

Anatomic Variant from Link between Medial Meniscus and Posterior Cruciate Ligament: A Case Report in Young Adult

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Abstract

Menisci congenital anomalies are rare morphologic abnormalities. The most frequently observed meniscal abnormality is discoid meniscus. Other congenital malformations including ring-shaped meniscus, accessory meniscus, double-layered meniscus, hypoplastic meniscus, and insertional abnormality are rare. The most frequently affected femoro-tibial compartment is the lateral one. We discuss a case of a 20 year-old male patient, whose Magnetic Resonance Imaging showed a bridging accessory bundle connecting the posterior cruciate ligament with the posterior horn of the medial meniscus. To the best of our knowledge the meniscal variation presented in this study was not described in any other study on meniscal abnormalities before. The recognition of meniscus variants is important as they can be misinterpreted for meniscal fragments or more significant pathology on magnetic resonance images.

Keywords: Knee; MRI; Anatomical meniscus variants

Introduction

The menisci act as shock absorbers and are important stabilizers of the knee joint [1]. The menisci in human embryos develop from an intermediate mesodermal blastema, which has thick-plate shape, and are fully defined approximately eight weeks after conception [2-4]. The existence of abnormal shaped menisci has long been known. Reporting these anomalies is important because they can lead to conditions limiting daily physical activities, and also because they can mimic clinical and radiological signs of a meniscal tear. The most frequently observed meniscal abnormality is discoid meniscus (DM). Other congenital malformations including ring-shaped meniscus (RSM), accessory meniscus, double-layered meniscus, hypoplastic meniscus, and insertional abnormality, are rare [5,6].

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Although these abnormalities can affect both femerotibial compartments, they are much more common in the lateral one [7-9]. We present a case report of an anatomical variant of the medial meniscus. To the best of our knowledge, there are no reports on bridging accessory bundles connecting the posterior cruciate ligament with the posterior horn of the medial meniscus.

Case Presentation

A 20 year-old male professional soccer player was referred to our department due to a 2-months history of right knee pain after a weight-bearing valgus stress injury occurred during exercise.

Magnetic resonance imaging (MRI) revealed a peripheral vertical longitudinal tear of the posterior horn of the medial meniscus with associated posterior superior meniscocapsular tear referred to “type 1 ramp lesion of the medial meniscus” (Figure 1). Moreover, MRI showed a "double posterior cruciate ligament" with anomalous appearance at tibial insertion, referred to an accessory bridging bundle that connected the posterior cruciate ligament (PCL) with the medial meniscus posterior horn (Figure 2 and 3). A differential diagnosis between meniscal tibial attachment lesion and anatomical variant was considered.

Subsequently an arthroscopic examination was performed and confirmed the anatomical variant previously detected by MRI. Ramp lesion was repaired, patient developed no postoperative pain and the results were satisfactory.

To the best of our knowledge, this is the first report of a bridging accessory bundle connecting the posterior cruciate ligament with the posterior horn of the medial meniscus.



Figure 1 MRI: Sagittal proton density (DP) fat saturation weighted image at the level of medial meniscus horns showing a peripheral vertical longitudinal tear of the posterior horn of the medial meniscus (white arrow) with associated posterior superior meniscocapsular tear (red empty arrow) referred to “type 1 ramp lesion of the medial meniscus”.



Figure 2(A-C) MRI: Coronal DP fat saturation weighted image from anterior to posterior. An accessory "bridging" bundle (red arrowhead) that connected PCL (empty arrow) with the medial meniscus posterior horn (white arrow).

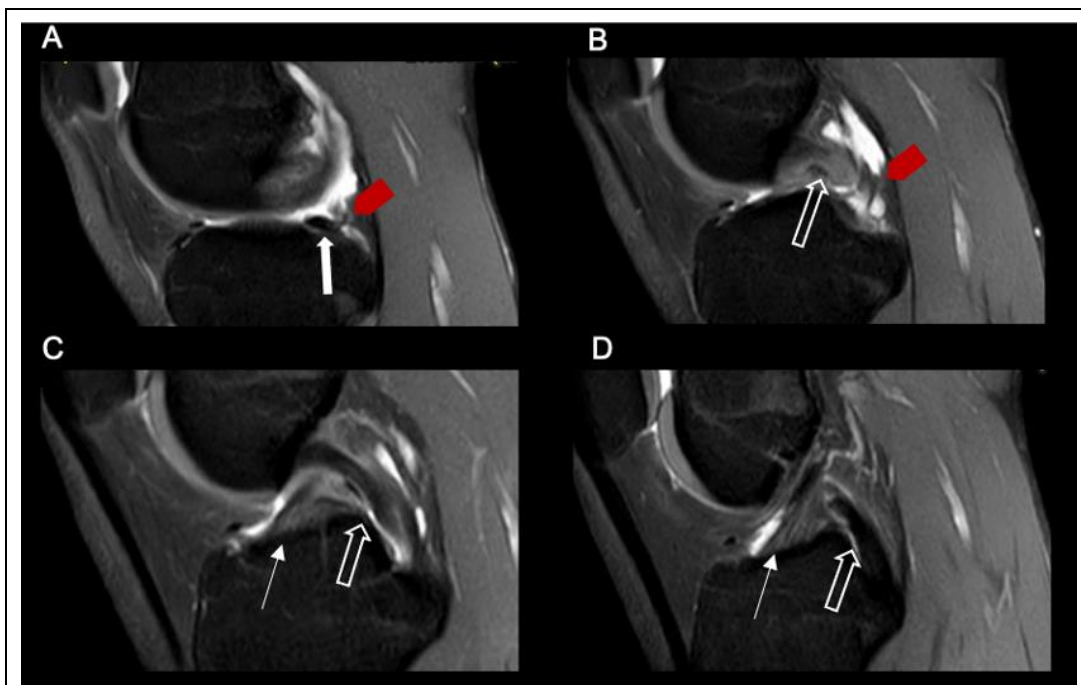


Figure 3(A-D) MRI: Sagittal DP fat saturation weighted image from medial to lateral revealing an accessory connection (red arrowhead) between PCL (empty arrow) and the medial meniscus posterior horn (white arrow). ACL (white thin arrow).

Discussion

The menisci are important stabilizers of the knee joint and act as shock absorbers [1]. Each meniscus can be anatomically divided in three parts: anterior horn, body, and posterior horn. The function of both anterior and posterior horns is to secure the menisci to the tibial plateau; these are critical structures for their biomechanical function [10,11]. Lesions in this region cause a loss in menisci biomechanical function, leading to an early degeneration of the articular cartilage, and, thereby, causing osteoarthritis [12].

The menisci develop in human embryos from an intermediate mesodermal blastema, which has thick-plate shape, and are fully defined approximately eight weeks after conception [2-4]. Meniscal variants are frequently identified on routine MRI and most commonly involve the lateral meniscus (77%) [13].

Among the morphological variations of the menisci, the most common is the discoid meniscus, which probably has an embryological etiology. Watanabe classified discoid meniscus abnormalities into three categories [1]: complete discoid meniscus [2], incomplete discoid meniscus [3], and Wrisberg-ligament meniscus [14]. In 1998 Monllau et al. proposed to include the ring-shaped meniscus (RSM) as a fourth variant in this classification [15].

Discoid meniscus resembles a disk instead of the usual shape, while the ring-shaped meniscus presents a circular form, with its external part being similar to the one of a normal meniscus. Recognizing RSM is of crucial importance since it can show at MRI a fragment-like meniscus structure located in the intercondylar notch, very similar to the "fragment in the intercondylar notch sign" observed in displaced bucket-handle tears. The clinical presentation of these abnormalities is variable, from asymptomatic to the presence of pain, crepitation, and decreased range of motion, especially in children and young adults [11,16]. With the exception of the lateral discoid meniscus, other malformations are infrequent, having a total incidence of 0.3% [17]. These anatomical changes include double layered menisci, meniscal ossicle, or insertional abnormalities, such as anomalous insertion of the meniscus posterior horn into the anterior cruciate ligament [6,18].

Through a literature review, there's a number of variants of intermeniscal ligaments, including the anterior and posterior (transverse) ligaments and the oblique intermeniscal ligament [19]. A study conducted on cadavers of Ghana's population on the anatomy of the menisci, found an anomalous insertion of medial meniscus anterior horn in the anterior cruciate ligament ACL in 35 knees [20]. The anomalous insertion of the medial meniscus anterior horn in the ACL may also occur in the posterior horn of the medial or lateral meniscus. Sadigursky et al report a case of a 36year-old Hispanic man presenting with knee pain, locking and effusion. MRI showed anatomical abnormality of the menisci corresponding to the junction of the posterior horns of the menisci in tandem with the insertion of the posterior meniscus fibers in the anterior cruciate ligament [21]. Ossola et al reported a case of a 35year-old male patient presenting with a two-month history of right knee pain after a weight-bearing valgus stress injury occurred during exercise. MR arthrography showed a bridging accessory bundle connecting the anterior cruciate ligament and posterior cruciate ligament with the posterior horn of the lateral meniscus [22]. To the best of our knowledge the meniscal variation presented in this study was not described in any other study on meniscal abnormalities.

Additional investigation of similar cases is required so that a suitable description can be added among the possible anatomical variations of the menisci.

Conclusion

This is the first study describing a meniscus anatomical variant with isolated posterior junction of the medial meniscus posterior horn with an anomalous insertion to the posterior cruciate ligament. The recognition of meniscus variants is important as they can be misinterpreted for more significant pathology on magnetic resonance images.

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Authors' Contributions

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Cristiana Fanciullo, and Eugenio Annibale Genovese. The first draft of the manuscript was written by Cristiana Fanciullo and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Acronyms and Abbreviations

ACL: Anterior Cruciate Ligament; **DM:** Discoid Meniscus; **DP:** Proton Density; **RSM:** Ring-Shaped Meniscus; **MRI:** Magnetic Resonance Imaging; **PCL:** Posterior Cruciate Ligament.

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