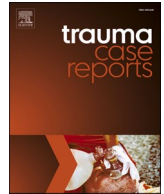




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## Case Report

# Isolated complete rupture of distal biceps femoris tendon following a motor vehicle accident: A case report and review of the literature

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## ABSTRACT

Isolated complete ruptures of the distal biceps femoris tendon are rare injuries. To our knowledge, very few cases have been reported in English literature.

We present the case of a young man who complained of pain on the posterolateral corner of the knee after a motor vehicle accident. Clinical examination and MRI findings revealed a complete rupture at the musculotendinous junction of distal biceps femoris tendon. We describe the surgical treatment performed, and the clinical outcome.

## Introduction

Biceps femoris muscle is the most important flexor of the knee as it provides 75 % of its bent strength [1]. Furthermore, it constitutes a dynamic stabilizer of the knee and part of the posterolateral corner. It is well described that the majority of the ruptures occur in the long head of the muscle [2]. The rupture of biceps femoris can be located proximal, distal, or in the muscle belly. Furthermore, injuries of distal biceps tendon commonly referred to avulsions from the fibula's head and rarely to ruptures on musculotendinous junction [3].

Common injury mechanism includes hyperextension of the knee and the hip, resulting in a high tension load on the tendon. Resisted flexion caused by running or kicking backwards can also provoke high tension on the tendon, in combination with possible tendon degeneration or previous trauma [4]. The injury occurs mainly during sports such as ice hockey, marathon, triathlon, cricket, water ski and floor ball [5].

To our knowledge, this case report describes for the first time a complete rupture of distal femoris tendon following a motor vehicle accident (MVA). We analyzed this rare injury, the surgical method performed and the final clinical outcome in order to document that this type of injury can also occur after an MVA.

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## Case presentation

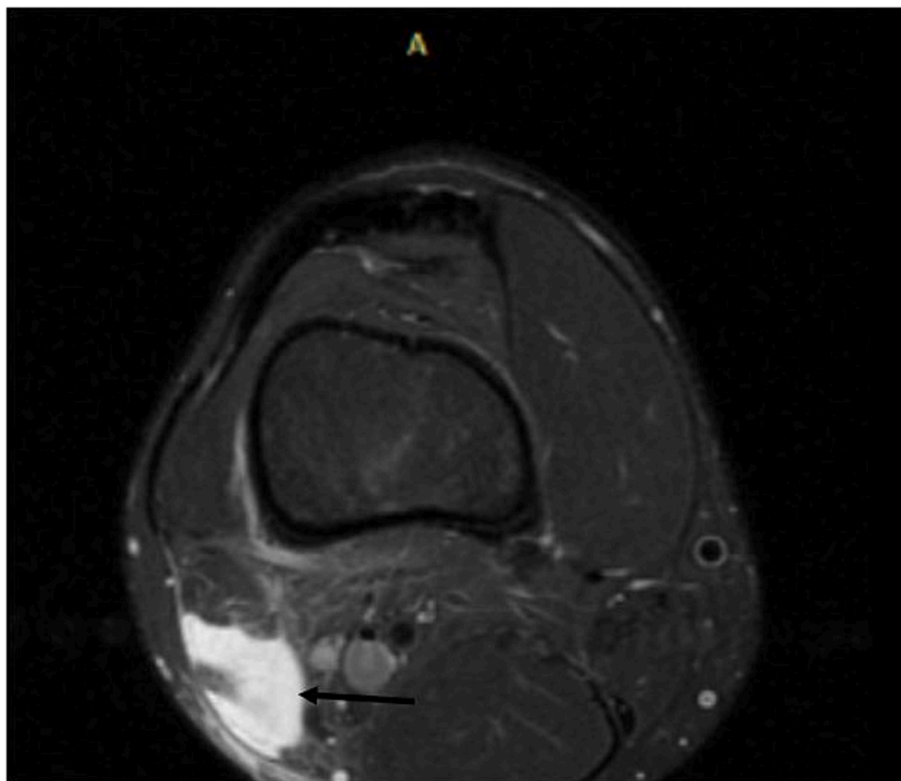
A case of an 18-year-old male was presented as an emergency following an MVA. Due to the impact of the collision, the patient was ejected from the co-driver's seat through the front windshield, as he was not wearing the seat-belt. The paramedics found him unconscious on the road, five meters away from the car. On arrival, the patient was confused and he had peritraumatic amnesia. The patient complained of pain on the posterolateral aspect of his right knee. Minor skin lacerations were revealed throughout his extremities and also on the posterior aspect of his knee. During trauma investigation under local anesthesia, foreign bodies, mainly small glass debris, were extracted. The exact mechanism of injury was unknown, as the patient was not able to recall the accident. Interestingly, he had no other injuries in any other part of his body or in any other organ system.

Clinical examination revealed a diffuse swelling in the posterolateral region of the knee, which was painful on palpation. Posterolateral ridge formed by the biceps femoris muscle tendon was absent. The knee had no ligamentous instability but the flexion strength was 3/5 compared to the contralateral side. Moreover, Puranen-Orava test and bent knee test were positive. Neurological examination of the limb, including peroneal nerve function, was normal. His past medical history was non-contributory.

A cast was applied initially for pain relief and no weight-bearing was allowed. As the radiographic control of the right knee and of the patella revealed no pathology without any avulsion fracture, the patient underwent an MRI scan. According to MRI findings, the tendon of the biceps femoris muscle had been ruptured at the musculotendinous junction and a hematoma was existent. All the other structures about the knee were normal (Fig. 1). The injury was classified as Grade 4c, according to classification system proposed by Pollock et al., [6]. A surgical treatment was decided, as the knee flexion strength was reduced in comparison to the contralateral side.

## Surgical technique

The surgical procedure was performed with the patient under general anesthesia in a prone position. The musculotendinous junction was palpated and a longitudinal incision of about 10 cm, over the belly of the biceps femoris, was made. The fascia of the biceps femoris was identified and dissected, and the hematoma was removed. The peroneal nerve was identified and it was protected. The rupture was found right at the musculotendinous junction. The muscle belly was visually healthy without any sign of degeneration. The rupture was repaired using Krackow suture technique by using Ethibond sutures (Fig. 2). Finally, an accordingly shaped fascia latta allograft was placed over the musculotendinous junction, by using absorbable sutures (Fig. 3). The knee was bended and extended to ensure the tension of the sutures. The wound was irrigated with normal saline and absorbable sutures were used to close the overlying fascia and subcutaneous tissue. Metal staples were used for the skin closure.



**Fig. 1.** MRI PDFS, Transverse image. Rupture of the long head of biceps femoris in musculotendinous junction. High signal density area (black arrow).

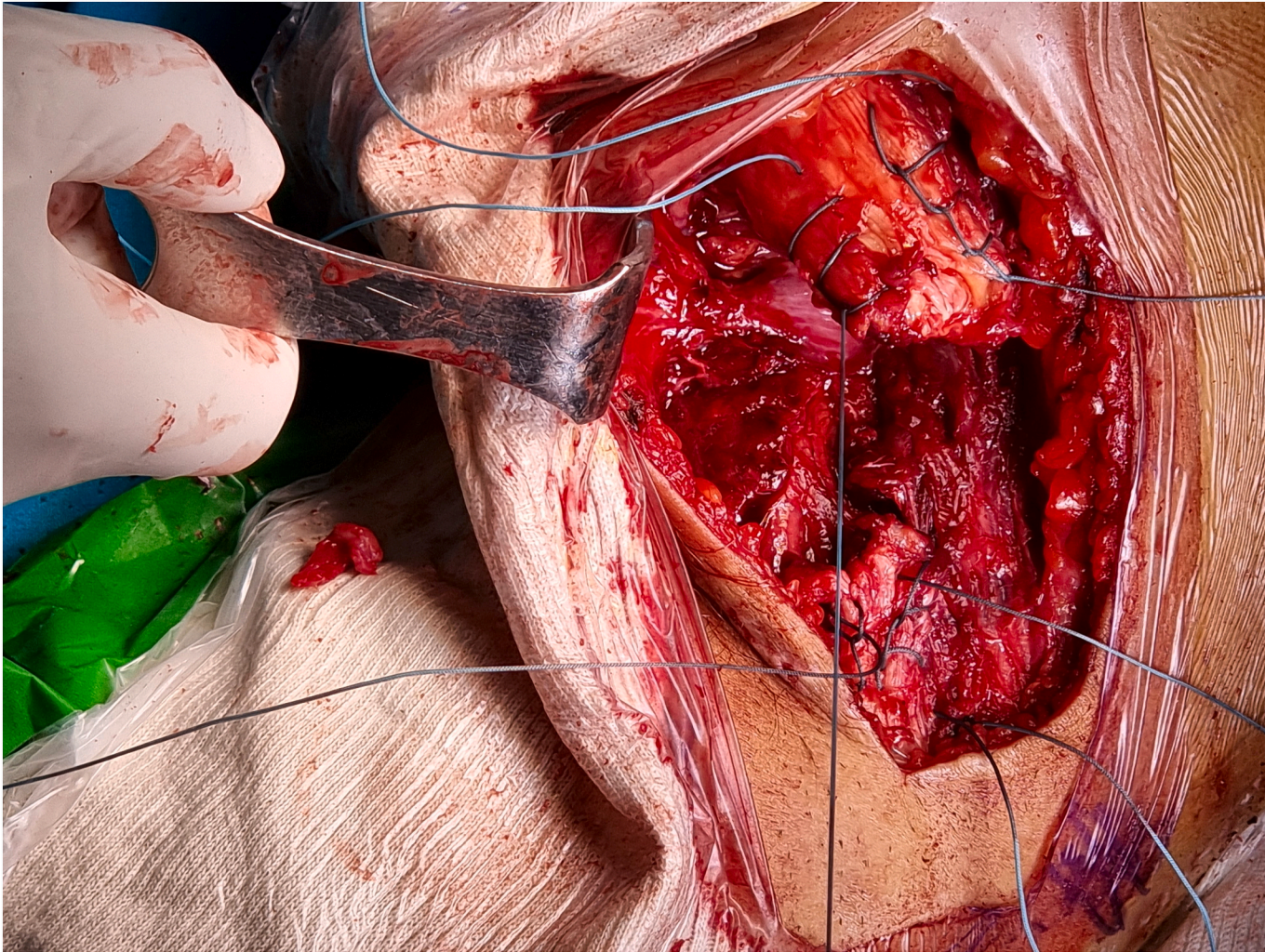


Fig. 2. Intraoperative photograph showing the complete rupture of the biceps femoris tendon, and the attempted surgical repair by using Ethibond sutures in a Krackow fashion.



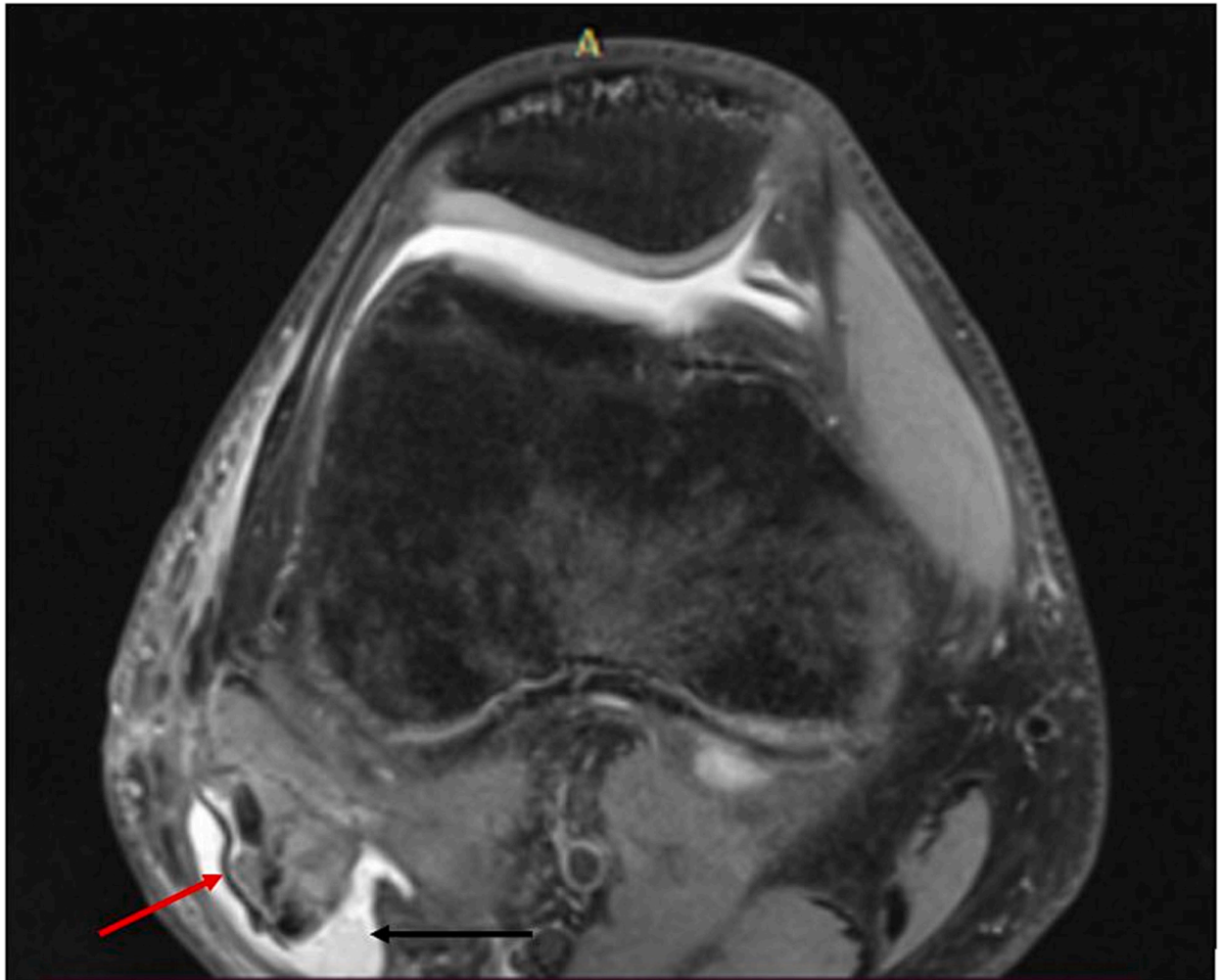
Fig. 3. Intraoperative photograph showing the placement of the shaped fascia latta allograft over the musculotendinous junction, after the surgical repair of the rupture.

Postoperatively, a hinged brace was induced, locked at 30 degrees of flexion, in order to protect the repair. The postoperative follow up was uncomplicated. Progressive weight-bearing four weeks after surgery was advised while the patient started isometric quadriceps exercises, and the patient underwent a new MRI scan in order to evaluate the surgical repair of the tendon (Fig. 4). The cast was removed six weeks postoperatively. At that time, physical therapy was used to recover the full range of motion of the knee and empowered both quadriceps and hamstrings. Two months postoperatively the patient was satisfied with the clinical outcome and he returned to daily activities. Six months post operatively he returned to sports, as a semi-professional basketball player. He had no pain or stiffness, but he needed more warming-up time than before. One year postoperatively the patient was free of any symptoms and the ridge formed by the biceps femoris muscle tendon had returned to normal to both visual inspection and palpation.

## Discussion

The hamstrings are the most commonly injured muscle groups in several sporting activities [6,7]. Injuries range from small sprains and muscle tears to partial or complete tearing of the musculotendinous junction or avulsions off the fibular head [3]. However, isolated complete rupture of the distal biceps femoris tendon is extremely rare. The majority of the published cases concern sprains, partial ruptures, complex ligaments injuries about the knee, and mostly tendon avulsion injuries [5,7]. Apropos of this case report, a review in the English literature focused in isolated complete ruptures of the distal biceps femoris tendon, revealed no more than 14 published cases [1,3,8–16] (Table 1). All of these injuries, but 3 including our case, were the result of sports related activities.

The present case reports an isolated complete rupture of the biceps femoris tendon after an MVA. The vehicle was a small, compact left-hand drive city car with seating for two. The possible mechanism of injury could be explained as follows: The inertia of the impact due to the accident caused his body to lift from the seat and probably prior to his body's ejection through the front windshield, the



**Fig. 4.** MRI PDFS, transverse image. Surgical repair of the rupture with suturing and allograft placement (red arrow). There is a small fluid collection at the surgical field, which is normal one month postoperatively (black arrow).

**Table 1**

Overview of cases included in review, reporting isolated complete tendon ruptures of the biceps femoris muscle. Authors are listed in ascending chronological order.

Author	Cases/ sex	Age	Activity	Mechanism of injury	Location of complete tear/ treatment/complications	Outcome/return to sports
Verburg &, Keeman [8]	1/M	50	Water skiing	Fall over wave, knee hyperextension	Proximal to its insertion/sutures	Excellent/3 m returned to sports
McGoldrick & Colville [9]	1/M	36	Cricket	Running, knee hyperextension	MTJ/sutures	Good/NR
David et al. [10]	1/M	41	Jogging	Knee hyperextension	Proximal ligamentous portion/ biodegradable sutures	Excellent/3 m returned to sports
Fortems et al. [11]	1/M (a) 1/F (b)	a) 44, b) 42	a) Soccer b) Fall on a slippery floor	a) Simultaneously contracting hamstrings and knee extensors b) Sudden flexion of the hip and extension of the knee	a) MTJ/conservative b) MTJ/resorbable sutures	a) Good/6 m mild decrease of peak torque values b) Fair/marked decrease of peak torque values
Lempainen et al. [3]	1/M	27	Floorball	NR	MTJ/sutures	Excellent/3 m
Jensen & Kramhoft [12]	1/M	35	Soccer	Hip was bent, and knee was fully stretched	MTJ/sutures	Good/3 m atrophy of the muscle with good performance power
Watura & Harries [13]	1/F	42	Hockey	Tibia internal rotation sustaining a varus injury	Proximal ligamentous portion/ conservative (history of proximal hamstring reconstruction in the same leg)	Excellent/10 m returned to sport
Valente et al. [14]	1 M	24	American football	Trauma to the knee with valgus hyperextension	MTJ/end-to-end tenorrhaphy with absorbable sutures	Excellent/6 m returned to sport, 12 m resumed previous level of activity
Fukunda et al. [15]	1/M	16	Running	Fall forward over an outstretched leg	MTJ/sutures-modified Kessler/ entrapment of peroneal nerve from sutures	Good/15 m function completely recovered/ residual numbness
Strasser et al. [1]	1/M	65	Housework	Stretched the leg while moving a carpet	Proximal ligamentous portion/ sutures with fiberwire/persistence of swelling	Good/6w able to walk without instability
Azzopardi et al. [16]	2/M	a) 60 b) 23	a) Soccer b) Soccer	a) Kicking the ball b) Knee flexion and external rotation	a) Proximal to its insertion/ conservative b) Proximal to its insertion/ conservative	a) Good/NR b) Good/NR
Papadakis et al. [present case]	1/M	18	MVA	Sudden flexion of the hip and extension of the knee	MTJ/Krackow suturing, Fascia latta allograft	Excellent/6 m returned to sport/12 m resumed previous level of activity

Abbreviations: MTJ: Musculotendinous junction, NR: Not reported, w: week/s, m: month/s.

lower aspect of his tibia blocked under the front panel cushion of the co-drivers' seat, and his right knee blocked against the dashboard and the side door. During ejection the upper body of the patient was pulled forward by the impact's inertia causing a sudden flexion of the hips and extension of the knee, as described above. Thus, the rupture of the biceps femoris tendon was happened before the patient's body reached the ground. We suppose that this mechanism of injury is similar to that described in water-skiers, in which the skies are stuck in a wave and the upper body is pulled forward by the towing rope [11]. The possibility that the tendon rupture was the result of broken windshield glass was excluded. There was no skin laceration above the tendon rupture, and small skin lacerations that were revealed during initial admission were far from the injured site.

Biceps femoris is the most commonly injured muscle and is mainly the result of sports related activities [7,17]. Our recent review of English literature revealed that 2 out of 13 previously reported cases with an isolated complete rupture of the distal biceps femoris tendon were either a fall on a slippery floor in a 42-year old woman [11], or during housework in a 65-year-old man [1], the rest being sports related injuries. Ours is the first case to report an isolated complete rupture of distal biceps femoris rupture due to an MVA. Therefore, we believe that it is essential to report it in order to document that this kind of injury can occur regardless of sports activities, and that there should be increased vigilance among physicians who encounter similar trauma cases.

Clinical examination, mechanism of injury and MRI scans are the mainstay for the diagnosis. MRI scan is the gold standard to find out the exact point of rupture and to exclude the existence of bone fragments or other lesions of the posterolateral corner of the knee [2,14,18].

Currently, surgery is the preferred treatment of choice, specifically in the cases of young athletes [5]. However, there have been 4 reported cases treated non-operatively with good and excellent final results. The first case was a refusal to undergo surgery [11], and in the second case a conservative treatment was decided as it concerned a previous hamstring injury treated surgically in the same leg [13]. Both authors stated that the final results were excellent. Azzopardi et al., presented the next two cases of isolated biceps femoris tendon injury immediately proximal to the fibula, treated conservatively with good final results [16]. In our opinion, since biceps femoris activates as the main flexor of the knee and helps also in the extension and external rotation of the hip [1], surgical treatment,

especially for a young patient such as in our case, is imperative. Although, there is a lack of comparable clinical results, surgical treatment seems to be beneficial, and only prospective, randomized clinical studies would reliably prove the efficacy of surgical versus conservative treatment [3].

The surgical procedure is performed with a lateral incision. In our case an accordingly shaped fascia latta allograft was placed over the musculotendinous junction, by using absorbable sutures after rupture repair. To our knowledge, no other case reports describe this technique. Fascia latta was used as a reinforcing graft as it is strong enough, pliable and can easily be sutured. Our final result justified its usage. Hamstring tendon allograft reconstruction technique, and a reverse fascia flap of biceps femoris as graft technique, has been also reported. However, these techniques are indicated for chronic biceps ruptures or avulsion injuries [19,20].

During surgery, surgeons should also pay attention to the common peroneal nerve at all stages of the procedure. Fukunda et al., described a case of entrapment of the common peroneal nerve by sutures following distal biceps femoris tendon repair [15]. Consequently, it is significant to perform neurological examination pre- and post-operatively.

## Conclusion

In English literature, no more than 14 cases, including the present case, of an isolated complete rupture of biceps femoris tendon have been reported. Ruptures of biceps femoris are not only a result of sports activity but could be a serious injury after a high energy trauma such as a MVA. These injuries can be treated surgically, especially in cases of high-demand patients. Clinical examination and MRI are the major diagnostics tools for the biceps femoris rupture.

## Declaration of competing interest

None.

## Acknowledgments

None.

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