

Case Report

Non-union lateral femoral condyle Hoffa fracture: a case report

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Received October 27, 2020; Accepted November 30, 2020; Epub December 15, 2020; Published December 30, 2020

Abstract: An isolated Hoffa fracture of either of the femoral condyle is infrequently encountered. Owing to its rarity, it is often missed and subsequently results in non-union. The knowledge of its surgical management comes from the sporadically reported cases in the literature. The most preferred approach is parapatellar, providing adequate exposure of the fracture and the joint surface. We report a case of non-union of Letteneur-2C lateral condyle Hoffa fracture of the left distal femur in a young adult as a result of missed bony injury. Surgical fixation was done using a posterolateral approach to the knee and fixing the fracture with headless compression screws placed postero-anteriorly. After about 1 year of follow up, patient demonstrated excellent functional outcome in the form of a pain free mobilisation and near normal range of motion. We emphasise the fact that the importance of vigilance while diagnosing fractures of distal femur cannot be stressed enough and with proper surgical management and rehabilitation, desirable results can be achieved.

Keywords: Non-union, Hoffa, lateral condyle, surgical fixation

Introduction

An isolated Hoffa's fracture is an uncommonly encountered entity. Isolated unicondylar fracture of the femur constitutes 0.65% of all distal femur fractures [1] of which Hoffa's fracture constitutes a small portion. It is often seen in the younger age group after a high energy trauma. The non-union of a Hoffa's fracture is even rarer.

Being a shear fracture, surgical fixation is the mainstay of management [2]. However, the situation gets complicated when Hoffa's fracture is missed on the initial presentation and patient reports with non-union. Missing a Hoffa's fracture is not infrequent and happens because of its rarity and limitation of routine radiographs in prompting the diagnosis [3]. Nonunion of a Hoffa's fractures is sporadically encountered and to the best of our knowledge, 18 cases have been reported in 10 case reports and 1 case series until now [4-14]. Authors have fixed the fracture fragment using screws [5-7, 10-12], plates [7] and their combination [4, 8, 9]. Even

the surgical approach and direction of screw insertion have varied according to the type of fracture. But eventually, all the authors were able to achieve stable union with acceptable range of motion (**Table 1**). A few authors have also opted for total knee replacement after they discovered joint degeneration due to long non standing Hoffa non-union [13-15]. In view of different treatment plans among these studies and low level of evidence establishing definitive treatment, we wish to share our experience and the surgical technique for management of the Letteneur-2C type lateral condyle Hoffa's non-union.

Case presentation

A 39-year-old farmer presented to our outpatient department with chief complaints of pain in the left knee, inability to squat, and difficulty in walking for the last one year. The patient had a history of a road traffic accident one year back. The patient was diagnosed with soft tissue injury after reviewing the radiographs and was managed with an above-knee slab followed

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Table 1. Reports of management of nonunion unicondylar Hoffa fracture compared to our study

S. No.	Author	Year published	Age/Gender	Time between trauma and presentation	Site of non-union Hoffa	Surgical approach	Number of cases	Primary treatment	Fixation method	Follow up	Outcome	Complications
1.	Jiang et al. [4]	2015	46/M	27 years	medial condyle	Medial approach	1	Missed	screws + plate + bone graft	12 months	Stable union with ROM 0-125°	none
2.	McDonough [5]	2000	8/M	5 years	lateral condyle	Lateral approach	1	Neglected	screws (posteroanteriorly)	2.5 years	Stable union with ROM 0-130°	none
3.	Oztürk et al. [6]	2009	35/M	10 years	medial condyle	Medial parapatellar	1	Missed	screws (anteroposteriorly)	4 years	Stable union with ROM 0-125°	none
4.	Singh et al. [7]	2011	46/Male	12 months	medial condyle	Medial parapatellar	6	Conservative	screws and plate	2.2 years (mean)	ROM 6-100°	none
			32/Male	6 months	lateral condyle	Lateral parapatellar		fixed surgically	screws + plate		ROM 6-96°	
			34/Male	5 months	lateral condyle	Lateral parapatellar		Conservative	screws		ROM 0-100°	
			18/Male	3 months	medial condyle	Medial parapatellar		fixed surgically	screws		ROM 10-100°	
			44/Male	2.5 months	lateral condyle	Lateral parapatellar		Conservative	screws		ROM 15-98°	
			42/Female	2 months	medial condyle	Medial parapatellar		fixed surgically	screws		ROM 10-100°	
5.	Nandy et al. [8]	2015	16/Male	9 months	medial condyle	Medial sub vastus	1	Neglected	screws	1.5 years	Stable union with ROM 0-150°, KSS 173/200	none
6.	Somford et al. [9]	2013	40/Male	2 years	lateral condyle	Lateral parapatellar	2	Conservative	screws (posteroanteriorly)	1 year	Stable union with ROM 0-120°	none
			55/female		medial condyle	Medial parapatellar		fixed surgically	screws (both anteroposterior and posteroanterior) + plate + bone graft		1 year	
7.	Payne et al. [10]	2005	50/Male	30 years	lateral condyle	Lateral parapatellar	1	conservative	screws + bone graft	-	Fracture union	Lateral compartment degeneration and patella femoral arthritis
8.	Tripathy et al. [11]	2013	12/Male	4 months	lateral condyle	Posterolateral	1	missed	screws	2 years	Stable union with ROM 0-135°	none
9.	Soni et al. [12]	2019	31/Male	1 year	lateral condyle	Lateral approach	1	Neglected	screws (both anteroposterior and posteroanterior)	2 years	Stable union with ROM 0-140°	none
10.	Mortazavi et al. [13]	2018	62/Male	3 years	lateral condyle	Medial parapatellar	1	fixed surgically	Total knee arthroplasty	1 year	Stable union with near full ROM, KSS 82/100	
11.	Albuquerque [14]	2011	60/Male	2 years	lateral condyle	-	1	-	Total knee arthroplasty	-	Returned to professional activities	

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12	Reddy et al. [15]	2011	48/Male	5 months	bicondylar Hoffa fracture	Medial parapatellar	2	Partially threaded cannulated screws	Total knee arthroplasty with femoral stem extender	3 years	Stable union with ROM 100°, KSS 86/100	
			52/Male	7 months	bicondylar Hoffa fracture	Medial parapatellar		Cancellous screws and plates screws	Total knee arthroplasty with femoral stem extender	2 years	Stable union with ROM 95°, KSS 82/100	
13	Du Traitement et al. [16]	2017	29/female	12 years	medial condyle	Medial subvastus	2	Missed	screws (anteroposterior)	15 months	Stable union with ROM 135°, KSS 170/200	
			36/Male	8 years	lateral condyle	Lateral approach		fixed surgically	screws (anteroposterior) + bone graft	4 years	Stable union with ROM 0-130°, KSS 173/200	First intervention with cancellous screw failed and non union persisted
15	Chouhan et al	Present study	39/Male	1 year	lateral condyle	direct lateral	1	Conservative	screws (posteroanterior)	8 months	Stable union with ROM -5-135°, KSS 100/100	none

ROM: range of motion; KSS: Knee Society Score; CCS: cannulated compression screws; ORIF: open reduction and internal fixation.

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Figure 1. Anteroposterior and lateral radiograph of the knee showing Hoffa fracture.



Figure 2. CT scan showing non-union lateral condyle Hoffa.

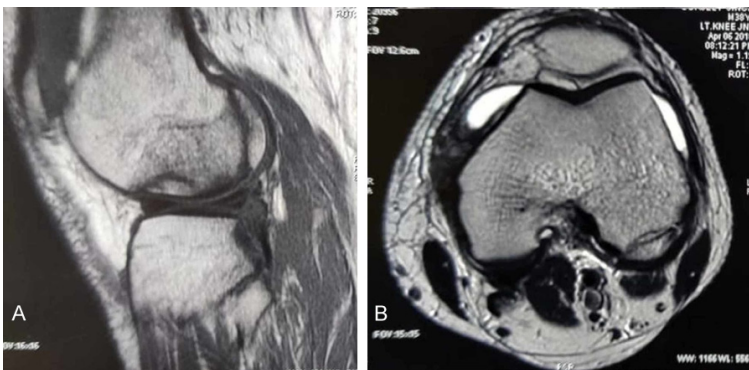


Figure 3. MRI showing no signs of avascular necrosis of the fracture fragment.

by rehabilitation at some local hospital. Despite 9 months of rehabilitation; the patient had persistent pain around the knee, stiffness, and was unable to squat. Because of persistent disability and knee pain, the patient presented to our center.

The routine anteroposterior and lateral radiographs in 60-degree flexion indicated non-union lateral condyle Hoffa fracture (**Figure 1**).

The sagittal (**Figure 2A**) and axial (**Figure 2B**) of a computed tomography (CT) scan confirmed non-union of the lateral condyle of Hoffa fracture with rounding and sclerosis of fractured surfaces. A coronal plane fracture posterior to the lateral epicondyle confirmed and a diagnosis of Letteneur type 2C left lateral condyle Hoffa's non-union was made. Magnetic resonance imaging (MRI) showed no associated ligamentous injury or any evidence of avascular necrosis (AVN) of the fractured fragment was detected (**Figure 3**). A written informed consent was obtained from the patient and patient was advised surgery. The clearance to follow up the patient and publish his results eventually was obtained from the institutional ethical committee.

Surgical technique

The surgery was performed in the right lateral decubitus position through a direct lateral approach. An approximately 10 cm long skin incision, centered over the lateral epicondyle, just posterior to and in line with the head of the fibula was given. The iliotibial band (ITB) was retracted anteriorly, which exposed the breach in the capsule between the lateral collateral ligament (LCL) complex and lateral head of gastrocnemius (**Figure 4A**).

After retracting the LCL complex anteriorly and obliquely running popliteus inferiorly, the ununited fragment of the lateral condyle was exposed (**Figure 4B**). Some capsuloligamentous structures were attached to the fragment on the medial side which were left undisturbed. The fracture ends were curetted and freshened (**Figure 4C**). The fragment was then fixed multiple headless compression screws to achieve interfragmentary compression and stable fixation (**Figure 4D**). The post-

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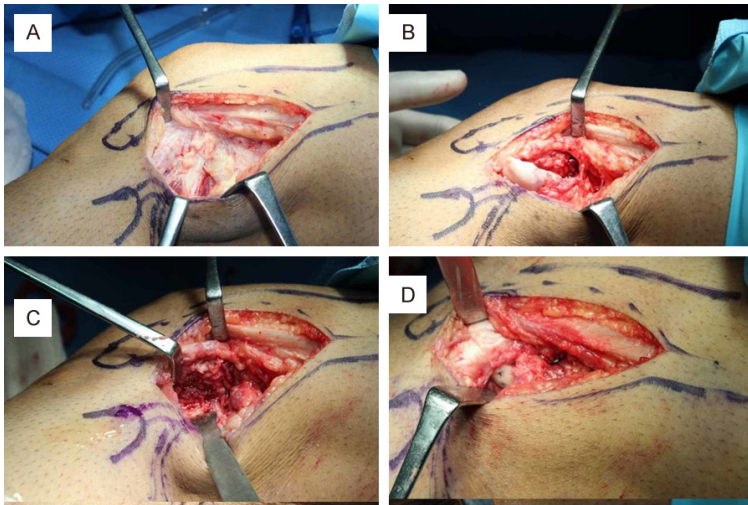


Figure 4. The surgical steps showing the breach of the capsule between LCL complex and popliteus (A), exposure of fragment (B), freshening of the fragment (C), and fixation with headless compression screws (D).



Figure 5. The anterior-posterior and lateral radiograph showing the fixation of lateral condyle Hoffa fragment with 3 headless compression screws.



Figure 6. Fracture healed completely at 3 months.

operative radiograph demonstrated an anatomical reduction of the lateral condyle Hoffa fragment (**Figure 5**).

Follow up and rehabilitation

The passive knee range of motion was started in the immediate post-operative period. The patient was advised non-weight bearing mobilization with crutches for 6 weeks followed by partial weight-bearing for another 6 weeks. After 12 weeks of follow-up, the fracture healed radiologically (**Figure 6**) and the patient was allowed full weight-bearing. At the last follow up at 12 months after surgery, the patient was having a knee society score (KSS) of 100, range of motion from -5 to 135 degrees, the knee was stable and was able to run and squat without any pain (**Figure 7**).

Discussion

Hoffa's fracture is often missed on standard radiographs of the knee on account of its rarity and coronal plane orientation [3]. Therefore, a CT scan is often recommended for confirmation and categorizing such fractures [17]. As per Letenneur classification, every pattern requires modification in surgical management, and failure to recognise it may lead to a suboptimal outcome [18]. Our case can be best classified as Letenneur type 2C Hoffa's fracture, in view of its coronal plane orientation posterior to the lateral epicondyle and very thin osteochondral fragment.

Being an intra-articular fracture, open-reduction and internal fixation with inter-fragmentary compression is the recommended treatment. Traditionally, the midline approach

is the gold standard surgical approach for open reduction of the intra-articular fracture involving the distal femur. However, its role in

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Figure 7. Full range of motion and no deformity after 12 months.

Letenneur type 2c Hoffa's fracture is limited by the morphology of the fracture [18]. The fracture reconstruction requires posterior to anteriorly directed compression screw to achieve a mechanically stronger fixation [19], which can be challenging when approached anteriorly [20]. Orapiriyakul et al. and Lewis et al. recommended a lateral approach to go around the collateral ligament and allow placement of screw directed from posterior to anterior [18, 21]. Alternatively, in selected cases with fracture line extending far anterior to the lateral epicondyle, lateral collateral may limit the articular exposure for direct reduction. A lateral epicondyle osteotomy combined with lateral approach allows lateral joint opening on the varus stress and direct visualization and palpation of the articular surface [22]. However, in our case, the fracture line was well posterior to the lateral epicondyle (**Figures 2B, 3B**) making it possible to visualize the articular side by retracting the popliteus tendon downward and anteriorly (**Figure 4B, 4C**). Additionally, the selection of the lateral surgical approach in our case also benefited in guiding compression screws from posterior to anterior direction. We believe that

lateral approach warrants greater caution because of the proximity to the common peroneal nerve, but could be more beneficial in treating Type 2 Letenneur's fractures because of better exposure even after very limited soft tissue dissection.

Another issue with Type 2 Letenneur fractures that they are more susceptible to nonunion and avascular necrosis because of the scarce soft tissue attachment over fracture fragment [9, 21]. However, during the follow-up, fracture united at 3 months after surgery and there was no clinico-radiological deterioration until the last follow-up at 12 months. Somford et al. [9] suggested sufficient nourishment provided by synovial fluid and creeping substitution like phenomena responsible for successful fracture healing. Additionally, in our case, there was some soft tissue still attached to the medial side of the fracture fragment which might have contributed to its blood supply. Both clinical and radiological clinical outcomes at 12 months were pleasing, with no signs of AVN and the patient was able to carry out all his routine activities at the pre-injury level.

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Conclusions

Letteneur-2C type Hoffa fracture is a rare condition to encounter in a routine clinical setting. Surgical approach favouring the direct reduction of the articular surface and placement of the posterior-to anterior directed compression screws should be the choice.

Disclosure of conflict of interest

None.

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