Bifurcated popliteus tendon: a descriptive arthroscopic study

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Abstract The objective of this study was to confirm the presence and frequency of a bifurcation of the popliteus tendon. The popliteus tendon has received attention due to its important function as a knee stabiliser. Several anatomical variants have recently been reported, one of them being a bifurcated tendon. However, the actual frequency as well as the possible role of this particular variant is still unknown. We prospectively analysed a series of 1,569 arthroscopies between January 2005 to December 2007. Six asymptomatic bifurcated popliteus tendons were found. No alterations in the magnetic resonance imaging were seen and no clinical signs (related to the popliteus tendon) were observed in these patients before surgery. In all cases the morphological variant was found by chance. Our results suggest that the presence of a bifurcated popliteus tendon is a fact and that its frequency, not previously reported, should not be ignored.

Résumé Le but de cette étude est de confirmer la présence et la fréquence de la bifurcation au niveau du tendon poplité. Introduction : le tendon poplité est un élément important de la stabilisation du genou. Plusieurs variations anatomiques ont été rapportées récemment, une d'entre-elles est la bifurcation du tendon. Cependant, la fréquence actuelle de cette anomalie et son rôle restent inconnus. Matériel et méthode: nous avons réalisé une étude prospective sur une série de 1569 arthroscopies de janvier 2005 à décembre 2007. Résultats : six bifurcations du

tendon poplité asymptomatiques ont été trouvées. Aucune altération n'a été mise en évidence à l'IRM, dans tous les cas cette variable morphologique a été trouvée de façon inopinée sans signe clinique. Conclusion : nos résultats nous permettent de penser que la présence d'une bifurcation du tendon poplité est une réalité et que sa fréquence ne peut être ignorée.

Introduction

In recent years, the posterolateral corner of the knee has received much attention. This is because of the significant role it plays in providing posterolateral rotation and varus stability to the joint [2]. This is particularly so in the case of the popliteous muscle (PM). Several functions are attributed to it. Some of those functions are derived from its capacity to invert its origin and insertion point, depending on whether it is fixed on the femur or the tibia. In this way, its two main functions are considered to be the internal rotation of the tibia in the already extended knee and external rotation of the femur over the fixed tibia [5].

Diverse anatomical variance of this structure has been the subject of publication [3, 7]. However, the exact frequency of these variants has not been described.

Thus, the purpose of this study was to confirm the presence and frequency of a bifurcation of the popliteous tendon (PT) in the posterolateral corner of the knee.

Material and methods

A series of 1,569 knee arthroscopies that were carried out over a three-year period were prospectively analysed. The average age of the subjects was 42.4 years (range 7–64 years),

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Fig. 1 One case in which it there appear to be two fascicles of equal thickness going in an identical oblique direction in their intraarticular trajectory

and the proportion by gender was 67.3% male and 32.7% female. The inclusion criterion was a knee arthroscopy performed regardless of whether it was a diagnostic or surgical procedure. The arthroscopies were carried out in three different centres by the same surgical team following the same systematic joint inspection protocol.

The systematic inspection of the knee was started in the suprapatellar bursa. It continued to the femoro-patellar compartment and was then followed by the medial gutter. It passed to the medial compartment, then to the central and lateral compartment. At this point, the morphology and trajectory of the PT and its hiatus above and below the lateral meniscus were visualised. After this, the joint

inspection ascended through the lateral gutter and finished in the suprapatellar bursa.

All data were recorded on a specific surgical data form, and any anatomical variation was recorded and photographed.

Results

The pathology observed at the time of arthroscopy was a medial meniscal tear in 964 cases (61.4%). In 506 patients, the main diagnosis at surgery was an anterior cruciate ligament tear (32.3%) in combination with a medial or lateral meniscal rupture in 412 of those knees (26.2%). Five patients (0.3%) were treated for synovial pathology. Finally, the arthroscopy was performed before open surgical treatment (e.g. osteotomy, patellar realignment, and uni-compartmental prosthesis) on 94 patients (6%).

Six bifurcations of the PT (0.4%), visualised through the hiatus and/or below the lateral meniscus, were found. In all of the cases, a double fascicle of the same size and thickness with a parallel trajectory (Fig. 1) was clearly observed. A bifurcation that originated proximal to the lateral meniscus which ran parallel along the popliteal hiatus and distal to the meniscus was seen in five of the six cases. A bifurcation that started out in the inframeniscal zone was observed in the remaining case (Fig. 2a). At first glance and suprameniscally seen, that unique case had the appearance of being a single tendon (Fig. 2b). When the arthroscope was introduced under the external meniscus and pushed up at the level of the hiatus, it was easy to see both fascicles of the bifurcation following the single tendon.

The six cases of popliteus tendon bifurcation presented different pathologies. The surgery was performed for an

Fig. 2 **a** In this case, a left knee, the bifurcation started out in the inframeniscal zone. **b** At first glance and suprameniscally, this case (also seen in Fig. 2a) had the appearance of being a single tendon

internal meniscal tear in two cases and for an external meniscal tear in three cases. No pathology was found via arthroscopy in the remaining case.

All patients in this study had preoperative magnetic resonance imaging (MRI). There were no alterations in the MRI of the aforesaid morphological variant at the posterolateral corner in any of these cases. Neither were there any changes at the level of the popliteus musculature.

Discussion

After studying a large number of knee arthroscopies with a systematic protocol, the presence of a consistent morphology for the PT was verified. Furthermore, the existence of a morphological variant consisting of a bifurcation of this tendon was observed in a low percentage of the cases.

Testut [9], in his classical treatise from more than a hundred years ago, probably observed a similar finding. The author described a variant of the PTs anatomy based on the existence of two muscular heads in the form of a biceps.

The lateral and posterior aspects of the knee have been extensively studied in recent years [3–5, 8]. Maynard et al. [6], in a cadaveric study, expounded on the presence of a tendon of the popliteus that can be separated into two distinct fascicles. It proposes that a PT divided into two fascicles of almost equal size clearly appears upon pulling back the capsular tissue that exists between the PT and the lateral meniscus. One of those fascicles continues toward the popliteus muscle and the other leads to and is inserted directly into the most proximal and posterior aspect of the fibular head [6].

Aronowitz et al. [1], more recently, concluded that there are vertically-oriented fibres descending from the inferior surface of the intraarticular portion of the PT at the popliteal hiatus that can be identified during arthroscopy. According to Maynard et al. [6], these fibres correspond to those of the popliteofibular ligament.

Perez Carro and Sumillera [7] appear to be the first to report a consistent variant of the normal anatomy consisting of a bifurcation of the PT at the level of the hiatus. It was found, by chance, during a knee arthroscopy.

One of the aims of our work was to verify the presence of this particular variant of the popliteus tendon. Arthroscopically, it appeared that there were two fascicles of equal thickness going in an identical oblique direction along their intraarticular trajectory. These bifurcated tendons were also followed along their course starting from the suprameniscal region passing through the hiatus and arriving to the muscle belly. These findings permit us to affirm that we are dealing with a true bifurcation of the PT, contrary to what some authors have stated [1, 6].

Our results suggest that the presence of a bifurcated PT is a fact and that its low frequency, not previously reported, should not be ignored. Also, we postulate that there is no relationship between the observed pathology in the knee and the presence of a popliteus bifurcation.

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