Clinical Case Report

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Anterolateral tibial plateau osteotomy as a new approach for the treatment of posterolateral tibial plateau fracture

A case report

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Abstract

Rationale: It is challenging to visualize and reduce a posterolateral tibial plateau fracture through an anterolateral approach as the tibial plateau fragments are often covered by the fibular head and ligamentous structures.

Patient concerns: In this case report, we describe a patient with a depression fracture of the posterolateral quadrant combined with a split fracture of the posteromedial quadrant and an avulsion fracture of the tibial intercondylar eminence.

Diagnoses: Tibial plateau fracture(AO type 41-B3).

Interventions: A posteromedial approach combined with an anterolateral approach and an osteotomy involving the proximal tibiofibular joint of the tibial plateau was used to expose, reduce, and fix the fracture.

Outcomes: There was no risk of injury to the common peroneal nerve or ligaments. The patient is recovering well and is satisfied with the function of the injured knee.

Lessons: We recommend anterolateral tibial plateau osteotomy for the treatment of posterolateral tibial plateau fractures in clinical practice.

Abbreviations: AL = anterolateral, CT = computed tomography, PL = posterolateral, PM = posteromedial.

Keywords: anterolateral tibial plateau osteotomy, fracture, injured knee, posterolateral tibial plateau fracture

1. Introduction

Fractures of the tibial plateau resulting from axial compressive forces that may or may not be combined with varus or valgus stress on the knee joint[1] present risks to knee function as these are joint fractures of the proximal third of the tibia where load transmission takes place. Management of these fractures requires preoperative planning based on comprehensive classification systems that have prognostic value, and therefore aid decision making. Luo et al[2] recently described an anatomic classification in which the tibial plateau is divided into the following 4 quadrants on an axial computed tomography (CT) image at the subchondral level: anterolateral (AL), posterolateral (PL), anteromedial, and posteromedial (PM).

PL fractures represent 7% of tibial plateau fractures and often result from a combination of axial loading and valgus force.[3] Evidence suggests that it is challenging to visualize and reduce PL fractures through an AL approach as the tibial plateau fragments are often covered by the fibular head and ligamentous structures.[4–6] Alternative surgical approaches have been employed for direct exposure and to support plate fixation of PL fractures, including osteotomy of the fibular neck or fibular head; however, these approaches are not in widespread use as they may result in injury to the peroneal nerve or ligaments.[6]

In this report, we describe a tibial plateau fracture involving the PL quadrant. We used a PM approach combined with an AL approach and an osteotomy involving the proximal tibiofibular joint of the tibial plateau to expose, reduce, and fix the fracture.

2. Case report

Informed consent for the publication of this study and the use of the photographs was obtained from the patient.

A 38-year-old man was admitted to our hospital complaining of right knee pain and limited mobility following a fall. At admission, X-rays revealed an AO type 41-B3 fracture (Fig. 1A). Neurovascular examination showed no abnormalities of the bilateral lower extremities. CT demonstrated a depression fracture of the PL quadrant combined with a split fracture of the PM quadrant and an avulsion fracture of the tibial intercondylar eminence (Fig. 1B–D). The patient underwent open reduction and internal fixation because of severe displacement of the fracture. Operative

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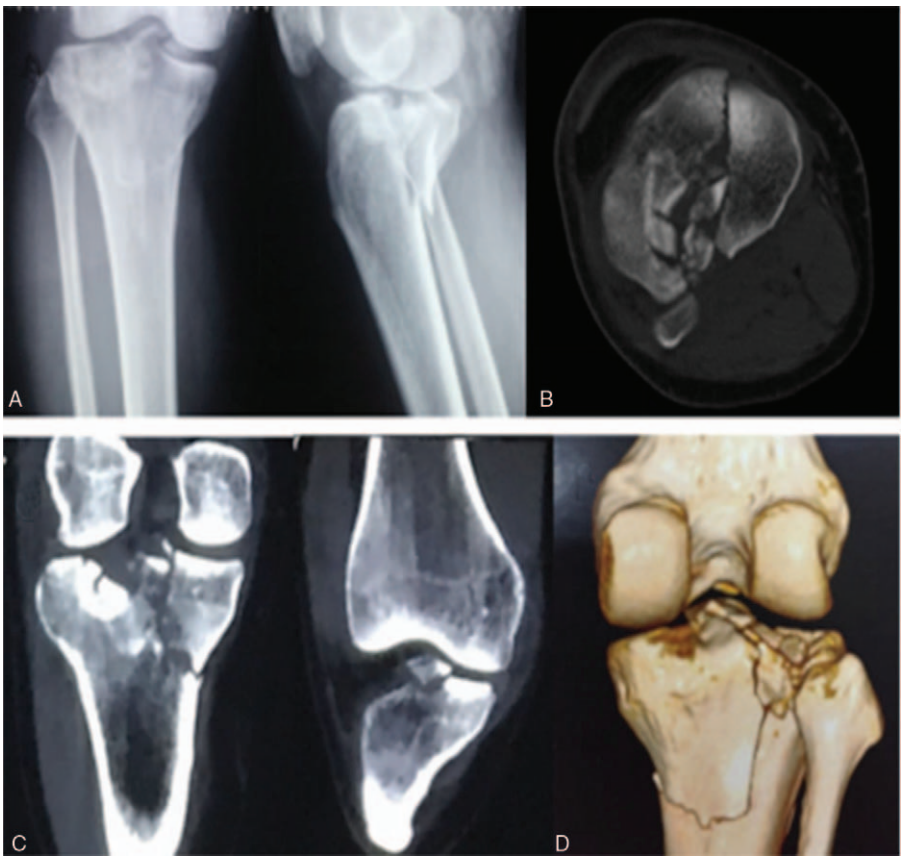

Figure 1. Preoperative plain radiographs and CT scans. A: AP and lateral views showing an AO type 41-B3 fracture. B: Axial CT scan showing a depressed fracture fragment of the posterolateral quadrant combined with a split fracture fragment of the posteromedial quadrant. C: Coronal CT demonstrating an avulsion fracture of the tibial intercondylar eminence. D: Reconstructed CT scan.

stabilization was performed after swelling had subsided at 10 days posttrauma.

2.1. Surgical technique

Two separate surgical approaches were used: PM and AL. The patient was under general anesthesia. For the PM approach, the patient was placed in a lateral decubitus "floating position" on a radiolucent table, the lower limb was rotated to a prone position,[7] and an arterial tourniquet was inflated. A 10-cm longitudinal skin incision through the deep fascia was made beginning at the medial corner of the popliteal fossa. A full-thickness fasciocutaneous flap was retracted to protect the sural nerve and short saphenous vein.[7] The medial head of the gastrocnemius was retracted laterally to expose the PM fracture. After reduction, the PM fragments were fixed with a plate (Synthes GmbH, Umkirch, Germany) (Fig. 3A). Subsequently, open reduction internal fixation of the PL depression fracture was performed. A 15 cm incision was made starting 1.5 cm lateral to the tibial crest, extending midway between Gerdy tubercle and the fibular head, and turning posterosuperiorly. A full-thickness fasciocutaneous flap was raised. The iliotibial tract was split longitudinally and reflected from its insertion on Gerdy tubercle. After dissecting the muscle, AL osteotomy of the tibial plateau was performed to expose the PL depression fracture. The lateral half of the AL quadrant was cut off longitudinally with a bone-chisel (Fig. 2A–C). The tibiofibular articular surface and ligaments were protected when removing the bone segment. The PL depression fracture was visible (Fig. 2D) and elevated to the joint line level by a small rod. The resultant space was filled with allocancellous bone graft. Then, the AL fragments and the bone segment created by the osteotomy were fixed with a proximal lateral tibial plate (Synthes GmbH) (Fig. 3B). Fixation of the avulsion fracture of the tibial intercondylar eminence was not required because of minimal displacement.

Intravenous antibiotic prophylaxis was routinely applied 30 minutes before surgery and continued for 24 hours postoperatively. Routine dressing changes, infection control, and symptomatic therapy were administered postoperatively. The patient was instructed to perform muscle strengthening and range-of-motion exercises. The incision healed and stitches were removed at postoperative 2 weeks; the patient was discharged. Partial weight-bearing started at postoperative 6 weeks, and full weight-bearing was allowed at postoperative 3 months. Postoperative X-rays revealed good reduction of the fractures (Fig. 3A, B). At postoperative 5 months, X-ray showed that fracture lines were blurred and calluses had formed (Fig. 3C, D). The patient was satisfied with the function of the injured knee.

3. Discussion

Fracture of the PL tibial plateau is rare and is not described in the Schatzker classification system for tibial plateau fractures. However, widespread use of CT for advanced imaging has increased awareness of PL tibial plateau fracture in orthopedic surgeons. In the current study, we report on a patient with a

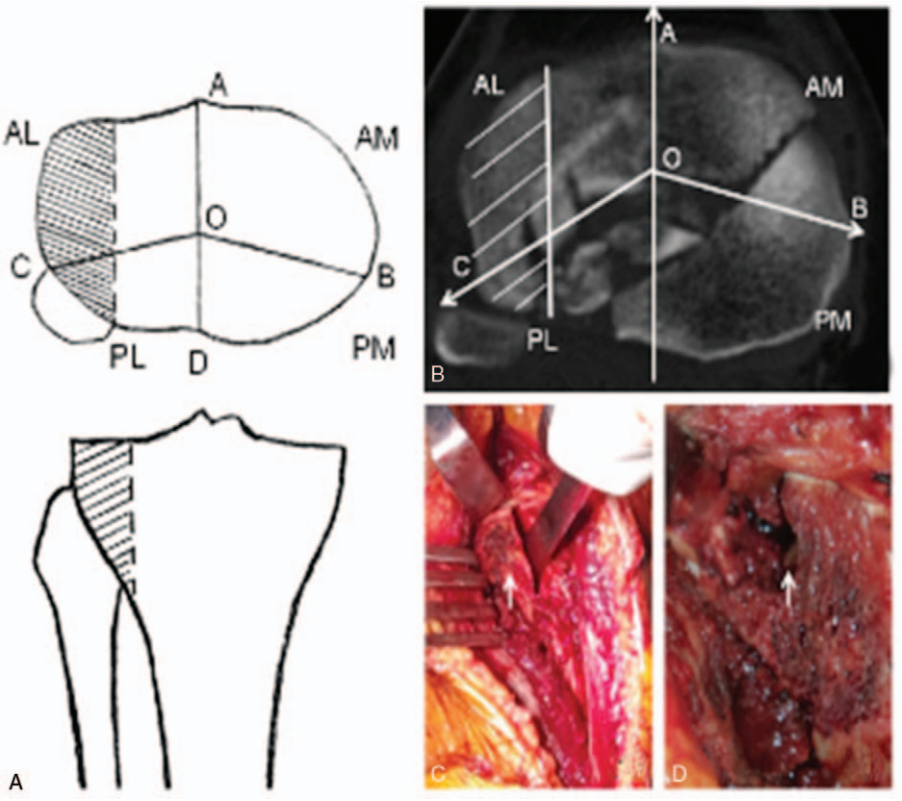

Figure 2. Osteotomy of the tibial plateau. A: Design of the osteotomy (shaded egion). O, center of the knee; A, anterior tibial tuberosity; B, posteromedial ridge of the proximal tibia; C, most anterior point of the fibular head; D, posterior sulcus of the tibial plateau. B: Axial CT at the subchondral level showing the osteotomy (shaded region). C: Intraoperative photograph of the osteotomy. White arrow, bone segment created by osteotomy. D: Photograph after osteotomy. White arrow, depressed articular surface.

depression fracture of the PL quadrant combined with a split fracture of the PM quadrant and an avulsion fracture of the tibial intercondylar eminence. PL tibial plateau fractures are difficult to reduce and stabilize. Preservation of joint stability is essential and adequate reduction reduces the risk of instability caused by ossification.[8] Current approaches for the reduction and fixation of tibial plateau fractures are associated with unsatisfactory outcomes as the fragments are often covered by the fibula head and PL corner structures, such as the popliteus muscle and the popliteofibular and patellofibular ligaments.[9] A number of surgical approaches for the treatment of PL tibial plateau fractures have been proposed.[4,6,10,11] Lobenhoffer et al[12] described a PL approach, which allows an optimal overview of the PL tibial plateau; however, this technique requires major soft tissue dissection. Tscherne and Lobenhoffer[13] suggested a lateral approach with fibular osteotomy, which allows retraction of the upper segment to the back or even rotation of the fibular head upward to expose the PL plateau. However, the common peroneal nerve is exposed and at risk for injury, and the fibular neck must be cut.[12] Yoon et al[14] used a combined lateral femoral epicondylar osteotomy and a submeniscal approach for the treatment of a tibial plateau fracture involving the PL quadrant, and Yu et al[6] introduced fibular head osteotomy as a new technique for the treatment of lateral or PL tibial plateau fractures. These procedures achieved good outcomes, but they are associated with increased risk of injury to ligaments. The

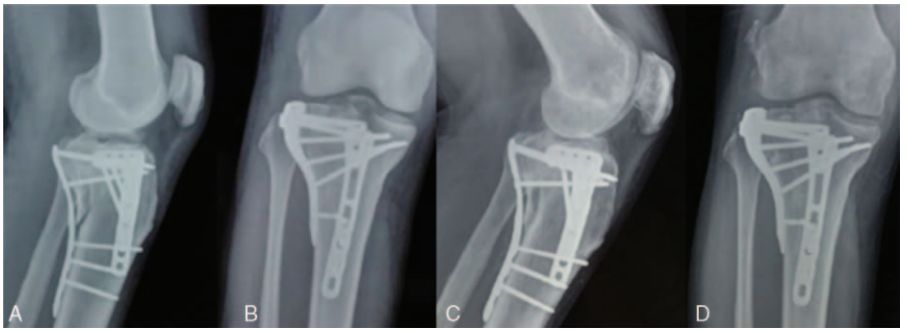

Figure 3. Postoperative X-rays. A–B: AP and lateral views showing reduction of the fractures. C–D: X-rays at postoperative 5 months revealed that fracture lines were blurred and calluses had formed.

Balloon technique has also proved useful for the reduction of PL fragments, providing good outcomes and no complications.[15,16] The Balloon technique is particularly effective for acute compression fractures, but may be less efficacious for chronic (>3-month old) osteoporotic, traumatic, or pathologic compression fractures.

An anterior or AL approach for the treatment of PL tibial plateau fractures may be safer and more effective that previously proposed techniques; however, it should be combined with an osteotomy if the fracture line does not extend to the anterior tibial cortex. In the current study, AL osteotomy of the tibial plateau was employed to expose a depression fracture of the PL quadrant, and the lateral half of the AL quadrant was cut longitudinally. If it is necessary to improve the view of the PL tibial plateau, the osteotomy can extend to the PL quadrant and involve the proximal tibiofibular joint. After removal of the bone segment, the depression fracture of the PL quadrant can be clearly seen and treated. The posterior aspect of the tibial plateau can be reached by a PM approach. This procedure minimizes risk of injury to the ligaments and common peroneal nerve. The patient in the current study recovered with no complications and is satisfied with the function of the injured knee. Therefore, we recommend AL tibial plateau osteotomy for the treatment of PL tibial plateau fracture in clinical practice.

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