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Functional outcome of Tibial condyle fractures treated by minimally invasive plate osteosynthesis

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Abstract

Introduction: Tibial plateau fractures with intra-articular extension are very difficult to manage. Age, skin conditions, compartment syndrome and osteoporosis further increase the obstacles in the healing process.

Complex biomechanics of its weight bearing position and complex ligamentous stability and articular congruency are the main reason why these fractures are of concern to surgeon.

In our study we have evaluated the functional outcome of locking plate fixation of tibial condyle fractures using minimally invasive technique, a minimum period of 6 months after plate fixation by Rasmussen score and Knee society score.

Materials and Methods: Tibial plateau fractures treated by minimally invasive plate osteosynthesis using locking compression plate from January 2010 to January 2015 were taken into the study. All the patients who had completed the inclusion criteria were called for assessment of functional outcome of knee using Rasmussen score and knee society score.

Results and Discussion: In our study, we were able to get away with unilateral plating for type V and type VI fractures without any late complications like loss of reduction and malalignment.

Choice of the procedure/implant should be based on the fracture pattern, bone quality and intraoperative reduction.

Conclusion: Treatment of intraarticular tibial plateau fractures is still unsolved.

Our results in minimally invasive percutaneous plate osteosynthesis (MIPPO) technique is in par with the literature.

Keywords: Tibial fracture, Schatzker, osteosynthesis, implants

Introduction

The knee joint is complex and most commonly injured joint now because of increased motor vehicle accidents and sports related injuries. As it is a superficial joint, it is more exposed to external forces and gets easily injured. Tibial plateau fractures with intra-articular extension are very difficult to manage. Age, skin conditions, compartment syndrome and osteoporosis further increase the obstacles in the healing process.

Complex biomechanics of its weight bearing position and complex ligamentous stability and articular congruency are the main reason why these fractures are of concern to surgeon. The ideal treatment of high-energy tibial plateau fractures is controversial. Open reduction and stable internal fixation helps in maintaining the articular surface and restoration of the mechanical alignment which allows early mobilization of knee. But, techniques of open reduction and internal fixation compromise the soft tissues and the rate of wound infection is relatively high.

Various other methods of treatment like hybrid fixation and now plate fixation using minimally invasive technique have been suggested. Each method has its own advantage and disadvantages. The development of locking implants has allowed the use of minimally invasive technique for unilateral plating^[37-39] with improvement in handling the soft tissue^[40-43].

There are lot of studies which assess the general outcome of these fractures but there are only few studies which assess the functional outcome of these fractures which is more important to the patient. In our study we have evaluated the functional outcome of locking plate fixation of tibial condyle fractures using minimally invasive technique, a minimum period of 6 months after plate fixation by Rasmussen score and Knee society score.

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Materials and methods

Tibial plateau fractures treated by minimally invasive plate osteosynthesis using locking compression plate from January 2010 to January 2015 were taken into the study.

Inclusion criteria

Age group: 18 years to 60 years all tibial condyle fracture treated by minimally invasive plate osteosynthesis.

Exclusion criteria

- 1) Skeletally immature patients,
- 2) Neurovascular injuries,
- 3) Concomitant lowerlimb fractures like patella, femur, ankle and pelvic fractures.
- 4) Open fractures

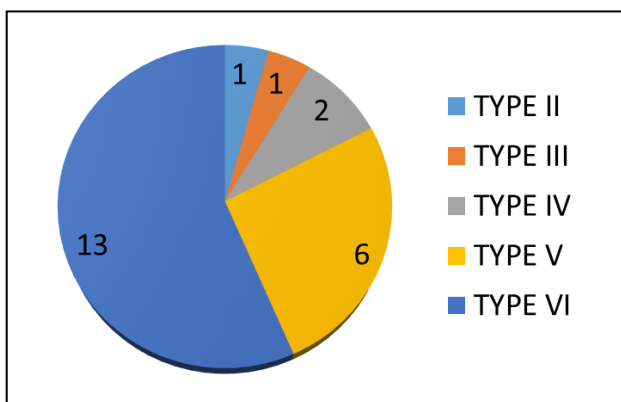
Methodology

This was both retrospective as well as a prospective study. For the retrospective study in-patients and out-patient records of the study population were collected from the medical records department and OT register. Age, gender of the patients, mode of injury, side of involvement, Associated injuries and medical comorbidities were documented. The Neurovascular status of the affected leg, compartment syndrome and any blisters or open wounds was noted. All Tibial condyles fractures were graded preoperatively using Schatzker classification. Patients were followed up postoperatively after a minimum period of six months after surgery. All the patients who had completed the inclusion criteria were called for assessment of functional outcome of knee using Rasmussen score and knee society score.

Results

In our study, 13 patients belonged to type VI, 6 patients belonged to type V, 2 patients belonged to type IV, 1 patient belonged to type III and type II respectively.

Total Number of Patients



Thirteen patients had right tibial plateau fractures and remaining ten patients had left tibial plateau fractures. Only fractures which were treated with MIPPO technique were taken for the study. RTA was the mode of injury in all the cases. In our study type VI Schatzker fractures was the commonest type. Functional assessment was assessed by Rasmussen score (subjective score) and knee society score (objective score). Average follow up period was 22.08 months.

Mean Follow Up

SL.NO	TYPE	AVERAGE FOLLOW UP (MONTHS)
1.	I	-
2.	II	17 (6-17)
3	III	18 (6-18)
4.	IV	32.5 (6-47)
5.	V	19.8 (6-27)
6.	VI	23.1 (6-53)

In type VI Schatzker there were thirteen patients of whom seven patients were treated by lateral plating and six patients were treated by medial plating. Mean Rasmussen score of type VI fractures was found to be 25.6, average knee society score was found to be 93.2 and mean range of knee flexion was found to be 118.8 degrees. All the patients were started on partial weight bearing from 8 weeks and full weight bearing by 12 weeks.

Average Scores by Knee Society and Rasmussen Score

Sl. No	Type	Knee Society Score	Rasmussen Score
1	1	-	-
2	2	98	27
3	3	96	29
4	4	94	26.4
5	5	81.3	22.8
6	6	93.2	25.6

Six patients belonged to type V Schatzker group. Mean follow up was 19.8 months (6-27). Lateral plating was done for 2 patients and medial plating was done for 4 patients. Average Rasmussen score was 22.8, mean knee society score was 81.3 and average range of knee flexion was found to be 118.3 degrees. Only one patient had flexion contracture of 10 degrees. All the patients were started on partial weight bearing at 8 weeks and full weight bearing was started at 12th week. Postoperatively there were no wound infections.

In type IV Schatzker fractures there were two patients. Mean follow up was found to be 32.5 months (6-47). All patients were treated by medial plating. Average range of flexion was found to be 122.5 degrees. Mean Rasmussen score was found to be 26.5. Mean knee society score was found to be 94. There was no wound infection and weight bearing was started at 12th week. In our study only one patient belonged to type III Schatzker fracture. Follow up was done at 18 months (6-18). He was treated by lateral plating and had Rasmussen score of 29. Range of flexion was found to be 120 degrees. Knee society score was found to be 96. No complications were noted.

In type II Schatzker there was only one case which met the criteria. Lateral plating was done. Follow up was done at 17 months (6-17). Rasmussen score was found to be 27, knee society score was 98 and range of knee motion was 125 degrees. No complications were noted. No bone grafts used in our study.

Discussion

Intraarticular tibial plateau fractures are complex fractures accounting for about 1.2% of all fractures. They affect knee function and stability which results in considerable morbidity. These fractures are caused by high velocity injuries and often associated with severe comminution and soft-tissue damage. The goals of treatment are to restore joint congruity, limb alignment and early mobilisation of joint. Stable internal plate fixation without damaging the soft-tissue envelope is very difficult to achieve, only fair results are seen in 20% to 50% in these fractures. Outcome after tibial plateau fracture fixation depends mainly on knee range of motion and strength of the quadriceps. Knee stiffness is more clinically relevant than instability in these fractures.

Open reduction and internal fixation (ORIF) with plates and screws enables direct fracture visualisation, reduction, and fixation, but there is high risk of soft tissue injury, stiffness and deep infection. The hybrid external fixator avoids soft tissue problems, but risks non-union, pin tract infections and poor patient compliance.

The concept of preserving the blood supply and atraumatic surgical technique led to the development of biological fixation techniques. Using this technique, soft tissue damage is reduced and shows higher union rate.

The development of locking implants has allowed the use of minimally invasive technique for unilateral plating [37-39] with improvement in handling the soft tissue [41-43].

Laterally placed locking plates provide better stability in the presence of complex proximal 1/3rd tibia fracture with metaphyseal comminution and serves as an alternative to medial plate or external fixator for additional support of the medial column when a non-locking plate is used for bicondylar fractures. This plate allows fixation through single incision which avoids wound dehiscence, infection and prolonged immobilisation associated with extensile approaches.

MIPPO enables indirect fracture reduction and percutaneous sub muscular implant placement. Favourable outcome is not due to MIPPO but due to less extensive dissection of soft-tissue envelope and devitalisation of fracture fragments.

The aim of our study was to evaluate the functional outcome of tibial condyle fractures treated by minimally invasive percutaneous plate osteosynthesis. There is no universal scoring system for assessing the functional outcome for these fractures. Literature shows multiple scoring system like Rasmussen, knee society score and oxford knee score. In our study, we have evaluated the patients using Rasmussen score which is subjective score and knee society score which is an objective score. All these fractures were treated by a single plate either medial or lateral (11 lateral and 12 medial). In case of type V and type VI fractures, if needed the opposite condyle was fixed with percutaneous cancellous screws.

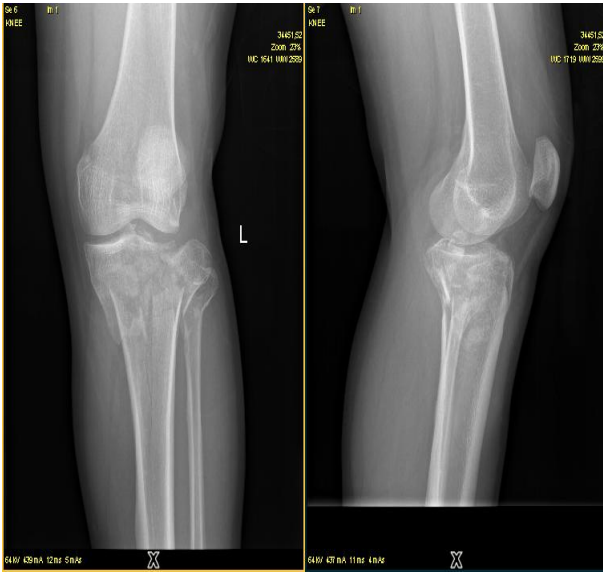
Mechanism of injury was road traffic accident for all these patients. The fractures were classified by Schatzker's classification. 13 patients belonged to type VI, 6 patients belonged to type V, 2 patients belonged to type IV, 1 patient belonged to type III and type II respectively. Even though, according to literature type II fractures were the most common, only one patient with type II fracture was included in our study as all other type II & type I fractures in the study period were fixed only by percutaneous screws hence excluded from the study. Type VI fracture with 13 patients (56.5%) were the most common in our study, next was type V (26.08) with 6 patients. Average followup period was 22 months (6-53). Hasnain Raza *et al*, in their study of assessing the functional outcome of tibial condyle fractures of 41 patients by

minimally invasive plate osteosynthesis by Rasmussen functional score found excellent results in 18 patients, good in 19 patients and 4 patients had unacceptable results. The mean Rasmussen score was found to be 25.3 and range of knee flexion was 118 degrees. In our study mean Rasmussen score was found to be 26.1 and average range of knee flexion was found to be 120.9 degrees. Of which ten patients had excellent and good results each. Only 3 patients had fair results. This is comparable to the study done by Hasnain Raza, Mohammad Ali Tahririan, Seyyed Hamid Mousavitadi, and Mohsen Derakhshan [13] in their clinical study comparing the functional outcomes of tibial plateau fractures treated with nonlocking and locking plate fixation by knee society score, found a score of 80.2 for locking plate and 72.5 for non-locking plate. Average range of knee flexion was found to be 122.3 degrees for locking plate and 115.7 degrees for non-locking plate. In our study, locking plate was used for all the cases. Average knee society score was found to be 92.5 and average knee flexion was found to be 120.9 degrees. So, functional outcome in our study was marginally better than the locking plate group in that study and significantly better than the non-locking group. This shows the superiority of the locking plate in view of stable fixation and early range of motion when compared to non-locking plate. Chang-Wug Oh *et al* [18] in their study on double plating of (twenty three) type V and type VI proximal tibial fractures using minimally invasive percutaneous osteosynthesis found Eighteen patients with excellent, three patients with good and two patients with fair results. Average Rasmussen score was found to be 26 and average knee range of motion was found to be 123 degrees. In our study, nineteen patients belonged to type V and VI fractures. Average Rasmussen score of these type V and type VI fractures were found to be 24.2. Average range of flexion achieved by type V and type VI was found to be 118.5 degrees. Seven patients had excellent, ten patients with good and two patients had poor results. In their study of ten patients Kye-Youl Cho *et al* [5], used a single midline longitudinal incision and dual plating for the treatment of type V and type VI schatzker fractures. Their mean knee society score for the study group was 85 and the mean range of motion was 125 degrees. They had only one case with delayed wound healing as postoperative complication. In our study, average knee society score was found to be 87.25. One patient had 10 degrees of valgus malalignment in type VI fracture and one patient had flexion contracture of 5-10 degrees. But the functional outcome was not significantly altered when compared with others.

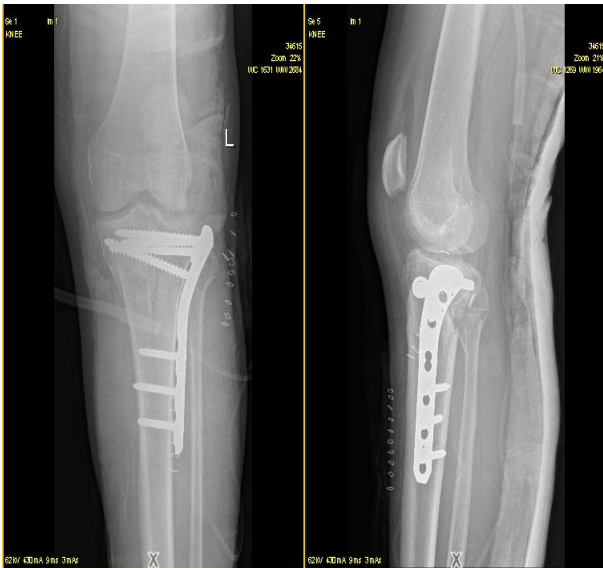
Dual plate gives better biomechanical strength and rigid construct thereby better control of both columns thus avoiding late collapse. There were no major wound problems in any of these studies. Weight bearing was started only at 8-12 weeks which was similar to our study. In our study, we were able to get away with unilateral plating for type V and type VI fractures without any late complications like loss of reduction and malalignment.

Choice of the procedure/implant should be based on the fracture pattern, bone quality and intraoperative reduction.

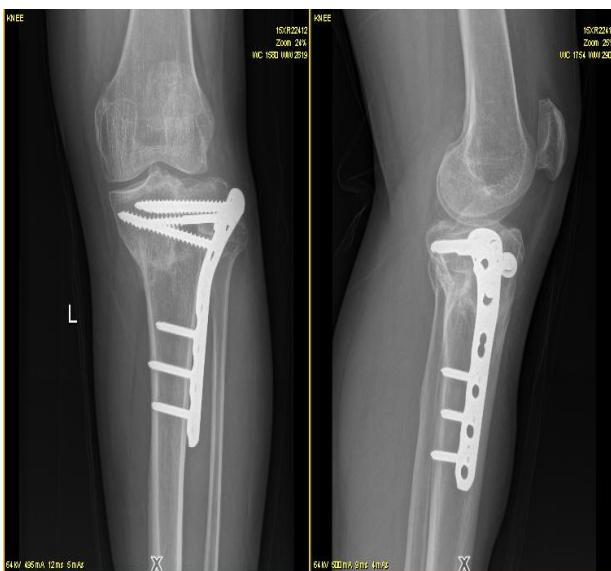
**CASE 1:
Preop Xray**



Immediate Postop Xray



After 6 Months



Clinical Picture



Conclusion

Treatment of intraarticular tibial plateau fractures is still unsolved. Our results in minimally invasive percutaneous plate osteosynthesis (MIPPO) technique is in par with the literature. There is no significant difference in the functional outcome between single plating in our study and dual plating of other studies at midterm followup. Choice of the procedure/implant should be based on the fracture pattern, bone quality and intraoperative fracture reduction.

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