

Specialty area: MSK  
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### Highlights

- Discussion of ACL and PCL partial rupture
- Discussion of meniscal roots and cartilage delamination
- Discussion of postoperative imaging findings

**Talk Title:** Knee

**Target Audience:** Radiologists

**Objectives:** To discuss and learn about findings in knee MR of professional athletes which are frequently missed or difficult to interpret.

### Abstract

MR imaging of the knee joint is a very frequent imaging examinations in professional athletes. Usually, there is good knowledge among radiologists with regard to the most common abnormal findings in the knee which include complete tears of anterior cruciate ligament, medial and lateral collateral ligaments injuries, as well as lesions of the meniscus (1). However, there are some typical diagnoses, which are challenging and thus often not exactly described, missed or misdiagnosed.

Anterior cruciate ligament (ACL) tears are the most common complete ligamentous injury in the knee (2). The presence of partial ACL tears however is often controversy discussed and interpretation of MR signal abnormalities within an partially intact looking ACL is difficult (3). This review lecture will provide some arguments when partial tears of the ACL should be considered in patients with ACL abnormalities on MR images. In the literature, there are reports that partial tears represent 10% to 28% of all ACL tears. Criteria of diagnosis include the absence of findings of complete ACL tear in conjunction with discrete focuses of high signal intensity within the midsubstance of the ACL or high signal intensity changes at the insertions with a normal ACL course. The non-visualization of the ACL on one MR imaging sequence with visualization of the fibers on other sequences or the bowing or undulating course of otherwise intact ACL may also indicate a partial ACL tear. Partial tearing may effect one or both bundles of the ACL, which means that one bundle, can be torn completely with the other bundle being partially torn at the same time.

Posterior cruciate ligament tears are less frequent than ACL tears, however sometimes also challenging (4). There are reports that partial tears represent 55% of all PCL tears. Criteria of diagnosis include the presence of increased signal intensity with discernible fibers along the

course of the ligament. The partial tear can be interstitial or can involve one of both PCL bundles. In partial interstitial tears, there is an increased longitudinal ligamentous signal intensity without disruption of the fibers. In these cases, the PCL bundles can be separated by the signal intensity changes. The findings of interstitial tear of PCL must be correlated with an appropriate history of trauma in order to differentiate from a mucoid degeneration of PCL i.e. in mid-aged patients.

In professional athletes, ACL or PCL reconstruction is a frequent therapy for ACL or PCL tears. Post-operative MR imaging can show tunnel misplacement, re-tears, tunnel cysts, infection, arthrofibrosis, and/or hardware related complications.

Meniscal root tears, displaced meniscal tears as well as tears in the posterior horn of the lateral meniscus are also commonly missed diagnoses in the knee (5). Radiologists should be aware of these abnormalities since they may be clinically relevant and treatment may be altered. Radiology reports should also specifically emphasize on radial, vertical, complex, or displaced meniscal tears since they appear more clinically relevant compared to horizontal and oblique meniscal tears. The latter are also frequently encountered in asymptomatic patients (6).

In professional athletes, arthroscopy with some form of meniscal repair is a frequent therapy for meniscal injury. Thus, postoperative imaging MR imaging of the postoperative meniscus is frequently ordered. Image interpretation is based on the evaluation of the meniscus shape, contour, and volume and intrameniscal changes. The MRI appearance of the meniscus after partial meniscectomy may vary from a normal meniscus shape and size (after minimal meniscectomy) to a diminished meniscal volume with or without truncation of the free edge (after mid- to large-volume meniscectomy). Total meniscectomy implies total removal of the meniscus and is followed by fibrous regeneration within 3 weeks to 3 months. In this case, the “new meniscus” is seen as a thin and small inhomogeneous signal intensity structure (Fig 5.). Autologous meniscal transplantation is rarely used but may be an option in some patients with irreparable tears or with failed prior meniscectomy. On postoperative MR images, susceptibility artifacts along the capsular margins and small linear defects in tibia are present. There is likely an altered intrameniscal signal that may be normalized after 6 to 12 months after transplantation. Most meniscal transplants show degeneration of the posterior horn and, in the case of allograft failure, fragmentation, meniscal detachment and extrusion, and cartilage defects are possible MR findings.

In the knee, radiologists often report on ligamentous structures and meniscus in detail, but often they report only little on the cartilage i.e. in the femoro-tibial compartment. Since the cartilage is relatively thin compared to the patellar cartilage, it is crucial to use state-of-the-art MR imaging technique to allow proper cartilage evaluation and to detect subtle injuries e.g. cartilage delamination. In this lecture, the advanced techniques for cartilage MR imaging such as dGEMRIC and T2\*/T2 mapping will be reviewed, but only briefly as most of these techniques are not clinically available or used. It is however important to understand the capabilities of these techniques as, in the future, they may allow detection of cartilage abnormalities in a pre-clinical stage where the surface of the articular cartilage remains intact.

Postoperative cartilage imaging will also be discussed, but not in depth as many procedures (MACI, ACT) are only performed in dedicated centers.

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