# Clinical and Functional Outcome of Schatzker Type V and VI Tibial Plateau Fracture Treated by Open Reduction and Internal Fixation

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## ABSTRACT

**Background**

One of the most challenging intra-articular fractures to treat is tibial plateau fracture type V and VI because of its controversial treatment protocol. Surgical intervention is the most compatible modality to achieve stable internal fixation and early joint movements. Although the soft tissue is compromised and chance of infection is high due to long exposure time, but the outcome is good after surgery.

**Objective**

To evaluate the clinical and functional outcome treated with open reduction and internal fixation (ORIF) and factors effecting the outcome of the patients.

**Method**

We treated 52 cases of Schatzker type V and VI tibial plateau fracture from April 2018 to May 2020. All of them were managed surgically and the outcomes were evaluated with regular follow ups using oxford knee scoring (OKS) criteria.

**Result**

Forty-three cases (82.7%) had excellent Oxford Knee Scoring (OKS). Wound infections were seen in 5 cases resulting poor outcome (Mean 24.0 compared to 44.7, p = 0.007). Female patients had better outcome in comparison to male patients (Mean 45.0 compared to 41.5, p = 0.041). Older patients had poor outcomes with negative correlation of 0.371, p = 0.007.

**Conclusion**

Open Reduction and Internal fixation in Schatzker type V and VI tibial plateau fractures is an excellent treatment option to achieve good clinical and functional outcome within short period of time interval with very minimum chance of malunion and other complications improving the patients' quality of life. Age, gender and infection are some of the factors that alters the outcome.

## KEY WORDS

*Open reduction and internal fixation, Outcome, Tibial plateau fracture*

## INTRODUCTION

About 1% of total fractures account for tibial plateau fracture and are among the most challenging intra-articular fractures to treat.[1] Varus and valgus force combined with axial loading after road traffic accidents, sports and fall injuries in middle aged males and older females causes fractures along with associated injuries.[2-4]

In Schatzker type V and VI tibial plateau fracture, proper radiological investigation along with the status of soft tissue dictates management option.[5,6] Irrespective of various treatment methods and approaches, ORIF is one of the treatment modalities that can achieve the goals of anatomic articular congruity and mechanical restoration, while allowing early knee immobilization.[7-9]

The main aim of this study is to evaluate the clinical and functional outcome of Schatzker's type V and VI tibial plateau fracture treated with open reduction and internal fixation (ORIF) and factors effecting the outcome of the patients.

## METHODS

We treated 52 cases of Schatzker type V and VI tibial plateau fracture from April 2018 to May 2020 in Orthopedics and Traumatology Department of the First Affiliated Hospital of Jinzhou Medical University, Liaoning, China. Ethical clearance was obtained from the Institutional Review Committee of JZMU on 6th October 2017 with reference number 264. Total of fifty-two patients with Schatzker's type V and VI tibial plateau fractures were included during the study period. The treatment protocol for study population was same i.e. Open Reduction and Internal Fixation. Patients with Schatzker's type I, II, III and IV fractures, pathological fractures and treated with amputation were excluded from the study.

Required parameters for the study as a part of data collection were noted among all 52 patients who met the inclusion criteria for the study. To classify the fracture on the basis of Schatzker's classification criteria of tibial plateau fracture, X-rays and CT scans were taken as a part of investigations. Also, MRIs were performed to rule out meniscus and ligament injuries along with soft tissue damage.[5,6] Fractures were classified using Schatzker's classification of tibial plateau fracture preoperatively.[11]

After radiological investigations and fracture classification, various surgical approaches irrespective of single, double or triple platting were planned accordingly. Selected patients underwent surgical management, ORIF under general or regional anaesthesia with tourniquet control. Cancellous screws, single, dual or triple buttress plates were used to fix the fracture sites via anterolateral or medial or open posteromedial approaches according to the fracture type (Fig. 1 a,b,c,d). Bone grafts from iliac crest were used in

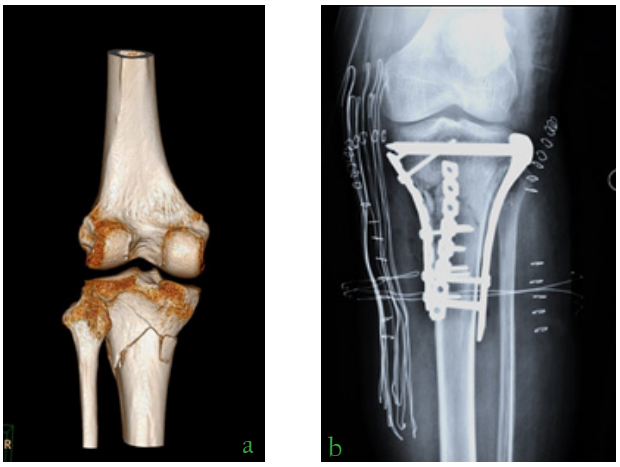


**Figure 1 a. Type VI tibial plateau fracture. b. Type VI tibial plateau fracture.**

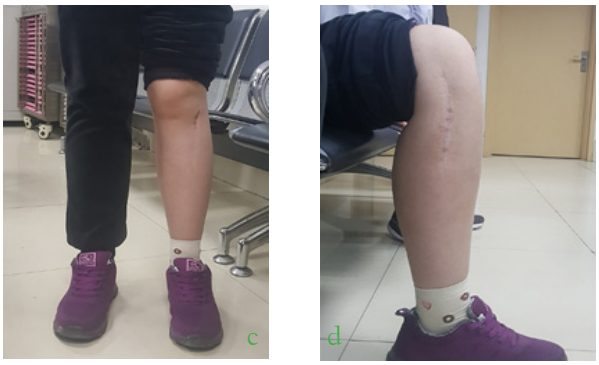


**Figure 1 c and d. Outcome after one year.**

depressed and communited fractures. Intraoperative intravenous antibiotic (Cefuroxime 2 gm stat) prophylaxis were given and patients were transferred to post-operative wards after the completion of the procedure. Amount of blood loss, operation time were noted. Non weight bearing mobilization, quadriceps exercises and active assisted knee bending were initiated on second to third post-operative day.

All patients were reviewed at the interval of three months, six months and one year clinically, functionally and radiologically. Standard Oxford Knee Score (OKS), one of the most validated scoring system questionnaires was used to evaluate the functional outcome of the patients.[12] To find out the outcome, twelve questions like severity of pain, night time pain, inference with usual works, difficulty in doing daily activities like washing, drying, using transportation, shopping, kneeling down and getting up and other questions are mentioned in OKS. After collecting the OKS, patients were grouped according to the maximum score obtained. Outcomes were categorized as poor (0 – 19), moderate (20 – 29), good (30 – 39) and excellent (40 – 48). Score more than 40 was considered to have minimum disability and satisfactory outcome. In addition, radiological union time and full weight bearing times were recorded during follow ups. OKS outcome in relation to various factors were evaluated. Clinical outcome was evaluated too during the follow up visit clinically.

Possible selection and information bias were minimised. Clinical and functional outcome results were analysed on the basis of OKS criteria. Statistical analysis was done in SPSS version 22.0. Quantitative data analysis was done by using Student's t- test to see the relationship between demographic data and OKS, and Pearson correlation coefficient was calculated for quantitative data. P value less than 0.05 was considered to be statistically significant.

## RESULTS

Out of fifty two, 21(40.4%) have Schatzker type V fracture and remaining 31(59.6%) have Schatzker type VI fracture. Most of the fractures were due to motor vehicle accident (n = 39, 75%), followed by fall injury (n = 13, 25%). The age of the patients ranged from 17 to 74 years old (mean age = 46.58 years) and the gender ratio of male (n = 34, 65.4%) to female (n = 18, 34.6%) is 2:1 in our study (Table 1).

**Table 1. Summary of the Patients.**

| Parameters | n (%) |
|---|---|
| Total patient | 52 (100) |
| Age (Mean, Year) | 46.5 |
| Sex (M:F) | 2:1 |
| Male | 34 (65.4) |
| Female | 18 (34.6) |
| **Fracture type** | |
| Type V | 21 (40.4) |
| Type VI | 31 (59.6) |

All patients underwent ORIF for the treatment of both types of fracture. Among all fractures, right sided tibial plateau fracture (n = 35, 67.3%) was more than double of left side (n = 17, 32.7%). We did not find any cases of bilateral tibial plateau fracture. The surgery time ranges from 2 hours 30 minutes to 5 hours. The time of surgery was recorded from the time of incision given to the patient to the incision closure time. Intraoperative blood loss ranges from 180 to 450 ml. Out of five bone grafts, four were done in type VI fractures and one was done in type V fracture. Hospital stay duration ranges from 5 to 18 days with mean stay of 8 days after the surgery. Since few patients developed post-operative infection so the length of the stay extended.

As type V and VI tibial plateau fracture occurs due to high velocity injury, associated injuries are to be expected. In our study six patients had some associated injuries. Two patients had deviated nasal septum along with mandibular fracture in one and right sided pneumothorax in another and both of them had type VI fracture due to road traffic accident (RTA). One patient, painter by occupation had extradural hematoma with right periorbital hematoma with type V fracture due to fall from sixth floor while painting the building. One patient with left distal radius fracture and one with both bone fracture of right hand with right sided type VI fracture in both of them were present due to RTA. One 26 years depressive female, attempted suicide from fourth floor had ipsilateral shaft of femur and proximal fibula fracture with multiple abrasions following type VI fracture.

Radiological bone union time period was in between 12 – 19 weeks with mean 14.92 weeks. There is no significant difference between union time in type V (Mean = 14.7 weeks) and VI (Mean = 15 weeks) fracture. Average full weight bearing was 16.8 weeks (Range 12 – 24 weeks). Along with radiological evaluation, OKS was used to evaluate the functional outcomes. In our study, we found 5 (9.6%) cases of infection postoperatively which were treated with regular intravenous antibiotics and wound dressing. The mean OKS score is much lower among the patients who had infection (24.0 compared to 44.7, t = 5.072, p = 0.007). This indicates that patients with infection had poor outcome.

**Table 2. Outcome according to Oxford Knee Score (OKS).**

| OKS score | No of patient | Outcome |
|---|---|---|
| 0 - 19 | 2 | Poor |
| 20 - 29 | 2 | Moderate |
| 30 - 39 | 5 | Good |
| 40 - 48 | 43 | Excellent |

As for the OKS in final follow up of twelve months, excellent outcome (OKS range 40 – 48) were seen in 43 (82.7%) patients, good outcome (OKS range 30 – 39) in 5 (9.6%) and moderate and poor outcome in 4 patients (n = 2 each) respectively (Table 2). There is significant negative correlation within age and OKS score (r = -0.371, p = 0.007). The result of this study strongly suggests that older aged patient had poorer outcomes compared to younger patient. The mean OKS score is significantly (p = 0.041) higher among females (45.0) compared to males (41.5), indicating the outcome is relatively poorer among males. The slightly poorer outcomes in males compared to females are primarily due to returning to daily outdoor work activities and not taking proper rests. According to the fracture type, there is no any significant difference in OKS Score (44.43 compared to 41.55, t = 1.56, p = 0.124) (Table 3).

**Table 3. Statistical summary of different variables with Oxford Knee Score.**

| Variables | OKS | Remarks |
|---|---|---|
| Age | r = -0.371, p = 0.007 | Poor outcome in older patients |
| Gender | t = 2.105, p = 0.041 | Outcome relatively poor among males |
| Type of fracture | t = 1.566, p = 0.124 | No difference according to type of fracture |
| Infection | t = 5.072, p = 0.007 | Significantly poor outcome seen in infected patients |

## DISCUSSION

Among all six types of tibial plateau fracture according to Schatzker's classification, type V and VI are high energy fractures and its management is challenging to the orthopedic surgeons.[10,11] Motor vehicle accidents and fall injuries are the commonest modes of injury to cause these fractures as we have also noticed in our study. The common age group is the productive age group ranging from 20 to 60 years as mean age in our study is 46.5 years. Globally, males are outdoor workers and females get involved in indoor and less weight bearing works. From various literatures, it is noticed that incidence of fracture is more in males than in females and it resembles with our study also.[3]

For proper surgical planning CT and MRI scan plays vital role and is also very useful to rule out any concomitant injuries.[5,6] In our study, all patients were asked to do either CT scan or MRI to rule out any meniscus injuries and to plan appropriate surgical approach for ORIF. Lachiewicz et al. in their study suggested ORIF with plating as a gold standard treatment method for type V and VI fractures with good to excellent functional and clinical outcomes.[13] OKS is one of the patient's compatible measurement tools to evaluate outcomes. The studies done by Oh et al. in 2006 suggested ORIF as the most acceptable method with excellent result in 91% cases with average healing time of 19 weeks radiologically.[14] Even though different tools have been used for outcome evaluation, outcome results are similar with some of the reported studies as we found 82.7% excellent result with mean radiological union time of 14.92 weeks in our study.

Duration of operation time varies according to type of fracture, associated injuries and amount of blood loss but is not proportionate every time.[10] Average blood loss and duration of operative procedure as recorded in our studies are 278.65 ml and 210 minutes respectively. No any difference is noticed in our study on the basis of associated injuries.

Age is one of the non-modifiable factors that affect the clinical and functional outcome. In many studies, we have noticed that age has strong negative correlation with outcome and so as in our study also. The functional and clinical outcome is poor in older age in relation to younger aged patients as the correlation is seen 0.371 negatively in our study. Jones et al. and Street et al. also reported younger aged patient have excellent outcome in comparison to elderly patients in their studies.[15,16]

In our study, we found 82.7% excellent Oxford Knee Score and 3.8% poor outcome. Since there are various factors like comorbidities of the patients, associated injuries, post-operative infections, age, smoking and alcohol consumption habits that have affected the outcome. Khatri et al. in 65 case series of type V and VI had reported 83% excellent result and the study done by Jagdev et al. in 26 patients observed excellent result in 65.21% of their patients treated with ORIF.[17,18]

We noticed poor clinical and functional outcome in males than that of females. This is because of male being more outdoor workers and they return to active working activities earlier postoperatively. No any studies has mentioned this relation prior. During the follow ups and data collection we found that female patients are more conscious regarding their health issues in comparison to males. This is the rationale why males had poor outcome than females. Though in larger sample size this can be better explained.

In any surgical intervention, infection is one of the deadliest challenges to any surgeons and infection is the most common complication that the surgeons encounter with during the management of tibial plateau fracture. Most of the studies had mentioned about infection effecting the outcome results.[10,17] Barei et al. reported 5.4% superficial infection.[19] Stevens et al. found 10.6% superficial infections in their study.[20] In our study, we found infection (total infection = 9.6%) had direct effect in outcome. Patients with infection had significantly poorer outcome. Some of the studies done by Kortram et al., Aghdassi et al. and Chang et al. have mentioned about the risk factors of infections after surgery.[21-23] In our study, we found infections were seen in those patients who are active smokers and those who consumes alcohol regularly. Also males were common gender for having postoperative infection.

Due to the small sample size, the results could not be generalised. Language barrier is one of the challenges to have the proper communication with the patients. Long-term complications could not be assesed due to the limited time of the study period.

## CONCLUSION

We conclude that even though the operative management of tibial plateau fracture is challenging, Open Reduction and Internal Fixation in high energy tibial plateau fracture Schatzker's type V and VI irrespective of single, double or triple plating could be the most acceptable method for better clinical and functional outcome with early recovery in middle aged and productive population. Some of the factors effecting outcome are increasing age, male gender and wound infection. The surgical approach in these types of fractures can definitely alters the lifestyle of the patients. Thus, minimum complications with excellent patients' satisfaction and optimal recovery can be achieved with ORIF in high energy tibial plateau fracture Schatzker's type V and VI.

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