Results of open reduction and internal fixation by plate osteosynthesis in tibial plateau fractures

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Abstract

Background: Open reduction and rigid internal fixation for displaced tibial plateau fracture achieves the goals of restoring the anatomic articular congruity and mechanical alignment, while allowing early knee mobilization. But open reduction and internal fixation, specifically through compromised soft tissues, improperly placed incision and soft tissue handling has historically been associated with major wound complications. Alternate methods of treatment have been described, each with its own merits and demerits.

Aims and Objectives: To study the, results, and complications of open reduction and internal fixation by plate osteosynthesis for tibial plateau fractures.

Method: 21 patients treated with open reduction and plate osteosynthesis were followed up for a period of 18 months and their functional outcome was assessed according to Modified Delamarter functional scoring system.

Results: According to Modified Delamarter functional scoring system we had 67% excellent to satisfactory result and 9% poor results due to non union at the fracture site.

Conclusion: Displaced tibial plateau fractures need optimum treatment in order for patients to return to early productive life. Surgical treatment when indicated is advantageous to get stable knee. We found out that surgical treatment with adequate physiotherapy can give good results in tibial plateau fractures.

Keywords: Plate osteosynthesis, Tibial plateau, Fracture, Knee joint, Functional outcome

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Introduction

Tibial plateau fractures constitute approximately 1% of all fractures[1]. Typical mechanisms include a combination of axial loading and angular forces, which result in a split/depression of the tibial plateau along with metaphyseal impaction and comminution[2,3].

The management of these fractures has been controversial. For many years, cast immobilization was the most common treatment. Apley recommended skeletal traction with early mobilization[4,5]. Many authors advocated selective cast bracing[6,7]. Comparable results with both conservative and surgical treatment have been found[8]. In recent years anatomical restoration has been recommended by operative measures[9,10]. Several authors advocate open reduction and internal fixation of the tibial plateau fractures. But open reduction and internal fixation, specifically through compromised soft tissues, has historically been associated with major wound complications[11,12].

Open reduction and rigid internal fixation achieves the goals of anatomic articular congruity and mechanical alignment restoration, while allowing early knee mobilization[13,14]. Alternate methods of treatment have been described, each with its own merits and demerits[13,14].

Despite all reconstructive efforts osteoarthritis following tibial plateau fractures is reported to evolve in 23-44%[15,16] underscoring the prognostic and socio-economic importance of these injuries.

Material and Method

This study was carried out at Integral Institute of Medical Sciences and Research, Lucknow

- **Type of Study**: Prospective
- **Duration**: September 2013 to March 2015.
- **Number of Patients**: A series of 21 patients was included in this study with fracture of tibial plateau.

Criteria for selection of patients:

- Depressed fractures >5 mm
- Articular step >8 mm
- Compound fractures
- Schatzker's type IV, V and VI fractures.

Criteria for exclusion

- Schatzker type I, II and III
- Articular step <8 mm
- Depressed fracture <5 mm.
- Closed fractures

The fractures were classified using Schatzker classification[17]. Soft tissue injuries were classified by the Gustilo–Anderson classification of open fractures

and Oestern and Tscherne classification of closed fractures[18,19]. If there was extensive soft tissue injury, as indicated by soft tissue edema or fracture blisters, surgery was delayed. The limb was elevated and calcaneal pin traction was applied with 3-5 kg of weight. Once the soft tissues recovered, as evidenced by resolution of the edema and the fracture blisters and appearance of skin wrinkles, the patient was taken up for surgery after getting surgical clearance from the anaesthetist.

Patients were followed up at months 6, 12 and 18. The outcome of each patient was analyzed functionally (pain, function, activity, residual angle, loss of extension and instability) according to the modified scoring system given by Delamarter[6] **(Table 1)**.

Table 1

Functional Score			
Pain		**Loss of extension**	
: Nil	30	: Nil	5
: Occasional	25	:< 10 degree	3
: Over implant	20	: >10 degree	1
: During walking	15		
Function		**Instability**	
: Movement > 120 degree	30	: Nil	5
:120-90 degree	25	: ACL or MCL or both	3
: 90-60 degree	20	: Above and PCL	1
: <60 degree	15		
Activity		**Grading (Total Score)**	
: No limitation	15	: Excellent (E)	90-100
: Limited to walking	10	: Good (G)	80-90
: Assistance required	05	: Satisfactory (S)	70-80
Residual angle		: Fair (F)	60-70
: 0 -5 degree	15	: Poor (P)	< 60
: 5 -10 degree	10		
: >10 degree	05		

Observations

Table 2: Age Distribution

Age of the patient	No. of patients	Percentage
20-29	6	28.6%
30-39	5	23.8%
40-49	4	19%
50-59	3	14.3%
60-69	3	14.3%
Total	21	

Table 3: Male-Female Ratio

Sex of the patient	No. of patients	Percentage
Male	20	95.2%
Female	1	4.8%
Total	21	

Table 4: Side of fracture

Side of the fracture	No. of patients	Percentage
Right	8	38.1%
Left	13	61.9%
Total	21	

Table 5: Mode of injury

Mode of Injury	No. of patient	Percentage
RTA	20	95.2%
Fall	0	0%
Assault/Other	1	4.8%
Total	21	

Table 6: Type of fracture (Schatzker Classification)

Schatzker type	No. of patients	Percentage
Type IV	10	47.6%
Type V	9	42.8%
Type VI	2	9.6%
Total	21	

Table 7: Type of fracture (Simple/Compound)

Fracture Type	No. of patients	Percentage
Simple	9	42.9%
Compound	12	57.1%
Grade I	1	4.8%
Grade II	0	0%
Grade III	11	52.4%

Table 8: Functional Outcome (According to Modified Delamarter Scoring System)

Functional Result	No. of Patients	Percentage
Excellent	1	4.8%
Good	7	33.3%
Satisfactory	6	28.6%
Fair	5	23.7%
Poor	2	9.6%
Total	21	

Table 9: Complications

Complications	No. of patients	Percentage
Superficial Infection	3	14.3%
Stiffness	2	9.5%
Degenerative Arthritis	4	19%
Non union	2	9.5%
Peroneal Nerve Injury	1	4.8%
Skin Flap Necrosis	1	4.8%

Results

In our study population, patients were in the age group of 20 years to 70 years **(Table 2)** with the mean age being 34 years.

The male to female percentage of our study population was 95.2% to 4.8% respectively **(Table 3)**.

Left side of the limb was more commonly involved (61.9%) than right side (38.1%) **(Table 4)**.

Road traffic accident (95.2%) was the most common mechanism of injury in our study **(Table 5)**.

According to Schatzker Classification, type IV fractures account for the major chunk of our study group (47.6%), while type V accounted for 42.8% and type VI for 9.6% **(Table 6)**.

Simple fracture accounted for 9 patients (42.9%) while compound fracture accounted for remaining 12 patients (57.1%) out of which grade III compounding was most common (52.4%) 9 **(Table 7).**

According to Modified Delamarter Scoring System, we had 66.7% excellent to satisfactory results while 2 patients (9.6%) had poor results. Both these patients developed non-union at the fracture site **(Table 8)**.

Degenerative arthritis was the most common complication encountered in our population (19%). Peroneal nerve injury was encountered during open reduction and internal fixation in 1 patient (4.8%) and 1 patient developed skin flap necrosis which healed subsequently by regular dressing **(Table 9).**

Fig. 1A: Pre-operative AP and lateral view. Fig. 1B: AP and lateral view at final follow up. Fig. 1C, D: Range of motion at final follow up

Discussion

Tibial plateau fractures may be divided into low energy or high energy fractures. Low energy fractures are common in older patients due to osteoporotic bone and are typically depressed fractures. High energy fractures are commonly the result of motor vehicle accidents, falls or sports related injuries. High energy tibial plateau fractures have always remained a challenge to the treating orthopaedic surgeon. Treatment strategies and specific indications for surgery of tibial plateau fractures continue to be a controversy[20]. Different treatment options have been established in the last decades. Nonoperative treatment options are restricted to un-displaced fractures that allow early partial weight bearing and functional exercise[21]. The use of open reduction and internal fixation techniques has historically been associated with wound complications, especially when a single midline incision is employed. This has led to the emergence of alternate methods of fixation like the Ilizarov ring fixation, external fixation with limited internal fixation, hybrid external fixation, etc., Achieving good reduction and stable fixation sparing knee joint is a challenging task in external fixation. Rigid fixation with good articular reduction is an important goal of surgery to get good knee function[22]. Open reduction and internal fixation achieves this goal. Most of the open reduction techniques were associated with high wound complication rates due to midline anterior approach. Reaching the posteromedial fragment through a single incision causes wide periosteal stripping and extensive muscle dissection and may hamper reduction as well. Dual incisions are better than single incision[23].

In our study, the most common mode of injury is being the road traffic accidents (95.2%). The majority of fractures occur between the age of 20 and 70 years with maximum incidence being involving the productive age group 20-40 years (52.4%).

The difference of incidence of fracture in males and females (95.2% versus 4.8%) can be attributed to our Indian setup where the female population largely work indoor and are generally not involved in sporting activities and road traffic accidents.

The major aims of treatment of tibial plateau fractures are to reduce the articular surfaces, achieve stable fixation and early motion, and to manage all soft tissue lesions[24]. Therefore, successful results depend on the quality of reduction, ligament stability, preservation of soft tissue envelope, with good evaluation of the articular surface, and minimal dissection.

During 18 months follow up, we came across four patients with osteoarthritis of knee. All these were having initial displacement and ligamentous instability[25]. We agree with Schatzker et al. report that initial fracture type and injury is important in determining the final outcome[26]. Various clinical and experimental studies have clearly pointed out that the

extent of anatomic reduction and degree of the articular congruency, determines the final outcome[27].

There is little controversy about the fact that open anatomic reduction followed by stable internal fixation remains the gold standard for intraarticular fractures[28].

Conclusion

Tibial plateau fractures need optimum treatment in order for patients to return to early productive life. Surgical treatment, when indicated is advantageous to get stable knee. We found out that surgical treatment with adequate physiotherapy can give good results in tibial plateau fractures. Hence, to conclude, the surgical management of tibial plateau fractures is challenging and open reduction and rigid internal fixation, achieving a good congruous joint surface, facilitates early knee mobilization and consequent good functional results in a majority of these controversial fractures.

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Conflict Of Interest: Nill

Ethical Clearance: Not required

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