

## Original Article

# Arthroscopically Assisted Reduction and Fixation of Tibial Plateau Fracture

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## ABSTRACT

**Objective:** To evaluate the role of arthroscopically assisted reduction and fixation in patients with tibial plateau fracture.

**Setting:** Al Razi Orthopedic Hospital, Kuwait.

**Subjects and Methods:** Forty-five consecutive patients with tibial plateau fracture were included in this study. They were graded as Schatzker type I-IV and were operated upon using arthroscopy to control reduction and fixation of the fracture. Fifteen fractures were fixed using three cancellous screws whereas the remaining thirty fractures were fixed using two cancellous screws. Nine patients had anterior cruciate ligament (ACL) tear and were treated by ACL reconstruction after healing of the fracture because of instability. Twenty-seven patients had meniscal injuries. Nine injuries were treated by meniscal repair whereas partial meniscectomy was

performed in 18 patients. All cases started rehabilitation within the first week after their surgery.

**Results:** All patients were assessed at the end of 36 months. Clinically, 33 cases showed full range of motion that was painless. Six cases had mild pain and were able to demonstrate a range of motion from 0 to 80 degrees. Six patients had mild chronic swelling. Radiologically, all cases showed a complete union after 12 weeks. No patient showed osteoporotic or osteoarthritic changes.

**Conclusion:** Arthroscopically assisted reduction and fixation of tibial plateau fracture avoids arthrotomy of the knee joint, helps in diagnosis of other associated intra-articular injuries and facilitates early rehabilitation. It may also give a better final outcome when compared with conventional arthrotomy.

KEY WORDS: arthroscopy, direct visualization, knee trauma, tibial plateau fracture

## INTRODUCTION

Tibial plateau fractures are relatively infrequent, representing approximately 1% of all fractures<sup>[1]</sup>. There is a controversy regarding indications for closed versus open treatment of tibial plateau fractures. The arthroscopic technique allows for less soft tissue stripping than with traditional arthrotomy, better visualization of the articular surface, early return to physical activity and obviates the need for meniscal detachment and repair<sup>[2]</sup>. Anatomical reduction cannot be restored in all cases of open reconstruction because of cartilage defects<sup>[3]</sup>. There is no consensus regarding the degree of articular depression that may be acceptable. Brown *et al*<sup>[4]</sup> showed in a mechanical study that contact pressures increased and became more concentrated when an articular step of more than 3 mm was present. Despite this, Hohl *et al*<sup>[5]</sup> noted in clinical studies that the results of operative and non-operative treatment of local compression fractures with a depression of 8 mm or less produced similar overall results. We used the Schatzker classification for tibial plateau fracture<sup>[6]</sup>.

This study was undertaken because this treatment program has not been described before in Kuwait.

## PATIENTS AND METHOD

Forty-five consecutive male patients with an average age of 35 years (range =18 - 47 years) were included. All the patients were suffering from tibial plateau fracture and the cases classified as Schatzker type I-IV (Table 1). All of them underwent arthroscopically assisted reduction and fixation of their fracture. Nine patients were obese, while the remaining 36 were of an average body build. The injuries had occurred in motor vehicle accidents (15 cases), and during sport games (30 cases).

On examination, tense effusion and severe tenderness were found. Aspiration of the knee joint revealed hemarthrosis. The injuries resulted in pronounced diffuse soft tissue swelling around the knee in nine cases. There was no neurovascular deficit in any case.

## Radiographic investigations:

Routine antero-posterior (AP) and lateral views

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**Table 1:** Fracture classification and number of cases

Fracture type	Number
Lateral split fracture; type I	21
Lateral split-depression fracture; type II	6
Lateral depression fracture; type III	9
Medial condyle fracture; type IVa	9

**Table 3:** Clinical results according to HSS knee score

	Type I	Type II	Type III	Type IVa
Excellent	18	3	3	6
Good	3	3	0	3
Fair	0	0	6	0

showed the fractures. Oblique and tunnel views were done to visualize fracture patterns. Posterior inclination of about 10-15° helped to measure the amount of depression in millimeters. The fractures were classified as type I-IV according to Schatzker (1979). Tomographic investigation was done in 30 cases for better assessment of the fractures. Magnetic resonance imaging was not used.

#### Operative management and technique:

All cases were operated under general anesthesia, tourniquet and an arthroscopic pump under low pressure. Standard laxity tests were done under anesthesia to assess the degree of injury accurately. A standard anterolateral arthroscopic portal was used 1-2 cm above the joint level to allow examination of the lateral plateau. A complete diagnostic assessment was done (Table 2). A thorough lavage was performed to clear the hemarthrosis and remove small loose bone fragments. Once the diagnostic arthroscopy was completed the fracture was reduced. During this procedure the pump was not used.

Percutaneous reduction of the fracture was performed under fluoroscopic and arthroscopic control and the fracture was fixed by a 2 mm K wire inserted below the articular cartilage. If there was no depression (type I, 8 cases), the fractures were fixed by two or three 6.5 mm AO cannulated screws inserted into the subchondral bone parallel to the articular surface. Depressed fractures (type II & III) were elevated through a cortical window, bone graft was impacted and 2 or 3 AO cannulated screws used to achieve fixation.

All patients were mobilized immediately after surgery using continuous passive motion and a physiotherapy program. Weight bearing was delayed until 12 weeks when clinical and radiological evidence of healing was present.

**Table 2:** Associated intra-articular lesions.

Injury	Number	Management
Lateral meniscal lesion	18	6 sutured, 12 partially resected
Medial meniscal lesion	9	3 sutured, 6 partially resected
Fracture of the intercondylar eminence	3	fixed with Pullout suture
ACL: haematoma/partial rupture	3	
ACL: complete rupture	6	Reconstruction after the fracture healed
Collateral ligament injury	18	
Articular cartilage lesion	3	

#### RESULTS

The outcome in all patients was graded as excellent, good and fair according to the Hospital for Special Surgery (HSS) knee score<sup>[7]</sup> as shown in Table 3. Six cases with Schatzker type III fracture had fair outcomes because the depression in the articular cartilage was big.

The following is an example of some cases in our series:

Case 1: A 41 year old male patient, manual worker by profession, presented with type I fracture after a fall. He was operated upon the next day and the fracture was fixed with two screws. At the end of three years, the patient showed painless motion and no evidence of osteoarthritis. The patient was followed up for a further three years. He now has a range of 0-140 degree for motion and very mild osteoarthritis.

Case 2: A 44 year old male patient presented with type IVa fracture. The lateral meniscus was torn and partially excised. ACL was intact. Fig. 1 (a&b) shows the fracture at arthroscopy, before and after reduction. Three screws were used to fix the fracture along with a bone graft from the iliac crest.

#### DISCUSSION

Since the mid 1980s, arthroscopically and radiologically controlled management of tibial plateau fractures is an established part of arthroscopic surgery of the knee<sup>[8]</sup>. The arthroscopic technique embraces the concept of minimally invasive surgery<sup>[9]</sup>. The treatment goals of restoration of joint congruity in tibial condylar fractures can be achieved arthroscopically<sup>[10]</sup>. Our outcomes after arthroscopic tibial condylar fracture treatment at three-year follow-up have been excellent to good. The few inferior results seen in Schatzker type III were due to a large depression in the articular surface. However, not all types of tibial plateau fractures are amenable to arthroscopic reduction and fixation. The Schatzker type I and II fractures, in young and active patients with good bone stock are ideally suited for arthroscopic reduction and fixation.



Fig. 1a: Arthroscopic view before reduction

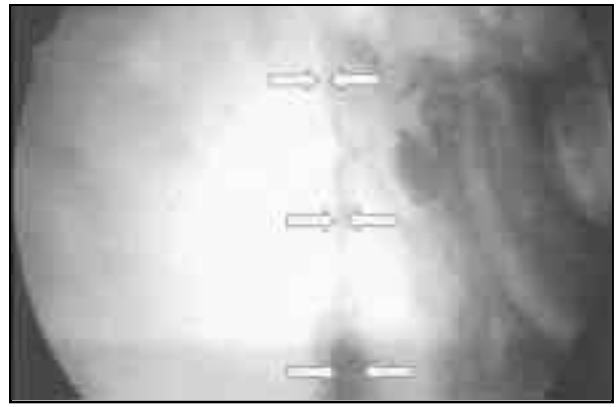


Fig. 1b: Arthroscopic view after reduction and fixation

Arthroscopic reduction and internal fixation of tibial plateau fractures does offer several potential advantages over conventional treatment regimes, including improved fracture visualization, and decreased morbidity<sup>[11]</sup>. Fowble *et al*<sup>[12]</sup>, reported on 23 patients with joint depression and split depression fractures. Arthroscopic assisted reduction and internal fixation was used in 12 patients and open reduction and internal fixation was used in 11 patients. The outcome in terms of length of hospital stay, time to full weight-bearing, and rate of anatomic reduction was superior in arthroscopic reduction and internal fixation group. This study is the only one which directly compares the results of arthroscopic reduction and internal fixation with conventional open reduction and internal fixation treatment<sup>[12]</sup>.

Arthroscopy, today, is a well accepted and preferred method of meniscal treatment. In the past, meniscectomy was performed through a formal arthrotomy with associated increase in post-operative discomfort and certain morbidity. The introduction of arthroscopic treatment to certain tibial plateau fractures may be analogous to that situation. The arthroscopically assisted reduction of tibial plateau fractures is a safe and promising procedure and the results are comparable to traditional methods of open reduction<sup>[13]</sup>.

Delmarter *et al*<sup>[14]</sup> and Hohl and Larsen<sup>[1]</sup> noted that ligamentous injuries occurred in 20% of tibial plateau fractures. If an acute anterior cruciate ligament tear is encountered and other patient characteristics warrant intervention, reconstruction may be carried out after fracture reduction and stabilization or after fracture healing as was the case in our study. Internal fixation devices must be positioned such that tibial tunnel placement for anterior cruciate ligament reconstruction is not compromised.

Some experience in arthroscopy is necessary, especially if the pump and anterior cruciate ligament guides are used. In a series of 20 patients with tibial plateau fractures, Van Glabbeek *et al*

reduced depression fractures with the aid of an anterior cruciate ligament tibial guide followed by immediate mobilization and continuous passive motion<sup>[15]</sup>.

In conclusion, it may be said that arthroscopically assisted reduction and fixation of tibial plateau fracture avoids arthrotomy of the knee joint, helps in diagnosis of other associated intra-articular injuries and facilitates early rehabilitation. It may also give a better final outcome when compared with conventional arthrotomy. However, randomized, prospective trials are needed to confirm the advantages of arthroscopic reduction and internal fixation in the treatment of tibial plateau fractures when compared with conventional open reduction techniques.

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