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Review Article

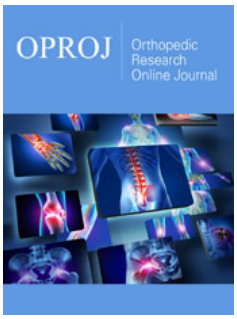
Arthroscopic Evaluation and Treatment of Isolated Coronal Femoral Condyle Fractures (Hoffa Fractures). An Experimental Surgical Technique Using a Cadaveric Model

Miguel S Daccarett[1]*, Mathew Mormino[2] and Jon Carlson[1]

[1]Department of Orthopedic Surgery, University of Louisville, USA

[2]Department of Orthopaedic Surgery, University of Nebraska Medical, USA

ISSN: 2576-8875



***Corresponding author:** Miguel S Daccarett, Department of Orthopedic Surgery, University of Louisville, USA

Submission: December 05, 2024
Published: December 17, 2024

Volume 11 - Issue 4

How to cite this article: Miguel S Daccarett*, Mathew Mormino and Jon Carlson. Arthroscopic Evaluation and Treatment of Isolated Coronal Femoral Condyle Fractures (Hoffa Fractures). An Experimental Surgical Technique Using a Cadaveric Model. Ortho Res Online J. 11(4). OPROJ. 000767. 2024.
DOI: 10.31031/OPROJ.2024.11.000767

Abstract

An isolated fracture of the distal femoral condyle in the coronal plane is a rare injury described first by Hoffa in 1904. This injury is an intra-articular fracture of the knee that corresponds to the OTA classification of 33-B3. The mechanism of trauma has been described as direct with abduction and axial compression on a flexed knee through the tibial plateau concentrating the force in the posterior half of the femoral condyles.

The reports in the literature show poor outcomes with non-operative treatment which includes knee instability and rapid development of post traumatic osteoarthritis. Operative treatment consisting of an open or mini open arthrotomy has become the most popular method for fixation. It was our goal to develop a reliable arthroscopic technique to avoid the complications associated with an open arthrotomy.

A Hoffa fracture pattern was created with osteotomes in two cadaveric knees. Arthroscopy was performed allowing visualization of fracture. A Schanz pin was then placed into the lateral femoral condyle and the fracture was reduced. An ACL guide was then introduced through a medial portal to aid in fracture reduction and provide compression across the condyle. Guide pins were placed through the ACL guide, followed by two cannulated 6.5 mm cancellous screws. Fluoroscopy was then used during the procedure to ensure adequate reduction and fixation of the coronal fracture. The described technique permitted adequate evaluation, reduction and secure fixation of coronal fractures of femoral condyles through a minimally invasive arthroscopic assisted procedure.

Introduction

An isolated fracture of the distal femoral condyle in the coronal plane is a rare injury. This injury was described first by Hoffa in 1904, by Smillie in 1946, and by Crenshaw in 1971. They describe this injury as an intra-articular fracture of the knee. This corresponds to the OTA classification of 33-B3. The mechanism of trauma has been described as direct trauma with abduction and axial compression on a flexed knee through the tibial plateau concentrating the force in the posterior half of the femoral condyles [1-3]. Common etiologies include motor vehicle accidents or falls. With the knee in flexion, the force is transmitted more posterior through the femoral condyles resulting in the Hoffa fracture. This same force transmitted from the tibial plateau while the knee in extension typically results in a supra condylar fracture.

Although the lateral femoral condyle is more commonly involved, a fracture may occur medially as well [2,4-6]. These fractures are also found in about 40% of supracondylar and

70% of intraarticular fractures of the distal femur. Additionally, about 30% of these fractures may be missed in plain radiography with the above high-energy fractures of the distal femur and require CT scan to make an accurate diagnosis [6]. Due to the association of these fractures with high-energy injury patterns, it is an important clinical point to exclude other injuries such as acetabular, femoral neck or shaft, patellar and tibial plateau fractures. Other associated injuries include those of the popliteal vessels and ligamentous disruptions of the knee.

Despite the paucity of literature available, operative treatment is recommended to avoid malunion, degenerative arthritis, and to achieve a functional knee [2-4]. These fractures are intraarticular, therefore anatomic reduction and stable fixation is essential. Traditionally, this procedure had been performed using an open knee arthrotomy in order to visualize and obtain anatomic reduction that ensured the integrity of joint surface. 2,3 Recent research has evaluated fixation methods and has demonstrated that two 6.5mm cannulated lag screws provide adequate fixation for similar types of fracture of the femoral condyles [1,3]. Although the type of fixation has been evaluated, there are few suggestions regarding surgical techniques.

Technique

An osteotomy was created to simulate the coronal fracture through the femoral condyle using two intact cadaver lower extremities. This was accomplished with a 5 cm incision on the lateral aspect of each knee used. Once dissection and identification of the lateral femoral condyle was performed, an osteotome was then used to create the simulated fracture under both direct and fluoroscopic view (Figure 1). The lateral retinaculum of the knee and skin were closed using a running nylon suture in order to seal the knee and allow arthroscopic examination. Standard anterolateral and anteromedial arthroscopy portals were then placed and a 300 angled scope was introduced in to the knee using the anteromedial portal. The joint was irrigated using gravity suction and a minimal debridement was performed using an arthroscopic 3.5mm shaver. After obtaining adequate visualization of the fracture line, a 4.0mm Schanz pin was placed through the lateral region of the femoral condyle perpendicular to the fracture line. This Schanz pin was used as a joystick in order to facilitate the reduction of the fracture. An ACL golden guide (Smith and Nephew) was passed into the joint using an anterolateral portal (Figure 2). A cannulated bullet form ACL golden guide and the previously placed Schanz pin were then used to assist the arthroscopic reduction and gain compression across the fracture line while the arthroscopic visualization was performed using the anteromedial portal. Using the same cannulated ACL guide, a 2.4mm guide pin was advanced in anterior-posterior direction through the fracture site under arthroscopic and fluoroscopic visualization to secure temporary reduction. A second 2.4mm guide wire was then placed parallel to the first one (Figure 3). These guide wires were placed at the lateral edge of the trochlear ridge in an attempt to avoid chondral injury. The anterior cortex of the lateral femoral condyle was drilled and two 6.5mm partially threaded cannulated screws were passed over the guide wires under fluoroscopic guidance to the subchondral surface of the lateral femoral condyle fragment (Figure 4) completing the fixation and creating compression across the fracture (Figure 5).

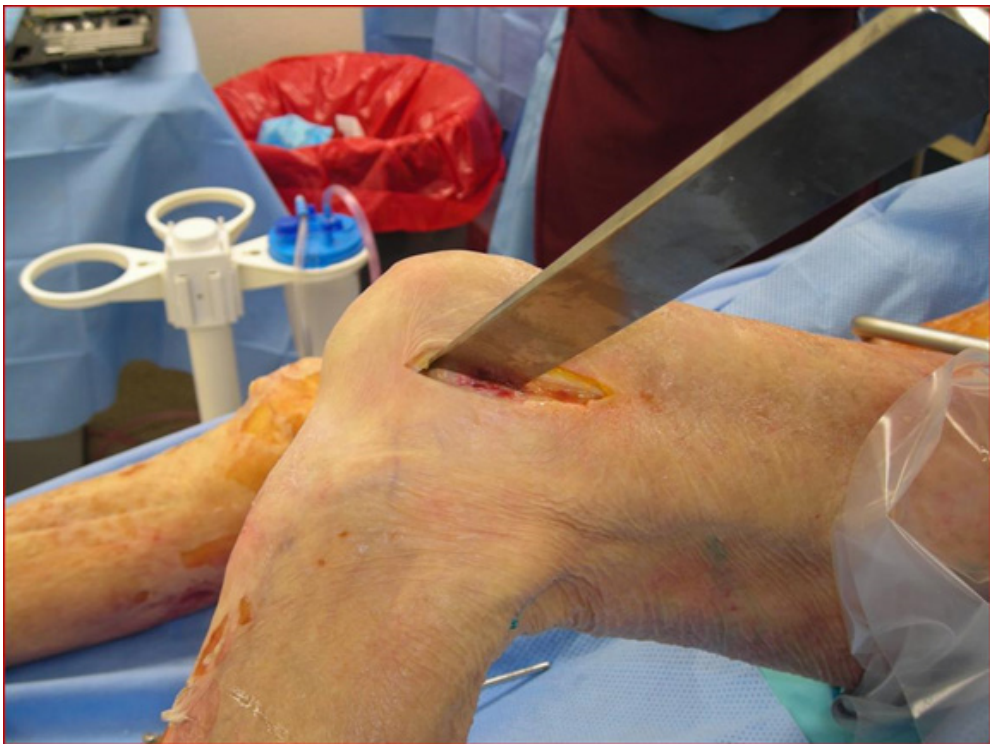


Figure 1:

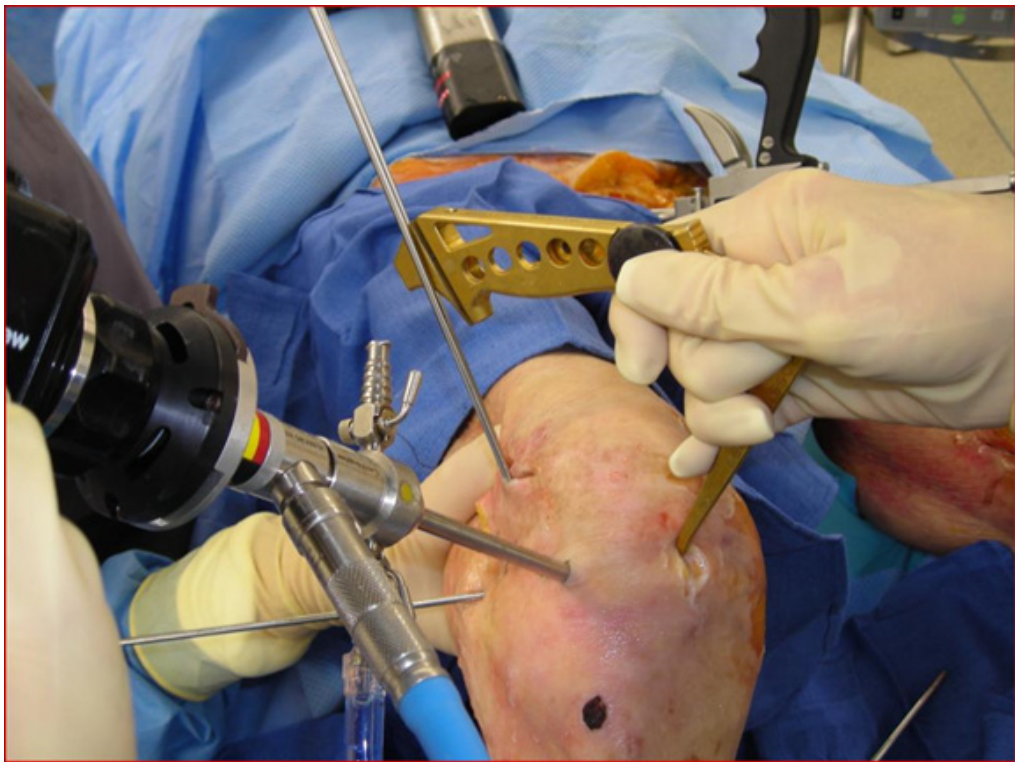


Figure 2:

Figure 3:

Figure 4:

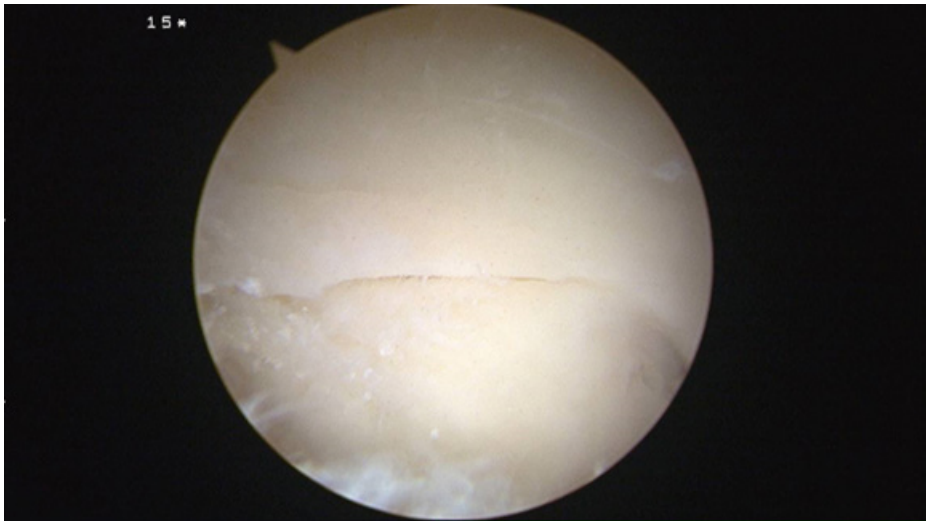


Figure 5:

On the right knee, the distal screw measured 45mm, and the proximal screw 50mm. While on the left knee, the distal screw measured 50mm and the proximal screw 55mm. Arthroscopic examination was then performed through both portals followed by a knee arthrotomy proving adequate reduction, stable fixation, and compression of the fracture line. All screws were placed using arthroscopic and fluoroscopic guidance for depth as well as visualization of compression across the fracture site.

Discussion

Hoffa fractures have been reported in the literature as the result of a combination of vertical shearing and twisting forces, such can occur in motor vehicle accidents or falls [2,4,5]. Operative treatment is recommended to provide secure fixation to avoid the complications associated with conservative therapy [2-4]. However, the traditional open athrotomy is not without its undesirable consequences. Open procedures are associated with greater morbidity including pain, risk of infection, bleeding and long post-operative rehabilitation in order to recover knee function and range of motion.

To our knowledge, only two publications describing minimally invasive techniques using a combination of arthroscopy and percutaneous fixation with cannulated screws for Muller type B1 have been published. Neither of these describes a technique for the Hoffa fracture [7,8]. Therefore, we sought a reliable arthroscopic technique that could be used to aid the orthopedic surgeon who encounters these fracture patterns. In our judgment, the technique described offers secure fixation without the morbidity of an

open arthrotomy. Using an arthroscopic technique, we were able to evaluate, reduce and obtain stable fixation comparable with those obtained by open procedures through arthrotomy or mini-arthrotomy approaches. The use of ACL instrumentation and cannulated screws provides a very reliable tool to reduce and compress the fracture line through a minimally invasive procedure using arthroscopic portals and percutaneous incisions, as well as allowing more accurate placement of screws. Wagih et al concluded that arthroscopic reduction and fixation with cannulated screws is simple, effective and reproducible way to achive good results. Arthroscopic evaluation of the knee in Hoffa fractures provide the option to rule out other intra-articular injuries associated with trauma like ACL and PCL tears, loose bodies, meniscus injuries and osteochondral fractures. We also theorize that this technique will allow earlier range of motion and shorten the recovery time. Ercin et al. [9] reported no apparent complications with no significant loss of range of motion at 29 moths follow up [10].

A potential weakness regarding this project is that research has demonstrated that posterior to anterior screw placement is more secure than the anterior to posterior placement used in our technique. Although this is a potential pitfall, our technique avoids the dissection necessary to accomplish the posterior placement. It also avoids the damage to the articular surface when screw heads are recessed beneath the articular surface. Furthermore, the direction of screw placement has not been assessed clinically to detect any differences in clinical outcomes. In addition, the described technique offers the expected advantages of less blood loss, possible shorter operative time, faster rehabilitation, and less potential for the loss of range of motion.

Acknowledgement

We thank the department of orthopedics for financing this research.

References

1. Hak DJ, Nguyen J, Curtiss S, Hazelwood S (2005) Coronal fractures of the distal femoral condyle: a biomechanical evaluation of four internal fixation constructs. Injury 36(9): 1103-1106.
2. Lewis SL, Pozo JL, Muirhead-Allwood WFG (1989) Coronal fractures of the lateral femoral condyle. J Bone Joint Surg Br 71(1): 118-120.
3. Jarit GJ, Kummer FJ, Gibber MJ, Egol KA (2006) A mechanical evaluation of two fixation methods using cancellous screws for coronal fractures of the lateral condyle of the femur. J Orthop Trauma 20(4): 273-276.
4. Holmes SM, Bomback D, Baumgaertner MR (2004) Coronal fractures of the femoral condyle: a brief report of five cases. J Orthop Trauma 18: 316-319.
5. Papadopoulos AX, Panagopoulos A, Karageorgos A, Tyllianakis M (2004) Operative treatment of unilateral bicondylar Hoffa fractures. J Orthop Trauma 18(2): 119-122.
6. Nork S, Segina D, Aflatoon K, Barei DP, Henley MB, et al. (2005) The association between supracondylar-intercondylar distal femoral fractures and coronal plane fractures. J Bone Joint Surg 87(3): 565-569.
7. Demierl M, Dereboy F, Ozturk A, Turhan E (2006) Arthroscopically assisted lateral femoral condyle fracture surgery. Arthroscopy 22(6): 690.e1-690.e4.
8. McCarthy J, Parker R (1996) Arthroscopic reduction and internal fixation of a displaced intraarticular lateral femoral condyle fracture of the knee. Arthroscopy 12(2): 224-227.
9. Ercin E, Baca E, Kural C (2017) Arthroscopic treatment of isolated Hoffa fractures. J Knee Surg 30(8): 842-848.
10. Wagih AM (2015) Arthroscopic management of a posterior femoral condyle (Hoffa) fracture: Surgical technique. Arthrosc Tech 4(4): e299-303.