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Study on the Functional Outcome of Internal Fixation in Tibial Plateau Fractures

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Abstract: *Tibial plateau fractures involve the articular surface of the tibia resulting from a combination of axial loading with varus or valgus stress. Inadequate and inappropriate treatment may result in significant functional loss.The purpose of this study was to determine the functional outcome of internal fixation in tibial plateau fracture. Between June 2011 to May 2013, 30 tibial plateau fractures which were treated operatively according to the principles advocated by AO/ASIF. Patients were reviewed at an 6 week, 3 month and 6 months post-operatively. Functional outcome was assessed using Rasmussen's functional system. At the end of 6 months we had 87% of excellent,10% of good and 3% of fair results. The mean Rasmussen's functional score was 28.53 (range 15-30). All patients had union with range of 9 -18 weeks(average 12 weeks).We believe that internal fixation in closed and grade I and II open tibial plateau fracture give excellent functional results.*

I. Introduction

There are two categories of proximal tibial fractures: Articular and non-articular. Articular fractures are termed tibial plateau or tibial condylar fractures.The tibial plateau is one of the most critical load-bearing areas in the human body. These fractures affect knee alignment, stability and motion.They range from minimally displaced lateral depression fractures to severe bicondylar fractures that may be associated with various complications

The goal of tibial plateau fracture management is to get a stable, well-aligned, congruent joint, with a painless range of motion and function. The treatment of displaced tibial plateau fractures, however, remains controversial. Surgical reduction and stabilization of displaced tibial plateau fractures, when indicated, requires careful evaluation of both the "personality" of the fracture and the soft-tissue envelope. The timing of surgery and the handling of the soft tissue in this region are critical in minimizing patient disability and reducing the risk of documented complications.

The options available to stabilize these fractures have multiplied during the past few years and include smaller screw diameters, locking plates, and improved osteobiologic implants.

Newer techniques have been developed in 1990s that have aided the surgeon in the treatment of high-energy fractures; specifically those complex fracture patterns that occur with sever soft tissue compromise. For these high energy fractures, there is little controversy regarding the way of operative management. However, the indications for non-operative versus operative treatment for low-energy fractures vary widely among surgeons.

II. Materials And Methods

This was a prospective study.The study period was two years from June 2011 to May 2013. A total of thirty patients with tibial plateau fractures were enrolled in this study.Skeletally immature patients and those with open fractures were excluded from the study.

Operative Procedure And Post-Op Protocol

After the investigations fracture will be classified according to Schatzker's[1] classifications. Patients will be thoroughly evaluated for associated soft tissue injuries and neurovascular injuries and treated accordingly .

Thorough pre-operative medical & anesthetic evaluation will be done once surgery is planned.

Type I Fracture Percutaneous 6.5 mm cannulated cancellous screws were used to fix the fracture fragments through stab incisions over the fractured condyle under 'C' arm control. If the lateral plateau fracture is associated with a fibular head fracture a lateral buttress plate is used.

Type II Fracture A lateral parapatellar approach was used. The articular surface was reconstructed and depressed fracture fragments were elevated and reconstituted with autogenous bone grafts from the iliac crest. Once anatomical reduction was obtained, fractures were fixed with 6.5 mm cancellous screws/ a precontoured T or L buttress according the fracture pattern.

Type III Fracture A lateral parapatellar approach was used. The articular surface was reconstructed and depressed fracture fragments were elevated through cortical window. The resultant gap was filled with autogenous bone grafts from the iliac crest. Once anatomical reduction was obtained, fractures were fixed with 6.5 mm cancellous screws / a precontoured T or L buttress plate.

Type IV Fracture A Medial parapatellar approach was used. The articular surface was reconstructed and depressed fracture fragments were elevated and reconstructed with autogenous bone grafts from the iliac crest. Once anatomical reduction was obtained, fractures were fixed with 6.5 mm cancellous screws/a precontoured T or L buttress plate.

Type V Fracture

For most patterns with coronal split of the medical condyle are treated with a combination of two approaches: anterolateral for the lateral side injury and posteromedial for medial side injury. The articular surface was reconstructed and Once anatomical reduction was obtained, fractures were fixed with dual plating.

Type VI Fracture

The decision is based on the characteristics of the medial side injury .if medial side is nondisplaced or if fragment is large and not comminuted, reduced indirectly and stabilize it from lateral side with a locking plate .in more complex medial side pattern are treated with a combination of two approaches: anterolateral for the lateral side injury and posteromedial for medial side injury. The articular surface was reconstructed and Once anatomical reduction was obtained, fractures were fixed with dual plating.

For the first 2 to 3 postoperative days, Continous Passive Motion machine is used in lieu of physical therapy. It is then used intermittently to permit gait training and active range-of-motion exercises. No weight beating until there is radiographic evidence of early graft incorporation and healing. Partial weight bearing for 4 to 6 weeks is initiated, with full weight bearing allowed at 3 months.

Patients will be followed at 2 weeks, 6 weeks, 3 months , 6 monthsfor clinical and radiologiocal union and knee function using RASEMUSSEN SCORING SYSTEM[2].

III. Results

The observation made on data collected from the group of thirty cases is as follows:

In our study we have 60 percent of patients in less than 40 aged group with an average of 37 years

Age Distribution **Mechanism Of Injury:**

Internal Fixation: **Time For Union:**

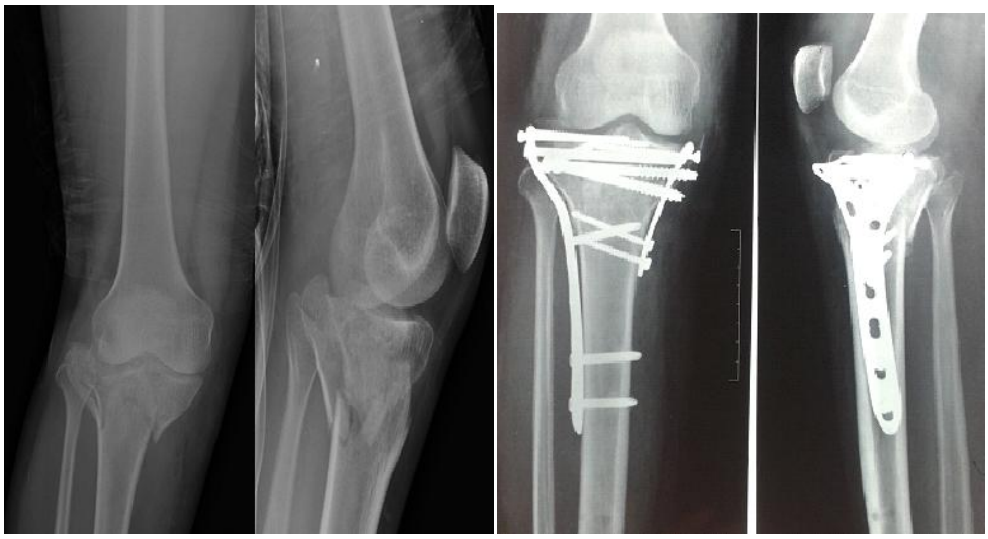
STATISTICS	TIME OF UNION
N	30
MEAN	12.60 weeks
MEDIAN	12.00 weeks
STANDARD DEVIATION	2.298
MINIMUM	9 weeks
MAXIMUM	18 weeks

Type Of Fracture Based On Schatzker's Classifacation: Functional Outcome Based On Rasemussen Scoring

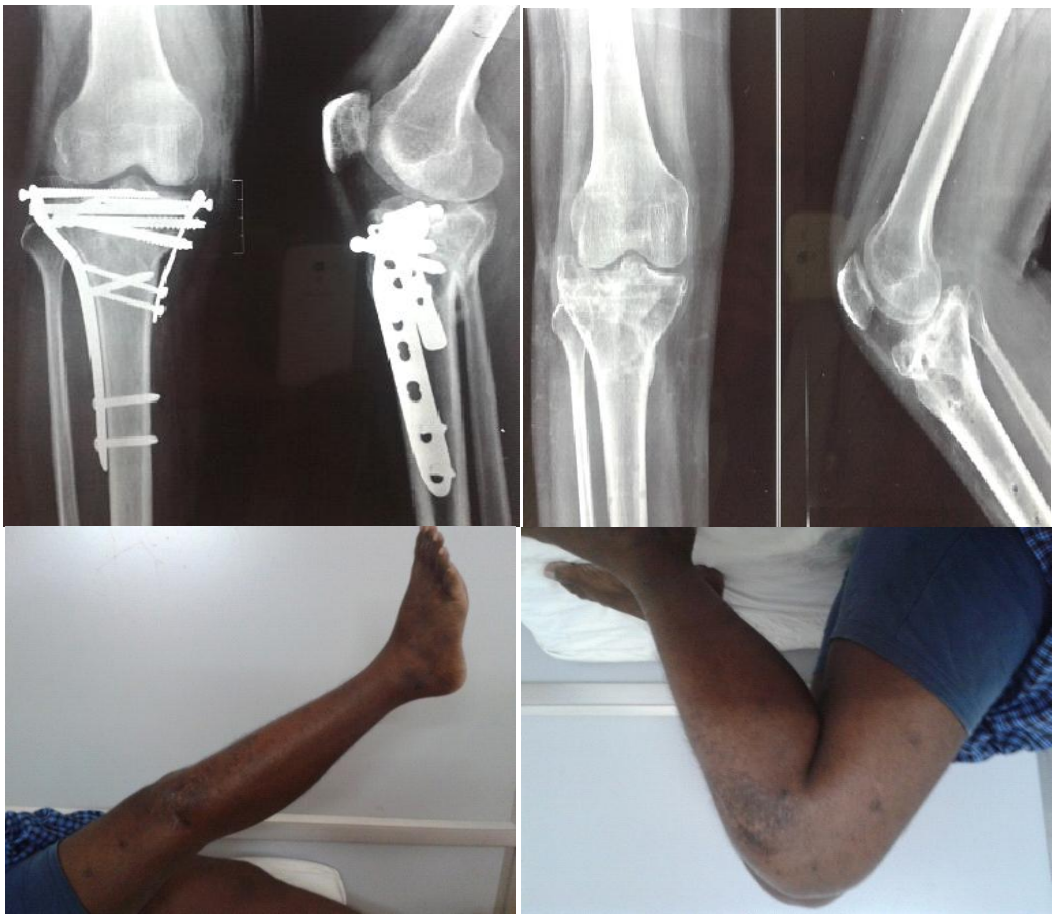
Complications

COMPLICATIONS	NO OF CASES	PERCENTAGE
NONE	23	76.7%
HARDWARE PROMINENCE	1	6.7%
STIFFNESS OF KNEE JOINT	2	6.7%
SUPERFICIAL INFECTION	2	3.3%
LOSS OF REDUCTION	2	3.3%
DEEP INFECTION + LOSS OF REDUCTION	1	3.3%
TOTAL	30	100%

Pre operative Immediate Post operative



4 Months follow up **Implant Removal**



IV. Discussion

Tibial plateau fractures occur in an important load-bearing area .The aim of treatment is anatomical restoration of articular surface, repair of soft tissue injuries and to minimize pain, stiffness, deformity and instability by way of rigid internal fixation .

We have reviewed the results of 30 tibial plateau fractures, which were treated operatively according to the principles advocated by AO/ASIF. Patients were reviewed at an 6 week, 3 month and 6 months post-operatively. We adhered to uniform reporting and evaluation criteria using Rasmussen's functional system.

We have compared our results with other similar studies under various topics as given below.

Age distribution
In our study we had patients of age group between 20-60 years with average of 37 years.
Thimmegowda M et. al . had an average age of 43 years (22 -64 years)[3].
Sangwan S et al showed The patients were aged from 21 to 50 years (average 35.5 years)[4].
Raza H et al noted The patients were aged from 19 to 75 years (average 40 years)[5].
Sament R et al noted aged 19 to 61 (mean, 36) years[6].
Our study had same age group distribution as of these studies.

Sex distribution
In our study we had male predominance with 90% males and 10% female patients.
Thimmegowda M et al All the patients in the study group were men (100 %) .
Sangwan S et al showed 88% male and 12 % female .
Shete K et al showed 88% males and 12% females[7].
Prasad G T et al noted 83% men and 17% women[8].
Raza H et al noted 85% men and 15% women .
Sament R et al noted 86% men and 14% women .

Mode of injury
In our series we had 73% patients with road traffic accidents and 27% due to fall from height.
Thimmegowda M et al noted 84 % of RTA , 16% of fall .
Sangwan S et al showed The mechanisms of injury were 84% of road traffic accident ,8% of hit by animal ,4% of fall from height and 4% sport injury .
Nabil A et al noted the mechanisms of injury were 46% motor vehicle accidents, 35% fall from height,10% Pedestrian struck by motor vehicle, 9% sports related injury[9].

Extremity affected
Our series we had 66% of fracture involving right side and 34% of them left side.
Thimmegowda M et al noted right sided fracture and left sided fracture were equal in number .
Nabil A et al noted 50% were left sided fracture and 47% were right sided fracture and 3% of the patient with bilateral.

Type of fracture
In our study According to the Schatzker classification as type I (3%), type II (43%),type III(7%), type IV (10%), type V (20%) and type VI (17%).
Thimmegowda M et al studied only about Schatzker Type V and VI only.
Sangwan S et al in his study According to the Schatzker classification as type I (36%), type II (8%), type IV (20%), type V (8%) and type VI (32%).
Mathur H et al noted Type II was the most common fracture type (33%) followed by type I (22%) in 27 cases[10].
Raza H et al in his study According to the Schatzker classification as types I (7%), II (22%), III (26%), IV (15%), V (17%), and VI (12%).
Sament R et al in his study According to the Schatzker classification, patients were classified into type I (16%), type II (39%), type IV (9%), and type V (36%).

Time of union
In our study All patients had union with range of 9 -18 weeks(average 12 weeks).
Thimmegowda M et al noted averaged 17 weeks (range 13-22 weeks).
Sangwan S et al showed Clinical and radiological union was achieved in average of 12.08 weeks (range 11-16 weeks).
Prasad G T et al noted all patients had union in 8-22 weeks (average 14 weeks).

Functional results
We evaluated our results as per the Rasmussen's criteria. We found we had 70% of excellent, 23% of good,7% of fair and no poor results at the end of 6 week.
At the end 3 months we had 80% of excellent ,17% of good and 3% of fair results.
At the end of 6 months we had 87% of excellent ,10% of good and 3% of fair results.
At the end of 6 months The mean Rasmussen's functional score was 228.53 (range 15-30).
Sangwan S et al showed that Patients were evaluated at a mean of 26 months after injury. Results as per the Rasmussen's criteria were 48% of excellent, 44% of good,8% of fair and no poor result.

Mathur H et al showed that patients were followed up for an average of 35.74 months (range 24-68 months).Results were 37% of excellent and 51.85% of good functional results with 11% having poor results .The mean Rasmussen's functional score was 25.062 (range 15-30).
Raza H et al noted functional outcome was 44%of excellent, 46% of good, and 10%of fair and poor results at the end of 12 months follow up. The mean Rasmussen functional score was 25.3 (SD, 3.2; range, 14-29).
Sament R et al showed that Patients were followed up for a mean of 2.8 (range, 1-4) years noted outcomes were 40% of excellent, 50% of good , 10 % of fair and 4% of poor results . The mean Rasmussen score was 25.7 for all patients.

Complications
In our study Complications were seen in 7 patients out of 30 patients.
1 patient had superficial infection which resolved with the administration of appropriate antibiotics.
2 patients had stiffness of knee joint. 1 patient had associated patella fracture on 6 week follow up patient was taken up for knee mobilization under anaestheia . post operative patient had 12o degree of range of motion at knee. Another patient had posttraumatic osteomyelitis of distal femur.
1 patient had loss of reduction due early weight bearing.
1 patient had deep infection and loss of reduction at 4 month .patient improved Following implant removal and administration of appropriate antibiotics.
2 patient had hard ware prominence for implant were removed following fracture union.

Sangwan S et al showed 1 superficial infection and 2 hard ware prominence out of 25 cases.
Shete K et al showed 1 Infection, 1 delayed wound healing and 2 loss of reduction out of 90 patients.
Mathur H et al noted complications in 5 patients out of 27 patients in their series. 2 patients had septic arthritis and underwent knee debridement 5 months and 7 months post surgery respectively. 3 patients had superficial infection, which resolved in 3 weeks.

Our results faired much better than Sangwan S, Mathur H, Raza H, Sament R et al .But their follow up was for long time . we aware that duration of the study was 6 months and sample size was 30 cases only. Perhaps patients need further long follow up till 3 to 5 years which may vary our results.

V. Conclusion

Tibial plateau fracture is a challenging fracture to manage. Restoration of articular congruity and early range of motion should be the primary goal. Proper and adequate preoperative planning is mandatory. Well maintained articular congruity with stable fixation helps early mobilization and better functional outcome.

From our study we concluded that internal fixation in closed and grade I and II open tibial plateau fracture give excellent functional results. However patients will need periodic evaluation to assess the possibilities of degenerative joint disease.

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