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Case Report

Bicondylar Hoffa Fracture - An Extremely Rare Case and Review of Current Literature

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Abstract

Bicondylar Hoffa fracture is an extremely rare injury. We describe this injury in a 40 year old male patient who presented following a high-energy motor vehicle accident. Plain radiographs were inadequate to define the exact pattern of injury. Computed tomographic (CT) scans demonstrated the coronal fracture involving both the femoral condyles . In our study, we treated this rare fracture successfully using a medial parapatellar approach with good functional results.

Keywords: Bicondylar; Hoffa Fracture; Medial Parapatellar Approach

Introduction

Fractures of the distal femur usually occur in the axial and sagittal planes [1].

A fracture of the femoral condyle in the coronal plane, eponymically called Hoffa fracture, is a rare injury, representing only 0.65% of femoral fractures [2].

Hoffa fracture usually affects a single femoral condyle, most commonly the lateral condyle, because of the physiologic genu valgum of the knee joint [19].

Most researchers [2,7,14]. currently believe that when the knee is in ≥90° of flexion and emergency braking is performed while driving a car, an axial force in either a varus or valgus direction is transferred from the proximal femur to the femoral condyle. At the same time, forces on the distal tibia are transferred to the tibial plateau, resulting in great shear stress between the femoral condyle and the tibial plateau [15,16].

These forces cause gross displacement of the condyle, which can not only rupture the quadriceps tendon but also perforate the skin, resulting in an open injury. With a lower degree of knee flexion, the extensor mechanism is damaged below the patella (patellar tendon); at higher angles, the quadriceps tendon is torn.

Furthermore, a Hoffa fracture is associated with cruciate ligament injury. In these cases, avulsion of the anterior cruciate ligament along with a large chunk of bone at its insertion [17] can lead to a Hoffa fracture.

Hoffa fracture with a bicondylar pattern is extremely rare, with only 26 cases described in the English literature according to current literature [5].

Bicondylar Hoffa fracture occurs when the flexed knee is subjected to a posterior and upward directed force without any varus or valgus component [2].

We describe a case of bicondylar Hoffa fracture subjected to open reduction and internal fixation with Herbert-type compression screws with a follow up of 12 months.

Case Presentation

A 40-year- old male patient was was involved in a head-on motor vehicle collision. He was submitted to the ATLS algorithm in the emergency room.

He was promptly observed in the emergency room by the orthopedic team, under the trauma protocol postulated in this institution, and on objective examination he presented intense left knee pain, apparent effusion, joint edema and abrasions at the level of the left knee with a punctiform wound in the patellar region with no need for suture.

He presented a marked limitation of active and passive ROM, palpable popliteal pulse, well perfused limb, without distal neurovascular or compartmental alterations.

Plain radiographs (Figure 1) revealed a shear fracture trace of the femoral condyles but was inadequate to define the exact fracture pattern. A computed tomography (Figure 2) scan was then performed and the diagnosis of bicondylar Hoffa fracture was confirmed.

The standardized AO-OTA classification describes the Hoffa fracture under 33-B3.3. However, this classification does not subdivide into the different patterns of Hoffa fracture.

According to Letenneur's classification [7], the bicondylar Hoffa fracture in our clinical case, would be LT type 1 of the medial condyle and LT type III of the lateral condyle.

Figure 1: AP X-ray and face of the left knee - evidence of isolated coronal Hoffa's fracture.

Figure 2: A computed tomographic image of the femoral articular cartilage of the right knee, showing the bicondylar Hoffa fracture.

Due to a pseudoaneurysm of the thoracic aorta, the patient was operated on just eight days later and underwent open reduction and internal fixation. Under general anesthesia, he was placed in the supine position with the left limb exsanguinated.

Medial parapatellar approach was performed with subsequent eversion of the rotula. (Figure 3).

Figure 3: Medial parapatellar approach.

The fragments were, anatomically reduced and multiple Kirschner wires were inserted for temporal reduction and stabilization (Figure 4 a, b).

Lateral condylar fragment was first reduced with knee in flexion and fixed with two herbert screws 7mm, inserted in an anteroposterior direction with screw heads buried into the cartilage.

Then a similar procedure was done for the internal condyle with 3 Herbert screws (Figure 5).

The reduction was confirmed by direct visualization of the articular surface and fluoroscopy. Postoperative X-ray showed congruity of the articular surface of the knee (Figure 6).

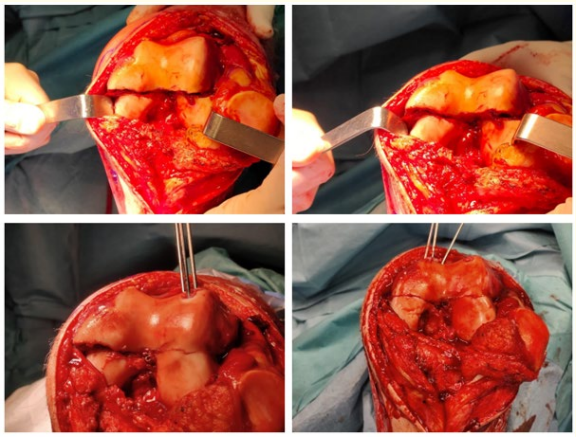

Figure 4: Intraoperative images with visualization of bilateral deviated Hoffa's fracture (a), provisional fixation with Kirschner wires (b), fracture with good reduction and definitive fixation with Herbert compression screws.

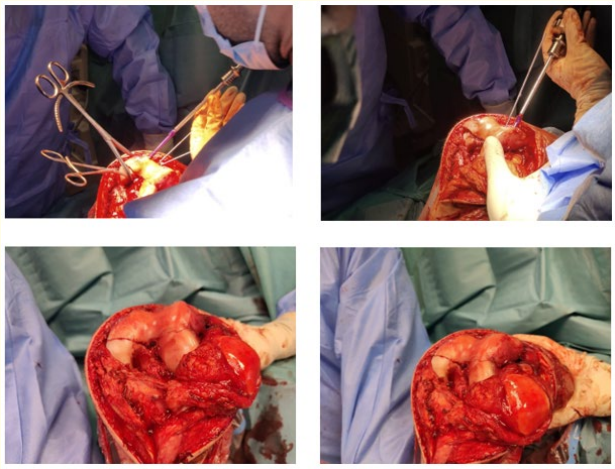

Figure 5: Intraoperative images with visualization of open reduction and internal fixation with Herbert-type compression screws.

Figure 6: Anteroposterior (a) and lateral (b) radiographs obtained right after surgery.

Results

From the first day after surgery, active and passive knee mobilization was started (0-90º only) along with isometric muscle strengthening exercise.

Partial weight-bearing was permitted at 8 postoperative weeks and full weight-bearing at 12 postoperative weeks.

In the posterior 4 weeks, the patient can't do any weight-bearing, from the 4-8 weeks it's allowed to do partial weight-bearing and after the 2 months he can do full weight-bearing.

At 2 months it began to perform a full load and had a ROM of 15-80º.

At 5 months, he was then submitted to arthroscopic arthrolysis to improve knee flexion, with a gain of about 10º in flexion (Figure 7).

At 9 months, the patient is fully loaded, able to work, and has almost complete mobility (ROM 5-120º). (Figure 7-9).

Figure 7: Arthroscopic arthrolysis to improve knee flexion.

Figure 8: Results at 9 months - ROM 5-120º.

Figure 9: Anteroposterior (a) and lateral (b) radiographs obtained 9 months after surgery.

Discussion

Bicondylar Hoffa fracture is an extremely rare injury, representing the 33-B 3.2 type according to the Association for the Study of Internal Fixation (AO) classification [8]. Although Hoffa fracture may occur in either condyle, the preponderance of lateral condylar fractures suggests a biomechanical vulnerability due to a physiological valgus of the knee joint [2].

Hoffa fracture generally results from severe high-energy trauma secondary to motor vehicle accidents or a fall from a height.

The specific mechanism of the injury that produces Hoffa fractures remains unknown.

Lewis., *et al.* [15] suggested that axial load to the femoral condyle when the knee is flexed to $>90^0$ produces a posterior tangential fracture pattern.

In our case, the bicondylar fracture might have been caused by a posterior and upward directed force with a hyperflexed knee without any varus or valgus, (as suggested by Ul Haq., *et al.* [20].

Initial anteroposterior and lateral radiographs may be unimpressive because Hoffa fractures, especially when not displaced, are sometimes difficult to detect. Oblique radiography and computed tomography have been recommended in facilitating diagnosis [16].

Hoffa fractures are difficult to treat, largely because of their intra-articular position, the limited access and the attachments of the collateral ligaments [10].

Conservative treatment of displaced Hoffa fracture with plaster cast was reported to lead to nonunion [8] or deformity, joint contracture, and subsequent osteoarthritis [15,16].

Especially in young persons, the long period of immobilization may have functional consequences to knee function. Considering these points, an early attempt at open reduction to restore normal condylar anatomy and rigid fixation allows early functional recovery [16].

Operative management in the form of open reduction and fixation with cancellous screws or Herbert screw is the treatment of choice for all bicondylar Hoffa fractures [19].

Zeebregts., *et al.* [6] and Papadopoulos., *et al.* [5] independently described two cases of unilateral bicondylar fracture fixed with two cancellous screws from an intact anterior cortex into each Hoffa fragment with good results.

Calmet., *et al.* [13] reported two cases of open bicondylar Hoffa fracture associated with extensor mechanism injury; both fractures were fixed with anterior-to-posterior 6.5-mm cancellous screws, and extensor mechanism injuries were managed appropriately [13].

An appropriate surgical approach allowing full fracture exposure is selected based on fracture type.

For bicondylar Hoffa fractures, it is necessary to simultaneously expose both condyles to allow proper reduction [29].

Lee., *et al*. [5]. reported that Gerdy osteotomy combined with an anterior lateral parapatellar approach provides appropriate exposure for bicondylar Hoffa fractures.

A swashbuckler approach [27-29] can be used to treat bicondylar Hoffa fractures because it protects the Quadriceps femoris abdomen during surgery, allowing quick postoperative recovery of muscle strength and range of motion, as advocated by Aman Dua., *et al.* [16].

However, we used a parapatellar medial approach because it allows excellent exposures of the articular surface and does not compromise future arthroplasty surgery.

No consensus has been reached on the fixation method in terms of the anterior/posterior direction of screw insertion and type/number of screws to use [20].

Screws inserted from anterior to posterior induce less soft tissue dissection and carry no risk of damaging the posterior neurovascular structures [29].

In our case, we had a LT type III in the medial condyle and a LT type 1 in the lateral condyle and so we chose to insert 2 herbert screws in the lateral condyle and 2 screws + 1 cancellous screw in the medial condyle, all with anterior to posterior direction.

Jarit., *et al*. [26]. showed that fixation with posteroanteriorly (PA) oriented lag screws was biomechanically superior to AP-oriented lag screws when subjected to vertical loads. However, PA screw fixation requires the recession of the screw heads beneath the articular surface, which creates a large cartilage defect [20].

Conclusion

In conclusion, we describe an EXTREMELY RARE case of a bicondylar HOFFA fracture treated SURGERGICALLY BY A MEDIAL PARAPATELAR APPROACH with open reduction and internal fixation with Herbert-type compression screws.

There is no consensus on the approach and method of fixation. This article we demonstrate a possible surgical technique with acceptable results.

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