Surgical management of complex intra-articular distal femoral and bicondylar Hoffa fracture

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ABSTRACT

Bicondylar Hoffa's fractures of distal femur are rare. We report the case of an 18-year-old male who sustained a closed complex fracture of both femoral condyles of the left femur on the sagittal plane (Hoffa fracture), combined with distal metaphyseal fracture. He was treated using parallel plates and interdigitating screws, with our technique based on an extrapolation of the principles of distal humerus fixation. The fracture united clinically and radiologically at 16 weeks. Twelve months postoperatively, the range of movement in the knee was 5°–115°. In this complex case, our technique provided stable fixation of the fragments and a satisfactory final functional outcome.

KEYWORDS

Distal femur – Fracture – Hoffa – Internal fixation – Knee

Accepted 17 January 2016

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Intra-articular fractures of the femoral condyles in the coronal plane are rare. Fractures involving the lateral condyle are more common than medial fractures, while fractures involving both condyles are extremely rare.¹ The treatment of Hoffa's fractures follows the principles of fixation of intra-articular fractures, and requires anatomic reduction and rigid fixation.¹ This is typically achieved with screws orientated from anterior to posterior, due to the ease of approach, visualisation and placement. Fixation with a buttress plate has also been reported.²

We report on the treatment of Hoffa fractures of both condyles with parallel plates and interdigitated screws, analogous to the concept of architectural arch reconstruction.³ At the time of writing, we are not aware of any similar report. In our opinion, this newly described technique follows all guidelines for the fixation of intra-articular fractures.

Case Presentation

An 18-year-old male sustained a closed complex intra-articular fracture of both femoral condyles of the left femur in the sagittal plane (Hoffa fracture), combined with a comminuted distal metaphyseal fracture as a result of a motorbike accident. The fracture was classified as AO 33-C3 (Fig 1a–b). A spanning external fixator was initially applied and a computed tomography scan was obtained (Fig 2a–d).

Four days later, definite fixation was undertaken. To obtain access to all aspects of the fracture, a modified anterior approach was used. A long (24cm) midline skin incision was made, followed by a horizontal osteotomy of the patella at the middle part. The osteotomy was started with a drill bit,

performing multiple drill holes up to the cartilage, but not through it, and completed with an osteotome to break the cartilage without creating any significant defects. Access to the femoral condyles and metaphysis was obtained via the medial and lateral subvastus approach intervals.

The metaphyseal part of the fracture was reduced and fixed with two 4.5mm cortical lag screws. The fractures were then reduced using pointed reduction clamps from back to front and temporarily stabilised with K-wires. Both condyle Hoffa fractures were fixed with two 4.5/5.0mm LCP L-Buttress plates (Synthes, Solothurn, Switzerland), one each on the medial and lateral sides, and interdigitating screws (Fig 3a–c). On the lateral side, three locking screws

Figure 1a–b Preoperative radiographs of the fracture

were used to fix the medial condyle fragment, while we used one locking and two non-locking screws distally on the medial site for fixation of the lateral condyle fragment. The non-locking screws were used due to the collision of the trajectory of the locking screws with the screws of the lateral plate. At the end of procedure, the patella was repaired using a standard tension band wiring technique. Partial weight-bearing with crutches was permitted 6 weeks after the operation. Full weight-bearing was allowed 10 weeks postoperatively.

The patient presented on the fourth postoperative week with a superficial infection of the lower part of the wound, which was treated with oral antibiotics without further consequences. The fracture united clinically and radiologically at 16 weeks (Fig 4a-b). At that follow-up interval, the patient had achieved a range of motion from 10° extension deficit to 105° of flexion. Wound healing was excellent, with no swelling or effusion observed around the knee. The knee joint was stable and pain-free.

Approximately 12 months postoperatively, the knee ROM was 5°–115°. The patient had only minimal occasional pain and had returned to his daily activities without restrictions. At that time, the metalwork was removed (Fig 5a-b). This was performed through the same midline incision and the medial and lateral subvastus intervals. For 4 weeks postoperatively, he was allowed only partial weight-bearing using crutches.

Discussion

Hoffa fractures are difficult to treat, largely because of their intra-articular position, the limited access and the attachments of the collateral ligaments. The standard method of treating Hoffa fractures has been lag screw fixation.¹ There have been reported cases where fixation was performed with buttress plates.²

In our case, the main difficulty arose from the co-existence of significant fragmentation on the metaphysis of the

distal femur, combined with both condyle comminuted Hoffa fractures. To overcome this difficulty, we used two buttress plates on the medial and lateral sides, more or less parallel to each other. Screws from the medial plate fixed the lateral condyle fragment and vice versa, creating a solid construct with anatomic reduction and compressive fixation in accordance with the AO principles of fixation of intra-articular fractures.⁴ This construct follows most of the principles described by O'Driscoll for the fixation of distal humeral intra-articular fractures.⁵

From biomechanical experiments on the fixation of the distal humerus, we know that parallel plating with interdigititation of screws in the bone fragments is the optimal construct for stability of the fixation.⁵ Other advantages of our technique are: avoidance of iatrogenic damage to the articular cartilage of the condyles, as screws are not inserted through the articular surface; superior pull-out strength and stability of fixation through the use of locking plates and screws versus lag screws only; and adequate exposure of the

fracture and unobstructed visibility due to the patellar osteotomy.

We believed that posterior buttress plates were not a viable option in our case. First, we would have had to extend our soft-tissue dissection significantly to gain access for plate positioning and fixation, thus compromising the blood supply to the fragments. Second, a plate of adequate length to act as a buttress plate would be required, compromising part of the posterior articular surface of the condyles. Our construct is obviously not based on any anatomically specific biomechanical studies. Specialised investigations may be necessary to prove the biomechanical efficacy of this construct.

Conclusions

The described technique is a combination of fixation techniques from different anatomic areas. In this case, it secured a stable fixation of fragments and provided a satisfactory final outcome, allowing early rehabilitation and an uneventful recovery.

Acknowledgements

We acknowledge the contribution of Mr Max Stewart, a medical student at Warwick University, in proofreading the manuscript for grammar, spelling and syntax.

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