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## AN EVALUATION OF TIBIA PLATEAU FRACTURE MANAGED SURGICALLY WITH BUTTRESS PLATE AND CANCELLOUS SCREWS

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### Abstract:

**Introduction:** Injuries to the bones forming knee joint particularly tibial plateau fractures can result in functional impairment and also one of the most challenging to treat. Proximal tibia fractures constitute about 8% of all fractures in elderly. Improvements in surgical techniques and implants, has favoured a trend towards surgical managements, with objectives including precise reconstruction of the articular surfaces, stable fixation, early mobilization and repair of all ligamentous and soft tissue lesions<sup>1</sup>. However success of the surgical management needs reevaluation.

**Materials and Methods:** It is a prospective analytical study of 2 year duration. A total of 50 patients with tibial plateau fractures were selected and managed surgically.

Results: In our study of 50 patients, 13 were managed by CRIF with PCCS, 37 were managed by ORIF with Buttress plate and Bone grafting. Post-operative assessment for an average period of 12.56 months done. And the results were analysed in terms of aetiology, sex ratio, age group, classification type, dominant side, complications like OA, knee stiffness, etc.

**Conclusion:** The management protocol of tibial plateau fractures is challenging. Fracture type is the chief determinant for the choice of procedure. The aim is to achieve anatomical reduction and rigid fixation to restore articular congruity, facilitate early knee motion by reducing postoperative complications and thus achieving optimal knee function at the earliest. These fractures, still pose a challenge to the surgeon, they need to be evaluated, planned and treatment executed in the best of experienced hands.

**Keywords:** fracture tibial plateau, Buttress plate, CRIF, ORIF, PCCS.

### Introduction

The knee joint injuries are one of the most challenging to treat. Injuries to the bones forming this joint (particularly intraarticular tibial condyle) can affect knee alignment, stability, movement and result in functional impairment. These fractures constitute about 8% of all fractures in elderly and 1% overall. The lateral condyle is more frequent<sup>1</sup>. Whereas the involvement of bicondylar lesions is found in 10-30% of the reported series<sup>2</sup>.

Tibial plateau fractures had been a therapeutic challenge. More than 1000 articles, thesis and books have documented

the trials and tribulations of treating these fractures. The indications for non-operative versus operative treatment of tibial fractures vary widely in literature. The objectives of surgical management of tibial plateau fracture, is precise reconstruction of the articular surfaces, stable fragment fixation, early mobilization and repair of all concomitant ligamentous and other soft tissue lesions<sup>1</sup>. With improvements in surgical techniques and implants, there has been a trend towards surgical management of these injuries. Nevertheless, tibial plateau fractures remain challenging because of their number, variety and complexity. Despite a plethora of articles, results of various methods of management remains

controversial<sup>4</sup> in this view, success of surgical management needs descriptive evaluation.

### Materials and Methods

The study was carried out at Department of Orthopaedics, Unique super specialty centre, Indore from 1<sup>st</sup> June 2011 to 1<sup>st</sup> June 2013. Fifty patients of the tibial plateau fractures were enrolled. All the required data were collected during their stay, during follow up and from the medical records, on the basis of fixed inclusion and exclusion criteria.

The study included patients with intra-articular fracture of proximal tibia with >2mm depression/displacement in the age group of 18-65 years including comminuted fracture. The exclusion criteria were a) age less than 18 years or more than 65 years, b) Open fractures (Gustillo Anderson type 2 and type 3), c) associated fractures of distal end of femur, d) patients with G.C.S. <7 and e) fractures with <2mm depression/displacement.

### Management Procedure:

In trauma unit, brief history, general and local examination with other injury assessment done. Intensive care is given for patients with low GCS and shock. Once the patients was stabilized, relevant X-rays (Antero-posterior, lateral & oblique view) and other blood investigations were done. Fractures were classified using Schatzker's classification, and were planned for surgery either with closed reduction and Percutaneous Cancellous screws or Open reduction and internal fixation with buttress plate.

### Surgery:

The surgery was done after the swelling subsided. All surgeries were done under image control. Out of 50 patients, 37 patients were treated by open reduction and internal fixation (ORIF) with buttress plate,

screws. Bone grafting was used in depressed and comminuted fractures. The fixation devices consisted of T Buttress plate, L Buttress plates, 4.5mm cortical screws, 6.5mm and 7.0mm cannulated and non-cannulated cancellous screws. Thirteen (13) patients were treated by closed reduction and percutaneous cancellous screw fixation with 6.5mm and 7.0mm screws.

Postoperative regime: patients were immobilized with an above knee posterior slab. The sutures were removed on the 12th postoperative day. An Intravenous antibiotic was given for 3 days followed by oral antibiotics for another 7 days. Depending on the type and post-operative fracture stability the patients were advised quadriceps exercises, knee mobilization and non-weight bearing crutch walking. An immediate postoperative X-ray was also done.

Follow up: At 2 weeks, the sutures were removed, surgical scar was inspected and range of movements noted. At second follow up at 1 month X-ray was taken to look for signs of fracture union and loss of reduction if any. The third follow up was done at 2 months; fourth follow up at 3rd month during which clinical evaluation of union was done. Based on the clinical and radiological signs of union patients were allowed partial weight bearing and which gradually progressed to full weight bearing. Next follow up were at 6 months, 1 year and 2 years (patients having any of the complications were followed up on monthly basis) respectively during which time the anatomic and functional evaluation was done using the modified Hohl and Luck evaluation method. The post-traumatic osteoarthritis was assessed on the most recent radiographs taken with the patients standing.

**Statistical Methods:** Mean  $\pm$  standard deviation, Chi-square test, Fisher Exact test, Confidence Interval, Statistical software namely Systat 11.0 and others has been used for computation of data.

**Table No: 1 - Functional grading used in evaluation**

**Modified Hohl and Luck Evaluation Method 5**

Grade	Lack of extension (degrees)	Range of motion, knee (degrees)	Varus / valgus instability (degrees)	Walking distance (meters)	Pain*
EXCELLENT all of the following	0	>120	<5	>3000	None
GOOD not more than one of the following	<10	<90	>5	<1000	Mild on activity
FAIR more than two of the following	>10	<75	>10	<100	Moderate on activity, intermittent at rest
POOR	All results worse than fair				

\*The grade cannot be higher than that for pain

**Table No: 2 - Radiographic grading used in evaluation****Radiographic grading in evaluation6:**

Grade	Valgus/varus Deformity (degrees)	Depression of articular surfaces(mm)	Osteoarthritis
EXCELLENT(all of the following)	≤5	< 5	None
GOOD (not more than one of the following)	>5	> 5	Minimal
FAIR (not more than two of the following)	>10	> 5	Moderate
POOR	All results worse than fair		

\*The grade cannot be higher than that for osteoarthritis

**Results**

The results were analysed under various terms- youngest patient was 23 years, oldest was 65 years, with average age group of 42.12 years, Majority (48%) of patients were between 31-50 years of age. 78% were male and 22% were female, 56% sustain injury on the left side and 44% on the right. 68% of the patients sustain injury secondary to RTA while 32% due to fall. As per Schatzker's classification system 10% of the patients were type I, 36% type II, 16% type III, 10% type IV, 20% type V and 8% type VI, Maximum being type II.

74% of the patients were treated with open reduction and plate fixation and 26% with percutaneous cancellous screw fixation. The early complications which includes infection, loss of reduction peroneal nerve injury and compartment syndrome are seen in 7 patients out of 50 (14%) and Late complications including posttraumatic osteoarthritis, knee stiffness, knee

instability, and malunion seen in 22% of patients. Both early and late complications are more associated with open reduction and plate fixation than close cancellous screw fixation. The average time of fracture union is 3.70 months. Based on H&L method 24% of the patients had excellent, 48% good, 18% fair and 10% poor outcome.

Fall is associated with higher age group (>30yrs compare to <30 yrs.) compare to RTA. Regarding associated injuries, there were 2 of fracture of lower end radius, 1 of Patella, 2 of metatarsals, 2 Bi-Malleolar fracture, 1 Medial Malleolus fracture, 1 contralateral fracture shaft femur, 1 ipsilateral fracture both bone forearm and 1 pelvic fracture.

**Table no- 3: Treatment and Outcome**

Treatment modalities	No. Of patients	Excellent	Good	Fair	Poor
ORIF	37	6(16.2%)	19(51.35%)	7(18.91%)	5(13.51%)
PCCS	13	6(46.1%)	5(38.46%)	2(15.38%)	0(0%)
TOTAL	50	12(24%)	24(48%)	9(18%)	5(10%)
P VALUE		0.001			

**Table no. 4: Treatment and type of fracture**

Type of fracture	Patients	Mode of treatment	
		ORIF with buttress plate	Percutaneous cancellous screws
TYPE I	5	0	5
TYPE II	18	13	5
TYPE III	8	7	1
TYPE IV	5	3	2
TYPE V	10	10	0
TYPE VI	4	4	0
TOTAL	50		

**Type I:** All # was fixed with a 6.5 cc screw per-cutaneously.

**Type II:** out of 13 two patients with associated bimalleolar fracture on the contralateral side managed simultaneously.

**Type III:** out of 7 patients who requires ORIF, two patients even required elevation of depressed plateau and bone grafting.

**Type IV.** One patient had associated 3rd metatarsal fracture of right foot, managed with percutaneous k-wire.

**Type V.** 3 pts had to even undergo bone grafting. One patient had associated fracture of patella (undisplaced) managed conservatively. One pt. had associated fracture of medial malleolus which is managed surgically with two malleolar screw. One had associated fracture of pelvis (minimally displaced) managed conservatively.

**Type VI.** All of them underwent Open reduction with plating, out of them 2 required bone grafting, one patient had associated fracture both bone forearms managed surgically simultaneously. The average period of hospitalization with Closed Reduction and percutaneous cancellous screw comes to be a mean of 5.54 days, Open reduction and buttress plating shows a mean of 9.32 days. The excellent and good results were significantly associated with cancellous screw fixation.

**Table no. 5: Treatment and hospital stay in days, Time of union in months, Follow up in months**

Treatment Modalities	No. of patients	Hospital stay (days)	Time of union(moths)	Follow up (moths)
ORIF WITH B PLATE	37	9.32±5.20	4.05±1.29	13.43±6.39
PCCS	13	5.54± 3.33	3.07±0.86	9.84±3.13
TOTAL	50	8.34± 5.04	3.76±1.09	12.56±5.97
P Value		0.005	0.0046	0.011

**Table no. 6: Pain during follow up**

Pain during follow up	No. of patients	Percentage (%)
Mild ache	9	18
Occasional pain	14	28
Discomfort in ordinary	7	14
Pin on all activity	8	16
No Pain	12	24

Evaluating Post traumatic OA grade (X-ray based), 88% of patients are under grade 0, while 8% and 4% of patients comes under grade 1 and grade 2 respectively.

## Discussion

High energy intraarticular fractures of the tibial plateau are a cause of ongoing management problems and debate, and remains challenging for orthopaedic Surgeons<sup>7</sup>. The fracture being intra articular complicates the treatment plan. The results of the non-operative management of these injuries have historically been unsatisfactory.<sup>8,9</sup>. In this study of 50 patients, followed up over a period of 24 months. 13 patients were managed by Closed reduction and Percutaneous cancellous screw, 37 were managed by Open reduction and internal fixation with Buttress plate and Bone grafting. Patients were followed up for a minimum of 3 months and a maximum of 2 years. These fractures need best treatment option which can provide maximal function, since majority of the patient are male, the working and earning age group / family heads. RTA founds to be the major cause of the fracture in young adults pertaining to more outdoor activity, while FALL as the cause of fracture in higher age group. However low velocity Type II fractures founds more commonly followed by Type V and Type III. Variable associated injuries like Coronal and sagittal plane instability, other bone fractures etc requires complete evaluation of patient as a whole with serial assessment (secondary and tertiary survey) of injuries. Early Identification of associated trauma and their simultaneous appropriate management helps in faster recovery and rehabilitation.

Displaced intraarticular fractures of proximal tibia, those belonging to Schatzker's type I, Should be treated by Closed reduction and Percutaneous cancellous screw while Displaced Type II, III, and IV needs ORIF with buttress plate and bone grafting. However depending on fracture geometry, percutaneous approach can also be considered, given promising results. In high velocity injuries belonging to Schatzker's' type IV, V, VI results varied depended on the reconstruction of the articular surface and collapse of the fracture during post-operative period. Incidence of minimal to moderate post traumatic osteoarthritis and infection were higher in

such patients. Radiograph based Incidence of osteoarthritis was assessed. Study shows minimal to moderate posttraumatic osteoarthritis in high velocity injuries. However in patients treated with precise surgical reconstruction of the articular surfaces, incidence of osteoarthritis is less.

The main surgical aim includes precise reconstruction of the articular surface, elevation of the depressed bone fragment, bone grafting, stable fragment fixation, repair of all concomitant ligamentous / soft tissue injuries and early range of movement. A rigid fixation and early physiotherapy reduces the complications like knee stiffness, post traumatic OA and hence less economic burden on the family and the society as a whole. Early ROM physiotherapy shows good results in the form of function range of arc of motion. Nevertheless high grade fracture with more pain and more duration of immobilization results in compromised arc of motion.

Both early and late complications are more associated with higher fracture grade and open procedure, than with low grade fractures and percutaneous procedures. Early mobilization also offered the advantage of patients returning to their work early. However few may show no pain, few may experience mild ache while some may have pain in all too even ordinary activities.

Most of the anatomically reduced fracture takes 3-4mths for union, so appropriate period of immobilization and non-weight bearing physiotherapy should be considered. However malunion may also occur. Patient with Even high grade of fracture can be discharged in nearly 8 days (Open reduction and fixation requiring more time of stay than, close reduction and fixation). Functional evaluation of the knee based on the modified Hohl and Luck evaluation methods shows good to excellent results in most of the patients managed surgically, favouring surgical management of tibia condyle fracture; however 10% shows poor result.

In summary, surgical intervention in the form of PCCS and ORIF has assumed a

prominent role in the treatment of tibial plateau fractures. The less period of immobilization, achievement of articular congruity, and anatomical reduction of fractures represents an important advantages. However in higher grade fractures the rate of infection, malalignment and development of osteoarthritis was a cause of concern.

Despite the prospective nature of the study, and smaller number of subjects. Still there are a number of results in our study which shows trends that approach the accepted level of significance. Both techniques provided a reasonable method of fracture reduction and stabilization. Closed reduction and Percutaneous cancellous screw results in shorter hospital stay, fewer and less serious complications, marginally faster return of function and similar and superior clinical outcome.

In our experience, care full ORIF with Buttress plate shows excellent functional and radiological results at long term follow up. Therefore for the patients with high grade fractures and fracture who has displacement of more than 2mm, we recommend treatment by ORIF or PCCS depending on fracture pattern and stability

after closed reduction. To some up, closed reduction and PCCS and ORIF with buttress plate have assumed a prominent role in the treatment of tibial plateau fractures.

### Conclusion

We conclude that closed reduction and internal fixation with PCCS gives excellent results for displaced fractures belonging to Schatzker Type I. In Type II, Type III, and Type IV, ORIF with B plate is to be done, but PCCS in selective patients also shows good results. Type V and Type VI can be managed by open reduction and internal fixation with Buttress plate and bone grafting especially in young individuals who require perfect anatomical reconstruction of the articular surface, stable fixation, early ROM physiotherapy, and rehabilitation Which help patient to achieve knee arc of motion in the functional degrees earlier. However aseptic operation technique, surgeons experience in handling soft tissues and patient related factors are important determinants for success of your surgery and post operative complications. Moreover a large number of subjects and multicentric study is needed to show the strict association.

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