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Original article

Prone and direct posterior approach for management of posterior column tibial plateau fractures

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ABSTRACT

Introduction: The three-column fixation concept is becoming popular in orthopedic practice. Posterior column fracture is an uncommon type of tibial plateau fracture. The supine position for the surgical approach is familiar to most surgeons; however, it is difficult to achieve good reduction and fixation in posterior column fracture.
Hypotheses: The prone position and direct posterior approach can achieve proper reduction and fixation for posterior column tibial plateau fracture, yielding good functional outcome.
Materials and methods: Between January 2010 and January 2012, 184 tibial plateau fractures were diagnosed and operated on in our institution. Sixteen posterior column tibial plateau fractures (10 male and 6 female patients, with a mean age of 41.5 ± 14.3 years) were diagnosed by preoperative plain films and CT scans. Ten patients presented with fracture-dislocation of the knee joint. A direct posterior approach in prone position was used to reduce the tibial condyle and fix it with an anti-glide buttress plate. Radiographic evaluation included reduction quality and bone union. Functional evaluation included Lysholm score and Tegner activity score.
Results: All fractures healed within 6 months, without secondary displacement. Ten knees had post-operative anatomic reduction (0 mm step-off) and 6 had acceptable reduction (< 2 mm step-off). At 34.4 ± 9.6 months, median extension was 3 (5–10) and flexion 135 (100–145). The mean Lysholm score was 95 (75–100) and the mean Tegner activity score was 6 (5–8). All patients were satisfied with the operation. No cases of post-traumatic osteoarthritis of the knee occurred during follow-up.
Conclusions: The prone position and direct posterior approach has great advantages in terms of reduction and stable fixation, yielding good results.
Type of study: Retrospective, case series.
Level of evidence: : Level IV.

1. Introduction

Posterior column fragments are relatively uncommon in proximal tibial fracture. It is a specific fracture pattern that is not well described by the AO (41- B2.2/B3.2) or Schatzker (IV, V, VI) classification systems [1], because these classification systems do not differentiate cases in which the medial fragment is primarily posterior and sometimes associated with a dislocation or subluxation of the knee joint. Recently, posteromedial fracture was well defined in the revised Duparc classification [2], using important findings to classify Schatzker type IV fractures as spinocondylar (74%), unicondylar (19%), posteromedial (5%) or bicondylar (2%). Posteromedial fractures, either isolated or associated with another fracture, were a challenge for observers to classify, because they are not described in the Schatzker [1] or AO classifications. Several reports have illustrated the importance of coronal plane proximal tibial fracture (posteromedial or posterolateral fracture), which are only visible on lateral radiographs or computed tomography scans. If wrongly diagnosed, they may lead to the use of inappropriate fixation techniques that result in poor outcome [2].

Moore classified this type of fracture but did not describe management in depth [3]. On the Moore classification, type 1 fracture-dislocation corresponds to the modified Duparc category of posteromedial split fracture, and type 2 to medial spinocondylar and lateral spinocondylar fracture (Fig. 1A).

These fractures are mostly caused by high-energy trauma and are sometimes associated with significant ligament and soft tissue injuries. They may include anterior cruciate ligament (ACL) avulsion fracture, posterior cruciate ligament (PCL) avulsion fracture, and posterolateral corner (PLC) injuries. This fracture pattern,

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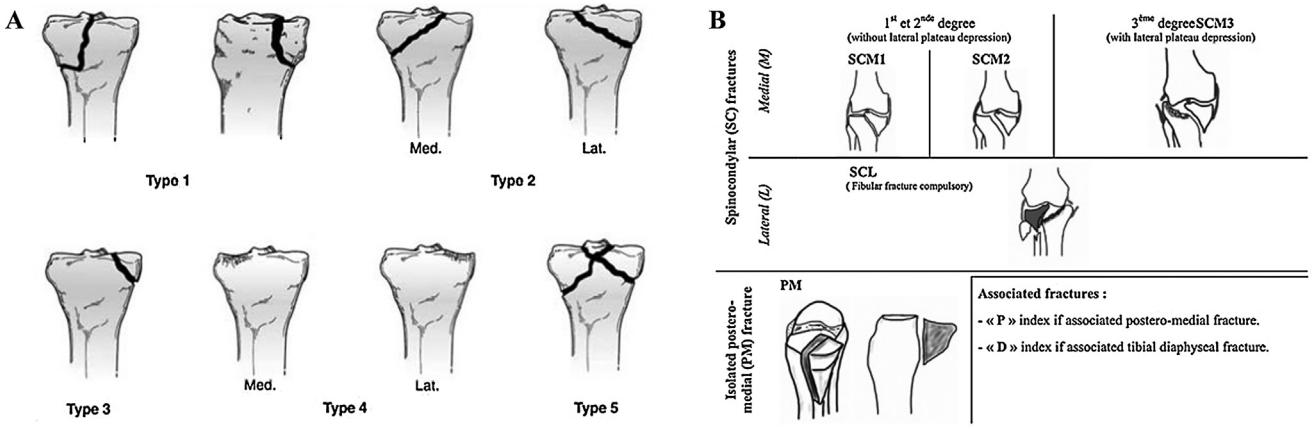

Fig. 1. A. Moore's classification of fracture-dislocation [1]. B. Modified Duparc's classification for spinocondylar fracture and isolated posteromedial fracture [2].

however, is inherently unstable and difficult to adequately reduce and stabilize by conventional techniques and approaches [4–6].

A reduction problem is often faced during posteromedial or posterolateral displacement of the tibial fragment under knee flexion. The supine position with a posteromedial or posterolateral approach requires extensive dissection for reduction purposes. Furthermore, the biomechanical principles of management of these fractures require placement of a posterior anti-glide buttress plate. Therefore, the posteromedial fragment sometimes cannot be optimally treated by conventional anterior, medial, or posteromedial approaches in the supine position [7].

A conventional vertical incision of the posteromedial collateral ligament and detachment of the medial capsule and medial head of gastrocnemius from the medial femoral condyle are required for full exposure of the posteromedial facet. Posterior approaches, such as described by Trickey in the 1960s, are more demanding and involve dissection of the neurovascular bundle [8,9]. To overcome these problems, Galla and Lobenhoffer described a direct posteromedial approach for managing Moore type I tibial head fracture-dislocations [10].

The main goal of the present study was to report a reverse L-shaped incision that allows more space for reduction and easier placement of implants. This approach does not involve dissection of the neurovascular bundle and allows excellent fracture visualization and appropriate placement of hardware, while minimizing soft tissue dissection. Furthermore, the prone position enables easy reduction by axial traction and hyperextension of the knee. Our hypothesis was that the prone position and direct posterior approach can achieve proper reduction and fixation for posterior column fracture, yielding good functional outcome.

Fig. 2. A. Posterior compartment tibial condylar fractures: anteroposterior and lateral views. B. CT scans give more information regarding articular impaction, sagittal plane fragment and fracture line orientation.

2. Materials and methods

This is a retrospective study. Between January 2010 and January 2012, 184 patients with tibial plateau fracture were operated on in our institution. All patients had CT scan examination as well as plain radiographs for classification (Fig. 2B). Following Luo et al. [11], all fractures were classified using the "three-column" concept. Using the axial CT view, the tibial plateau was divided into three areas: lateral column, medial column and posterior column. These three columns are separated by three connecting lines: CA, CL and CM. Point C is the center of the tibia (midpoint of two tibial spines); point A represents the anterior tibial tuberosity; point M is the posteromedial ridge of the proximal tibia; and point L is the most anterior point of the fibular head. Point P is the posterior sulcus of the tibial plateau, which bisects the posterior column into posteromedial (PM) and posterolateral (PL) fragments (Fig. 3). Besides the axial view, accurate classification was usually ensured with the assistance of three-dimensional (3D) reconstruction. Patients with posterior column fracture were enrolled in the study. Sixteen knees were diagnosed as pure posterior column tibial plateau fractures (10 male and 6 female patients, with a mean age of 41.5 ± 14.3 years). There were 8 isolated PM fractures, 4 isolated PL fractures and 4 PM and PL fractures. Patients were followed up for at least 24 months (34.4 ± 9.6 months).

2.1. Operative procedure

The patient was placed prone on a well-padded radiolucent table, and the injured leg was slightly elevated, with flexion of the knee joint. A tourniquet was used in all cases. Intraoperative fluoroscopic imaging was used to ensure proper reduction of the fracture and accurate location of the implants.