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# A retrospective analysis of intra articular Schatzker type 5 and 6 proximal tibia fractures treated by dual plating

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**Abstract**
**Aim:** The aim of the present study was to analyse intra articular schatzker type 5 and 6 proximal tibia fractures treated by dual plating.
**Material and method:** The present retrospective study was conducted in the department of KGMC, Lucknow from 2014 to 2018 among 50 subjects who had been treated for a tibial plateau fracture. Their inpatient records were traced from the medical records department. The patients were called for followup. The preoperative data including demographic data, mode of injury, and fracture classification were collected. Radiographic findings including the fracture pattern, displacement of fragments, and depression of fragments were also noted. Computed tomography (CT) scan findings, intraoperative findings, and data regarding the course in the hospital were collected from the inpatient records. After discharge from the hospital, the patients had been followed up in the outpatient clinic at monthly intervals till fracture union and maximal functional recovery.
**Results:** All our patients had 120° and above knee flexion. Four patients had extension lag of less than 5°. None of our patients had deep infection. Functional outcome of our patients was graded by the Oxford Knee Score criteria. 38% of the patients had scores between 40 and 48. Forty percent of the patients had scores between 30 and 39.
**Conclusion:** The results of the present study concluded that open reduction and internal fixation of high‐energy tibial plateau fractures with dual plates gives excellent to good functional outcome with minimal soft tissue complications.

**Keywords:** tibia, fractures, Schatzker type 5, Schatzker type 6

## Introduction
The optimal treatment of Schatzker type V and VI tibial plateau fractures is a controversial and challenging. There is no specific and proven treatment protocol yet. Most patients have significant residual dysfunction even after the completion of treatment.1 though open reduction and internal fixation (ORIF) of these fractures provides good fracture reduction and stability, several authors have reported high rates of complications–deep wound infection, unplanned secondary procedures, and even amputation [1-3].
Lasanianos *et al* [4] in their biomechanical study comparing intramedullary nailing and compression bolt fixation with single lateral locking plate fixation and dual plating technique in the osteosynthesis of Schatzker type VI fractures showed that the collapse of the medial tibial plateau occurred exclusively in the single lateral locking plate fixation group.
Alternate methods of treatment have been described, each with its own merits and demerits [5-7]. In the present study, we evaluated the functional outcome and complications of Schatzker V and VI tibial plateau fractures treated with a lateral plate through an anterolateral approach and a medial plate through a minimally invasive medial approach or an open posteromedial approach.

## Materials and Methods
The present retrospective study was conducted in the department of KGMC, Lucknow from 2014 to 2018. We conducted a search of our medical and operation theatre records for patients who had been treated for a tibial plateau fracture. Patients with Schatzker type I, II, III and IV fractures were excluded from the study. Patients whose fractures had been fixed with a single plate or screws were excluded from the study. Fifty six patients who presented with Schatzker types V and VI tibial plateau fractures during the study period and who had been treated with dual plates were included in the study. Out of 56 subjects, 50 gave consent for the study. Their inpatient records were traced from the medical records department. The patients were called for Follow up. The preoperative data including demographic data, mode of injury, and fracture classification were collected. Radiographic findings including the fracture pattern, displacement of fragments, and depression of fragments were also noted. Computed tomography (CT) scan findings, intraoperative findings, and data regarding the course in the hospital were collected from the inpatient records. After discharge from the hospital, the patients had been followed up in the outpatient clinic at monthly intervals till fracture union and maximal functional recovery. The follow up data were collected from the outpatient records which were retained by the patients and they had brought with them during follow up.
Data regarding the age and gender of the patients, mechanism of injury, side, any concomitant injuries and comorbid conditions were collected. The neurovascular status of the fractured leg, presence of compartment syndrome, and the presence of any fracture blisters or open wounds were also noted. In two patients with popliteal artery injury, vascular surgeon's opinion had been sought and Doppler study had been performed. They were taken up for emergency vascular reconstruction by the vascular surgeon, followed by primary internal fixation. The radiographs and CT scan with 3D reconstruction pictures were reviewed to note the type of the

fracture, the location and extent of articular depression, and fracture extension into the diaphysis, if any.

The fractures were graded preoperatively using the Schatzker's classification of tibial plateau fractures[8]. Soft tissue injuries were classified by the Gustilo–Anderson classification of open fractures and Oestern and Tscherne classification of closed fractures [9, 10]. If there was extensive soft tissue injury, as indicated by soft tissue edema or fracture blisters, surgery was delayed. The limb was elevated and calcaneal pin traction was applied with 3-5 kg of weight. Once the soft tissues recovered, as evidenced by resolution of the edema and the fracture blisters and appearance of skin wrinkles, the patient was taken up for surgery. The operation notes were reviewed to note the time since injury to the surgery, the duration of the surgery, the type of anesthesia, and the extent of blood loss. Details of the operative technique such as the position of the patient, surgical incisions employed, reduction techniques, use of bone grafts, implants used for fixation, and techniques for assessment of reduction were also recorded. Antibiotic prophylaxis was administered at the time of induction of anesthesia in the patients with closed fractures and it was continued for 24 h. Prophylaxis was continued for 72 h.

All the patients had undergone open reduction through an anterolateral approach, and a minimally invasive medial or an open posteromedial approach, and internal fixation with a lateral plate, and a medial or posteromedial plate. Surgeries were performed under fluoroscopic control to aid and assess the reduction. All the surgeries were performed by the senior surgeon, (NKS).

### Operative procedure

Patients were operated under regional or general anesthesia. They were placed in the supine position on the radiolucent table with a sand bag under the ipsilateral gluteal region for the anterolateral approach, which was removed while starting the minimal invasive medial approach. The sand bag was placed under the contralateral hip if a posteromedial approach was used. Tourniquet was used for all the surgeries.

The results were analysed according to the Oxford knee score criteria. The patients were questioned regarding the degree of pain in the knee during the past week, distance that they are able to walk, any difficulty in toilet activities, any difficulty in getting in and out of a car or bus, getting up from the floor or chair, any limp, ability to kneel and get up, any night pains, ability to do household chores or activities of daily living, climbing on coming down stairs, and household shopping. The scores were graded as poor (0-19), moderate (20-29), good (30-39), and excellent (40-48).

### Statistical analysis

Data so collected was tabulated in an excel sheet, under the guidance of statistician. Data was analyzed using IBM SPSS. Statistics Windows, Version 24.0. (Armonk, NY: IBM Corp) for the generation of descriptive and inferential statistics.

## Results

In the present study, all the injuries were a result of vehicular accidents. The age of the patients varied from 21 to 58 years (mean 38.4 years). Hospital stay varied from 4 to 13 days (mean 6 days). The mean duration of follow-up was 4 years (range 1-8 years). Two patients had open fractures (Table 1). The mean duration of the surgery was 1 hour 59 min (range: 54 min to 2 hrs 23 min). The average blood loss was 240 ml (range: 210 ml to 360 ml). All our patients had union in 8-22 weeks (average 14 weeks). All our patients had 120° and above knee flexion. Four patients had extension lag of less than 5°. None of our patients had deep infection. Among the complications, postoperative compartment syndrome, common peroneal nerve palsy, valgus malalignment, skin necrosis, delayed wound healing, follow-up reduction altered 2 mm/less, anterior cruciate ligament laxity grade 1 was reported among 4%, 2%, 4%, 4%, 2%, 8% and 8% of the subjects (table 2).

Functional outcome of our patients was graded by the Oxford Knee Score criteria. 38% of the patients had scores between 40 and 48. Forty percent of the patients had scores between 30 and 39 (Table 3).

**Table 1:** Fracture distribution according to type

| Schatzker Type | Closed fractures (grade - Oestern and Tscherne) | Open fractures (Gustilo - Anderson) | Total |
|---|---|---|---|
| V | 25 ($C_0$4; $C_1$18; $C_2$3) | | 25 |
| VI | 23 ($C_1$14; $C_2$7; $C_3$2) | 2 (IIIC) | 25 |
| Total | | | 50 |

**Table 2:** Complications among the study subjects

| Complications | N | % |
|---|---|---|
| Postoperative compartment syndrome | 2 | 4 |
| Common peroneal nerve palsy | 1 | 2 |
| Valgus malalignment | 2 | 4 |
| Skin necrosis | 2 | 4 |
| Delayed wound healing | 1 | 2 |
| Followup reduction altered 2 mm/less | 4 | 8 |
| Anterior cruciate ligament laxity grade 1 | 4 | 8 |

**Table 3:** Oxford knee score among the study subjects

| Oxford Knee Score | N | % |
|---|---|---|
| 0-19 | 0 | 0 |
| 20-29 | 11 | 22 |
| 30-39 | 20 | 40 |
| 40-48 | 19 | 38 |

## Discussion

Achieving good reduction and stable fixation sparing knee joint is a challenging task in external fixation. Rigid fixation with good articular reduction is an important goal of surgery to get good knee function [11]. Open reduction and internal fixation achieves this goal. Most of the open reduction techniques were associated with high wound complication rates due to midline anterior approach. Reaching the posteromedial fragment through a single incision causes wide periosteal stripping and extensive muscle dissection and may hamper reduction as well. Dual incisions are better than single incision [12].

Loss of articular reduction of less than 2 mm was encountered in three patients and of 2-4 mm in one patient due to loosening of screws in the osteoporotic metaphyseal bone, but it did not affect the functional recovery. Minimal articular cartilage incongruity was well tolerated in the knee joint, possibly due to the presence of menisci [13-14]. Commonly used techniques to assess articular reduction are fluoroscopy, arthrotomy, and arthroscopy. We have relied entirely on fluoroscopy and submeniscal arthrotomy in all cases to assess articular reduction intraoperative.

Our study population was mainly in third or fourth decade, and that may be the reason for no new osteoarthrosis changes

in the series. We found that ligament laxity has a greater impact on the functional outcome than minor irregularity in articular cartilage. Other authors have reported similar good results with dual plating in this difficult subset of fractures. Chang-Wug Oh *et al.* [15] reported the outcome of double plating in a series of 23 unstable proximal tibial fractures in 23 patients with a mean age of 54 years. All fractures healed at an average of 19 weeks. Twenty one patients had excellent or good clinical and radiographic results. There was one case of shortening (1 cm), two cases of mild varus malalignment (less than 10°), and one case of superficial infection which healed after hardware removal. No deep infections occurred. In our series, postoperative compartment syndrome, common peroneal nerve palsy, valgus malalignment, skin necrosis, delayed wound healing, follow-up reduction altered 2 mm/less, anterior cruciate ligament laxity grade 1 was reported among 4%, 2%, 4%, 4%, 2%, 8% and 8% of the subjects.

## Conclusion

The results of the present study concluded that open reduction and internal fixation of high-energy tibial plateau fractures with dual plates gives excellent to good functional outcome with minimal soft tissue complications. The minimally invasive approach should be utilized wherever possible, preventing soft tissue problems, and thus avoiding wound healing issues. Rigid fixation obtained with dual plating is essential to start early aggressive rehabilitation. Regaining full range of movements depends on early and aggressive knee mobilization, and this goes a long way in ensuring optimal functional recovery and patient satisfaction.

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