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Case report

Management of a rare intra-articular fracture of the lateral femoral condyle: case report

Riccardo Compagnoni [1,3], Martina Ricci [1,2], Francesca Alice Pedrini [1,2], Paolo Ferrua [1,2], Alessandra Menon [1,2], Pietro Simone Randelli [1,2]

[1]Laboratory of Applied Biomechanics, Department of Biomedical Sciences for Health, Università degli Studi di Milano, Milan, Italy; [2]1° Clinica Ortopedica, ASST Centro Specialistico Ortopedico Traumatologico Gaetano Pini-CTO, Milan, Italy; [3]Università degli Studi di Milano, Department of Biomedical, Surgical and Dental Sciences, Milano, Italy

Abstract. Unicondylar fractures of the femur are uncommon injuries that can occur in the sagittal or, less frequently, in the coronal plane (Hoffa fractures). Distal femoral fractures are usually described following the AO/OTA Classification system (1) which includes extra-articular, partial articular and intra-articular injuries, further divided in three types based on the pattern and comminution. Accurate reduction and stable fixation are needed especially in articular injuries in order to allow early mobilization and reduce complications such as knee stiffness, malunion or secondary osteoarthritis. The aim of this paper is to report a case of an unusual articular fracture of the lateral femoral condyle in a 39 years old man. This fracture reminds the pattern of a typical tibial plateau injury, not embedded in the most common descriptions of femoral traumas. Indeed, in most cases, high energy traumas in valgus of the knee result in a damage to the tibial plateau because of the condyles impact on the tibial articular surface, while in the present case the opposite occurred. The patient was successfully treated with an open reduction and fixation with two cannulated leg screws, reporting good clinical outcome and excellent healing of the fragment evidenced with CT scan at 6 months follow-up. (www.actabiomedica.it)

Key words: distal femur, fracture, articular, unicondylar, open reduction, screw fixation.

Introduction

The overall incidence of distal femur fractures is 8.7/100,000/year, accounting for 3–6% of femoral fractures in adults and 0.4% of all fractures (2,3). In the young population, these fractures are typically a consequence of high energy traumas, such as traffic accidents or a fall from heights, and the most common mechanism of injury is represented by axial or rotational forces expressed on the knee (4,5). Complex articular condyle fractures are not common and the treatment is challenging due to different possible complications, such as secondary osteoarthritis (50%), joint stiffness (35%), infection (13% - 29% in open fractures), malunion (4-40%) and septic or aseptic nonunion (2-10%) (6). Stable surgical fixation is often recommended in articular fractures around the knee, to permit an early mobilization and reduce unsatisfactory clinical outcomes (7). Many classifications have been proposed to describe distal femoral fractures and help clinicians in surgical planning. The most commonly used is the AO/OTA Classification (1) but many authors as Neer (8), Seinsheimer (4), Egund, and Kolmert (9) have proposed other grading systems. All these classifications are mainly focused on complex supracondylar fractures, with extension to the articular region. To author's knowledge description of distal femoral fractures similar to the Schatzker classification of intra-articular proximal tibial fractures is not available (10). Some patterns of fracture are therefore not classifiable and a clinical decision regarding their treatment could be complicated. This case report aims

to present an unusual intra-articular fracture of lateral condyle treated with an open internal fixation using cannulated lag screws.

Case Presentation

A 39-years-old man had a motorcycle accident reporting a direct trauma to his left knee. The physical examination showed moderate effusion, tenderness on the lateral compartment, hemarthrosis and limited range of motion particularly in flexion (ROM 20°/40°). Neurovascular status was physiological, the skin was intact and laxity in valgus stress was observed with patients under anesthesia. Knee X-rays (Figure. 1) and a 3D CT (Figure. 2) scan were taken, showing a multifragmentary fracture on both sagittal and coronal plane at the posterior side of the lateral femoral condyle, involving the articular surface with a displaced parcellar detachment of the lateral border. The fracture pattern reminded the typical articular surface "décalage", approximately large 2 cm x 3 cm, commonly seen

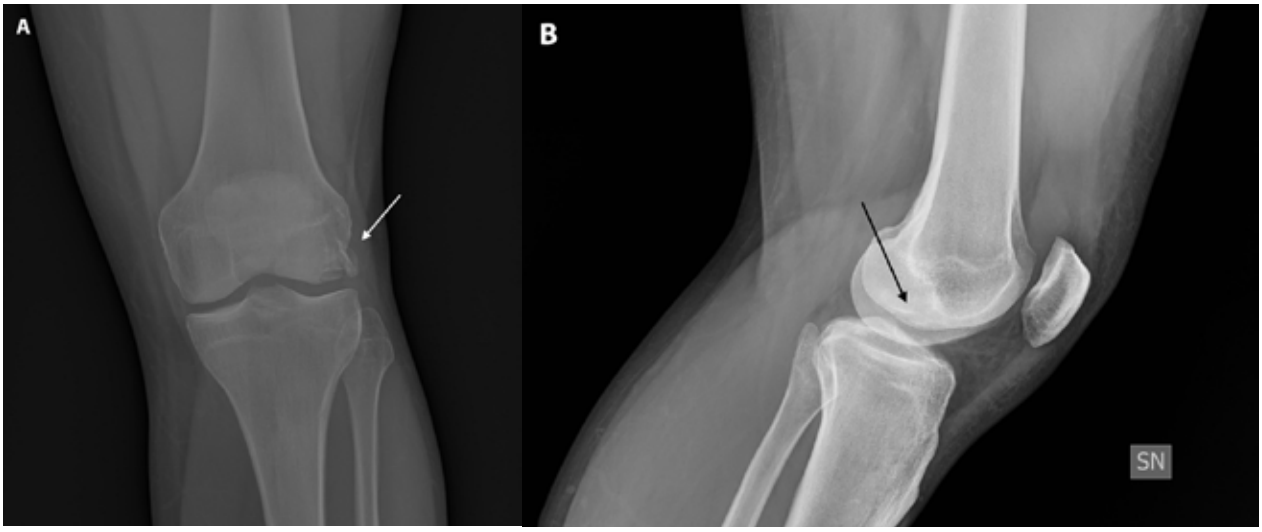

Figure 1. Preoperative plain radiographs: (A) standing anterior-posterior view; (B) lateral view.

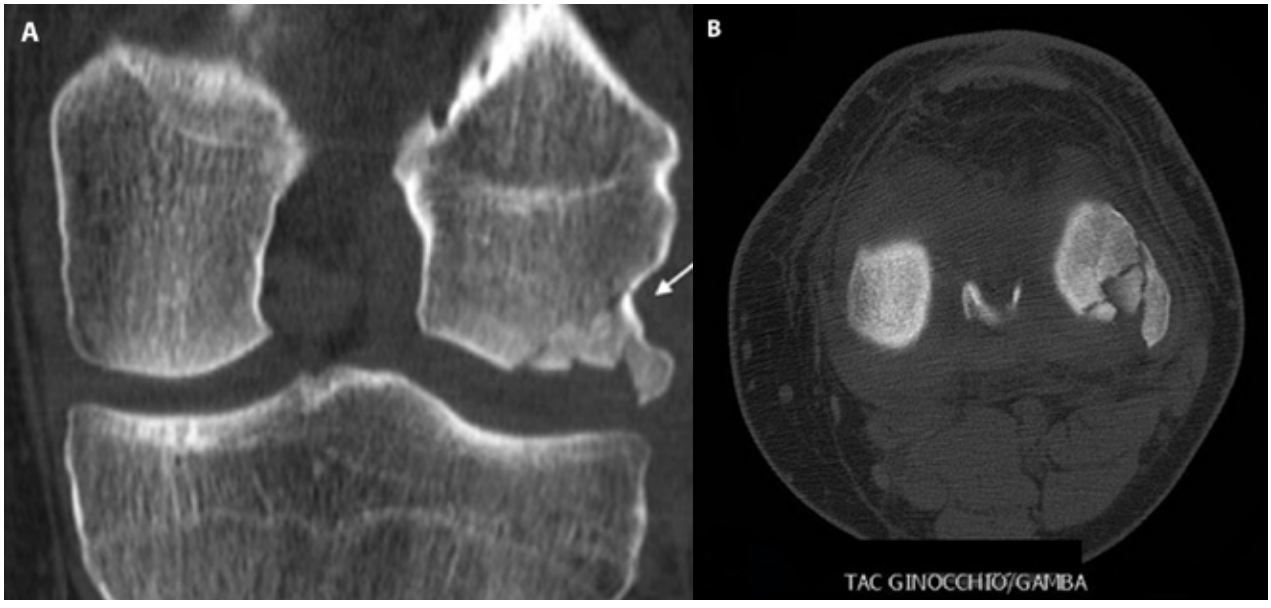

Figure 2. Preoperative CT scan: (A) coronal bone window; (B) axial bone window. The arrows indicate the fracture.

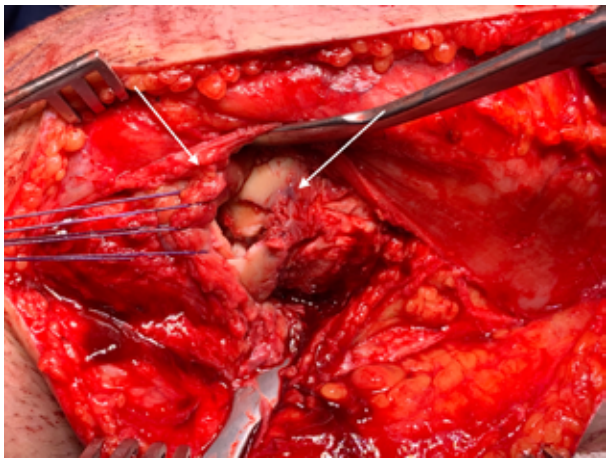

Figure 3. Intraoperative view of the fracture: the arrow on the left side indicates the lateral meniscus being protected and displaced for fracture reduction, the arrow on the right side shows the intra-articular "decalage" of the lateral condyle.

in tibial plateau fractures, though on the femoral side. Because of the unusual shape, it was difficult to classify it following the usual classifications for distal femoral fractures.

Treatment

After preoperative surgical planning, based on the 3D CT scan and x-rays, an open reduction and internal fixation of the fragments with two cannulated screws were suggested. The patient was positioned supine with his knee flexed 30° and the left limb elevated compared to the contralateral one to obtain clear fluoroscopy images in both plans. To visualize both the anterior and lateral side of the condyle, a lateral approach to the knee was performed, protecting the lateral collateral ligament. The lateral meniscus was loaded with temporary suture to mobilize and get it away from the lateral femoral condyle (Figure.3). The fracture was reduced and temporarily fixed by guidewires, using the lateral tibial plateau as a reference to restore the correct articular surface. The fracture was fixed inserting two parallel cannulated screws (50 mm long, diameter 4 mm – Synthes, Soloturn, Switzerland) oriented from lateral to medial and from distal to proximal towards the center of the trochlear groove, which was not violated (Figure. 4). Articular cartilage was preserved. At the end of the procedure, the articular surface looked perfectly restored and the fragment stable throughout the whole range of motion of the knee. After surgery, a knee brace in full extension was applied for 21 days, then progressive flexion of the knee was allowed (30 degrees every 10 days). Weight-bearing was not allowed for 35 days after the operation, then the patient was examined at the outpatient clinic and the full loading was progressively allowed.

Outcome

At every follow-up (1 and 6 months after surgery) a questionnaire was administered to the patient for evaluating symptoms and knee function:

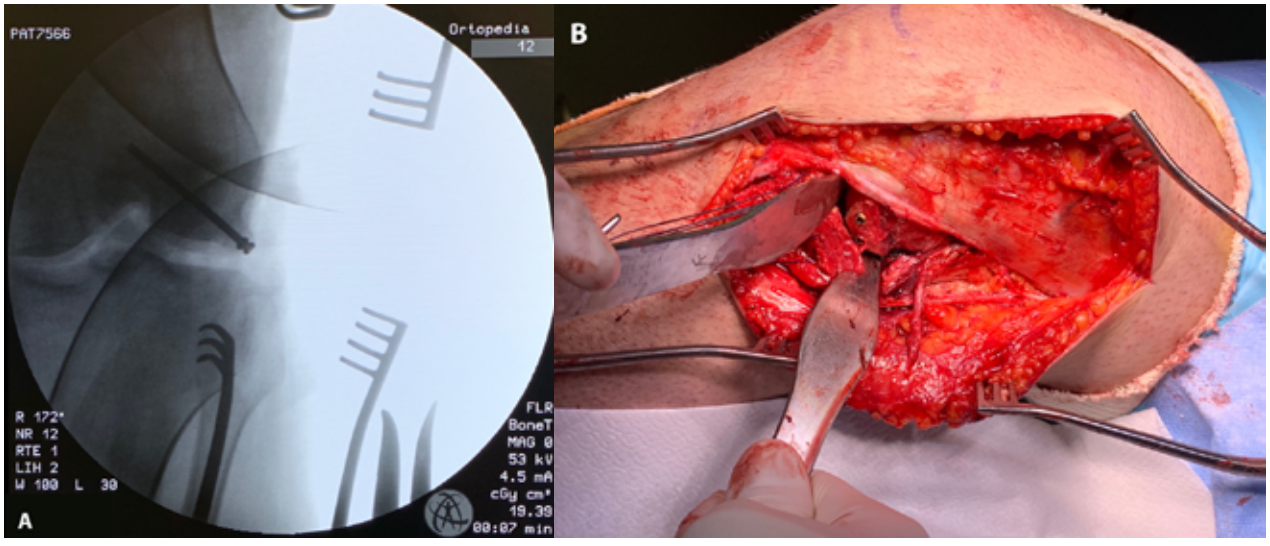

Figure 4. Intraoperative stabilization using two cannulated screws: (A) fluoroscopic anterior-posterior view; (B) lateral surgical view.

it included the Numeric Rating Scale (NRS) for pain (11), the International Knee Documentation Committee (IKDC) subjective score (12) and the Western Ontario and McMaster Universities Arthritis Index (WOMAC) (13). X-rays were performed at one month and two months follow-up. At 6 months after surgery, a CT scan was performed to check the stability of the implant and the progression of bone healing.

At one-month follow-up, the patient presented a slightly swollen knee, laxity in varus at 30 degrees of flexion was still significant, but only a slight pain was reported. Toe-touch weight-bearing and progressive flexion of 30 degrees every 10 days were allowed, as well as strengthening of the limb muscles through isometric exercises. Two months after the operation, the knee did not present any ligamentous laxity, ROM was 0-100 degrees. At 6 months follow-up, the injured knee was neither painful nor swollen and range of movement was complete; CT scan showed full healing of the fracture and restoring of the articular surface (Figure. 5). At every follow-up the patient reported an improvement in all the clinical scores (Table. 1).

Table 1. Clinical scores at 1 and 6 months follow-up.

Score (points)	**1 MONTH**	**6 MONTHS**
NRS	4	2
IKDC	17.2	49.4
WOMAC	35	19

NRS: Numeric Rating Scale for pain, IKDC: International Knee Documentation Committee questionnaire, WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index.

Discussion

This case report describes the surgical treatment of a rare intra-articular fracture of the lateral condyle, not classified accordingly to literature, resulted in a good clinical outcome.

Most of the studies on intra-articular distal femur fractures lack validated classifications and information about the trauma mechanism, unlike tibial plateau fractures which are well described; this could be due to the lower incidence and the variety of traumatic mechanism and associated features that make fractures involving the distal femur very different from case to case. Common distal femur fractures described in the literature are the supracondylar and periprosthetic ones, which require a different treatment compared to this case. The peculiarity of the fracture reported in this paper is the location: the most similar fracture described in the current literature is the B1 partial articular sagittal by Muller or type 1 following the Shatzker classification (14); the originality of the present case is that it did not involve the complete interruption of the condyle cortex, but it appeared as a partial articular depression that dislocated the distal lateral border of the femur. Usually, in most cases of high energy knee traumas in valgus, fractures involve the tibial plateau due to direct compression of femoral condyle on the tibial articular surface: in this case, the opposite occurred.

Indications for operative treatment of distal femur articular fractures are a displacement of 3 mm, which is likely to lead to a further dislocation of the fragments and the development of osteoarthritis (15). The goal of

Figure 5. Six months follow-up CT scan: (A) 3D-CT scan reconstruction; (B) Coronal bone window; (C) Sagittal bone window. The present follow-up shows bone healing and the correct restoration of the articular surface.

surgical management is the anatomic reduction of the articular surface and restoration of limb length, rotation and alignment (16); the surgical procedure should also avoid soft tissue stripping of the metaphyseal-diaphyseal region while ensuring a stable fixation (17).

Several studies have reported good results after open reduction and internal fixation of unicondylar distal femoral fractures et al (18) found 83% excellent results at Neer score at a mean follow-up of 3.8 years in 61 patients with an intra-articular fracture; in a study including 27 unicondylar fractures, Ostermann et al (19) obtained good to excellent results in 96% of patients at a mean follow-up of 68 months. They underlined that all patients who did not achieve an excellent outcome had accompanying injuries and the outcome was significantly affected by musculoskeletal associated injuries. Rademakers et al (20) showed that open reduction and rigid internal fixation leads to excellent functional results in 84% of patients after an average of 14 years follow-up, but they found that in case of multiple fractures early rehabilitation is hard to perform and that leads to a worse knee function compared to patients with a single fracture; on the other hand, they found no significant difference in outcome comparing unicondylar to bicondylar fractures.

Since the development of secondary osteoarthritis is a common complication in intraarticular fracture - over 30% of all patients even when treated by experienced surgeons (20,21) - and patients are often young and active, the strategy and choice of implants needs to be accurate to realize a synthesis as much anatomical as possible.

Partial articular distal femoral fractures are difficult to treat, mainly because of their position. The conventional anterior approaches sometimes provide a limited site exposure, so these cases may require the detachment of ligaments and/or the menisci to get an anatomic reduction of fragments.

The main surgical difficulty in the present case arose from the location of the "decalage" that required a partial tissue detachment around the postero-lateral condyle cortex to reduce the defect and restore the articular profile.

Arthroscopy has been described in a previous case report for the treatment of Hoffa fractures, (AO-33 B3 type) using cannulated screws, showing good results and good intra-articular control of fracture reduction (22). However, in this particular case, it would have been difficult to obtain an anatomic reduction of the fracture, due to the small dimension, mobility and lateral localization of the fragment (23).

Submuscular plating would disrupt soft tissue and periosteal vascular supply even around the metaphysis and diaphysis, so plates should be reserved for more complex fractures.

In the present case, the patient was young and healthy, so it was possible to achieve a strong internal fixation which was tested intraoperatively, using only two cannulated screws. A reliable synthesis represents one of the surgeon's main goals and is essential for early rehabilitation therapy, reducing the risk of joint stiffness.

Conclusions

Management of distal articular femoral fractures is challenging, as they are often complex and involve the articular surface. Moreover, fracture pattern changes from case to case and classifications sometimes fail to describe it. Careful planning and consideration of biomechanics as well as biology are essential for a successful treatment. In this particular case, the mini-invasive synthesis with two parallel screws provided a stable fixation and a satisfactory outcome.

Patient gave his informed consent for publishing all the personal information about the case reported in this paper.

Conflicts 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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Correspondence:
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Francesca Alice Pedrini
I Clinica Ortopedica,
ASST Centro Specialistico Ortopedico Traumatologico
Gaetano Pini-CTO
Piazza Cardinal Ferrari 1,
20122, Milan, Italy.
Phone: +39 02.582961
Email address: francesca.pedrini@unimi.it