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Original Research Paper

Radiology

MRI: A CASE REPORT HIGHLIGHTING NEW POTENTIAL PITFALLS IN MRI SIGNS OF DISPLACED MENISCAL TEARS

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ABSTRACT For meniscal injuries, MRI has been proven to be an excellent modality in imaging. Various MRI signs have been described to detect displaced meniscal injuries, specifically the bucket-handle tears. Although these signs are useful in identifying meniscal injuries, they have also been linked to a number of pitfalls. The presence of a linear hypointense soft tissue anterior to the ACL, which indicated the flipped bucket-handle rupture of the meniscus, is known as the double anterior cruciate ligament (ACL) sign. Asymmetrically thickened horns of the menisci due to overlaying displaced meniscal fragments cause disproportional posterior horn and flipped meniscus symptoms. We present a case in which an MRI of the knee revealed a tear and dislocation of the medial patellofemoral ligament (MPFL), vastus medialis complex, medial collateral ligament (MCL), and posterior cruciate ligament (PCL) that matched these symptoms. Internally displaced MPFL and MCLs have not yet been described as mimics for displaced meniscal fragments, to our knowledge.

KEYWORDS : Bucket handle tear; disproportional posterior horn; double anterior cruciate ligament sign; flipped meniscus sign; knee; magnetic resonance imaging

INTRODUCTION

Tears in the menisci are common after a knee injury, with a piece of the torn meniscus displaced away from the meniscus. Because most displaced meniscal tears require surgical intervention in the form of reattachment or removal, it is critical that the radiologist recognises them. Various publications have described multiple magnetic resonance imaging (MRI) signals that suggest the presence of misplaced meniscal tears in general, and bucket handle tears in particular.[1,2] Despite the fact that these indications are highly useful, it is important to be aware of the numerous mimics of these signs.

Case Report

A 40 year old male was referred to our radiology department for a MRI of the right knee with history of road traffic accident (RTA). MRI was performed on 1.5 T system (Siemens 1.5T Magnetom Sempra – 156 channel) and sequences were acquired in sagittal [T1weighted (T1W), T2 weighted (T2W), proton density (PD)-fat saturated], coronal [T1W, short tau inversion recovery (STIR)], and axial (T2W) planes.

MRI shows the evidence of soft tissue and multiple bony injuries with concomitant mild synovial effusion. There was increase in medial tibiofemoral joint space with anterosuperior subluxation of the medial femoral condyle. Minimal bony contusions were also seen in the tibial and femoral condyles. MRI also showed complete tears of the anterior and posterior cruciate ligaments at its proximal attachment site with redundant distal ligaments.

On sagittal T1W and T2W images through the intercondylar fossa MRI showed interesting observations, which showed linear band like soft tissue anterior to the ACL (double ACL sign) [Figures 1 and 2].

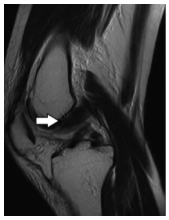

Figure 1: MRI sagittal T2W image through the intercondylar fossa shows, thick "band-like" soft tissue (arrow) anteriosuperior to the ACL, mimicking the double ACL sign

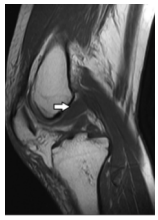

Figure 2: MRI sagittal T1W image at the same level as Figure 1 shows, the thick band-like soft tissue (arrow) isointense to the anterior cruciate ligament

And also, on sagittal T2W sequences a wedge shaped soft tissues were seen overlying the medial meniscus at its posterior horn, resembling a "flipped (posterior) meniscus sign" or "disproportional posterior horn sign" [Figures 3 and 4].

Figure 3: MRI sagittal T2W image through the medial aspect of the knee joint shows, a wedge-shaped soft tissue (arrow) superior to the body and posterior horn of medial meniscus, resembling the "posteriorly" flipped meniscus sign

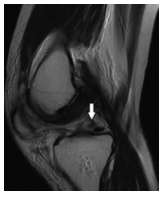

Figure 4: MRI sagittal T2W image through the intercondylar fossa of the knee joint shows, a small triangular soft tissue (arrow) seen superior to the posterior horn of medial meniscus, resembling the disproportional posterior horn sign

These findings seen on MRI were suspicious of displaced meniscal tears.

These "signs" were revealed to be deceiving after further investigation. The "double ACL sign" was caused by the vastus medialis complex being pushed into the joint area due to a ruptured medial patellofemoral ligament (MPFL). [Figures 5A-C].

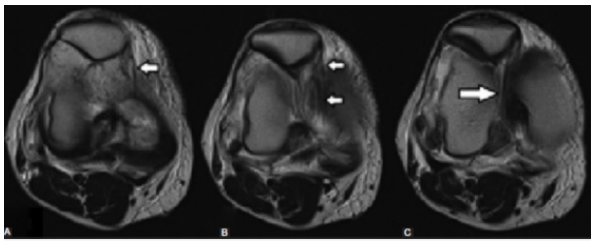

Figure 5 (A–C): MRI axial T2W images at the level of patellofemoral joint shows, torn medial patellofemoral ligament which is displaced internally (arrow), causing a fallacious double ACL sign

The medial collateral ligament (MCL) was totally detached from its femoral attachment and displaced into the medial joint space, as seen on coronal STIR sequences. It was observed laying over the medial meniscus at the body level [Figures 6A-C]. The torn PCL's proximal end was also found laying over the posterior horn of the medial meniscus (demonstrated through consecutive images in Figures 7A-C). The "thick" posterior horn of the medial meniscus resulted from these components. Following that, the menisci were determined to be normal in mass, with no indication of truncation, supporting the "pseudosigns."

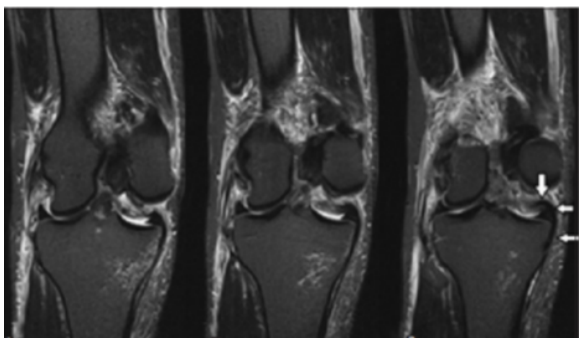

Figure 6 (A–C): MRI coronal STIR images shows, complete tear of the femoral attachment of medial collateral ligament. The torn ligament is seen internally displaced and lying superior to the medial meniscus (arrows)

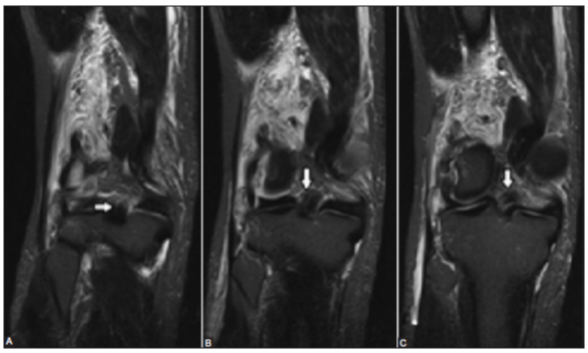

Figure 7 (A–C): MRI coronal STIR images in the posterior aspect of the knee joint shows, torn redundant PCL (arrow) lying over the posterior horn of medial meniscus

DISCUSSION

MRI has proven to be quite helpful in identifying misplaced meniscal tears, particularly bucket handle tears. Because misplaced meniscal tears frequently necessitate surgery, MRI is frequently requested to detect them.

Bucket handle tears are meniscal tears that have an attached fragment that has been displaced away from the meniscus. On MRI, a variety of signs have been documented to diagnose such tears.

A displaced meniscal fragment lying anterior and parallel to the PCL is represented by a double PCL sign. A flipped meniscus sign is a meniscal fragment that is anteriorly displaced and lies superior to the normal anterior horn.[3,4] The absent bow tie sign is defined as the visualisation of only one or no meniscal body segment in consecutive peripheral sagittal MR images.[5] The misplaced meniscal fragment and complete anterior horn are positioned in the same horizontal plane in the double anterior horn sign.[6] On sagittal MR images, the presence of a bigger meniscal posterior horn in the central portions than in the peripheral sections is known as the disproportional posterior horn sign.[7]

Aydingoz et al.[8] investigated various MRI signs of meniscal bucket handle tears and compared the MRI findings and arthroscopic classification of misplaced meniscal tears in a large study encompassing 654 menisci in 327 participants. According to them, the fragment in the notch and the absence of bow tie indications were the most common and sensitive MRI signs of meniscal bucket handle tears in arthroscopically verified cases of such tears (98% frequency for each). The symptoms of a double PCL, flipped meniscus, double anterior horn, and disproportional posterior horn were less common and sensitive (32, 29, 29, and 27 %, respectively). They also discovered that all patients with at least three of the six MRI signs of meniscal bucket handle tears had an arthroscopically verified bucket handle tear. In their investigation, MRI sensitivity (as well as positive predictive value) was 90%.

The absence of bow tie sign had a high correlation with misplaced meniscal tears[8] and was not seen in our case, demonstrating the sign's use. However, in many circumstances, such as people who have had previous surgery (meniscectomy), small menisci (children and small adults), or osteoarthritis with free edge maceration or wearing, the absence of a bow tie sign has been proven to be a false positive.[5]

Takayama et al.[9] recently published the double ACL sign, a new MR sign for buckethandle tears in which the displaced meniscal fragment was seen in front of the ACL on sagittal MR. They theorised that this happens when a longitudinal tear in the medial meniscus's anterior horn extends to the posterior horn. They did not, however, identify any probable mimics or traps for this indicator. An internally displaced MPFL and/or vastus medialis can resemble this indication, as shown in our example.

In 324 patients with lateral patellar dislocation, Guerrero et al.[10] looked at the MRI characteristics of MPFL damage. In 195 cases, MPFL tears were observed. Loose bodies, patellar avulsion/fracture, meniscal tears, MCL tears, and osteochondral lesions were all related with MPFL tears. In none of the cases, however, was torn MPFL discovered displaced in the intercondylar fossa.

The prevalence of disproportional posterior horn sign has been estimated to be between 21 and 27 % by various authors.[7,8] On arthroscopy, this result has been found to be false positive in individuals with a degenerative medial meniscus and posterior horn lacerations.[8] A ruptured PCL or MCL lying on the meniscus might also cause aberrant thickening of the menisci, according to our findings.

In a survey of 3686 MRI exams of the knee, Lecas et al.[11] found 11 occurrences with torn meniscal fragments displaced inferiorly between the MCL and the tibia. They also highlighted that misplaced meniscal fragments can be

misinterpreted for semimembranosus tendon. We'd like to highlight that when meniscal fragments are found in this region, MCL tears should be ruled out.

A good indicator for medial meniscus bucket handle tears is the double PCL sign. However, there have been multiple reports of this sign being imitated.[12] Meniscomeniscal ligaments, accessory meniscofemoral ligaments (Humphrey and Wrisberg ligament), loose bodies, osteophytes, and fracture fragments,[13] fat globules around the PCL, and sometimes a double barrelled PCL are among the normal and pathological structures in the intercondylar fossa.

This case underlines the importance of carefully examining the menisci in both sagittal and coronal imaging whenever there is evidence of one or more MRI symptoms of displaced meniscal tears, specifically looking for a distinct tear or a truncated/absent meniscus.

Finally, there are various normal and pathological structures in and around the joint that resemble the symptoms of a bucket handle medial meniscal tear. A radiologist should be conversant with the structures that can mimic these symptoms. It's critical to keep track of these structures on the sequential images to prevent diagnosing meniscal tears incorrectly.

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