



## Evaluation of percutaneous fixation of tibial plateau fractures by cannulated cancellous screws with respect to mode of injury and type of fracture

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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 13 patients with tibial plateau fractures were selected and managed surgically.*

*Results: In our study of 13 patients, all were managed by CRIF with PCCS. Post-operative assessment for an average period of 12 months done. And the results were analysed in terms of aetiology, sex ratio, age group, classification type, complications like OA, knee stiffness, etc.*

*Conclusion: The management of tibial plateau fractures is a great challenge to surgeons . the type of fracture will decides the the choice of procedure. Our goal is to achieve anatomical reduction and rigid fixation to restore articular congruity, facilitate early knee motion by reducing postoperative complications so that optimal knee function achieved at the earliest. These fractures need to be evaluated, planned and treatment executed in the best of experienced hands.*

**KEYWORDS : tibial plateau fracture, CRIF, PCCS,OA**

### INTRODUCTION

The lateral side of the knee joint is most commonly injured during road traffic accidents, which results in torn ligaments, sprains, and fractures of one or both condyles.<sup>1</sup> Tibial plateau fractures are intra-articular fractures caused by high-velocity trauma. They are usually associated with neurovascular injury, compartment syndrome, compounding of fractures,

and crushing of soft tissues. Associated injuries at and around the knee joint are more common and severe in patients with fracture-dislocation.<sup>1,2</sup> The treatment outcomes for tibial plateau fractures are inconsistent.<sup>1-3</sup> Closed reduction (based on ligamentotaxis principles) and internal fixation (with percutaneous cancellous screws and washers) avoids the disadvantages of both operative and conservative treatments. However, it is not suitable

for all types of tibial plateau fractures, particularly

grossly comminuted and depressed fractures, Schatzker type-VI fractures, and open fractures.<sup>4,5</sup> We evaluated treatment outcomes of closed reduction and percutaneous screw fixation for tibial plateau fractures.

### MATERIALS AND METHODS

Between January 1999 to December 2002, 10 men and 3 women aged 20 to 60 years underwent closed reduction and percutaneous screw fixation for closed tibial plateau fractures with >8 depression. The causes of injury included high-velocity road

traffic accident (n=9), fall from height (n=3), and others (Blow, assault, spot injuries etc n=1). According to the Schatzker classification, patients were classified into type I (lateral fracture) (n=5), type II (lateral fracture with depression) (n=5), type IV (any medial fracture) (n=3). Associated injuries included polytrauma (n=2), minor injuries / local abrasions (n=2) compartment syndrome (n=1). Patients with head injury & nerve injuries were excluded.

This study was approved by the ethics committee of our hospital. Informed

consent was obtained from each patient. Appropriate emergency treatment was given for associated head, chest, and/or abdominal injuries after haemodynamic stabilisation. Anteroposterior and lateral radiographs of the knee joint were obtained. Computed tomography was not performed unless there was articular depression. Lower tibial pin traction was applied and the limb was rested over a Böhler-Braun splint. Patient characteristics, injury mechanism, injury pattern (based on Schatzker

classification), distal neurovascular status, and associated injuries were recorded using a predesigned proforma. (ANEXURE I) Patients were operated on as soon as they were

medically fit. A preoperative template was prepared using traction radiographs. Closed reduction was achieved using manual ligamentotaxis with traction in extension under image intensifier control. A femoral distractor was used in patients with comminution. Both sides of the proximal tibia were thumped to dislodge the depressed articular fragment. Reduction was held temporarily with one- or 2-pointed reduction forceps, and then fixed percutaneously with cancellous screws (6.5 mm) and washers. The direction and the number of screws ( $\geq 2$ ) used were based on the fracture pattern and orientation. Articular congruency was checked under a C-arm in anteroposterior and lateral views. The limb was then immobilised in a groin-to-ankle slab (cylinder slab). The rehabilitation protocol was standard for all patients. Patients were encouraged to perform isometric quadriceps exercises, ankle pump, and toe

movements. Analgesia and antibiotics were given. The slab was removed after 3 weeks, and the knee joint was examined for tenderness, swelling, and instability.

Gradual knee bending and extension exercises were advised with non-weight-bearing crutch walking for further 3 weeks. Early mobilization was started within one week in 8 cases. 5 cases having depressed plateau fractures were mobilized after third week of plaster immobilization. Full weight bearing advised only after complete union of fracture, usually after 12 weeks, in most of cases.

Patients were followed up at 2<sup>nd</sup> week ,then 6<sup>th</sup> week ,later 3<sup>rd</sup> month & 6months and 12 and annually thereafter.At the final follow up, functional outcome (pain, walking capacity, extension lag, range of motion, and stability) was evaluated .

## RESULTS-

**Table I**

Heads	No. of Cases	Percentage %
<b>Mode of Injury</b>		
Road traffic accident	9	69
Fall from high	3	24
Other (Blow, assault, spot injuries etc)	1	7
<b>Type of Fracture (According to Shatzker's ) classification</b>		
Type I	5	38
Type II	5	38
Type III	-	-
Type IV	3	24
<b>Nature of fractures</b>		
Closed	12	93
Open	1	7
Total	13	100
<b>Degree of Flexion</b>		
>120°	10	76%
90-120°	3	24%
75-90°	-	-
<75°	-	-

In our study group the patients were ranging from 21 -60 years .The above table show that tibial plateau fractures were more common in adults below 50 years, which was the most active period of life. The youngest patient in our series was 24 years old and oldest patient was 60 years old.

Out of 13 cases , majority of our cases was males 10 (76%)and only 3 were females . Probably due to frequent exposure to high velocity injuries and trauma.

In our study closed fractures 12 (93%) was more common as compared to open fractures in our series.

The 2 Patients (16%) had associated bony injuries other than tibial condyles indicating the severity of violence. One patient (7%) had compartment syndrome at the time of presentation.

No patient in our series had early postoperative complication. One patient develop knee joint pain 16 months after operation due to early osteo-arthritis changes.

Most of the patients having isolated injuries were discharged after fifth postoperative day. Prolonged hospitalization required for patients having multiple injuries and associated complication compartment syndrome.

Early mobilization was started within one week in 8 cases. 5 cases having depressed plateau fractures were mobilized after third week of plaster immobilization. Full weigh bearing advised only after complete union of fracture, usually after 12 weeks, in most of cases.

In all the cases, fracture united within 14 weeks. Average period of radiological union was 12 weeks. Type I fracture required less time (Avg. 10.6 weeks) for union than other types of fractures.

## DISCUSSION:

Fractures of tibial plateau are serious injuries that result in functional impairment. The importance in treating these fractures are anatomical restoration of fracture surface, repair of soft tissue injury, rigid fixation to obtain a stable painless knee with normal range of motion, the

management of tibial plateau has always been a subject of debate. In quest of perfection any treatment modality that has varied opinion is a subject for research and study. High energy intra - articular tibial fractures are still a major concern among orthopaedic surgeons -

The debated was divided between two major groups, one favoring non-operative management and the other favoring operative treatment. Difficulties with conservative treatment include inadequate reduction, instability, and prolonged hospitalization, and knee stiffness, development of early osteoarthritic changes while open reduction and internal fixation is a difficult operation, even in experienced hands. It requires extensive exposure of the knee joint, compromise the soft tissue and devascularise the bone fragment. It is occasionally complicated by deep infection, wound dehiscence

We have endeavored to present the various types of tibial plateau fractures in our semi urban Indian set up. It is found that the zeal for modernization, mechanization and industrial development made more automobile accidents due to increase in population and automobiles. In this we operated upon 13 tibial plateau fractures and analyzed the results with respect to age of the patient, sex distribution, mode of violence, fracture type, condylar depression, modalities of treatment, complications, associated injuries and the functional outcome.

The majority of fractures occurred between the age of 20 and 60 years . The average age of 40 years was observed in our series. This is due to the fact that this is the working age group with increased mobility. Hence they are more exposed to the exterior and consequently more injured. Seppo<sup>6</sup> also showed age incidence 20-60 years with average of 39. 8 years. This correlates with the present study<sup>7</sup>.

Our study out of 13 patients; there were 10 male and 3 female patients. A male to female ratio was 3.1:1. The increased incidence of fracture of tibial plateau in male may attribute to active outdoor life-style of males. Most of the previous studies by Bowles, Duvelius and Rinonpoli<sup>7,8,9</sup> emphasised the male dominance in tibial plateau fractures.

In the present series it was observed that road traffic accident were most common cause of tibial plateau fractures (69%). Fall from height (24%) was the second common cause. The high incidence of tibial plateau fractures due to road traffic accidents is comparable to other series. However, no case of tibial plateau fracture was observed due to sports injury. This may be attributed to the fact that this being rural area, people have lesser inclination towards sports activities.

In our series of 13 patients, only tibial plateau fractures Schatzker's type-I to type-IV was include. Split fractures (38%) and mixed fracture (38%) of lateral tibial plateau constituted majority of our cases. We did not come across with any case of Schatzker's type-III tibial plateau fracture, during our study period of 3 years. The difference might be attributed to small subject pool.

As our series is small and consisting of selected case of tibial plateau fractures suitable for percutaneous fixation with cannulated cancellous screws, the Schatzker types fractures (close or open) cannot be compared with other series consisting of non-selected cases.

In this series we studied 13 cases of both simple and high energy tibial plateau fractures treated we studied only by surgical methods. Different authors used different criteria for the surgical management of these fractures. Hohl<sup>10</sup> and David<sup>11</sup> considered 5mm depression as a surgical cutoff. Seppo E. Honkonen<sup>6</sup> conducted 130 tibial plateau fractures taking into consideration of condylar widening of >5mm. lateral condyle step off > 3mm, all medial condylar fractures for the surgical management.

In our study we considered 8mm displacement as an indication for surgery. Each case was individualized and treated accordingly as it required. All fractures were treated with percutaneous cancellous screw fixation.

In present series of 13 patients there were 2 patients with polytrauma (16%); 2 patients with minor injuries or local abrasion at other sites (16%) while one patient had compartment syndrome at the time of

presentation (7%).

There were no early complication related to surgery such as superficial or deep infection, damage to neurovascular structures, deep vein thrombosis. There were one case of Schatzker's type IV tibial plateau fracture with poor results. She had significant loss of fracture reduction, developed early osteoarthritis 16 months after trauma and knee joint pain affecting her daily activities. A total of 2 patients required removal of implant because of local discomfort after fracture had healed .

Most of the patients in our series having isolated tibial plateau fractures were discharged after first check dressing, usually on fifth post-operative day. Prolonged hospitalization of 6-7 weeks was required for 2 patients having multiple bony injuries and 1 patient with compartment syndrome. The average hospital stay required in our series was 10.46 day.

It is interesting to note that in tibial condylar fractures the extent of damage is more than what the radiographs depict. Paradoxically the patient does better than what one expects. The key to success is early mobilization postoperatively . The duration of immobilization should be up to 4 weeks or less in both surgical and non-surgical cases for better results states Schatzker<sup>12</sup>. M. Hohl<sup>13</sup> has explained that articular defects form adhesions after one month of immobilization from experimental studies in the knees of monkeys; In present series, early mobilization was started within one week in 8 cases. Remaining 5 cases with depressed plateau fractures with bone grafting were immobilized in above knee plaster for 3 weeks and then gradually range of motion at affected knee was started

Some authors suggested that early weight bearing across fractures site, stimulates osseous healing and early ambulation allows for retention of muscular strength. In our cases to avoid loss of reduction and development of varus or valgus deformity, we advised full weight bearing only after clinical and radiological evidence of fracture union; usually after 10-12 weeks.

In present series the entire patient achieved knee range of motion more than 90° within 3 months after operation. Ten patients (76%) achieve full range of movement. Time required to regain full range of movement was lesser for Schatzker's type I fracture, which was mobilized earlier with cast brace.

The union was not a problem in our series of 13 patients. All the fractures of tibial plateau were united within 14 weeks. Average time required for radiological union was 12 weeks. It was observed that comparatively less time required for union of Schatzker's type I tibial plateau fractures (Average = 10.6 weeks).

Thomas A et al, in their presented series of 27 cases of tibial plateau fractures treated conservatively with cast brace, reported average time required for union was 10 weeks.

#### CONCLUSION:

The correct method of management of tibial plateau fracture depends on good clinical judgement. If rational treatment is to be instituted the surgeon must have a sound knowledge of type of injury and a clear understanding of the knee examination, imaging studies and different modalities of treatment of these fractures.

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