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Normal Magnetic Resonance Imaging Anatomy of the Capsular Ligamentous Supporting Structures of the Knee

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Abstract

Recognition of the normal magnetic resonance (MR) imaging appearances of the capsular ligaments of the knee is of great importance. These ligaments contribute to stability of the knee joint and are frequently injured. In this article, we describe the normal MR imaging anatomy of the capsular ligaments of the knee including the lateral and medial collateral ligamentous complexes, the extensor mechanism, and the supporting ligamentous structures of the proximal tibiofibular joint. Normal MR imaging findings and important anatomic variants of the neurovascular structures of the knee are also described.

Résumé

Il est essentiel de reconnaître les aspects d'imagerie normaux que présentent les ligaments capsulaires du genou à l'examen d'imagerie par résonance magnétique (IRM). Ces ligaments contribuent en effet à stabiliser l'articulation du genou et font souvent l'objet de blessures. Dans le présent article, nous présentons les caractéristiques anatomiques normales des ligaments capsulaires du genou (notamment celles associées aux formations ligamentaires latérales externes et internes, à l'appareil extenseur et aux structures ligamentaires de soutien de l'articulation tibio-fibulaire proximale) observées par IRM. Nous passons également en revue les résultats d'IRM normaux et les variantes anatomiques associés aux structures neurovasculaires du genou.

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The knee is a hinged synovial joint composed of the medial and lateral femorotibial compartments, patellofemoral compartment, and the proximal tibiofibular joint. The capsular ligamentous structures of the knee joint are complex. Knowledge of normal magnetic resonance (MR) imaging anatomy of these structures is important for further understanding and evaluation of complex ligamentous injuries.

In this article, we describe normal MR imaging findings of the medial and lateral supporting ligamentous structures

and the extensor mechanism of the knee joint as well as the ligamentous structures of the proximal tibiofibular joint. The neurovascular structures of the knee and their important anatomic variants are also described.

Lateral Supporting Ligamentous Structures

The lateral supporting ligamentous structures of the knee are divided into 3 layers [1] (Figures 1-7). The structures of the posterolateral corner are crucial for posterolateral stabilization of the knee and resist posterior translation, varus angulation, and external rotation [2–4]. The popliteus tendon is a dynamic stabilizer while the other structures are static stabilizers of the knee [2,3].

The structures in layer 1 are shown in Figures 1 and 2. This layer consists of the lateral fascia, iliotibial band, and long

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Figure 1. Iliotibial (IT) band at the lateral aspect of the knee shown on PD-w fat saturated coronal magnetic resonance image. The IT band (solid arrows) is part of layer 1 of the lateral supporting capsular ligamentous structures of the knee, representing a continuation of the tensor fascia lata and inserting onto Gerdy's tubercle of the proximal tibia.

and short head biceps femoris tendons. The iliotibial band, which represents the continuation of the tensor fascia lata, is found anteriorly, inserting on Gerdy's tubercle of the proximal tibia. The biceps femoris tendons are found posteriorly,

with the majority of distal fibers inserting on the fibular head or styloid [1]. The long head of biceps femoris tendon has 2 arms—the direct arm attaching to the anterior and posterolateral aspects of the fibular head and the anterior arm inserting slightly anterior to this region [5]. The short head of biceps femoris tendon is also composed of 2 arms—the direct arm inserting just anterior to the fibular styloid process and medial to the anterior arm of the long head of biceps femoris tendon, and the anterior arm inserting onto the superolateral edge of the lateral tibial plateau [5]. The common peroneal nerve lies posterior and deep to the biceps femoris tendon.

Layer 2 consists of the lateral patellar retinaculum and patellofemoral ligament (PFL). In layer 2, the lateral retinaculum of the quadriceps muscle is found anteriorly and the PFL is found posteriorly [1]. Layers 1 and 2 are adherent to each other at the lateral margin of the patella.

Layer 3 consists of the posterolateral corner and usually includes the popliteus tendon, fibular collateral ligament (FCL), popliteofibular ligament (PFL), and the posterolateral joint capsule [2]. The posterolateral capsule is reinforced by the arcuate and fabellofibular ligaments (FFL), which are also considered posterolateral corner structures [2,4]. This is the deepest layer, which is illustrated in Figure 3.

The layer 3 structures are attached to the edges of the proximal tibia and fibula and distal femur [1]. The coronary, or meniscotibial, ligament extends from the lateral joint capsule to the inferior peripheral margin of the lateral meniscus [1]. There is a hiatus in part formed by this ligament through which the popliteus tendon courses. Superficial and deep divisions of the joint capsule are separated by the lateral geniculate artery, a division of the popliteal artery [1,3]. The superficial capsular division encompasses the

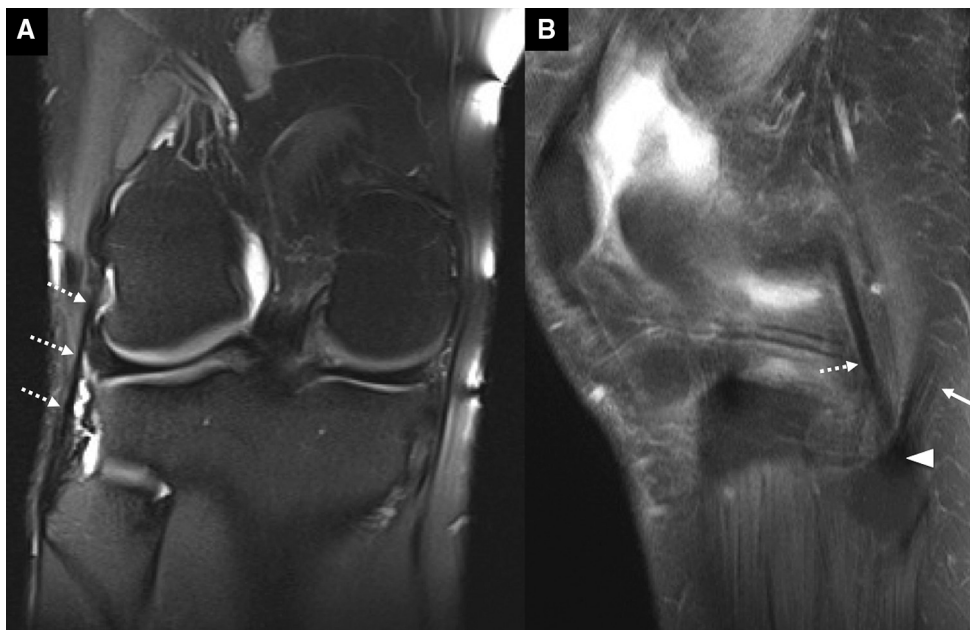


Figure 2. Fibular collateral ligament (FCL) at the lateral aspect of the knee shown on PD-w fat saturated magnetic resonance (MR) images. (A) Coronal MR image shows the FCL (dashed arrows), which is part of layer 3 of the posterolateral corner of the knee. The FCL attaches to the lateral femoral condyle proximally and upper facet of the fibular head distally. (B) Sagittal MR image at the level of the fibular head shows the FCL (dashed arrow) and biceps femoris tendon (solid arrow), which is part of layer 1, forming a conjoint tendon (arrowhead) about their fibular attachments.

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