications. In our study, we found that tibial plateau fractures were more common amongst the younger and middle aged population. Most cases were between 31-50 years,i.e. fifth and sixth decade. Males were affected more than females(80% and 20% respectively).

Table 1.

Age distribution (Years)	Frequency	Percentage
<20	3	10
21-30	5	16.7
31-40	9	30
41-50	9	30
51-60	3	10
>60	1	3.3
mean+-SD	39.21+- 11.67	100

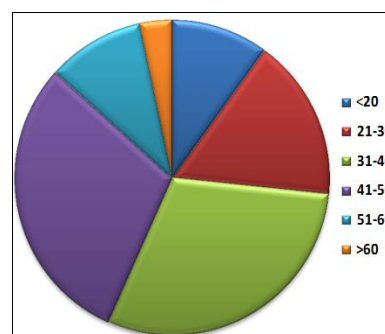


Fig 1.

Majority of the patients showed involvement of right tibia (21 out of 30), as compared to left tibia(9 out of 30). Road traffic accident was the most common mode of injury, accounting to 77% of the cases (23 out of 30), while 23% of patients had history of self-fall.

Out of 30 patients,27 patients(90%) had closed type of fracture, while 3 patients (10%) had open fractures. Among the open fractures,2 patients had type II open fracture, while one had type I open fracture.

Fracture grade (Schatzker Classification)

Schatzker Classification was used to grade the tibial fractures. It was observed that 16 patients (53.3%) had type V fracture and 14 patients (46.7%) had type VI fractures. This signifies that the majority of tibial plateau fractures are severely comminuted intra-articular fractures, which are due to high velocity trauma.

Out of 30 study subjects, 17 of them (56.7%) required dual plating, while 13 of them (43.3%) underwent single plating. Cortico-cancellous bone grafting was performed in 6 patients (20%), who had depressed fracture segments.

Post-operative infection was seen in 2 patients (6.7%), while the rest 28 patients (93.3%) had no complications. The average time for fracture reunion in our study was calculated to be 17 weeks. In 17 patient(56.7%),the fracture union occurred by 17-20 weeks. Among others, 9 fractures(30%) united in 14-16 weeks, while 4 fractures(13.3%) united in 21-24 weeks.

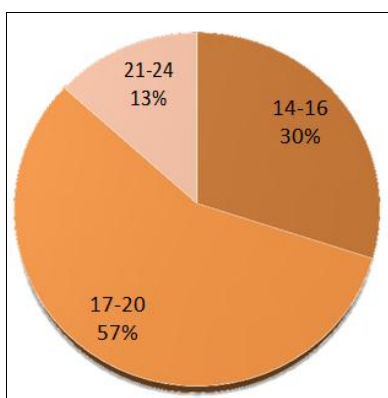


Fig 2.

Table 2.

14-16	9	30
17-20	17	56.7
21-24	4	13.3

Post-operatively, 18 patients (60%) had knee flexion of greater than 120 degrees, while 8 patients (26.67%) had flexion of 90-120 degree. Only 4 patients (13.3%) had a knee flexion of less than 90 degrees.

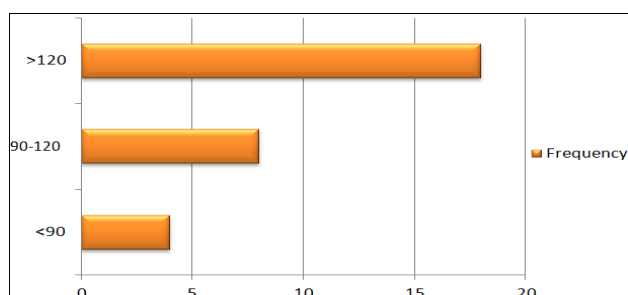


Fig 3.

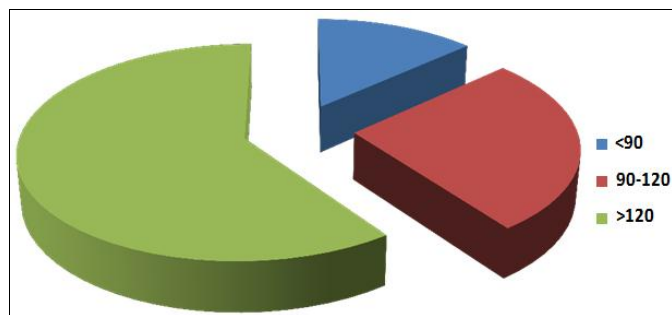


Fig 4.

Table 3.

flexion	frequency	percentage
<90	4	13.3
90-120	8	26.67
>120	18	60

The modified Rasmussen Clinical and Radiological Assessment criteria were used for evaluation of the 30 study subjects post-operatively. It was observed that 17 patients (56.7%) had excellent, 8 patients (26.7%) had good, 3 patients(10%) had fair and 2 patients(6.7%) had poor outcome.

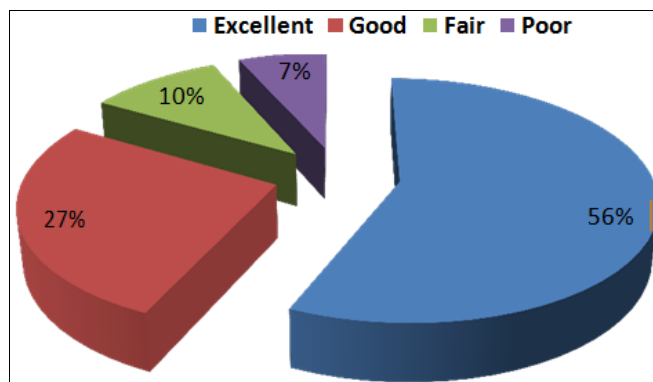


Fig 5.

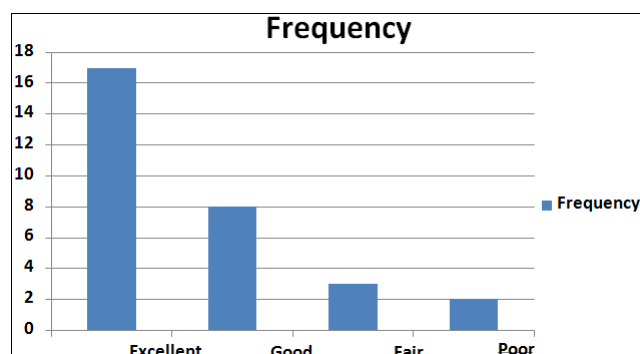


Fig 6.

Table 4.

Result	frequency	percentage
excellent	17	56.7
Good	8	26.7
Fair	3	10
Poor	2	6.7

Discussion

Tibial plateau fractures are high energy intra articular fractures. These serious injuries are usually associated wound dehiscence and severe comminution leading to malalignment.

They are also associated with significant secondary early and late complications. Early diagnosis and prompt treatment allow early joint mobilisation and good clinical results. Our study included 30 cases of Tibial plateau fractures presenting to the emergency and outpatient department at Kempegowda institute of medical science and research center, Bangalore from October 2016 to May 2018.

Age and sex incidence

In our study, it was observed that tibial plateau fractures were more commonly seen in younger and middle age group. The mean age was found to be 39.27%, with the range of 18-65 years. Males were found to be more commonly affected than females. This is probably due to the increased likelihood of involvement in outdoor activities in younger individuals which makes them prone to injury as a result of vehicular accidents. The results were similar to many other studies, as listed in table below.

Table 5.

	Mean age (years)	Gender	
		Male	Female
Biggi f <i>et al.</i> [6]	43	39	19
Lee <i>et al.</i> [7]	42	23	12
Stannard <i>et al.</i> [8]	42	25	12
Schutz <i>et al.</i> [9]	42	16	6

Lee *et al.* (2006) [7], in their study noted that the mean age of patients is 42 years (range 18-82 years), with male preponderance. Sangwen *et al.* [10], conducted a study in north india in 2002, in which they observed that the mean age of patients was 35.5 years (range 21-50 years) with male to female ratio of 11.5:.

The age group of 31-60 years is the most productive period of one's life. Any severe injuries in this period will have a negative effect on the quality of life. Hence prompt and appropriate treatment of these injuries is necessary.

Mode of injury

In our study, we observed that the majority of the patients suffered such fractures after high velocity road traffic accidents (77% of cases; 23 patients), and the remaining were after a domestic fall (23% of cases; 7 Patients). Similar observations were made by Rademakers *et al.* (2007) [11], who reported that 78% of patients had injury sustained by Road traffic accidents. Lee *et al.* [7] also road traffic accidents as major cause of tibial plateau fractures (28 out of 35 patients). In the study by Biggi f *et al.* [6], the most common mode of injury noted was automobile and motorcycle collision (61%; 35/58 patients) followed by domestic fall accounting for 21% (12/58) of the cause of injury. Thus, proximal Tibial fractures are more common after high energy trauma especially motor vehicular accidents.

Fracture type and grade

Gustillo and Anderson classification was used to classify the type of fractures. In our study, we observed that 27 patients (90%) had closed fractures, while 1 patient (3.3%) had type I open fracture and 2 patients (6.6%) had type II open fractures. All the 30 fractures analysed in this study were graded in accordance with the Schatzker classification and it was observed that 16 out of 30 fractures were type V fractures, while 14 out of 30 fractures were type VI fractures.

Sangwan *et al.* [10] noted type I in 9 patients, type II in 1 patient, type IV in 5 patients, type V in 2 patients and type VI in 8 patients, in their study. Prasad *et al.* [12], in their study observed that 20 out of 40 patients had Schatzker type V and other twenty had Schatzker type VI fractures. Hence, majority of fractures were severely comminuted intra-articular fractures. Higher grade of these fractures might be due to the high velocity trauma sustained by the road traffic accidents.

Dual Plating (Lateral L.C.P and medial buttress plate)

In our study, it was observed that Dual plating (Lateral L.C.P and Medial buttress plate) was applied in 57% of the cases (17 cases), which were highly comminuted fractures, i.e. Schatzker Type V & VI. Among these, 8 fractures were Type V & 9 fractures were Type VI.

Chang- Wug Oh *et al.* [13] reported the outcome of double plating in a series of 23 unstable proximal tibial fractures. All fractures healed by an average period of 19 weeks. Among them, 21 patients had excellent or good clinical and radiographic results.

Patil *et al.* (2017), in their study on management of Schatzker's type V & VI tibial plateau fractures, observed that single plating and dual plating of complex Schatzker's type 5 and type 6 fractures ensures stable fixation, immediate mobilization, satisfactory radiological outcome, very high functional outcome with a very low rate of complications [14].

Fracture union

Clinical union is defined as a painless fracture site during full weight bearing and radiographic union as bridging trabeculation across the fracture lines on three of four cortices seen on orthogonal projection in the absence of migration, loosening, or breakage of hardware [15].

In our study, the meantime of fracture union was found to be 17 weeks, with 57% of fractures uniting in 17-20 weeks. Among 30 patients, 6 patients needed additional procedure of cortico-cancellous bone grafting, in view of depressed fracture segments.

These results were similar to the observations made by Lee *et al.* [7], who noted the average time of fracture union to be 4.2 months. Stannard *et al.* [8], in their study reported an average of 15.6 weeks for reunion to occur. Similarly, by Biggi f *et al.* [6], 94% had radiological union by 16-18 weeks' time. Thus, rate of union in our study was in accordance with the other studies using locking plates.

Compartment syndrome

In our study, there were 3 cases (15%) of impending compartment syndrome. Patients were managed conservatively with strict immobilization, foot end elevation and anti-edema measures were taken to reduce the intra compartmental pressure.

The compartment syndrome after Tibial plateau fracture was noted in 31% of patients, in a study by Zura *et al.* [16] with a positive correlation to fracture severity. Barei *et al.* [17] in their study on high energy Tibial plateau fracture reported an occurrence of compartment syndrome in 14.5% patients.

Hence, it is necessary to be aware of the possibility of occurrence of compartment syndrome after high-energy Tibial plateau fractures.

Complications

In our study, complication in the form of infection was observed in 2 cases (7%) out of 30. The infections were superficial, and were treated with antibiotics given according

to culture and sensitivity report. No deep tissue infections were noted. Lee *et al.* [7] and Stannard *et al.* [8] reported occurrence of infection in 8% and 5.9% of their study subjects respectively, which is similar to our study.

Low rate of infection can be attributed to the wound management protocol in the emergency department in conjunction with radical debridement, ensuring skillful handling of soft tissues and perioperative antibiotic coverage.

Functional outcome

The functional outcome was assessed using the Modified Rasmussen Clinical and Radiological Assessment criteria. The criteria involved pain, range of motion at the knee, walking capacity, residual extension lag and stability for functional outcome whereas articular depression, condylar widening, valgus and varus stress and progression to osteoarthritis were used for radiological assessment to determine the final outcome. In our study, 17 patients (56.7%) had excellent, 8 patients (26.7%) had good, 3 patients (10%) had fair and 2 patients (6.7%) had poor outcome.

Reduction of knee motion after tibial plateau fracture is usually due to damage to the extensor retinaculum, to the joint surface or during surgical exposure for fixation. Scarring with or without arthrofibrosis of the knee or patellofemoral joint can lead to restricted knee movement. It is exaggerated by immobilisation of the knee joint after fracture or surgery. It is found that early stable fixation of the fracture, proper soft-tissue handling and early mobilization of the knee maximizes the optimal outcomes after most tibial plateau fractures [17,18]. Schutz *et al.* [9], concluded that surgery with proximal tibia LCP system ensured stable fixation until healing. The range of motion noted in their study was 0-105 degree. A complete healing, a restriction averaging 85 degree was observed in 3 patients, at the knee joint. An extension deficit of 10 degree was observed in one case.

In their study, Stannard *et al.* [8], knee motion ranged from a mean of 1 degree (range 0-10 degree) to 127 degree (range 90 - 145 degree). Biggi F. *Et al.* [6], in their study observed that the average Rasmussen score was 25 at the end of 6 months and the results were good to excellent in 41 out of 58 patients (87%). Egol *et al.* [20], in their study noted the mean knee extension was 1° (0–15°) and the mean knee flexion was 109.3° (60–135°), which they attributed to the

locking plate, which they used for the treatment of bicondylar tibial plateau fractures. Locking plates provide stable internal fixation with a low rate of complications and very good clinical results [21]. Furthermore, they concluded that fractures that have historically required plating through two separate incisions could be treated with one laterally placed implant.

The findings in our study are similar to the above studies. Thus, locking compression plate is an efficient bone stabilization device, even in cases with soft tissue injuries.

Conclusion

Proximal tibial locking plate is a good device to stabilize the fractures of tibial plateau, especially when used in conjunction with proper intra operative handling of soft tissues and active participation of the patients in the rehabilitation programme

MIPPO (minimally invasive percutaneous plate osteosynthesis) technique minimizes the size of the surgical incision and avoids soft tissue injury, which in turn reduces post-operative complications and leads to better wound healing. Surgical treatment lead to proper reconstruction of articular surfaces.

There was no statistical difference in assessing the Schatzker type V and VI fracture patterns. Comparable Results were achieved in radiological, clinical, subjective and functional outcomes based on The Modified Rasmussen Clinical and Radiological Assessment criteria.

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