Case Report

Isolated Avulsion of the Biceps Femoris Insertion: A Case Report and Literature Review

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Abstract

Isolated avulsion of distal biceps femoris tendon is a rare occurrence. We report a case of a 34-year-old football coach with isolated avulsion of distal biceps tendon which occurred while kicking a ball backwards with his heel. He underwent surgical treatment and recovered fully. We obtained an MRI scan 22 months postoperative and found good tendon to bone healing. In reviewing other literature of similar injuries, we found 23 reported cases in 11 publications. 21 of the 24 cases (including our reported case) injured the tendon in a sporting activity. 21 cases underwent surgical treatment while 3 took conservative treatment. Both methods of treatment resulted in a good clinical outcome. Most of the cases were able to return to pre-injury level of sports. Any advantages of one method of treatment over the other could not be determined.

Keywords: avulsion, biceps femoris, tendon rupture, treatment

Hamstring injuries in athletes are common, but isolated avulsion or tear of biceps femoris tendon are a rare occurrence. Only a few case reports have been published. McGoldrick[1,2] has been credited as the first to report a case of spontaneous rupture of biceps femoris. Since then, there have been several other reports.[2-11] We report a case of complete avulsion of distal biceps femoris tendon from head of fibula with a review of previously published cases of isolated rupture of biceps femoris tendon to look for patterns in epidemiology, mechanism of injury, location of tear, treatment methods and their outcome.

Case Report

A 34-year-old Brazilian football (soccer) coach was admitted to the emergency room after he felt a sudden pain and a pop in the lateral side of his right knee after kicking a football backwards with his heel. He was not able to walk afterwards. Physical examination showed mild swelling and marked tenderness in the posterolateral part of his knee and fibula head. Full passive flexion or knee extension was not possible due to pain. Active movement of his knee was also very painful. There was no gross instability of the knee. Magnetic resonance imaging (MRI) scan showed avulsion of distal biceps femoris insertion at the head of the fibula with no other pathology (Figure 1).

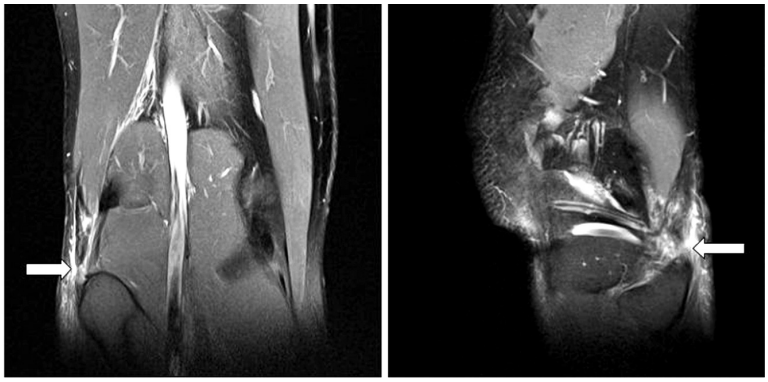

Figure 1 : MRI findings in coronal and sagittal planes shows avulsion of biceps femoris tendon from fibular head (arrow).

Due to the patient's profession in sports, he was advised to undergo surgical treatment. Nine days after the injury, he underwent surgery. Examination under anesthesia revealed no instability of the knee. A longitudinal incision exposed the distal biceps femoris tendon, slightly anterior to center head of the fibula. Distal biceps femoris tendon was found to be completely avulsed from the head of the fibula. Common peroneal nerve was dissected and protected. After removing all soft tissue remnants and preparing tendon footprint on the head of the fibula by making small drill holes in the bone, a 4 mm bone tunnel was created from posterolateral to anteromedial direction, avoiding common peroneal nerve. Biceps femoris tendon was sutured in Krakow fashion with FiberWire 5/7 metric (Arthrex). The free ends of the suture material were passed through 3.5 mm Suture Button (Arthrex), and the button passed through the 4 mm bone tunnel. The sutures were then tightened and tied securely over the Suture Button. Security of the repair was checked by putting the knee through a full range of motion. Wound was irrigated with saline and was closed before applying a long hinged knee brace locked at 30 degrees knee flexion.

Postoperatively the knee was immobilized in a brace at 30 degrees of flexion for a week. Afterwards, the brace was adjusted to allow more range of motion on a weekly basis until a full range of motion was reached at 5 weeks. After 1 week, intensive rehabilitation was started. The patient was non-weight-bearing for 6 weeks, after which he was allowed full weight-bearing without wearing a knee brace. After 3 months, the patient was able to start jogging and perform active hamstring exercises without pain. 4 months postoperatively, he was able to resume his preinjury sports activities.

22 months after the surgery, the patient complained of persistent painless prominence at the site of fibula head. An MRI scan showed focal thickening of biceps femoris tendon insertion but with good tendon to bone healing (Figure 3).

Literature Review

We reviewed 11 published reports, as well as our case report (Table 1). eight of them were single case reports, 2 of them reported 2 cases each, and 1 was a case series.[1-11] The case series was a retrospective review of 18 surgically treated cases of distal hamstring injuries, which included biceps femoris, semimembranosus, and semitendinosus tendons. We have included only the 11 cases with biceps femoris tear in our review. Overall we reviewed 24 cases.

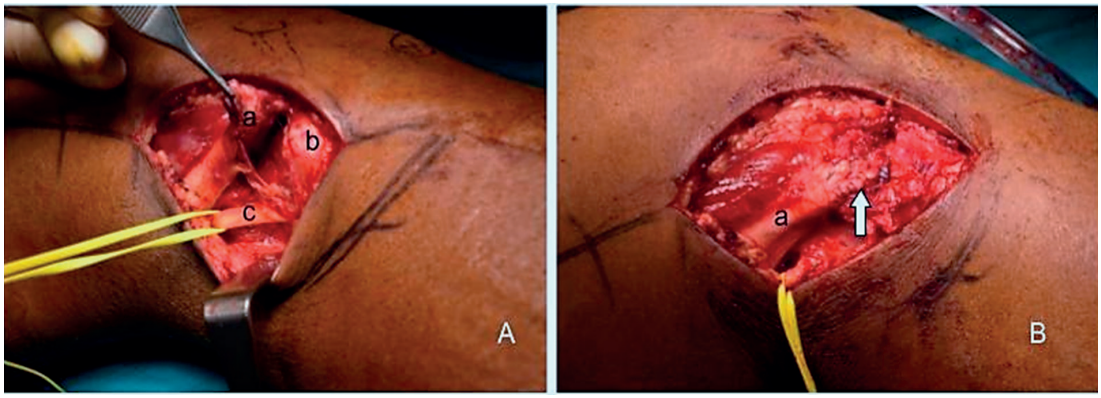

Figure 2A-B: Intraoperative pictures. **B:** shows reattached biceps tendon (arrow)
a: biceps femoris tendon; **b:** head of fibula; **c:** common peroneal nerve.

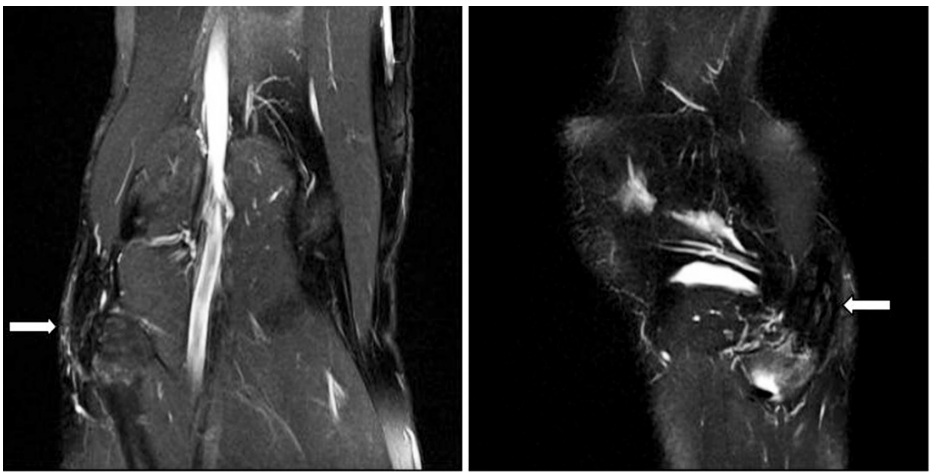

Figure 3: MRI pictures 22 months postoperative shows well healed biceps femoris tendon to fibular head and thickening of the biceps femoris tendon (arrow)

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Table 1

Author	Age/ Sex	Sport	Mechanism of injury	Location of tear	Diagnostic investigation	Treatment	Time from injury to surgery	Rehabilitation program	Return to pre-injury level of sport
McGoldrick et al.[1]	36/M	Cricket	Running	MTJ	None	Surgery: Repair of defect	Nm	Serial casting with progressing knee extension followed by a period of rehabilitation.	No
Sebastianelli et al.[2]	21/M	American football	Extension and valgus load	A	MRI	Surgery: Transosseous fixation using sutures placed through drill holes made in fibula head	Nm	Immobilized for 4 weeks in 60 degree flexion. Active 30 - 60 degrees arc of motion from 4 - 6 weeks. Full active and unrestricted knee ROM at 6 weeks. Full recovery at 6 months.	Yes
David et al.[3]	41/M	Jogging	Jogging	MTJ	USS	Surgery: Repair with 4 strong degradable sutures	2d	Knee brace with restricted motion 20 - 70 degrees. Full ROM at 6 weeks. Full recovery at 12 weeks.	Nm
Jensen et al.[4]	30/M	Soccer	Hyperextension	A*	None	Conservative: by ultrasound for pain control and restricted mobility.	NA	Full recovery in 2-3 weeks after injury.	Yes
	35/M	Soccer	Hyperextension	MTJ	None	Surgery: (details not provided)	Nm	Restricted movement and weight bearing by splint for 6 weeks. Extensive rehabilitation after 6 weeks. Full recovery after 3 months.	Nm
Fortems et al.[5]	44/M	Soccer	Passing ball backwards with sole of foot while running forwards	MST	USS	Conservative: by plaster of paris immobilization for 3 weeks in 30 degrees knee flexion followed by intensive physiotherapy	NA	Resumed sporting activities in 4 months. Cybex isokinetic dynamometer examination 6 months after injury showed mild flexion and extension peak torque deficit compared to other knee.	Yes
	42/F	NA	Fell forwards over an outstretched leg on slippery floor	MST	USS, MRI	Surgery: by repair with resorbable sutures	Nm	Protected with POP for 4 weeks. Cybex isokinetic dynamometer examination 6 months after injury showed marked flexion and extension peak torque deficit compared to other knee.	Nm
Pan et al.[6]	33/M	Soccer	Hyperextension: missed ball while attempting to kick it	A	None	Surgery: plicating tendon to non-absorbable sutures (nylon 2.0) and fixing it to fibula head through drill holes. Fractional lengthening at musculotendinous junction.	4m	Immobilized with posterior plaster splint at 80 degrees flexion for 2 weeks. Gradual extension of knee with cast change until 15 degrees at 6 weeks. Followed by unrestricted ROM. Achieved full ROM at 6 months.	No

Author	Age/ Sex	Sport	Mechanism of injury	Location of tear	Diagnostic investigation	Treatment	Time from injury to surgery	Rehabilitation program	Return to pre-injury level of sport
Kusma er al.[7]	43/M	Soccer	Hyperextension	A	USS, MRI	Surgery: Fixation using suture anchor	Nm	Immobilized in 30 degrees flexion for 6 weeks. 6 - 12 weeks motion within 0 - 90 degrees. After 12 weeks full ROM with resistive exercises.6 months to full recover.	Yes
Lempainen et al.[8]	40/M	Ice hockey		A	USS or MRI	Surgery: reinserted to fibular head with suture anchor	5d	No immobilization was used. Elastic bandage was used for 3-5 days.	Yes
	27/M	Floorball		MTJ	USS or MRI	Surgery: repaired using suture after excision of scar tissue	2w	Partial weight bearing within 2 weeks.	
	24/M	Sprinting**		MTJ	USS or MRI		1.5m		
	20/M	Long jump		MTJ	USS or MRI		3m	Full weight bearing within 4 week. Swimming and water training 2-4 weeks after surgery. Bicycling began after 3-6 weeks. Running was allowed 6-8 weeks after surgery.	
	24/M	Sprinting**		MTJ	USS or MRI		3m		
	40/M	Marathon**		MTJ	USS or MRI		3m		
	24/M	Soccer		MST	USS or MRI	Surgery: longitudinal tear in tendon was repaired after excision of scar tissue	3m		
	18/M	Sprinting**		MTJ	USS or MRI	Surgery: repaired using suture after excision of scar tissue	4m	All patients returned to pre-injury level of sports in an average of 4 months (range 2-6 months).	
	29/M	Triathlon**		MTJ	USS or MRI		5m		
	24/F	Road cycling		MTJ	USS or MRI		9m		
	18/M	Sprinting**		MTJ	USS or MRI		15m		
Watura et al.[9]	44/F	Hockey	Tibial internal rotation and varus injury to left knee	MST	USS, MRI	Conservative: (details not provided)	NA	Return to sports 10 months after injury.	Yes
Valente et al.[10]	24/M	American football	Direct trauma with valgus hyperextension	MTJ	MRI	Surgery: end to end tenorrhaphy with absorbable suture.	1 w	Immobilized in 30 degrees flexion for 4 weeks. Rehabilitation to achieve full ROM and full weight bearing in next 4 weeks. Full recovery after 6 months.	Yes
Strasser et al.[11]	65/M	NA	Extension of knee while moving carpet	MST	MRI	Surgery: Suture with FiberWire	Nm	Limit knee extension to 30 degrees with free flexion in splint for 6 weeks with 20 kg weight bearing. Full recovery after 6 weeks.	Nm
Budhraja et al.	34/M	Soccer	Kicking ball backwards with heel of foot.	A	MRI	Surgery: Transosseous fixation to fibular head by bone tunnel and Suture Button	9d	Immobilized in knee brace at 30 degrees knee flexion for 1 week. Non weight bearing for 6 weeks. Adjusted brace for more ROM weekly till full ROM by 6 weeks. Started full weight bearing gait and aggressive rehabilitation at 6 weeks. Full recovery at 4 months.	Yes

A= avulsion; A*= avulsion from physical examination; d = days; NA= not applicable;
Nm= not mentioned; m = months; MRI = magnetic resonance imaging; MST= midsubstance of tendon; M

The majority of the cases were male (n = 21/3). Ages ranged from 18 to 65 years with a mean age of 32.5 years. In all cases, except for 2, the injury happened during a sporting activity. Of the 2 non-sporting injuries, a 42 year old female fell forward over an outstretched leg on a slippery floor, and another was a 65 year old male who injured the tendon during extension of the knee while moving a carpet. Of the sporting injuries, the age ranged from 18 to 44 years with a mean of 29 years. The most common sporting activity was soccer (7/22), followed by sprinting (6/22). There were only 2 cases injured in a contact mechanism, both in American football.[2,10] The non-contact injuries involved either hyperextension of the knee with the hip flexed (as in missing an attempted kick on a ball), or knee flexion against resistance (as in passing the ball backwards with the heel).

Most cases sought medical attention during the acute phase. There was only one case with delayed presentation[6] due to difficulty in accessing a medical facility. Patients describe a feeling of a sudden blow or kick to the back of the knee with a snap or a popping sensation and sudden sharp or stabbing pain. They were unable to resume physical activity afterwards. In the case with a delayed presentation[6], the patient also had difficulty standing up from sitting position; controlling the brakes and accelerator of a car; going downstairs and carrying heavy weights.

Physical examination described the injury as the absence of posterolateral ridge with diffuse or no swelling. Bruising or hematoma may be present. Depression or a gap in the tendon could be palpated and tenderness above fibula head. Diminished strength of resisted knee flexion and no instability of the knee could be demonstrated when pain level is low.

Both ultrasound and MRI scan have been used for definitive diagnosis. Ultrasound was used in 2 cases.[3,5] In the 11 cases reported by Lempainen8 it was not specified which scan was carried out. In 4 cases, the diagnosis was made on clinical findings alone.[1,4,6] The majority of the tears were located at the musculotendinous junction (13 cases). 5 cases had a tear in the midsubstance of the tendon and 6 had avulsion of tendon to the head of fibula.

Of the 24 cases, 3 underwent conservative treatment. The first case[4] underwent conservative treatment because he was urgently needed to play for the soccer team. He underwent ultrasound therapy for pain relief and restricted mobility. He fully recovered and was able to take up soccer again within 2-3 weeks. The second case[5] underwent conservative treatment because he refused surgery. He was treated with plaster of paris immobilization in 30 degrees of knee flexion for 3 weeks followed by intensive physiotherapy. He was able to resume sporting activities after 4 months. The third case[9] was a female hockey player who had injured her biceps femoris tendon for a second time. The first time was two years earlier in the proximal hamstring, which was treated surgically and this was the reason stated for the conservative treatment of distal biceps injury the second time. The details of her treatment were not reported, but she was back to playing hockey 10 months later.

Time period between the injury to surgery varied from 2 days[3] to 15 months[8]. The surgical technique was dependent on the location of the tear of tendon. For tears at the musculotendinous junction or midsubstance tear of the tendon, repair with resorbable sutures[3,5] and with FiberWire[11] has been described. Lempainen[8] describes the excision of scar tissue before repair. For avulsion of the tendon, transosseous fixation[2,6] or fixation with suture anchor[7,8] has been described. Pan[6] describes fractional lengthening of the tendon for their case of delayed repair.

The postoperative rehabilitation program reported a high level of variation, from no immobilization to immobilization for 6 weeks.[7,8] The degree of flexion for immobilization also varied from 80 degrees to 30 degrees.[6,7,10] Restricted mobility of 20-70 degrees in knee brace has also been reported.[3]

18 of the 24 cases were able to return to their pre-injury sporting activities. 2 cases were not able to return to sporting activities, and 4 cases did not report whether the patients were able to return. Full recovery was reported from 2-3 weeks to 10 months.[4,9] The majority of cases had full recovery within 4-6 months.[2,5,6-8,10,11] Only one complication was reported[6], comprising of persistent discharge from a sinus tract. The wound was examined 2 months postoperatively. No infection was found and the wound subsequently healed.

Discussion

The biceps femoris tendon is made up of 2 heads. The long head originates from the ischial tuberosity and inserts in the head of the fibula, and the short head originates from the lateral lip of linea aspera of the lower third of femoral diaphysis and joins with the fibers of the long head.[7,9,10] Its attachment at the knee shows very complex anatomy.[12] It is the strongest hamstring responsible for knee flexion and external rotation. Being biarticular, it is also responsible for hip extension. In a cadaveric biomechanical study, Brunet[13] has shown that its flexion capability is reduced by 75% after resection. In patients whose biceps femoris tendon had been used to reconstruct the quadriceps tendon, loss of 30% - 85% flexion force has been demonstrated by isokinetic Cybex test.[3] The biceps femoris tendon also acts as a static and dynamic stabilizer of the knee as part of the posterolateral complex of the knee. It shows increased activity in anterior cruciate ligament-deficient knees[14]. These could be the reason why most surgeons recommend surgical treatment for tear of the biceps femoris tendon.

Most reports of isolated biceps femoris tendon tears have been case reports confirming its rarity, though it is more common than isolated injury of the medial hamstring8, being the stronger muscle of the two. The mechanism of injury, in most cases, has been a quick and forceful knee extension with the hip in flexion (as in a football kick), which puts a high tension load on the distal biceps tendon.

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Isolated injury of distal biceps femoris could easily be missed because of its rarity and relative minor and non-contact injury pattern. Thorough clinical evaluation and high level of attentiveness should be maintained by clinicians. Appropriate imaging is indispensable. Although all of the cases reviewed had normal x-ray findings, fibular avulsion fractures could be detected. Ultrasound has been shown to provide good diagnostic accuracy except in cases with significant hematoma.[11] MRI has been the most commonly used imaging technique. MRI has the advantage of evaluating the injury in multiple planes and ruling out intra-articular structure injuries.

The disproportionate number of conservative versus surgical treatment makes comparison useless. 3 cases underwent conservative treatment[4,5,9], and all 3 went on to full recovery and returned to pre-injury level of sports activities, whereas 2 of the 21 surgical cases did not return to pre-injury sports and return to sports was not reported in 4 cases. The earliest case[4] of conservative treatment returning to sports activities was 2-3 weeks, while the latest case[9] was 10 months. In the 2 cases reported by Fortems[5], the one treated conservatively showed less weakness in knee flexion by Cybex isokinetic dynamometer examination at 6 months post-injury compared to one treated surgically. With the current data available, it would be unjustified in preferring one form of treatment over the other.

For injuries where there was an avulsion from the head of the fibula, all surgical cases either underwent repair when the tear was in the musculotendinous junction or in the midsubstance of the tendon, or by reattachment to the head of fibula by some form of transosseous fixation. Fixation was either with a suture anchor[7,8], or through a drill hole through fibula head. A detailed surgical technique for repair of isolated rupture of biceps femoris insertion has been described using FiberTape suture (Arthrex) and SwiveLock anchor (Arthrex).[15] A biomechanical study of repair techniques of biceps femoris[16] showed that a technique involving transosseous fibular tunnel had a higher mean failure load compared to repairs relying on suture anchors for fixation.

Conclusion

We report a rare case of isolated avulsion of biceps femoris tendon and result of surgical transosseous fixation of the tendon. We were able to obtain a 22 month postoperative MRI scan to demonstrate good healing of the tendon to the fibula head.

Isolated tears of distal biceps femoris are uncommon. Most injuries occur during sporting activities. Most injuries are located at the musculotendinous junction. Most authors prefer surgical treatment considering the functional importance of the biceps femoris muscle, though both conservative and surgical treatment has resulted in a good clinical outcome. Prospective, randomized studies would be ideal for determining the best treatment.

Conflict of Interests: The authors declare no conflict of interest.

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