FIXATION OF POSTERIOR TIBIAL PLATEAU FRACTURE AND ITS OUTCOME: A COMPARATIVE STUDY

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Abstract

Introduction: Tibial plateau fractures are complex injuries of proximal tibia which are produced by high- or low-energy trauma and principally affect young adult population. These fractures usually have associated soft-tissue lesions affecting the treatment. Posterior tibial plateau fractures (PTPF), may be medial or lateral, are common and they occur in about 28.8% patients as a part of bicondylar tibial plateau fractures. These fractures are difficult to reduce, therefore articular incongruity was not found to be detrimental factor in final functional outcomes. Studies have supported the fact that residual articular incongruence is well tolerated by proximal tibial plateau fracture in the form of minimal functional limitation or onset of arthrosis. Anterolateral and anteromedial surgical approaches do not show adequate reduction and fixation of posterolateral and posteromedial fragments. To achieve this, it is advised to reduce and fix the fracture through specific posterolateral or posteromedial approaches that allow optimal reduction and plate/screw placement.

Material and Methods: This comparative prospective cohort study was done on 50 adult patients. Two groups were formed: Group A – double-plate fixation with both posterior and anterolateral having 25 participants and Group B – single anterolateral plate fixation having 25 participants in PTPFs were followed up to 1 year. For Group A, the reduction was done under direct vision and assisted with fluoroscopy in two planes. The reduction was assessed with submeniscal approach. In Group B posterior fragment was reduced by screws through the anterolateral plate followed by CT scan. Patients were evaluated by radiographs every 6 weeks till fracture union is evident. Fracture union was assessed by cortical continuity and progressive loss of fracture line on X-rays. Functional status at 1-year postoperative CT scanogram was done at final follow up to record articular subsidence, nonunion, coronal, or sagittal deformities. Knee functions were assessed by the International Knee Documentation Committee 2000 subjective knee evaluation form and objective functional Knee Society Score (KSS).

Results: There were 22 male and 3 female in Group A while in Group B there were 20 male and 5 female. Right tibial fracture was observed in 15 cases and left in 10 cases in group A while in Group B right fracture was seen in 17 cases and in 8 cases left sided fracture. 23 cases each in group A and B were associated with RTA. Operative time (minutes) in group A and group B was 124 ± 26.7 and 79.52 ± 16.22 respectively. Total mean hospitalization days were 9.4 ± 2.6 in group A and 8.2 ± 1.5 in group B. Union time in group A was 14.6 ± 3.4 weeks while in group B was 15.4 ± 3.2 . Statistically significant correlation was observed in group A and B with respect to KSS clinical outcome and KSS functional outcome. Flexion deformity was observed in 3 (12%) cases in group A and in 6 (24%) cases in group B.

Conclusion: PTPF can achieve an early and satisfactory functional outcome. Rehabilitation and fracture healing are better in PTPF.

Keywords: Tibial plateau fractures, PTPF, Open reduction and internal fixation (ORIF)

Introduction

Tibial plateau fractures are complex injuries of legs which are produced by high- or low-energy trauma and principally affect young adult population. These fractures usually have associated soft-tissue lesions affecting the treatment. Staged treatment is recommended in more complex fracture patterns. Open reduction and internal fixation (ORIF) is the gold standard method of treatment. Complex articular fractures can be treated by ring external fixators and minimally-invasive osteosynthesis (EFMO) or

by ORIF. Posterior tibial plateau fractures (PTPF), may be medial or lateral, are common and they occur in about 28.8% patients as a part of bicondylar tibial plateau fracturesⁱ. Morphology of this fragment has clinical implications when using laterally applied fixed-angle screw/plate implants for stabilizationⁱⁱ. Recently these fractures are approached through posterior route, such as direct posterior, Burke's, and Lobenhoffer, and has enabled surgeons to tackle PTPF more accuratelyⁱⁱⁱ, ^{iv}. These fractures are difficult to reduce, therefore articular incongruity was not found to be detrimental factor in final

functional outcomes. Studies have supported the fact that residual articular incongruence is well tolerated by proximal tibial plateau fracture in the form of minimal functional limitation or onset of arthrosis^{v, vi}.

Anterolateral and anteromedial surgical approaches do not show adequate reduction and fixation of posterolateral and posteromedial fragments. To achieve this, it is advised to reduce and fix the fracture through specific posterolateral or posteromedial approaches that allow optimal reduction and plate/screw placement^{vii}. Therefore this study was carried out to look for the efficacy of posterior approach for fixation of the posterior fragments in addition to standard anterolateral fixation for PTPF.

Material and Methods:

The present study was carried out in Department of Orthopedics at Geetanjali Medical College and Hospital Udaipur. This comparative prospective cohort study on done on 50 adult patients. Ethical clearance by the Institutional Ethical Review Board was obtained. Written informed consent was obtained from all the study participants. Patients included were from the age group of 25 to 64 years. All included patients were skeletally mature patients with closed tibial plateau fractures involving the posterior condyles which was confirmed on CT scan. Patients having open fractures, old or maluniting/malunited fractures, polytrauma, pathological fractures, and floating knee injuries or associated with patella fractures were excluded from the study.

Two groups were formed: Group A – double-plate fixation with both posterior and anterolateral having 25 participants and Group B – single anterolateral plate fixation having 25 participants in PTPFs were followed up to 1 year.

Surgical procedure

All cases were operated in spinal anesthesia and tourniquet application with epidural analgesia. For primary posterior fixation through posteromedial approach of Lobenhoffer, the patient was taken prone on a radiolucent table. If required, a posterolateral approach was used where posterior condylar fracture was from lateral aspect. The patient was repositioned to supine position after posterior fixation and closure were done, for anterolateral fixation. Anterolateral plate was used in both the groups through standard anterolateral approach or minimal invasive percutaneous plate osteosynthesis (MIPPO)

For Group A, the reduction was done under direct vision and assisted with fluoroscopy in two planes. The reduction was assessed with submeniscal approach. In Group B posterior fragment was reduced by screws through the anterolateral plate followed by CT scan.

Postoperatively 3rd day after surgery, dressing was changed and isometric exercises were initiated for quadriceps. Fifth day to 2 weeks after surgery, knee range of motion exercises was initiated when pain subsides. Six weeks postoperative, patients walked with partial weight-bearing with walker on the affected extremity. 16–20 weeks later, when radiograph showed early bone union, full weight-bearing was allowed.

Patients were evaluated by radiographs every 6 weeks till fracture union is evident. Fracture union was assessed by cortical continuity and progressive loss of fracture line on X-rays. Functional status at 1-year postoperative CT scanogram was done at final follow up to record articular subsidence, nonunion, coronal, or sagittal deformities. Knee functions were assessed by the International Knee Documentation Committee 2000, subjective knee evaluation form and objective functional Knee Society Score (KSS)^{viii, ix}.

Statistical analysis was done by using SPSS® version 21.0, IBM, USA. All data was entered in the Microsoft Excel and Categorical/nominal variables were analyzed by Chi-square test with continuity correction.

Results:

Table 1: Demographic data of 50 patients in both the groups was obtained.

Parameters	Group A (n=25)	Group B (n=25)
Male	22	20
Female	3	5
Limb affected (Right/Left)	15/10	17/8
Road traffic accidents (RTA)	23	23
Other	2	2

There were 22 male and 3 female in Group A while in Group B there were 20 male and 5 female. Right tibial fracture was observed in 15 cases and left in 10 cases in group A while in Group B right fracture was seen in 17 cases and in 8 cases left sided fracture. 23 cases each in group A and B were associated with RTA.

Table 2: Functional outcomes and other parameters

Parameters	Group A (n=25)	Group B (n=25)	P value
Operative time (minutes)	124 ± 26.7	79.52 ± 16.22	P < 0.0001
Hospitalization (days)	9.4 ± 2.6	8.2 ± 1.5	P = 0.0513
Union time (weeks)	14.6 ± 3.4	15.4 ± 3.2	P = 0.3959
KSS clinical outcome	85.9 ± 7.4	73.4 ± 11.5	P < 0.0001
KSS functional outcome	80.5 ± 4.9	72.9 ± 10.6	P = 0.0021
Flexion deformity	3 (12%)	6 cases (24%)	P = 0.2743

Operative time (minutes) in group A and group B was 124 ± 26.7 and 79.52 ± 16.22 respectively. Total mean hospitalization days were 9.4 ± 2.6 in group A and 8.2 ± 1.5 in

group B. Union time in group A was 14.6 ± 3.4 weeks while in group B was 15.4 ± 3.2 . Statistically significant correlation was observed in group A and B with respect to KSS clinical outcome and KSS functional outcome. Flexion deformity was observed in 3 (12%) cases in group A and in 6 (24%) cases in group B.

Discussion:

Both high- and low-energy trauma can cause tibial fractures. Usually complex knee fractures are seen in pedestrians struck by vehicles and also in work-related accidents^x. Our study also showed similar results as 23(92%) cases each in group A and B were associated with RTA. Quality of the osteoporotic bone, particularly in third-age people, can lead to complex fracture patterns with low-energy injuries. Also the age of the patient and previous functional status can be crucial in deciding the type of treatment to be applied for such fractures^{xi}. Soft-tissue damage in fractures around the knee is of critical importance and fractures should be considered as soft-tissue injuries with a broken bone inside^{xii}.

Radiographs do not show an exact fragment identification and the initial fracture classification can change in 5% to 24% (mean 12%) of cases and treatment can change in up to 26% of cases after CT scan imaging^{xiii}. Therefore all cases in this study were identified by the CT scan.

Functional outcomes were compared earlier with the various fixation methods. Lee *et al.*^{xiv} compared the outcome of tibial plateau fractures in three groups, wherein Group I isolated lateral tibial plating, Group II classic dual plating, and Group III with hybrid dual plates were assessed using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scoring for 18 months. They demonstrated no significant differences in those scores. Contrary to this, our study revealed a significant difference in objective and functional KSS at 1-year follow-up which implies a better outcome in the dual plating. Difference may be because study did not specifically define the posterior condylar fixation.

Perioperative parameters showed significant differences in both the groups; time for undertaking surgery post-trauma was significantly different. Operative time (minutes) in group A and group B was 124 ± 26.7 and 79.52 ± 16.22 respectively. Total mean hospitalization days were 9.4 ± 2.6 in group A and 8.2 ± 1.5 in group B. Total mean hospitalization days were 9.4 ± 2.6 in group A and 8.2 ± 1.5 in group B which was also statistically significant in our study. In a meta-analysis by Chang *et al.* showed lower surgical time, hospital stay, union time, and incision necrosis in single-plate group as compared to the dual-plate group. The 12-month Hospital for Special Surgery scoring was better in single-plate group^{xv}. No significant difference was observed in Union time in group A (14.6 ± 3.4 weeks) and in

group B (15.4 ± 3.2). Similar observations were shown in studies as union was achieved on an average of 15–16 weeks in either Group^{14, 15}. Our study did not report any infection in both the groups similar findings were observed by other authors^{xvi, xvii}.

Conclusion:

Our study showed that PTPF can achieve an early and satisfactory functional outcome. Rehabilitation and fracture healing are better in PTPF.

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