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UP-TO DATE REVIEW AND CASE REPORT • KNEE - ANATOMY

Bilateral snapping biceps femoris tendon: a case report and review of the literature

Ieuan Reid[1] · **Ali Mofidi**[1]

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Abstract

Snapping biceps femoris tendon is an uncommon cause of lateral knee pain. We report the case of a 15-year-old athlete with bilateral snapping biceps femoris tendons, painful over his right lateral leg during exercise. He underwent elective exploration of the right knee which revealed an accessory biceps femoris tendon with attachment to the anterolateral tibia. The accessory tendon was released and reinserted onto the fibular head with a Krackow suture. There were no perioperative complications, and he returned to full sporting activities within 3 months. We describe the operative technique used and summarise the existing literature. Restoring the anatomy with release of the accessory tendon and reinsertion onto the fibular head is an effective technique in the management of knee pain due to snapping biceps femoris tendon. Other approaches include simple release of the anomalous tendon without reinsertion or partial resection of the fibular head. Partial resection of the fibular head is the only technique described in the literature with complication requiring a further operation on the same site. There remains a paucity of evidence in the literature regarding long-term outcomes required to inform the best operative approach. Further anatomical, intraoperative and radiological studies are required to delineate the true pathology of this condition.

Keywords Snapping biceps femoris · Operative technique · Case report · Anatomy

Introduction

Snapping biceps femoris tendon is an uncommon cause of lateral knee pain. It is characterised by a painful click on flexion or extension of the knee, usually due to snapping of the distal tendon of the long head of the biceps femoris over the fibular head [1, 2]. The biceps femoris muscle complex can be described as having a long head and a short head with a distal conjoined tendinous insertion, separated into medial and lateral components by the fibular collateral ligament. These tendons form anterior and posterior (direct) extensions that insert into the anterolateral portion of the tibia and the fibular head, respectively [3, 4]. The snapping biceps femoris phenomenon may occur due to anomalous tendon insertion [5–13], subluxation of an anatomically normal tendon [14, 15], abnormal fibular morphology [1, 16–19] or secondary to trauma [2, 20]. Symptoms can affect activities of daily living and conservative management tends to fail, indicating a role for surgical intervention [1]. We report the case of a young athlete with bilateral snapping biceps femoris tendons where the distal tendon of the biceps femoris extended into the anterolateral portion of the tibia in addition to its fibular attachment. Surgical management involved resection of the accessory tendon and repositioning to the fibular head with good post-operative recovery and return to sporting activity within 3 months.

Case report

A 15-year-old club-level rugby player presented to our clinic with an atraumatic, 5-year history of bilateral snapping of his distal biceps femoris tendon over the fibular head, becoming progressively more painful over his right leg. Despite 2 years of conservative management, running during rugby matches had become increasingly painful, forcing him to abandon play after 10 to 20 min. He was otherwise fit and

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✉ Ali Mofidi
ali.mofidi@wales.nhs.uk

[1] Abertawe Bro Morgannwg University Health Board, Swansea, Wales, UK

healthy with no problems in his birth history and up-to-date immunisations.

On examination, he was moderately built with no wasting of the quadriceps or calf muscles. There was some increased fibular bossing of the right fibular head compared to the left with a clicking sensation over the anterolateral aspect of the right knee on active movement. There was no varus or valgus thrust on walking with no deformity or effusion of the knee joint and normal symmetrical patella movements. Snapping of the biceps femoris tendon with posterior movement over the fibular head occurred on flexion over 90°–100° of the right knee with associated posterolateral tenderness. The iliotibial band appeared normal, and there was a full range of stable knee movements. Examination of the left knee also revealed a snapping biceps femoris tendon but was not painful. Hip and ankle examination was normal. The only abnormal examination finding was snapping over the anterolateral aspect of the knee related to the biceps femoris tendon which was much more pronounced on active movement which suggested an extra-articular pathology (online resource 1). Plain films were unremarkable. Magnetic resonance imaging of the knees did not reveal any evidence of meniscal tear or instability; however, there was some slight prominence of the right fibular head (Figs. 1 and 2).

Intraoperatively, a lateral approach to the right knee was undertaken to expose the fibular head (Fig. 3a–c). The common peroneal nerve and lateral collateral ligament were exposed and protected. The biceps femoris tendon had an

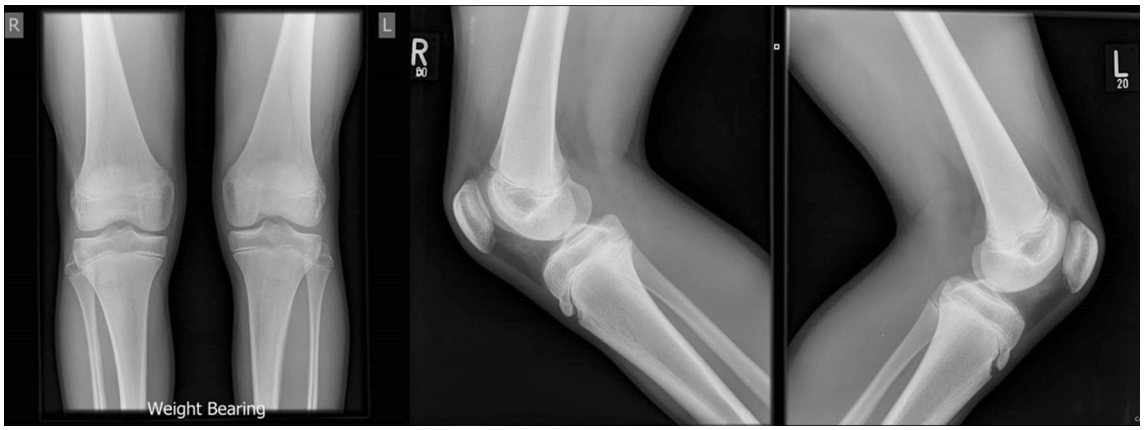

Fig. 1 Plain X-ray films both knees anterior and lateral views

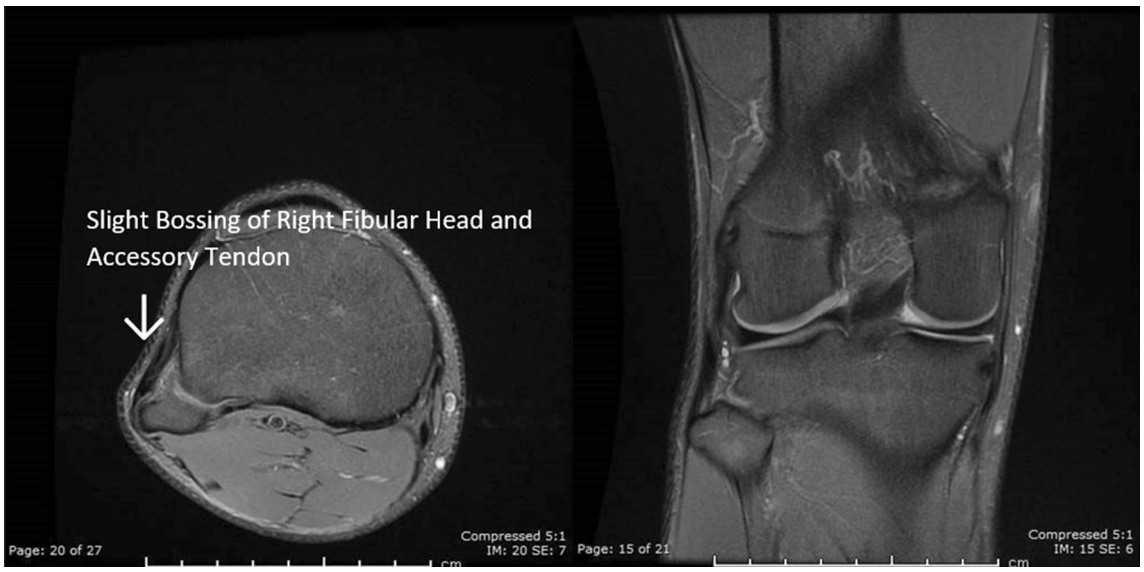

Fig. 2 Magnetic resonance images of the right knee in coronal and transverse plains revealing slight fibular bossing and accessory band of the biceps femoris tendon

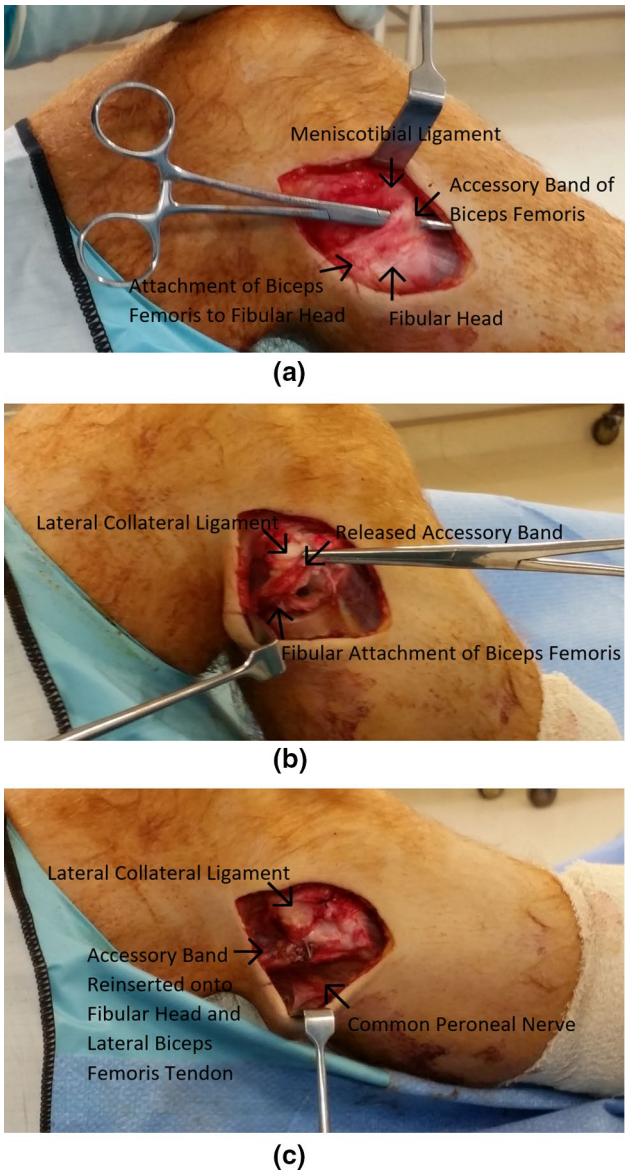

Fig. 3 **a** Identification of the biceps femoris accessory band. Note the attachment to the tibia and proximal meniscotibial ligament as it runs over the fibular head, **b** release of accessory band; released while preserving the lateral collateral ligament, **c** accessory tendon of biceps femoris reinserted to the fibular head with bone anchor and tenodesis to lateral biceps femoris tendon. Note the position of the common peroneal nerve

insertion to the anterolateral aspect of the tibia in addition to its fibular attachment which resulted in clicking over the fibular head on knee flexion. This accessory tendon was released from Gerdy's tubercle and reinserted onto the fibular head with two polyethylene suture anchors using a Krackow suture: one Fiberwire® (Arthrex) and one Ethibond Excel® (Ethicon) suture [21]. Tendon sheath and deep fascia were repaired in layers with 1-0 polyglactin (Vicryl® Ethicon), and skin was closed with metal clips with soft dressings. There were no perioperative complications, and the patient was mobilised fully weight bearing with crutches for 6 weeks. Physiotherapy with hamstring stretching exercises was undertaken, and the patient regained full unaided mobility and range movement without any snapping of the right biceps tendon at 6 weeks. He was discharged from clinic at 3 months and returned to playing rugby with no further problems.

Discussion

Snapping knee syndromes have numerous intra- and extra-articular causes with a wide range of congenital and acquired mechanisms [22]. Causes of intra-articular knee snapping syndromes include meniscal instability, vestigial remnants and intra-articular bodies and tumours. Extra-articular causes include acquired or congenitally abnormal movements of tendons or ligaments over local anatomy, or subluxation at the joint. Snapping phenomenon may also occur following total knee replacement [22]. The rarity of the phenomenon with a general lack of abnormality on plain X-ray and magnetic resonance imaging can make the diagnosis difficult; however, there may be a role for the use of dynamic ultrasound scanning when there is diagnostic doubt [22, 23]. Our patient had an anomalous insertion of his distal biceps femoris tendon as previously described in the literature [5–13].

The biceps femoris complex is a muscle of the posterior compartment of the thigh which functions to extend the hip joint, flex the knee, laterally rotates the leg and contributes to lateral stability of the knee joint. The long head is innervated by the tibial division of the sciatic nerve and the short head by the peroneal division. The blood supply is derived from the inferior gluteal arteries, perforating branches of the profunda femoris and the popliteal arteries. The biceps femoris muscle complex consists of a long head and a short head which are continuous with the iliotibial band anteriorly and the fascia of the lateral compartment of the thigh distally and anterolaterally [3]. Tendons of the long and short head are separated by the fibular collateral ligament before insertion into the fibular head.

The long head has its origin at the ischial tuberosity. Its tendinous insertions can be divided into a posterior (direct) arm which inserts onto the posterolateral edge of the fibular head, lateral to fibular styloid, and an anterior arm which inserts along the lateral edge of fibular head, crossing laterally to the fibular collateral ligament and terminating in lateral and anterior aponeuroses. The anterior arm has also been found to insert into the lateral tibial condyle [4]. The short head of the biceps femoris has its origin medial to the linea aspera of the distal femur with insertions into the tendon of the long head, posterolateral joint capsule and

iliotibial tract. It has tendinous insertions to the fibular head lateral to fibular styloid and medial to fibular collateral ligament [3]. There is also insertion of an anterior arm onto the lateral tibial tuberosity just posterior to Gerdy's tubercle and the proximal part of the lateral tibial condyle superior to the proximal tibiofibular joint capsule [3, 4]. There is also confluence with the popliteus tendon, arcuate ligament, lateral condyle of femur and crural fascia [4].

A number of surgical approaches to symptomatic snapping biceps femoris tendon are described in the literature, and the method applied tends to depend on the abnormality found on radiological investigation or intraoperatively [1, 2, 5–20, 24]. Some recent reports describe their techniques in greater detail [9, 19, 24]. Most cases described are young males with no history of blunt knee trauma; however, many are described as very athletically active or have active occupations. In all cases described, initial conservative measures failed, and the decision was made to explore surgically with all patients eventually returning to normal activities with full resolution of symptoms (Table 1). Some authors describe resection of the fibular head [7, 10, 15–19], but this is the only technique with a reported failure requiring a second operation on the same site to remove the snapping phenomenon [6]. It has also been argued that this technique can lead to rupture of the biceps femoris tendon by attrition or detachment [10]. Other authors describe methods of reinsertion of anomalous tendons either through tunnels formed through the fibular head [1, 2, 6] or directly onto the periosteum [5, 8, 9, 12, 13] with no reported early failure of treatment. Two reports in the literature describe simply releasing the anomalous tendon without any anatomical repair with an equally satisfying return to full mobility [11, 14].

In addition to the variety of surgical approaches to the snapping biceps femoris tendon, there is no current consensus on the best post-operative management. Some authors favour joint immobilisation or restriction of movement of the operated knee for a period of time [1, 2, 5, 6, 9, 13, 17, 24], some allow limited weight bearing [12] or full weight bearing as tolerated [10, 11, 14–16, 18]. There is also limited information regarding long-term outcomes with the longest follow-up of 3 years after the index procedure [6].

The underlying pathology of the snapping biceps femoris tendon is also unclear. The condition may be congenital or a result of high-impact trauma from prolonged sporting or occupational activity. Cadaveric studies of the anatomy of the biceps femoris suggest that insertion of the tendon onto the proximal tibia may form a normal anatomical variant [3, 4]. It may be speculated that snapping of the biceps femoris tendon may be due to a loss of the normal anatomy, and prolonged abnormal movements of the remaining tendon may lead to inflammation with reactive exostosis of the fibular head or thickening of the tendinous insertion with resultant worsening of snapping symptoms over time.

Conclusions and limitations

Snapping biceps femoris tendon is a rare phenomenon with a limited body of literature regarding the optimum management of the condition when it is symptomatic. The diagnosis is formed from the history and a sound clinical examination. Investigation with magnetic resonance imaging where possible is essential to exclude other pathology that can lead to snapping phenomenon around the knee joint and may contribute to diagnosis. Although there is no current consensus on the optimum surgical management of this condition there is agreement that the use of a tourniquet intraoperatively should be avoided to prevent compression of the biceps femoris and falsely obviate the snapping phenomenon after surgical correction. Identification and protection of the common peroneal nerve is essential to avoid post-operative foot drop, and there may be a role for neurolysis.

A lack of information regarding long-term outcomes makes the choice of operative approach challenging. A simple release of the problematic tendon may allow for a quicker return to full mobility, but there is no information on the risk, if any, of post-operative joint instability. Partial resection of the fibular head around which the snapping occurs is the only technique which is reported to have failed and require a second operation on the same site to resolve the symptoms. There may be a greater risk of prolonged immobility and expense to the patient. This technique also fails to address the pathology of an anomalous tendon as the cause of the snapping when it exists. For these reasons we prefer the method of anatomical restoration with a reinsertion of the problematic tendon to a position on the fibular head where the snapping phenomenon is removed. This approach allows for a relatively rapid return to full mobility and may continue to contribute to joint stability around the knee. However, in light of the limited evidence on long-term outcomes, the approach taken by the surgeon continues to depend on whether the snapping is perceived to be caused by an anomalous tendon or prominence of the fibular head and ultimately the preference of the surgeon.

Future directions

To inform the operative approach to the snapping biceps femoris tendon, it would be valuable to produce further case reports and series with an emphasis on any long-term complications or lack thereof for the technique applied. More importantly, further anatomical, intraoperative and magnetic resonance imaging studies to delineate

Table 1 Summary of demographics, intraoperative findings and management of patients described in the literature with snapping biceps femoris tendon

Case report	Age/sex	Injury	Contralateral snapping	Intraoperative finding	Treatment relating to long head of biceps femoris tendon	Post-operative mobility
Fritch and Mhaskar [1]	18/M	None	Not recorded	Abnormal anterior insertion on proximal tibia	Tendon rerouted through tunnel in fibular head	ROM brace to 30° extension for 2 weeks
Bansal et al. [2]	19/M	Present	Absent	Injury to reflected arm of long head of biceps femoris	Tendon rerouted through tunnel in fibular head	Immobilised for 6 weeks
Lokiec et al. [5]	23/M	None	Present	Abnormal anterior insertion on fibular head	Reinsertion of anterior part of tendon posteriorly	Immobilised for 6 weeks
Hernandez et al. [6]	16/M	None	Present	Abnormal anterior insertion on proximal tibia	Tendon rerouted through tunnel in fibular head	Immobilised for 4 weeks
Kristensen et al. [7]	20/M	None	Present	Abnormal anterior insertion on proximal tibia	Partial fibular head excision	Not recorded
Date et al. [8]	15/M	None	Present	Abnormal anterolateral insertion on proximal tibia and lateral fibular head	Reinsertion of tendon onto posterolateral fibular head	Not recorded
Matar and Farrar [9]	49/M	None	Not recorded	Partial avulsion of insertion on fibular head	Reinsertion of sleeve of tendon laterally	Hinged knee brace to 90° flexion for 6 weeks
Bagchi and Grelsamer [10]	22/M	None	Present	Bilateral abnormal anterior insertion on proximal tibia	Bilateral partial fibular head resection with re-operation of left knee	Weight bearing as tolerated
Ernat and Galvin [11]	23/M	None	Not recorded	Abnormal anterior insertion on proximal tibia and thickened anterolateral fibular insertion	Release of abnormal tendon insertions	Weight bearing as tolerated
Bernhardson and LaPrade [12]	28/M	None	Absent	Avulsion of posterior tendon from fibular head	Reinsertion onto posterolateral fibular head	Toe touch weight bearing for 6 weeks
	43/F	None	Absent	Avulsion of posterior tendon from fibular head	Reinsertion onto posterolateral fibular head	Toe touch weight bearing for 6 weeks
	41/F	None	Absent	Avulsion of posterior tendon from fibular head	Reinsertion onto posterolateral fibular head	Toe touch weight bearing for 6 weeks
Kissenberth and Wilckens [13]	20/M	None	Present	Too distal bifurcation of long head tendon	Anterior arm released and anchored posterolaterally	ROM brace limiting full flexion for 6 weeks
Crow et al. [14]	49/M	None	Absent	Normal attachment with subluxation over fibular styloid	Release of subluxing tendon	Weight bearing as tolerated
Vavalle and Capozzi [15]	37/M	None	Absent	Normal attachment with subluxation over normal fibular head	Partial resection of posterior fibular head	Weight bearing as tolerated
McNulty et al. [16]	19/M	None	Absent	Normal attachment with subluxation over prominent fibular head	Partial resection of fibular head	Weight bearing as tolerated
Fung et al. [17]	17/M	None	Present	Normal attachment with subluxation over fibular head exostosis	Bilateral partial resection of fibular head	Immobilised for 1 week

Table 1 (continued)

Case report	Age/sex	Injury	Contralateral snapping	Intraoperative finding	Treatment relating to long head of biceps femoris tendon	Post-operative mobility
Bach and Minihane [18]	24/M	None	Present	Prominent fibular head with normal tendon insertion	Bilateral partial fibular head excision	Weight bearing as tolerated
Hadeed et al. [19]	Not recorded	Not recorded	Not recorded	Prominent fibular head	Partial resection of fibular head and release of anterolateral tibial attachment	Not recorded
Saltzman et al. [20]	16/F	Present	Absent	Abnormal insertion onto proximal anterolateral tibia	Reinsertion of anomalous tendon to fibular head with 'pie-crust' lengthening	Not recorded
	13/F	None	Absent	Abnormal insertion onto proximal anterolateral tibia	Reinsertion of anomalous tendon to fibular head with 'pie-crust' lengthening	Not recorded
Kennedy et al. [24]	Not recorded	Not recorded	Not recorded	Anomalous tendon insertions onto fibular head	Reinsertion of anomalous tendons onto fibular head	Knee immobilised and non-weight bearing for 6 weeks
Our case	15/M	None	Present	Abnormal anterior insertion on proximal tibia	Reinsertion of anomalous tendon to posterolateral fibular head	Weight bearing as tolerated

the normal anatomy and biomechanics of the posterolateral knee could establish whether the pathology is due to anomalous accessory biceps femoris tendons or bony deformities and help inform best surgical practice.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflicts of interest.

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