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Results of closed reduction and percutaneous screw fixation in tibia plateau fractures

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Abstract

Introduction. Tibial plateau fractures are common injuries that require anatomic reduction to obtain the best functional results. Advances in mechanization and the acceleration of travel has been accompanied by an increase in the number and severity of fractures, and those of the tibial plateau are not an exception. This fracture constitutes approximately 1% of all fractures. The primary goal in the management of proximal tibial articular fracture is a stable, congruous, pain-free, mobile joint.

Objectives. To study the technique, results, and complications of percutaneous cancellous screw fixation for tibial plateau fractures.

Materials and method. 22 patients treated with percutaneous screw fixation were followed-up for a period of 18 months and their functional outcome assessed according to the Modified Delamarter functional scoring system.

Results. According to the Modified Delamarter functional scoring system, a 91% – excellent to satisfactory result was achieved, and 9% poor results due to non-union at the fracture site.

Conclusions. Closed reduction and percutaneous screw fixation for tibial plateau fractures is minimally invasive. It reduces the length of hospital stay and costs, enables early mobilization with minimal instrumentation, and achieves satisfactory outcomes.

Key words

percutaneous fixation, tibial plateau fracture, cannulated cancellous screw fixation

INTRODUCTION

Tibial plateau fractures constitute approximately 1% of all fractures [1], and usually result from axial loading in combination with varus/valgus stress forces. The number of tibial plateau fracture has increased significantly and their managemnt has been controversial. For many years, cast immobilization was the most common treatment. Apley recommended skeletal traction with early mobilization [2, 3, 4, 5], while 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. However, a poorly placed incision and extensive dissection tend to compromise the overlying soft tissue envelope, and may result in soft tissue necrosis and deep wound infections adding to the disability [11].

Closed reduction by ligamentotaxis and, if required, elevation of the depressed plateau by various techniques, and stabilization with percutaneous screw fixation, have also given excellent results [12, 13, 14].This technique is minimally invasive and avoids many of the complications of both conservative and open reduction and internal fixation [15, 16].

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OBJECTIVE

The purpose of this study is to evaluate the results of tibial plateau fracture treated with closed reduction and percutaneous fixation. When treating such fractures, the aim is to obtain a stable joint permitting an early range of motion for cartilage nourishment and preservation [8]

MATERIALS AND METHOD

- The study was carried out at the Integral Institute of Medical Sciences and Research in Lucknow, India.
- *Type of Study:* Prospective
- *Duration*: September 2013 – March 2015.
- *Number of patients*: 22 patients with fracture of tibial plateau were included in the study.
- *Criteria for selection of patients:*
  - Schatzker type I, II, III and IV fractures
  - Articular step <8 mm
  - Depressed fracture <5 mm.
- *Criteria for exclusion:*
  - Depressed fractures >5 mm
  - Articular step >8 mm
  - Compound fractures
  - Schatzker's type V and VI fractures.

The fractures were classified usingSchatzker classification [17].

On admission, all patients were investigated for skin condition, deformity, instability, any other associated injuries. X-rays, antero-posterior and lateral radiographs of the knee usually show a plateau fracture; 40° internal and

external oblique views were also obtained to see the profile of the lateral and medical plateau, respectively.

Lower tibial pin traction was applied and the limb rested over a Bohler-Braun splint. Patient characteristics, injury mechanism, injury pattern (based on Schatzker classification), distal neurovascular status, and associated injuries, were recorded. After obtaining surgical clearance, the patients were posted for operation. Closed reduction was achieved using manual ligamentotaxis with traction in extension under image intensifier control. Both sides of the proximal tibia were thumped to dislodge the depressed articular fragment. Reduction was held temporarily with 2 pointed reduction forceps, and then fixed percutaneously with cancellous screws (6.5 mm) and washers. The direction and the number of screws used were based on the fracture pattern and orientation. Articular congruency was checked under a C-arm in antero-posterior 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 a further 3 weeks. Partial and full weight bearing was allowed at week 6 and week 12, respectively. 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 by Delamarter [6] (Tab. 1).

Table 1. Modified scoring system by Delamarter

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 5	

OBSERVATIONS

Table 2. Age distribution

Age of the patient	No. of patients	Percentage
20–29	8	36%
30–39	5	23%
40–49	2	9%
50–59	4	18%
60–69	3	14%
Total	22	

Table 3. Male-female ratio

Sex of the patient	No. of patients	Percentage
Male	21	95%
Female	1	5%
Total	22	

Table 4. Site of fracture

Side of the fracture	No. of patients	Percentage
Right	17	77%
Left	4	18%
Bilateral	1	5%
Total	22	

Table 5. Mode of injury

Mode of Injury	No. of patients	Percentage
RTA	19	86%
Fall	2	9%
Assault/Other	1	5%
Total	22	

Table 6. Type of fracture (Schatzker Classification)

Schatzker type	No. of patients	Percentage
Type I	10	45%
Type II	9	41%
Type III	2	9%
Type IV	1	5%
Total	22	

Table 7. Functional Outcome (According to Modified Delamarter Scoring System)

Functional Result	No. of Patients	Percentage
Excellent	8	36%
Good	5	23%
Satisfactory	7	32%
Fair	-	-
Poor	2	9%
Total	22	

Table 8. Complications

Complications	No. of patients	Percentage
Superficial infection	3	14%
Stiffness	2	9%
Degenerative Arthritis	4	18%
Non-union	2	9%

RESULTS

In the presented study population, the patients were in the age group 20–70 years (Tab. 2); mean age – 36 years. The male to female percentage of the study population was 95% – 5%, respectively (Tab. 3).

The right side of the limb was more commonly involved (77%) than the left (18%), while 1 patient (5%) had bilateral involvement (Tab. 4).

Road traffic accident (86%) was the most common mechanism of injury in the study (Tab. 5).

According to Schatzker Classification, type I and type II fractures account for the major proportion of the study group (86%), while types III and IV accounted for the remaining 14% of cases (Tab. 6). According to the Modified Delamarter Scoring System, 91% excellent to satisfactory results were obtained, while 2 patients (9%) had poor results. Both these patients developed non-union at the fracture site (Tab. 7). Degenerative arthritis (Table 8) was the most common complication that developed in 4 patients (18%).

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. In the presented study, the most common mode of injury was caused by road traffic accidents (86%), the next most common was fall from a height (9%), followed by physical assault (5%). The majority of fractures occur between the ages of 20 and 70 years with the maximum incidence involving the productive age group 20 – 40 years (59%).

The difference in the incidence of fracture in males and females (95% versus 5%) can be attributed to the Indian setup where the female population largely works indoors, and are generally not involved in sporting activities and road traffic accidents.

Hohl and Burri [8, 18] reported an about 60% good result and 11% poor result with open reduction and internal fixation, compared to a 70% good result and no poor result by percutaneous screw fixation, as reported by Dendrinos et al. Gahr et al [19] also found that the functional results of percutaneous fixation, in all respects, were comparable to cases of open reduction and internal fixation.

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 [11]. Therefore, successful results depend on the quality of reduction, ligament stability, preservation of the soft tissue envelope, with good evaluation of the articular surface and minimal dissection.

During 18 months follow-up in the current study, 4 patients had osteoarthritis of the knee, and initial displacement and ligamentous instability [20]. The authors of this study are in agreement with Schatzker et al. who reported that initial fracture type and injury is important in determining the final outcome [21].

CONCLUSION

Although percutaneous fixation is still in its infancy, it is expected to develop rapidly as an alternative to open reduction and internal fixation. The method appears to avoid major soft tissue complications, speeds-up rehabilitation, shortens the length of a patient's stay in hospital, reduces the cost of treatment, and improves functional results. However, the exact indication and criteria need to be developed to make the procedure more precise.

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