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# EVALUATION OF THE FUNCTIONAL OUTCOME AFTER TREATMENT OF TIBIAL PLATEAU FRACTURES BY INTERNAL FIXATION- A RETROSPECTIVE STUDY

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**Abstract**

**Background and Aim:** Tibial plateau fractures are challenging, attributing to the fact of their increased incidence, complexity, associated complications, and availability of different treatment options. In this study we evaluated the functional outcome after treatment of tibial plateau fractures by internal fixation.

**Material and Methods:** This retrospective study was conducted on 44 patients who had undergone surgery for tibial plateau fractures over a period of 2 years. All patients were operated under suitable anaesthesia and tourniquet. In all patients, parapatellar approach (medial or lateral) was preferred. Once fracture site was exposed, depression and displacement was noted by elevating the meniscus. Type I Fracture: Percutaneous cannulated cancellous screws under image intensifier guidance were used. Type II **Fracture:** A lateral parapatellar approach was used. Functional Evaluation was: Knee Range of movements and ability to do day to day activities.

Results: There were 13 patients in the age group of 21-30 years, 11in the age group 31-40 years, 9 in the age group 41-50 years, 11 in the age group 51-60 years. Out of 44, 11 were found to be females while 33 were males. Among all, 19 had excellent, 17 had good, 4 had fair and 4 had poor functional outcome.

**Conclusion:** Treatment of tibial plateau fractures is a difficult task. Restoration of articular congruity and early rehabilitation is the primary goal. Proper preoperative planning and adequate reduction will help to achieve early mobilization and optimal functional outcome. The techniques demand considerable skill and timely and proper judgment.

**Keywords:** *Internal fixation, Mobilization, Surgery, Tibial plateau*

## Introduction

Tibial plateau fractures are challenging, attributing to the fact of their increased incidence, complexity, associated complications, and availability of different treatment options. With increased mechanization and acceleration, traveling is associated with increased incidence and severity of these fractures. Sitting mode of traveling expose the knees directly to the loading forces. Bumper fracture is pedestrian injuries seen when a stationary limb is subjected to injury with a moving object. These subjected forces can cause impaction, angulation, rotation or sheering strain. Tibial plateau fractures occur due to a combination of axial loading and varus/valgus applied forces leading to articular depression, malalignment and an increased risk of posttraumatic osteoarthritis (OA) Tibial Plateau fractures vary from being simple undisplaced fractures to severely communited fractures with compartment syndrome. Tibial Plateau fractures vary from being simple undisplaced fractures to severely communited fractures with compartment syndrome. The tibial plateau is a crucial load-bearing area in the human body. These fractures affect knee biomechanics significantly. When treating intra-articular fractures, the goal is to obtain a stable joint permitting early range of motion for cartilage nourishment and preservation.[1] various treatment modalities have been used over the years, with mixed results. These include traction or closed treatment with cast bracing.[2] Surgical procedures including circular frames percutaneous screw fixation open reduction/internal fixation (ORIF) and arthroplasty have also been advocated.[3-7] More recent techniques such as the use of fixed angle devices, arthroscopically-assisted reduction, calcium based cement augmentation and the use of novel grafting methods to address articular depression], constantly gain popularity amongst orthopaedic surgeons.

The tibial plateau is a crucial load-bearing area in the human body. These fractures affect knee biomechanics significantly. They were classically called “bumper” or “fender” fracture. Majority of these fractures are due to high energy trauma like road traffic accidents and fall from height.[8,9] The magnitude, direction, location of the force, limb position at the time of injury, determine the fracture pattern, location, and amount of displacement.[10] Mostly they involve lateral tibial plateau (55% to 70%), medial tibial plateau being rare (10% to 23%) and both plateau are involved in 10% to 30%. Fractures of tibial plateau occur due to a valgus or varus force with axial loading.[11,12]

The main aim of the treatment is to achieve good articular congruity, anatomic and stable fixation with good functional range of motion. However sometimes there is a controversy regarding the timing of surgery and the cost of implants. Earlier due to non-availability of good implants and fear of infection, most of these fractures were managed conservatively. However, with current knowledge about knee biomechanics, availability of good implants including locking plates and introduction of minimally invasive techniques, soft tissue management and antibiotics there is a trend towards operative management.[13] Non operative treatment can lead to complications like stiffness, malunion and prolonged immobilization. Closed/ Open reduction and internal fixation includes use of cannulated cancellous screws, buttress or locked plates including LISS and MIPPO to achieve union and optimal knee function. Soft tissue-friendly approaches and MIPPO or LISS techniques have lead to significant improvement in outcomes after these fractures. Crucial points in management of such fractures include: Extent of damage in tibial plateau fracture is often greater than what is seen on x-ray. Malunion is more common than non-union, Post traumatic stiffness and arthritis are possible complications. In this study we evaluated the functional outcome after treatment of tibial plateau fractures by internal fixation.

## Materials and Method

This retrospective study was conducted on 44 patients who had undergone surgery for tibial plateau fractures over a period of 2 years. The patients of age between 17-65 years of either sex were included in study. Ethical Approval was taken from the institutional ethical committee and written informed consent was taken from all of the participants.

### Inclusion Criteria were

Patients age between 17-61 years of either Gender and those who were willing to participate.

### Exclusion Criteria were

Patients with open fractures and ligamentous injury and those who were not willing to participate.

Type of fracture was decided according to Schatzker classification. All displaced, depressed fractures were operated upon to achieve anatomical reduction, rigid internal fixation and early mobilization.

All patients were operated under suitable anaesthesia and tourniquet. In all patients, parapatellar approach

(medial or lateral) was preferred. Once fracture site was exposed, depression and displacement was noted by elevating the meniscus.

**Type I Fracture:** Percutaneous cannulated cancellous screws under image intensifier guidance were used.

**Type II Fracture:** A lateral parapatellar approach was used. Articular congruity was restored by elevating the depressed fragment using autologous iliac crest graft. Anatomic reduction was obtained and fixed with screws, T or L buttress plates. Type III Fracture: A lateral parapatellar approach was used. A cortical window was made and fragments were elevated using bone graft and fixed. Type IV Fracture: A Medial parapatellar approach was used. Articular congruity was restored by elevating the depressed fragment using autologous iliac crest graft. Anatomic reduction was obtained and fixed with screws, T or L buttress plates. Type V Fracture: A combination of anterolateral and posteromedial approaches with dual plating was used for these fractures. Type VI Fracture: If the fracture involving the medial plateau was undisplaced or if the fragment is large a lateral locking plate was sufficient. However, in comminuted fractures dual plating using a combination of anteromedial and posterolateral approach was preferred.

**Post-Operative Care and rehabilitation:** Static quadriceps exercises were begun from second day followed by gentle knee range of motion exercises. Continuous passive motion was given for about 1 hour daily after pain and edema subsided. The patient was mobilized with non weight bearing walking. Monthly follow up was done and partial weight bearing was started from 6 to 9 weeks depending upon the progress of fracture healing both clinically and radiologically. Any complications, if found, were addressed accordingly.

A detailed questionnaire was completed with each patient to evaluate subjective factors such as pain, functional limitations and occupational considerations. Objective examination included inspection knee and upper tibia for deformity, tenderness, measurement of knee range of movements, light touch and pin-prick sensibility.

The radiographic evaluation included serial anteroposterior and lateral X ray of knee and tibia. Functional Evaluation

1. Knee Range of movements.
2. Ability to do day to day activities.

**Follow up assessment:** All patients underwent investigations of anteroposterior and lateral x-ray of knee and tibia. Functional evaluation was done by using Rasmussen's functional scoring system. Patients were followed up at 6 weeks, 3 months and 6 months postoperatively for clinical and radiological union.

## Statistical analysis

The data was coded and entered into Microsoft Excel spreadsheet. Analysis was done using SPSS version 15 (SPSS Inc. Chicago, IL, USA) Windows software program. The variables were assessed for normality using the Kolmogorov-Smirnov test. Descriptive statistics were calculated.

## Results

There were 13 patients in the age group of 21-30 years, 11in the age group 31-40 years, 9 in the age group 41-50 years, 11 in the age group 51-60 years. (Table 1) Out of 44, 11 were found to be females while 33 were males. (Table 2) Out of total 44 patients, the proximal tibias of left side were 15 and right were 29 patients.

Out of 44 patients, Screw fixation was used in 17 patients, ORIF with Plating in 19 patients and ORIF with Plating and bone grafting in 6 patients. Among all, 19 had excellent, 17 had good, 4 had fair and 4 had poor functional outcome Cannulated Cancellous Screw fixation 16 had excellent, 1 had good, 1 had fair outcome. ORIF with Plating: 2 had excellent, 11 had good, 3 had fair, 1 had poor outcome. ORIF with Plating and Grafting: 4 had good, 1 had fair, 1 had poor outcome.

**Table 1: age wise distribution of study participants**

| Age (years) | Number | Percentage |
|---|---|---|
| 21-30 | 13 | 29.5 |
| 31-40 | 11 | 25 |
| 41-50 | 9 | 20.4 |
| 51-60 | 11 | 25 |
| Total | 44 | 100 |

**Table 2: Gender wise distribution of study participants**

| Gender | Number | Percentage |
|---|---|---|
| Male | 33 | 75 |
| Female | 11 | 25 |
| Total | 44 | 100 |

**Table 3: functional outcome wise distribution of study participants**

| Functional outcome | Number | Percentage |
|---|---|---|
| Excellent | 19 | 43.1 |
| Good | 17 | 38.6 |
| Fair | 4 | 9.09 |
| Poor | 4 | 9.09 |
| Total | 44 | 100 |

## Discussion

Tibial plateau fractures are difficult to manage due to the nature of these fractures being intraarticular, connected with comminution, insufficient soft tissue cover, poor skin condition and risk of compartment syndrome. Even after the best of implants, antibiotics and techniques

management of these fractures remains a challenging task. Tibial plateau fractures especially type V and type VI pose a challenge to orthopaedic surgeons for being very complex, as they are associated with significant amount of comminution, severe soft tissue and ligament injuries, and associated other long bony injuries. In a country like India, it is commonly observed that only the male person is the breadwinner of the family, while others are dependent on him. During such situations if the wage earner gets injured then there is tremendous pressure on the family. Hence it not only affects the man himself but the entire family.

To achieve good radiological and functional outcome, emphasis should be laid on anatomical reduction, stable fixation and early rehabilitation In the present study we assessed the functional outcome of tibial plateau fractures treated by internal fixation.

In our study, individuals in between 21-40 years are the ones who have maximum incidence of these high energy fractures. Boume in 1981 has also presented with similar results with 74 % of the patients in the age group between 15-55 years, whereas 79 % of the patients present in the age group of 20-49 years. Our study also correlates well with the results of the study conducted by Seppo in 1993 on 130 patients where maximum patients belong to middle age group 30-49 years. In our study 75% of the patients were males. In an Indian setup this data can be attributed to the fact that the males are more involved in outdoor works, driving and sports while most females are involved in house hold work. This correlates well with the study done by Vasanand et al (2013)[14] who found 90 % of the patients were male and Wu at al. (2015)[15] found 75% male prevalence in their studies.

In surgically treated patient, acceptable results were obtained in around 82% of patient, which corresponds to series of Palmer I, Rasmussen P.S.[16,17] Poor result was obtained in 4 patients. Patients were satisfied with the final result, and resumed their duties. In our series around 82% of our patients had good to excellent results and this outcome was possible due to proper preoperative planning, suitable timing of surgery, stable fixation, taking care of soft tissue and skin and early rehabilitation., in addition we had 9% fair and 9% poor results. The functional evaluation was done using Rasmussen's criteria. These results were comparable with previously documented studies.

## Conclusion

Fractures of proximal tibia are increasing with the increase in mechanization and increased road traffic in current world today. These fractures are more in men and those who use automobiles frequently for their outdoor ventures. Skin should be healthy to withstand the stress of dual incision and free from any contusion or abrasion as it may affect wound healing. Swelling at fracture site can lead to difficulty in attaining the closure after fixation.

Treatment of tibial plateau fractures is a difficult task. Restoration of articular congruity and early rehabilitation is the primary goal. Proper preoperative planning and adequate reduction will help to achieve early mobilization and optimal functional outcome. The techniques demand considerable skill and timely and proper judgment. The surgeon must have a thorough understanding of local anatomy, the mechanics of fracture fixation, and patterns of fracture healing after fixation if excellent results are to be achieved.

## References

1. Honkonen SE: Degenerative arthritis after tibial plateau fractures. J Orthop Trauma 1995 9:273–277.
2. Jensen DB, Rude C, Duus B et al (1990) Tibial plateau fractures. A comparison of conservative and surgical treatment. J Bone Joint Surg Br 72:49–52.
3. The Canadian Orthopaedic Trauma Society. Open reduction and internal fixation compared with circular fixator application for bicondylar tibial plateau fractures. Results of a multicenter, prospective, randomized clinical trial. J Bone Joint Surg Am 2006 88:2613–2623
4. Ali AM, Burton M, Hashmi M et al. Outcome of complex fractures of the tibial plateau treated with a beam-loading ring fixation system. J Bone Joint Surg Br 2003 85:691–699
5. Apley AG. Fractures of the lateral tibial condyle treated by skeletal traction and early mobilisation; a review of sixty cases with special reference to the long-term results. J Bone Joint Surg Br 1956 38-B:699–708
6. Bansal MR, Bhagat SB, Shukla DD. Bovine cancellous xenograft in the treatment of tibial plateau fractures in elderly patients. Int Orthop Mar 2008 27 (Epub ahead of print)
7. Barei DP, Nork SE, Mills WJ et al. Functional outcomes of severe bicondylar tibial plateau fractures treated with dual incisions and medial and lateral plates. J Bone Joint Surg Am 2006; 88:1713–1721.

8. Cotton FJ, Berg R. Fender Fractures of the Tibia at the Knee. New Engl J Med. 1929;201:989.
9. Schulak DJ, Gunn DR. Fractures of tibial plateaus. A review of literature Clin Orthop 1975;109 June:166-77.
10. Koval KJ, Helfet DL. Tibial plateau fractures: evaluation and treatment. J Am Acad Orthop Surg 1995;3(2):86-94.
11. Hohl M. Fractures of the proximal tibia and fibula. In: Fractures in adults.
12. Rockwood C, Green D, Bucyholz R, eds. Philadelphia: JB Lippincott; 1991; 3rd edn: 1725- 61.
13. Volpin G, Dowd GS, Stein H, Bentley G. Degenerative arthritis after intra-articular fractures of the knee. Long-term results. J Bone Joint Surg Br. 1990 Jul;72(4):634–8.
14. Vasanad GH, Antin SM, Akkimaradi RC, Policepatil P, Naikawadi G. "Surgical Management of Tibial Plateau Fractures – A Clinical Study." J Clin Diagn Res JCDR. 2013 Dec;7(12):3128–30.
15. Wu D, Reng G, Shrivastava A, Yu Y, Zhang Y, Peng C. A useful surgical strategy for proximal tibial fractures (AO/OTA type 41-C) with diaphyseal involvement. Int J Clin Exp Med. 2015 Aug 15;8(8):13455–63.
16. Palmer, I. Fractures of the Upper End of the Tibia. Bone & Joint Journal 1951 33–B(2), 160–166.
17. Rasmussen, P. S. Tibial condylar fractures. Impairment of knee joint stability as an indication for surgical treatment. The Journal of Bone and Joint Surgery 1973; 55(7), 1331–1350.