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Case report

A remarkable pattern of a tibial plateau fracture. Use of a safe technique with practical advantages in the surgical field

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Summary. Bicondylar plateau fractures are complex injuries often requiring a challenging treatment. We report a case of a 68 year-old-male patient with a complicated tibial plateau bicondylar fracture. The fracture of the tibial plateau involved all columns (lateral, medial, posterior). The fracture pattern of the proximal tibia managed by triple plating through dual posteromedial and anterolateral incisions. Posterior-medial and the medial plating result in increased stability. The posteromedial approach to the knee that we used in our case, offers various advantages. We recommend the option of the posteromedial access, as an approach that allows excellent control of the posterior involvement of this pattern of tibial plateau fracture. (www.actabiomedica.it)

Key words: tibial plateau fixation, posteromedial knee approach, bone plates

Introduction

Bicondylar tibial plateau fractures have always been a challenge to treat. Stable fixation is mandatory and the degree of complication in surgical management increases with a posterior involvement of the tibial plateau. Direct posterior access became popular for the excellent operative visualization in the surgical field, but despite being very practical, it still remains quite demanding during orthopedic procedures (1).

In the past, the most used classification for the tibial plateau fractures, the Schatzker one, has never described a posterior tibial involvement.

Nowadays, the extensive use of classification systems that take into consideration posterior fragments of the tibial plateau, such as the Luo classification, has point out the importance of the posterior fragmentation in the orthopedic surgical society (2).

Here, we present a case of a complicated tibial plateau bicondylar fracture with posterior involvement underlying the management possibilities of posterior fragmentation when using a posteromedial approach.

Case report

A 68 year-old-male patient was involved in a motorcycle accident. He presented to our emergency department with diffuse swelling and severe pain over the left knee and over the left ankle. No evidence of other skeletal injury was reported at the clinical examination. Both a radiographic examination and a CT scan revealed a left tibial fracture (Schatzker type VI) with a depression of the lateral-posterolateral side. A medial and posteromedial involvement of the tibial plateau was found, associated with a non-displaced fracture of the peroneal malleolus (Fig. 1a, 1b, 2d, 2e). The fracture of the tibial plateau involved all columns (lateral, medial, posterior), as previously described by Luo. A long leg partial splint - was applied and limb elevation was recommended until surgery. A 3D reconstruction of the knee was done for a more accurate investigation of the fracture and an in-depth preoperative planning (Fig. 2a, 2b, 2c).

The fracture of the proximal tibia consisted in a split depressed lateral condyle with a posterior-lateral

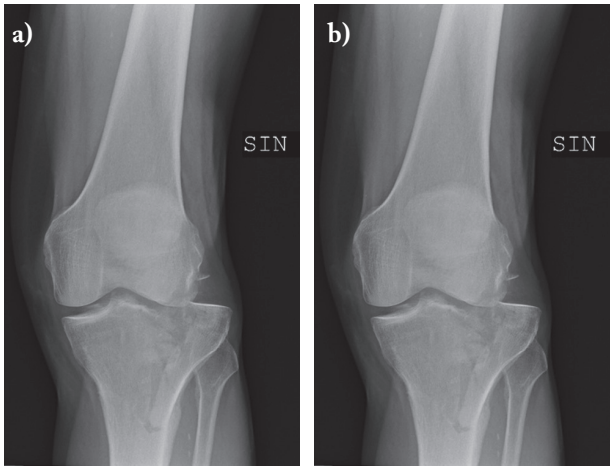

Figure 1. a, b) Radiographs of a 68 year-old-male patient with a tibial plateau type VI fracture according to the Schatzker classification

involvement. Medial plateau fracture was more complex, as the posterior-medial involvement was more extended in the medial side. The patient was operated seven days later to the admission, as a detailed cardiologic examination was requested by the anesthesiologist before surgery.

The patient was placed onto an orthopedic transparent bed in supine position to facilitate fluoroscopy and without using a pneumatic tourniquet. Cephazoline (2 gr iv bolus) was administered 30 minutes prior to skin incision as antibiotic prophylaxis.

The knee was externally rotated and flexed about 30 degrees and a posteromedial approach was firstly made. Incision was made posterior to the superficial medial collateral ligament. The fascia was identified and incised, the space between pes anserinus and the medial gastrocnemius was developed. Under direct visualization, the posterior fragment of the posterior medial column was reduced and stabilized in an anti-glide way with a 3.5 mm T-plate (Synthes, Switzerland). The medial fragment was fixed with an one-third 3.5 mm Tubular Plate (Synthes, Switzerland). Subsequently, a folded pillow was placed under the knee in internal rotation. The lateral fragment of the tibial plateau was exposed with an anterolateral approach. The articular depressed fragment was identified and elevated. Sponge cubes bone grafting was used to support the elevated fragment. Fixation

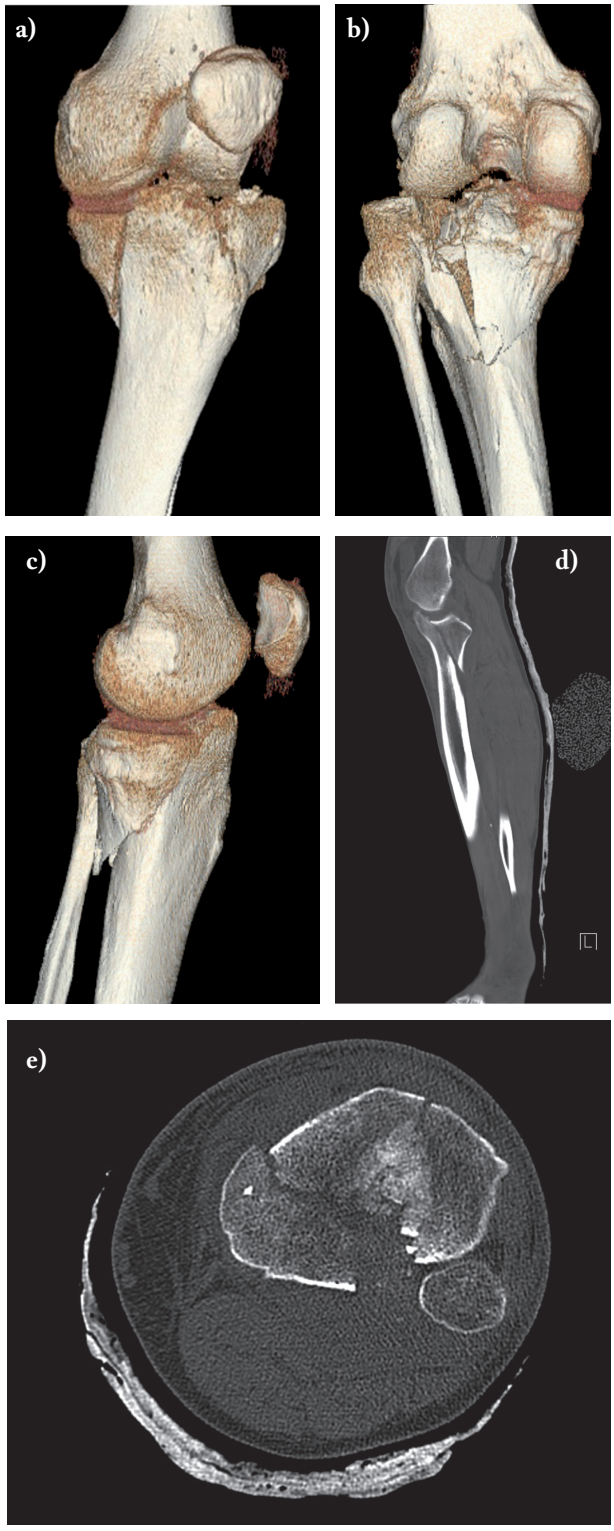

Figure 2. a, b, c, d, e. Ct scans of tibial plateau reveal a complex fracture pattern with involvement of all the four columns (lateral, medial, posterior) of the proximal tibia, as described by Luo

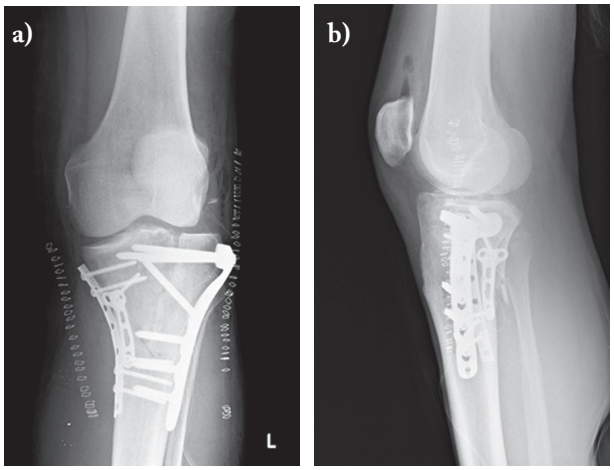

Figure 3. a, b) Post-operative x-rays of the knee

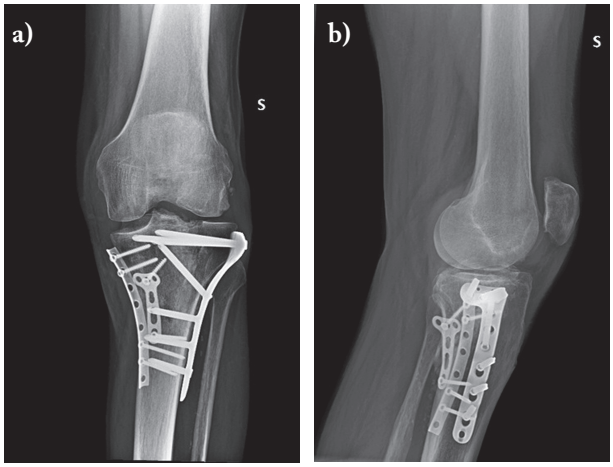

Figure 4. a, b) After a 9-month post-operative follow-up period, the surgical outcome was excellent and the fracture healing was more than satisfactory

was obtained by using an LCP Proximal Tibial Plate 4.5/5.0 (Synthes, Switzerland); the distal screws were placed with a minimally invasive percutaneous plate osteosynthesis (MIPO) technique (Fig. 3a, 3b). A drain was placed and then removed 24 hours later. A knee brace with a full range of motion was applied. The non-displaced lateral malleolus fracture was treated with a tight bandage to be carried for another 20 days.

Motion of the knee with active assisted exercises was started the day after surgery and a non-weight bearing walking was allowed from the third operative day and on. Full-weight bearing was started at week 10 following X-ray exams. For thromboembolic prophylaxis we administered low molecular weight heparin subcutaneously (according to the patient's weight) until the full weight bearing was reached.

X-ray assessments were performed one month after surgery and later after 2, 3, 6 and 9 months in the outpatient clinic (Fig. 4a, 4b). The standard AP and lateral X-ray views were used to assess callus formation of the proximal tibia. On the third month of the follow-up period, the patient reached full range of painless motion. No complications were occurred after surgery.

The informed consent of the patient was obtained, regarding the use of clinical data for scientific publication.

Discussion

Bicondylar plateau fractures are complex injuries often requiring a challenging treatment. Some fracture patterns are not adapted in the Schatzker classification and, due to this fact, several classification systems have been proposed the last years, including some unusual tibial plateau variations.

These fractures frequently present soft tissue lesions and the best treatment option depend on the local health status of the skin around the knee and the actual experience of the surgeon. Several surgical options are valid such as plating or external fixation. The goal of the treatment is the anatomical correction of the tibial plateau and a stable fixation, so as to prevent secondary displacement and to decrease the rate of complications as well (3).

In our case, we explained that it was crucial to obtain the lateral view and the 3d CT scan for a complete analysis of the fracture. The Schatzker classification only considers the anteroposterior view. Identification of posterior displacement is better stressed with lateral view and CT scans.

High-energy traumas often result to a posterior involvement and it is imperative to immediately discuss the possibility of either a posteromedial or a posterolateral fragmentation (4).

Preoperative planning is mandatory to obtain satisfactory results. In our case all the four columns were

interested. The main topic of our discussion regarding the planning preoperatively was the choice of surgical approach for the medial and posterior columns. We decided to proceed with a posteromedial access instead of the posterior one. For the lateral and posterolateral columns, the anterolateral approach was proposed with common agreement of all the surgical members that took place in our pre-operative meeting.

The posterior access of the knee joint requires a deep knowledge of the anatomy of the popliteal fossa, with regards to the neurovascular structures like the tibial nerve, the common peroneal nerve, the popliteal artery and the popliteal vein (5). A long S-shaped incision has to be made and it is required to lift a large skin flap, which can cause dehiscence and skin necrosis, especially if an acute incision is made. This risk is much increased in case of a high-energy trauma. In order to get the posterior surface of the knee joint better exposed, the medial head of the gastrocnemius muscle needs to be cut, which comes up against a fast recovery of the normal range of motion of the knee joint (6). A posterior approach is often combined with another access to the knee in order to treat complex fractures of the tibial plateau, and the prone position is another pitfall. In such cases, the surgeon has to change surgical field during the operation if a combined approach is necessary (7).

The posterior-medial approach that we used in our case offers various advantages. The supine position of the patient does not lead to any complications related to anesthesia. It is a relative safe approach because the saphenous nerve and the saphenous vein could be retracted either anteriorly or posteriorly, and also because the popliteal neurovascular bundle is located medially to the medial head of the gastrocnemius muscle which works as a shield. No muscle dissection is needed; the medial head of the gastrocnemius muscle, which is relaxed by knee flexion, is separated from the tibia by blunt dissection (8). The posterior-medial skin incision allows exploration of the structures anteriorly and posteriorly to the medial collateral ligament. Implant placement could be performed in both the medial and posterior-medial side of the tibial plateau.

Posterior tibial plateau has a complex structure and it is challenging to restore the joint anatomy when posterior multi-fragmentation occurs. In such cases, reduction could be more difficult if it is to perform a posterior medial approach when compared with a direct posterior one. Moreover, the persistent soft tissue suffering, typically seen in high energy tibial plateau fractures, is the condition that will ultimately direct the choice of the approach. We emphasize that the combination of anterolateral approach and posteromedial approach allows a wider skin bridge between the two skin incisions.

In our case all the columns were affected; nevertheless, we decided to face the fracture by choosing an approach which was closer to multifragmentation. The posteromedial side of the tibial plateau seemed more complicated on the CT scan, so, we preferred to deal with the fracture by using an approach the offers better visualization of the more complicated posteromedial fragmentation.

Before attempting a reduction of the fracture, through the posteromedial approach, we mobilized the fragment to allow the extraction of the hematoma and of the osteochondral fragments which often disturb the reduction. This is facilitated by placing the knee in a flexed position. On the other hand, we noticed that positioning the knee in extension facilitates the reduction of the posteromedial tibial plateau. The technique of Kirschner wire joysticks is also helpful in facilitating reduction of small articular fragments.

Accurate reduction of the posterior medial side is mandatory and temporary stabilization with K-wires also allows an intra-operative check with a C-Arm image intensifier, before a definitive stabilization is performed. A small sub-meniscal release at the fracture site at the medial side is helpful, whenever oblique fluoroscopy images do not clearly illustrate the articular surface.

The double posteromedial and medial plating resulted in increased stability. A “T” plate was initially inserted to restore anatomical slope of the posteriormedial plateau. Low profile slim 3,5mm “T” plates have been countered and adapted to the metaphyseal posterior segment of the tibial plateau, in order to facilitate the laborious reconstruction. Subsequently, the one-third tubular plate stabilized the medial column to prevent secondary varus collapse and to increase stability of the metaphyseal zone of the proximal tibia (9). Attention was paid non to insert long screws that

could have interacted with the lateral plating. After medial and posteromedial plating, this apparently complex pattern was transformed to a simple Schatzker III fracture variation that needed to be stabilized and supported by grafting. C-arm controls confirmed the anatomical fragment reduction of the tibial plateau surface.

In this tibial fracture pattern, we strongly suggest and recommend the option of the posteromedial access, as a better alternative approach that allows excellent control of the posterior involvement of the fracture.

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Conflict of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article

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