Pictorial Magnetic Resonance Imaging Findings in Common Sports Injuries of Knee

Mahesh Prakash, Anindita Sinha, Mandeep Dhillon, Niranjan Khandelwal

ABSTRACT

Magnetic resonance imaging (MRI) is often modality of choice to evaluate the sports related injuries involving knee joint. It is important for the clinicians to identify the common injuries pattern seen on MRI for quick management.

Keywords: Knee joint, Magnetic resonance imaging, Sports injuries.


Source of support: Nil

Conflict of interest: None

INTRODUCTION

Knee joint is one of the common joints affected in sports injuries, predominantly contact sports where twisting movements of the knee are involved. These injuries may affect bones, cartilage, menisci, ligaments, and other soft tissues with complex structure involvements being more common in comparison with isolated structures. Magnetic resonance imaging (MRI) is now widely used for imaging of internal structures of the knee. Although MR protocol for evaluating these injuries can be variable in different centers, typical MR protocol includes proton density (PDW) in sagittal and coronal planes with or without fat saturation, STIR/fat sat T2W in one plane, and T1W in one/two planes. Added sequences can be done depending upon the situation and further need for evaluation. Basic knowledge of common imaging findings on MRI is helpful to the clinicians for the best possible management of these injuries.

Anterior Cruciate Ligament Injuries

Anterior Cruciate Ligament (ACL) injuries are one of the common findings in knee joint trauma. The ACL is attached to the posteromedial aspect of the lateral femoral condyle with tibial attachment at the anterior tibial spine. On sagittal MR images, the normal ACL fibers are parallel to the intercondylar roof and have a striated appearance (Fig. 1). The common location of ACL tear is in the middle portion; however, tear can occur in proximal and distal attachments also. Magnetic resonance imaging has high sensitivity and specificity of >95% in diagnosing acute complete ACL tears. The primary signs of ACL injuries are non-visualization of ligament and discontinuity with altered MR signal (Fig. 2). The secondary signs are characteristic bone contusions, uncovered posterior horn of the lateral meniscus, anterior tibial translation, and buckling of the posterior cruciate ligament (PCL) (Fig. 3). Occasionally, intact ACL may be seen in case of its avulsion of its tibial attachment (Fig. 4).

PCL Injuries

Posterior cruciate ligament is twice as strong as the ACL and uncommonly injured. Posterior cruciate ligament originates from the medial femoral condyle and inserts onto posterior tibia in the middle part. Normal PCL shows uniform hypointense signal on all sequences (Fig. 5). It is also commonly injured in the middle portion and seen as a thickened and increased signal on MRI.

Fig. 1: Fat-saturated proton density sagittal image shows normal ACL in intercondylar groove parallel to the intercondylar roof, with striated appearance and straight anterior margin (arrow)
Collateral Ligament Injuries

Medial collateral ligament (MCL) comprises superficial and deep components. The superficial component originates from the medial femoral epicondyle and inserts at the proximal tibia on the medial aspect (Fig. 7). The MRI findings of MCL injuries include disruption of its fibers, thickening, and increased T2W/PDW-signal (Fig. 8). These findings are best seen on the coronal PDW MR images. The lateral collateral ligament (LCL) originates from the lateral femoral condyle and inserts on the fibular head. It can have a common attachment with the tendon of biceps femoris. An acute LCL tear appears as a lax or discontinued ligament on MRI scan (Fig. 9).

Meniscal Injuries

Menisci are C-shaped fibro-cartilaginous structures attached to the condyles of the tibia. The peripheral component of the meniscus is thicker than the central portion and also has more vascularity. The menisci show
low signals on all MR pulse sequences with a typical “bow-tie” configuration on sagittal MR images (Fig. 10). On MR imaging, meniscal tear is diagnosed when there is a linear area of increased signal extending to the articular surface\(^4\) (Fig. 11). This finding has an accuracy of >90%.\(^5\) Meniscal tear can be classified according to signals extending in vertical or horizontal planes. Acute tear mostly occur in vertical planes, which can be longitudinal, radial, or oblique types. Sometimes, the inner fragment of meniscus displaces into the center or the intercondylar notch, which are called bucket-handle tears with the latter creating a “double PCL” sign (Figs 12A and B). Longitudinal tears of the menisci are usually degenerative in nature.

**Bony Injuries**

Bone injuries can be in the form of bone bruise/contusions or fractures. Bone edema appears hypointense on T1W and hyperintense in PD/T2W images\(^6\) (Fig. 13). Many times MRI can show the fracture that was occult on plain X-ray.

**Cartilage Injuries**

Hyaline cartilage covers the articular surface of bones of the joint. Cartilage injury may be seen as focal hyperintensity in the cartilage, focal disruption, or in the form of osteochondral fractures.
Fig. 10: T1 weighted sagittal image shows normal bow-tie appearance of meniscus (arrows)

Fig. 11: Fat-saturated proton density sagittal image shows tear of posterior horn of meniscus (arrow)

Figs 12A and B: (A) Fat-saturated proton density weighted coronal, and (B) sagittal show bucket-handle tear of meniscus with appearance of double PCL sign

Other Injuries

Other structures that can be injured are extensor mechanism structures, including patella, quadriceps muscles/tendon, patellar tendon, and patellar retinaculi. Quadriceps and patellar tendons are best assessed by sagittal MR sections (Fig. 14) while patellar retinaculum injuries are best imaged on axial sections. Other findings that can be seen in patients with significant knee trauma are hem/lipoarthrosis (Fig. 15) and soft tissue swelling/hematoma.

SUMMARY

Magnetic resonance imaging is very important imaging modality for evaluation of sports injuries involving the knee joint as it can evaluate every component/structure of the joint, which are useful for guiding clinicians for further management of these injuries.

Fig. 13: Fat-saturated proton density weighted sagittal image shows bone contusions in femoral condyles
Pictorial Magnetic Resonance Imaging Findings in Common Sports Injuries of Knee

Fig. 14: T2-weighted axial image shows tear of quadriceps tendon (arrow)

Fig. 15: T1-weighted sagittal image shows lipo-hemoarthrosis of knee joint extending into supra patellar bursa (*)

REFERENCES