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Case Report

Arthroscopic-assisted fixation of Hoffa fracture: A case report and description of technique

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ABSTRACT

Medial condyle Hoffa fractures are intra articular injuries, which require prompt anatomical reduction and internal fixation. Arthroscopy-guided fixation of these fractures has also been advocated; the advantages include avoidance of soft tissue dissection, fast recovery and mobilization. We describe a case of a 28-year-old male patient presenting with a 10-day-old medial condylar Hoffa fracture. Skin condition prevented from conventional open reduction and internal fixation; hence, taking note of the urgency of fixation of an intraarticular fracture, arthroscopic-assisted minimally invasive approach was performed with good outcome.

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1. Introduction

Coronal plane fractures of the distal femoral condyle are labeled as Hoffa fractures.¹ Albert Hoffa gave an initial account of these fractures in the year 1904.² The distal fragment owing to no muscle attachment acts as a free lying; large, intra-articular, bone piece. This fragment is bathed in a pool of synovial fluid and is commonly a cause of non-union in conservatively managed and neglected fractures. Other

complications include knee joint osteoarthritis and knee stiffness. Hence, early anatomical reduction and internal fixation remain the treatment of choice.

Arthroscopy-assisted reduction and internal fixation (ARIF) of these fractures is a novel technique with minimally invasive procedure. This avoids large soft tissue disruption and helps in early recovery with less morbidity. We hereby present a case of medial condyle Hoffa fracture, which was managed by ARIF. This was the only choice in this patient because poor skin condition on the medial side of knee thus precluded an open

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reduction procedure through the medial side. We present the review of the current literature and salient points for surgeons to learn this technique.

2. Case report

A 28-year-old male was referred to us 10 days after injury to left knee after a motorbike accident. The knee was swollen and painful. There was a large graze abrasion (size: approx. 5 cm × 7 cm) on medial side of knee, which was covered by a thick scarred scab (Fig. 1). Radiographs of the knee revealed a minimally displaced Hoffa fracture of the medial femoral condyle (Fig. 2). Though Hoffa fracture warrants an early anatomical fixation, poor skin condition on the medial side of knee was a challenge. Henceforth, after due informed consent, patient was planned for ARIF.

3. Procedure and findings

Patient was given spinal anesthesia and positioned supine with leg on table position. A tourniquet was applied to the upper thigh. Arthroscopy was performed through standard anteromedial and anterolateral portals. After washing off the hemarthrosis, diagnostic arthroscopy was initially performed. The cruciates and menisci were found to be normal. Large coronal fracture was seen in the medial condyle with a small loose fragment anteriorly (Fig. 3). The clots between the fracture surfaces were removed by a 3.5 mm shaver. Loose fragment (2 mm × 2 mm wide) was removed arthroscopically with the help of a grasper. Fracture reduction was achieved with slight manipulation (Fig. 4). Next, two guide wires were inserted just medial to the margin of the cartilage of the distal femur in antero-posterior direction, perpendicular to fracture

Fig. 1 – At presentation, note is made of swelling in knee with large medial scab, hence prompting the surgeons to avoid medial parapatellar approach.

Fig. 2 – Radiograph showing coronal plane Hoffa fracture of the medial femoral condyle.

Fig. 3 – Coronal placed fracture of the medial condyle as seen on arthroscopy.

site. The position and length of the guide wires were checked under C-arm. Following this, anterior to posterior, 6.5 mm cannulated cancellous screws with washers (Synthes, WestChester, PA) were inserted over the guide wires (Fig. 5). Fig. 6 highlights minimal skin dissection away from the abrasion site. The patient was given above knee slab in the postoperative period for 2 weeks, following which knee ROM exercises were started on a hinged knee brace. Patient remained non-weight bearing for 6 weeks and then was allowed to bear weight partially for another 6 weeks. At 3 months, the fracture was well united without any subsidence, so full weight bearing was allowed and brace was discontinued. The patient had a range of motion 0°–100° at knee without any sign of infection.

At 1 year, patient had 0°–130° of range of movements without pain and deformity (Fig. 4). Radiographs showed

Fig. 4 – Fracture reduced and confirmed under arthroscopic assistance.

Fig. 5 – Two parallel anterior to posterior 6.5 mm ccs are inserted in a perpendicular direction to the fracture using image intensifier.

no signs of avascular necrosis, osteoarthritis, or implant breakage.

4. Discussion

Hoffa fractures are rare injuries, and lateral fractures are more common than medial fractures by a ratio of 3:1.¹ They usually occur as an isolated injury to the involved femur, but bilateral and unilateral bicondylar Hoffa fractures have been reported.³ In addition, Hoffa fractures associated with supracondylar intercondylar (AO/OTA 33C) femur Fractures have been observed, and the reporting authors highlight the need for

preoperative detection of the Hoffa fracture to select the appropriate fixation method for the supracondylar fracture. CT scans are useful in delineating the coronal shear component, which can easily be missed.

The specific mechanism of injury that produces the Hoffa fracture is unknown. Though a shearing force on the posterior femoral condyle is postulated, both direct impact and vertical shear with twisting mechanisms have also been proposed and a single mechanism is not agreed upon.⁴ Lewis et al.⁴ argued that axial load to the lateral femoral condyle with the knee in 90° or more of flexion produces posterior tangential fracture patterns. Four of seven patients in their series were riding motorcycles at the time of injury, placing the knee in 90° of flexion and positioning the lateral femoral condyle to receive an impact. Also physiological genu valgum, predisposes the lateral femoral condyle to sustain a direct shearing force, and hence it is more likely to get injured compared to medial condyle.⁴ The Hoffa fracture effectively separates the patello-femoral joint from the tibiofemoral joint; knee movement and particularly weight bearing cause high shear forces along the fracture line, making nonoperative management unpredictable and adequate stabilization challenging.⁴

Non-operative treatment has been associated with poor outcomes.^{5,6} The goals of treatment are anatomical reduction of the articular surface with rigid, stable fixation to allow early mobilization in order to restore function.^{7–10} Few reports in the literature also suggest that describe operative treatment but do not outline clearly a straightforward, dependable treatment approach with its underlying rationale, and they vary considerably with respect to the surgical approach, postoperative protocol, and outcome measures. There is a dearth of specific information on the preferred management of this fracture in several popular orthopedic fracture management texts.^{11,12}

Fig. 6 – Condition at 1 week postoperatively: scab is still healing while fracture is already fixed with minimal dissection and scars.

Ostermann et al.¹³ have emphasized fracture compression and rigid internal fixation to allow immediate postoperative knee motion in their report on the long-term (average 68 months) results of 29 condylar femur fractures; out of which, six were Hoffa fractures. Manfredini et al.¹⁴ treated 19 patients with unicondylar femur fractures, six of which were Hoffa fractures, using a variety of open reduction and internal fixation techniques. 16 of them were available for follow-up at a mean of 60 months; 11 had good or excellent results, and 5 had fair or poor results. The four patients treated nonoperatively had an unfavorable outcome, with three fair and one poor result.

A cadaveric study compared the stiffness and load to failure of 3.5-mm cortical lag screws, 4.5-mm cortical lag screws, and 6.5-mm cancellous screws used to fix experimentally created Hoffa fractures. There was no difference in stiffness between any of the groups, but the load to failure was significantly higher for 6.5-mm screws compared with 3.5-mm screws.¹⁵

Baumgaertner et al.¹⁶ employed a standardized surgical ipsilateral parapatellar approach to the fracture and achieved rigid fixation with optimally positioned lag screws placed perpendicularly to the fracture plane. They highlighted visualization of the fracture and articular surface for achieving a perfect anatomic reduction and rigidly fix the fracture with multiple lag screws.

Few reports of ARIF of femoral condyle fractures are available.¹⁷⁻²¹ Wallenbock and Ledinski¹⁷ in a series of 24 patients of intraarticular knee fractures treated two Hoffa fractures with ARIF. They acknowledge the challenging and demanding nature of work involved in arthroscopic fixation and reported good early results, but they did not describe specifically the technique or outcome of the patients with coronal fractures. McCarthy and Parker¹⁸ described a single patient report with a sagittal plane lateral femoral condyle fracture. Although their fixation did not appear to achieve rigid compression,¹⁹ they highlighted reduced soft tissue dissection, blood loss, and operative time and a faster recovery time after arthroscopic management as advantages. Ercin et al.²¹ described arthroscopy as an important diagnostic tool for management of fixation of these coronal fractures and nonunions. They also advocated that arthroscopy could be considered in all such injuries as associated articular pathologies may be overlooked by clinical or radiological means.

As the injuries are usually high velocity trauma, comminution and loose fragments may be encountered while doing arthroscopy. Smaller fragments are usually removed while the larger bone pieces should be fixed with the help of Herbert screws. Arthroscopic reduction may not be possible in all patients; hence patient should be preconsented regarding the backup plan that includes open reduction and internal fixation. As in the presented patient, medial skin condition was a challenge, a backup plan of wound debridement followed by open reduction and internal fixation, was in place. Accordingly, a plastic surgeon was on call for any available help pertaining to subsequent wound coverage.

ARIF for a Hoffa fracture is hence a novel but demanding procedure even in the best hands. But merits outplay these limitations, thus making it an excellent option for surgeons to explore in properly selected patients (Table 1).

Table 1 – Pearls and pitfalls of arthroscopic-assisted Hoffa fracture fixation.

Advantages

- Allows articular reduction without a formal open arthrotomy
- Avoids long incision and soft-tissue disruption
- Allows diagnosis and treatment of additional intra-articular injuries
- Minimal blood loss
- Excellent intra-articular visualization
- Less scarring hence less stiffness and early rehabilitation
- Reduced postoperative morbidity and hospital stay

Indications

- Acute fractures: non-comminuted, large fragments
- Nonunions: non-comminuted, large fragments; good bone quality

Contraindications

- Irreducible and comminuted fragments
- Nonunions that require autografting

Tips

- Use radiolucent table and image intensifier for fixation and screw direction
- Debride the fracture site with arthroscopic shaver and curettage
- Manipulate fragment into reduced position by a k wire as a joystick followed by holding fragment with a reduction forceps
- Confirm anatomic articular reduction with direct arthroscopic visualization
- Use cannulated, partially threaded 6.5-mm screws
- Check impingement of screw head in flexion and extension, countersink screw head
- Alternatively, headless screws/Herbert screws can be used

Key points

- Adequate exposure of fracture site is needed
- Maintain reduction by use of reduction forceps during guide-wire insertion
- Repeat stability tests after fixation

Limitations

- Requires highly demanding arthroscopy skills

Conflicts of interest

The authors have none to declare.

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