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Original Research Article

MR imaging of meniscal tears

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ABSTRACT

Background: Menisci transmit the forces across the joint and cushion the mechanical loading of the joint. Thus, it is important to identify meniscal tear. A thorough understanding of normal meniscal anatomy and surrounding structure is critical for diagnosis. Magnetic resonance imaging is the current modality of choice providing fine resolution and multi-planar imaging for identifying the meniscal injuries and the various pattern of tear, helping to plan the subsequent management. The purpose of the work was to study the role of MRI in classifying the meniscal injuries.
Methods: MRI Knee of 136 patients with meniscal injuries was studied. All the MR imaging scans were performed on 1.5-T MR system (Siemens magnetom Essenza).
Results: A total of 136 patients were studied in which majority of the patient's i.e. 90.44 % had medial meniscal tear while 18.38 % patients had lateral meniscal tear. Both medial and lateral meniscal tears were found in 8.82 % patients. Among the different types of tears, horizontal tear was the most common tear in both medial and lateral meniscus comprising 52.8 % and 52 % respectively. The tears being most common in the age group 41-50years. There were associated injuries to the other ligaments of the knee joint along with meniscal tear, ACL tear being the most common and was seen in 50% of patients.
Conclusions: MRI is a good modality for classifying meniscal injury and evaluation of injuries to the associated ligaments. Secondary signs are good predictors of underlying meniscal tear in equivocal cases.

Keywords: ACL (Anterior cruciate ligament), Knee joint, Medial meniscus, MRI (Magnetic Resonance Imaging), PCL (Posterior cruciate ligament), PPV (Positive predictive value)

INTRODUCTION

MRI is the commonest non-invasive imaging investigation of choice for evaluating the meniscus. It gives a high sensitivity of 93% for medial meniscus and 79% for lateral meniscus and also a high specificity of 88% for medial meniscus and 96% for lateral meniscus for diagnosing the meniscal tears.[1] The early diagnosis of meniscal tear is important for planning the treatment strategy, in view of evolving treatment strategies one must identify the tear and also describe its location, extent and tear pattern to guide and chose the appropriate treatment option. So, the role of MRI is not only limited to diagnosis but also in management of meniscal injury whether to obviate surgery and so on. The common tear patterns include longitudinal-vertical, horizontal, radial, root, complex, displaced and bucket-handle tears.

This article emphasizes on the normal meniscal anatomy, classification of meniscal tear, imaging criteria for diagnosing meniscal tears, imaging appearance of various patterns of meniscal tears, secondary signs of meniscal tears. An accurate and precise diagnosis can facilitate pre-surgical planning and prevent unnecessary surgical exploration or repeat surgery. The aim and objectives of the work was to study the MRI features of various types of meniscal tears and also to study associated injuries with meniscal tears.

METHODS

This prospective study was carried out for a period of 8 months, with due permission from the ethics committee. The MRI knee of 136 patients were performed who were referred to the Department of Radio diagnosis at Dr. Vasantrao Pawar Medical College, Hospital and Research Centre, Nashik, Maharashtra, India with complaints of knee pain and suspected injury to the meniscus. The clinical and demographic data were recorded after due consent to correlate the findings. The patients who have undergone meniscal reconstruction, repair or removal and those with no associated knee complain were not included in the study.

Methodology

All the MRI scans were done on 1.5-T magnet MR system (Siemens magneto Essenza) using dedicated knee coil. Imaging was performed using the surface coil with the affected knee joint of the patient in supine and extended position with slight external rotation. Some cushions are placed around the knee joint so as to restrict any motion. Another cushion is kept under the ankle to keep the leg straight.

The exact MR imaging pulse sequences used to image the knee vary among different institutions. The pulse sequences at our institution for the knee joints are as follows Axial T2-weighted (Repetition time in msec/Echo time in msec, 3500/85) spin echo images (slice thickness, 4mm; FOV, 170mm; acquisition matrix, 342x384; and number of sections, 19) and Axial Proton density fat suppressed (3000/25) spin echo images (4mm; 170mm; 228x256; and 19), Coronal T1 weighted (600/12)) spin echo images (4 mm; 180mm; 320x320; and 16), Coronal Proton density fat suppressed (3000/25) spin echo images (4mm; 180mm; 256x256; and 16) and Coronal T2 weighted (4500/48) turbo inversion recovery magnitude sequence (4mm; 180mm; 256x256; and 16), Sagittal T1 weighted (500/12)spin echo images (4 mm; 180mm; 320x320; and 16), Sagittal Proton density fat suppressed (3000/25) spin echo images (4mm; 180mm; 256x256; and 16) and Sagittal T2 weighted (3300/90) spin echo images (4mm; 180mm;320x320; and 16) and lastly Sagittal three dimensional proton density (850/40) fat suppressed images (1mm; 180mm; 256x256; and 80). Three-dimensional (3D) sequences with isotropic resolution have are also taken that provide thinner sections and reduce partial volume averaging. The total acquisition time for the study is approximately 30minutes.

RESULTS

Total 136 patients with suspected meniscal injuries referred to our department in a span of 8months were studied. The most common age group of patients affected with meniscal injuries was between 41-50years (Figure 1).

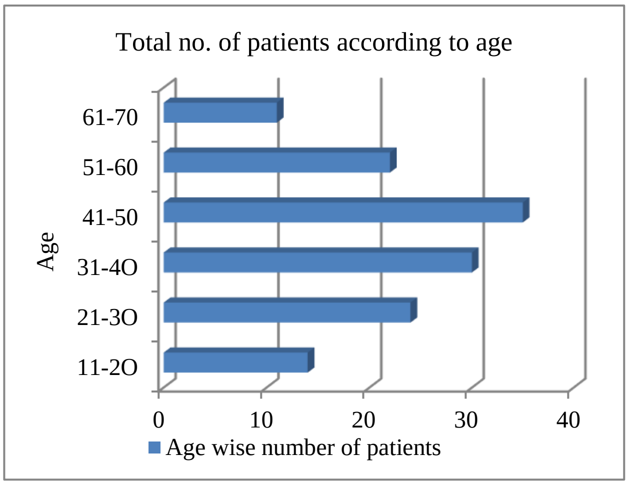

Figure 1: Total no of patients with meniscal tear according to the age.

Majority of the patient's i.e.123 had medial meniscal tear, 25 patients had lateral meniscal tear and 12 patients had tears in both medial and lateral meniscus (Figure 2).

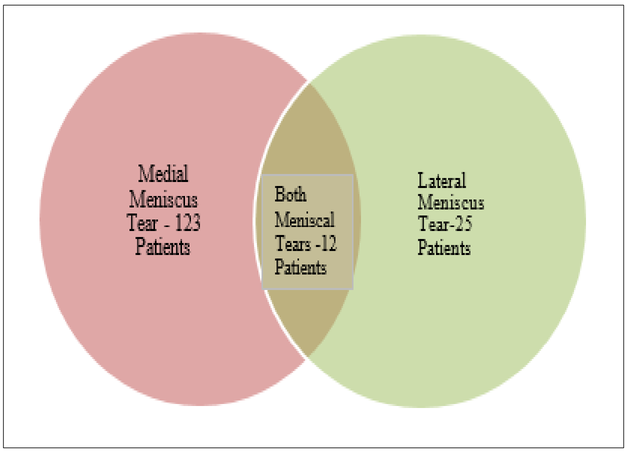

Figure 2: Number of patients with meniscal tears. The overlapping portion denotes the patient's having both medial and lateral meniscal tears.

The numbers of patients with different types of tears in medial and lateral meniscus are illustrated in Figure 2 and 3 respectively. Among the different types of tears, horizontal tear was the most common tear in both medial and lateral meniscus comprising 65 and 13 patients respectively.

The most common age groups for the different types of medial and lateral meniscal tears are detailed in Figure 4 and 5 with horizontal, vertical, root and complex tear being the commonest. The tears are common in the posterior horn in both medial and lateral meniscus. There are often associated injuries to the other ligaments of knee joint along with the meniscal injury which should be mentioned, among them ACL tear being the most common in 50% of patients.

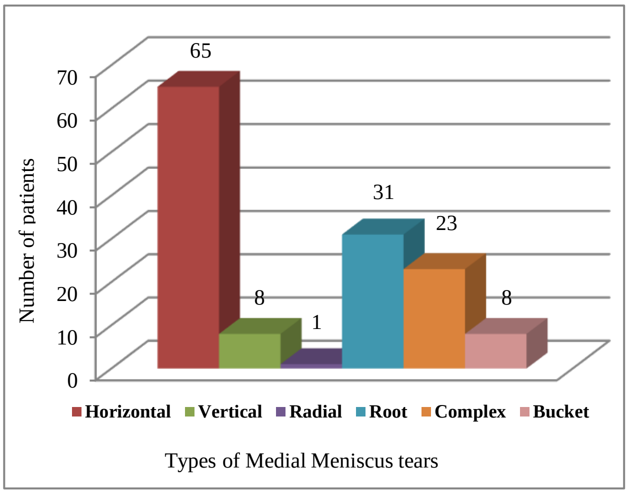

Figure 3: Types of medial meniscal tear.

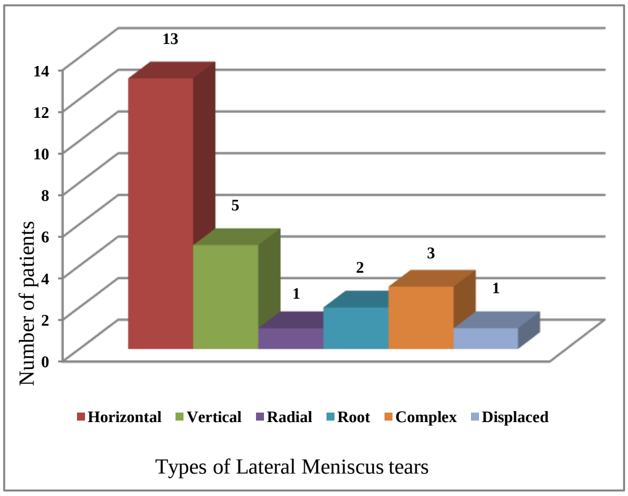

Figure 4: Types of lateral meniscal tear.

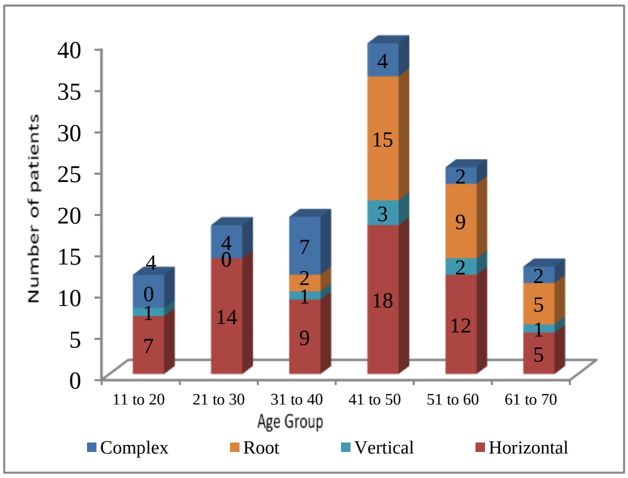

Figure 5: Types of common medial meniscal tears in different age groups.

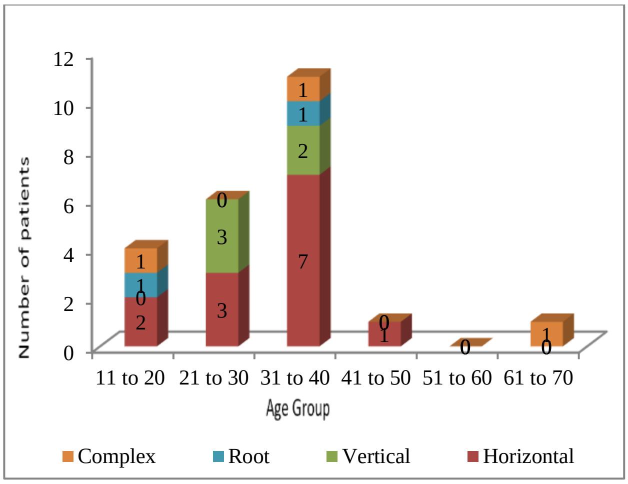

Figure 6: Types of common lateral meniscal tears in different age groups.

DISCUSSION

Normal anatomy and MR appearance of the meniscus

The menisci confer an ability to absorb shock, protect the articular cartilage, disFtribute axial load, assist in joint lubrication and maintain joint stability in extremes of flexion and extension and facilitate nutrient distribution.[2] The menisci are wedge shaped, semilunar fibro cartilagenous structure attached to the condylar surface of the tibia and femur. The proximal or superior surface of each meniscus has smooth concave shape which provides greater contact with the femoral condyles and inferior surface is flat and rests upon the condylar surface of the tibia.[3] The peripheral portion of the meniscus is thick and convex and is attached to the inside of the capsule and it tapers to a thin, central free edge towards the intercondylar notch.[4]

The longitudinal fibers are circumferentially oriented and provide hoop strength, resist axial load and prevent meniscal extrusion. The loosely organized radial fibers are interposed perpendicular to longitudinal bundles and act to tie these bundles together, forming a lattice and providing structural support.[2,5] The vascular supply is provided by the perimeniscal capillary plexus and supplies only the peripheral 10 to 25% of the meniscus throughout its attachment to the joint capsule, the rest of the meniscus in adults is relatively avascular.[6,7] The vascularity in children, is restricted to the peripheral third of the meniscus, and the inner two thirds are relatively avascular.[8]

On MRI, the intact menisci appear as uniform low-signal-intensity structures on all sequences. They are triangular in cross section, with an outer convex curve and apex directing towards the intercondylar notch. Each meniscus is arbitrarily divided into thirds: the anterior horn, the body and the posterior horn. On sagittal sections, the menisci have a “bow-tie” appearance peripherally and on sections close to intercondylar notch it is seen as opposing triangles representing anterior and posterior horns (Figure 6).[4] On coronal sections, the menisci appear either triangular or wedge-shaped, depending on whether the imaging plane is through the body or horn, respectively. Although the menisci have a similar composition and signal intensity, they are distinct.[9]

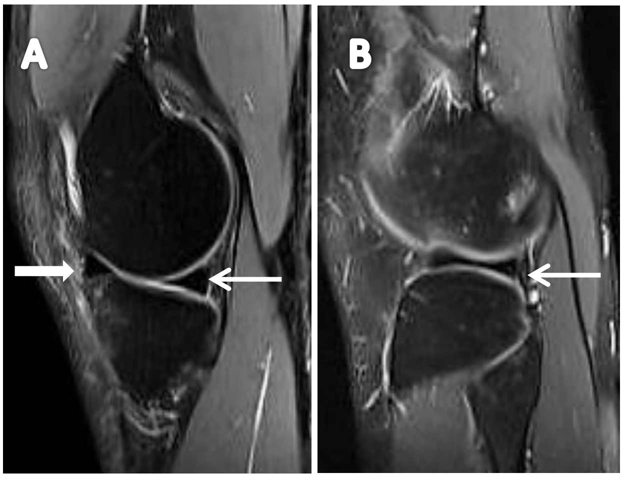

Figure 7: Normal MRI appearance of the menisci in a 30-year-old male. Sagittal T2-weighted FSE fat-suppressed image (A) and (B) shows the typical bow-tie configuration of the menisci. (A) Medial meniscus: The posterior horn (thin arrow) is larger than the anterior horn (thick arrow). (B) Lateral meniscus: shows the typical bow tie appearance of body of lateral meniscus (arrow). Both the horns are similar in shape and size.

Medial meniscus

The medial meniscus has a more open C-shaped with an increase in its width from anterior to posterior (Figure 2A), resulting in wide posterior horn and narrow anterior one when viewed in cross section (Figure 7A). The anterior horn is attached to the area of intercondylar fossa of tibia, anterior to the tibial attachment of ACL.[3] The posterior horn is located at the posterior intercondylar fossa of tibia between the attachment of posterior horn of lateral meniscus and PCL.[3,10,11] Along its entire peripheral circumference the medial meniscus is attached to the joint capsule and also to the deep fibres of medial collateral ligament which limits its mobility and thus leads to increase susceptibility to injury compared with more mobile lateral meniscus.[2,12]

Lateral meniscus

The lateral meniscus has a tight C shape and is more circular with relatively symmetrical width of anterior and posterior horn (Figure 8B).[13] The anterior horn of lateral meniscus is attached between the anterior attachment of the ACL and tibial intercondylar eminence.[3,10,11] The posterior horn of the lateral meniscus is attached between the tibial intercondylar eminence and the posterior horn of medial meniscus. The lateral meniscus is relatively mobile and cover 2/3rd of the tibial articular surface.[14] Popliteomeniscal fasciles which arises from the posterior horn of lateral meniscus forms a posterolateral meniscocapsular extension and forms a hiatus for popliteus tendon and also stabilize and control the motion of posterior horn.[15] The meniscofemoral ligaments originates form posterior horn of medial meniscus and attaches to the lateral aspect medial femoral condyles via the ligament of Humphrey coursing anterior to the genu of PCL and ligament of Wrisberg coursing posterior to the genu of PCL.[16,17]

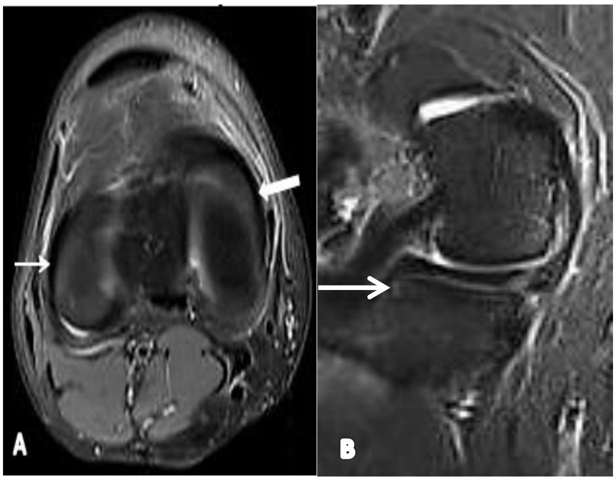

Figure 8: Normal MRI appearance of the menisci in a 30-year-old male. (A) Axial T2-weighted FSE fat-suppressed image shows normal medial (thin arrow) and lateral (thick arrow) menisci. (B) Coronal T2-weighted image shows normal posterior meniscal root (arrow).

Imaging base diagnosis of meniscal tear

MR is an excellent tool for diagnosing meniscal tears with high accuracy. The increased signal intensity in tears is best visualized on short-TE images using T1 and intermediate-weighted (PD), or GRE sequences.[4] At times there can be increased intrameniscal signal which can be attributed either secondary to increased vascularity in children, mucoid degeneration in adults, or after trauma resulting in meniscal contusion, all of these lack the characteristic imaging findings of a tear.

In the absence of previous surgery, the criteria for diagnosing the meniscal tears on MRI includes either increased intrasubstance signal unequivocally contacting the articular surface or distortion of meniscal morphology, such as alterations in size and shape of the meniscus.[18,19] If these criteria's are met on two or more images, thereby fulfilling the two slice touch rule, there is increase in the specificity, with PPV of 94% for medial meniscus and 96% for lateral meniscus, and the findings should be reported as meniscal tear.[20,21] The findings must be seen in the same area on any two consecutive MR images, they can be either two coronal images or two sagittal images, or one coronal and one sagittal image. The increased intrasubstance signal intensity with no obvious extension to the articular surface is often not associated with a tear at surgery, nor has this finding been shown to progress to a tear.[22,23] Although most tears are best visualized on sagittal images, the coronal images not only act as a supplement and cross-reference but also have importance for depicting and characterizing certain tears, including root tears, most displaced/bucket handle tears, and tears involving the meniscal body.[24,25] In addition, axial images may be helpful for detection of small radial tears, displaced tears, and peripheral tears of posterior horn of the lateral meniscus.[26]

Most tear involve the posterior horn of the meniscus, that too more frequently occurring in the medial meniscus. However, in younger patients with an acute injury, tears are more common in the lateral meniscus. In the presence of ACL tears, there is an increased prevalence of peripheral tears and a decreased sensitivity for detection of lateral meniscal tears, particularly involving the posterior horn, at MRI. Therefore, special attention should be given to this location, where a subtle tear can be present.[27] The prevalence of meniscal tears increases with age, and often associated with degenerative joint disease.

Meniscal tear classification

The treatment for meniscal tears can be with conservative therapy, surgical repair, or meniscectomy and is considerably based on several factors, including the meniscal tear pattern. Longitudinal tears are often amenable to repair, whereas horizontal and radial tears may require partial meniscectomy.[28,29] Therefore, an accurate description of a tears morphology and pattern is critical for treatment planning. Currently, there is no standard radiological classification system for tears. The most common tear patterns described are horizontal, Longitudinal-vertical, radial, root, complex, displaced, and bucket-handle tears.

Horizontal tear

A horizontal tear is the one which runs parallel to the tibial plateau, involving either one of the articular surface or the central free edge and extends towards the periphery of the meniscus, dividing it into superior and inferior halves. Meniscal cyst formation is commonly associated with horizontal tears that extends to the peripheral rim, presumably secondary to joint fluid permeating into the tear.[30] If the meniscal cyst is identified on MR imaging, this indirect sign has a PPV of more than 90%, except along the anterior horn of lateral meniscus.[31]

These tears are more often seen in patients older than 40years without a history of trauma and are more common in the setting of underlying degenerative disease.[32] The typical MR imaging appearance is of a high signal intensity line running parallel to the tibial surface and is contact with the meniscal surface or free edge (Figure 9).

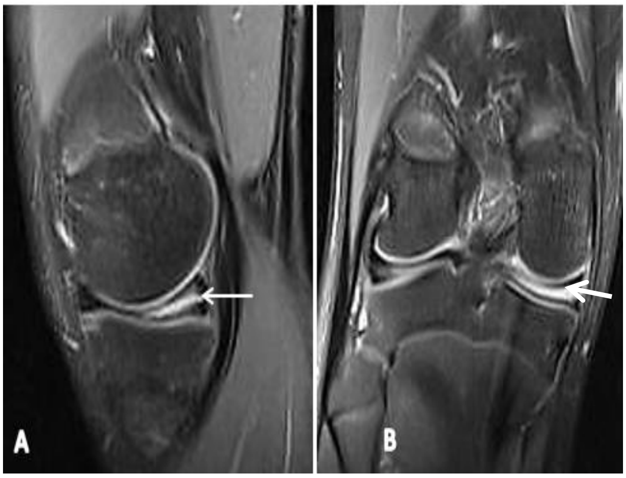

Figure 9: Horizontal tear of medial meniscus in an 18-year-old male. (A) Sagittal T2-weighted FSE fat-suppressed image shows a hyperintense signal in the posterior horn of medial meniscus (arrow) parallel to the tibial plateau and reaching up to the articular surface. (B) Coronal T2-weighted FSE fat-suppressed image shows a linear hyperintense signal in the body of medial meniscus (arrow).

Longitudinal tear

Longitudinal tears occur in the peripheral aspect of the meniscus and run perpendicular to tibial plateau and parallel to the long axis of the meniscus involving a single or both articular surface, separating the meniscus into central and peripheral halves.[33] The longitudinal vertical tears does not involve the free edge of the meniscus. There are several anatomical structures that may be mistaken for a longitudinal tear and this includes intra-articular course of popliteus tendon; insertion of transverse inter-meniscal ligament, popliteomeniscal fascicles and meniscofemoral ligaments to the posterior horn of lateral meniscus and the normal striated appearance of the anterior root ligament of the lateral meniscus formed from fibers originating from the ACL.[20,34-36]

Therefore because of the complex surrounding anatomy and posterior attachments it is difficult to identify peripheral longitudinal tears of the posterior horn of lateral meniscus. Longitudinal-vertical tears often occur in younger patients after significant knee trauma and have a tendency to involve the peripheral third of the meniscus and posterior horns.[32,37]

The typical MR appearance is of a vertically oriented high signal intensity line in the peripheral part of the meniscus which is in contact with one or both articular surfaces (Figure 10). There is an association between the peripheral longitudinal-vertical tears and ACL tears with

90% of medial meniscus and 83% of lateral meniscus longitudinal tears occurring in the setting of an ACL tear.[27]

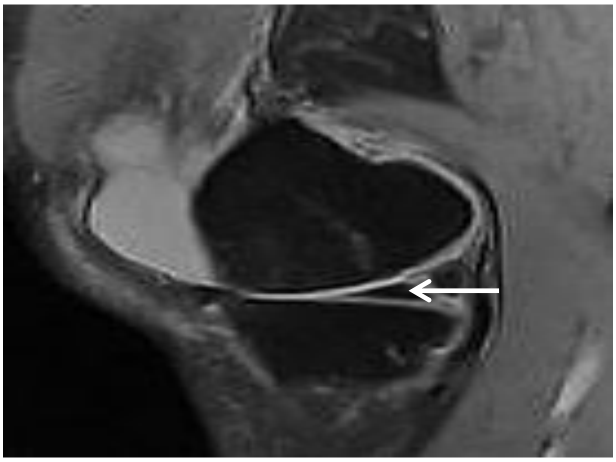

Figure 10: Vertical tear in medial meniscus in a 57-year-old male. Sagittal T2-weighted fat-suppressed image shows a vertically oriented hyperintense signal in the posterior horn of medial meniscus (arrow) perpendicular to tibial plateau.

Radial tear

A radial tear is seen involving the free edge of the meniscus where there is relatively higher concentration of the radially oriented collagen bundles and is perpendicular to the tibial plateau and long axis of the meniscus and thus divides the meniscus into anterior and posterior portions. As it extends towards the periphery it involves the longitudinal collagen bundles and thus disrupts the meniscal hoop strength, resulting into peripheral subluxation and possible meniscal extrusion.[38]

The radial tears are located within the avascular "white zone" and are frequently not repaired with a low likelihood of healing or regaining significant function.[39] The three-recognized classic location of radial tears-the anterior horn-body junction, posterior horn-body junction and body.

The MR findings in the classic radial tears are

- Increased signal intensity tear in the anterior third with blunted anterior horn and elongated posterior horn-body segment,[40]
- Increased intensity in junction of posterior horn and body with blunted posterior horn and elongated anterior horn-body segment,
- Increased intensity restricted to the middle third of the meniscus that does not involve blunting or elongation of the anterior or posterior horn (Figure 11),
- On axial images, radial tears appear as clefts oriented perpendicular to the free edge.

There are four imaging signs of radial tears: "the truncated triangle sign", "the cleft sign", "the marching cleft sign", and "the ghost meniscus".[28] The variable appearance is dependent on the location of the tear relative to the imaging plane. These MR signs can improve the detection rate of radial tears to 89%.[28,42]

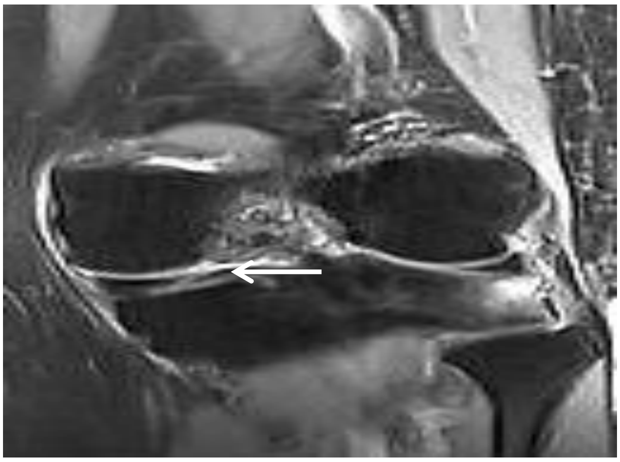

Figure 11: Radial tear in medial meniscus in a 50-year-old female. Coronal T2-weighted FSE fat-suppressed image shows a hyperintense signal involving the free edge of medial meniscus (arrow) and is perpendicular to the tibial plateau.

Root tears

The root tear is typically a subtype of radial tear. The unique anatomy of the posterior root ligaments and their undulating course along the tibial slope leads to diagnostic dilemmas as a result of MR magic angle effect and pulsation artifacts. There is increased recognition of root tears in the recent years partly due to previous under diagnosis of root tears at MRI. Nowadays attention is being directed to the region of roots, which has led to increase in the sensitivity and specificity to 86-90% and 94-95%, respectively for detection of tear at MRI.[43,44] The roots are better delineated in Coronal and fluid-sensitive sequences and also partially compensates for magic angle and pulsation artifacts. On coronal sequences the roots should course over its respective tibial plateau on at least one image (Figure 12).[9]

On sagittal sequences, if the posterior root of medial meniscus is not detected just medial to the PCL, one should suspect a tear.[45] It can occur either in medial or lateral meniscus, although more common in medial meniscus, where it is thought to represent a degenerative tear.[46] Additionally, when an ACL tear is present, incidence of lateral root tear is increased.[44,47]

There is an increased propensity of extrusion seen with complete root tear, particularly when tear occurs in medial meniscus.[47,48]

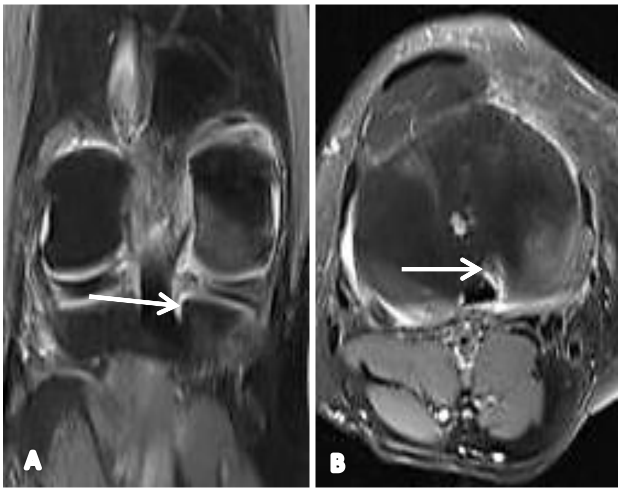

Figure 12: Root tear in posterior horn of medial meniscus in a 65-year-old female. (A) Coronal T2-weighted FSE fat-suppressed image shows tear at the posterior root of medial meniscus (arrow). (B) Axial T2-weighted FSE fat-suppressed image shows a posterior root tear (arrow).

Complex tear

A tear that shows component of tear extending into multiple planes, including a combination of radial, horizontal, and longitudinal components (any two or all three) should be considered as complex tears (Figure 13). Often the meniscus appears fragmented on imaging.

Figure 13: Complex tear in lateral meniscus in a 65-year-old male. (A) Sagittal T2-weighted FSE fat-suppressed image shows both vertical (arrowhead) and horizontal (arrow) components in the posterior horn of lateral meniscus. (B) Coronal T2-weighted FSE fat-suppressed image shows a complex tear in lateral meniscus (arrow).

Flap tear

Flap tears are complex unstable injuries of high clinical significance. They represent a composition of vertical or horizontal or oblique flap tears with displaced fragment. The flap tears usually involve the inner 1/3rd to ½ of the meniscus, with superior or inferior extension creating a flap which is dislocated adjacent to the meniscus or into the synovial recess, in contrast to the, longitudinal tears which predominantly involve the peripheral 1/3rd of the meniscus.[4] The criteria for prospective diagnosis of flap tear based on the characteristic morphology of signal intensity and meniscal morphology in the sagittal plane includes.[4]

- Vertical tear encompassing the inner third of the meniscus either displaced or undisplaced.
- Relative deficiency of the inner third of inferior meniscal surface with associated blunting of the remaining inferior leaf.
- A blunting of free edge of the meniscus with displaced meniscal tissue inferior to meniscus.
- A change in the slope of the superior surface of the meniscus, indicating a change in the direction of the tear that creates the flap.

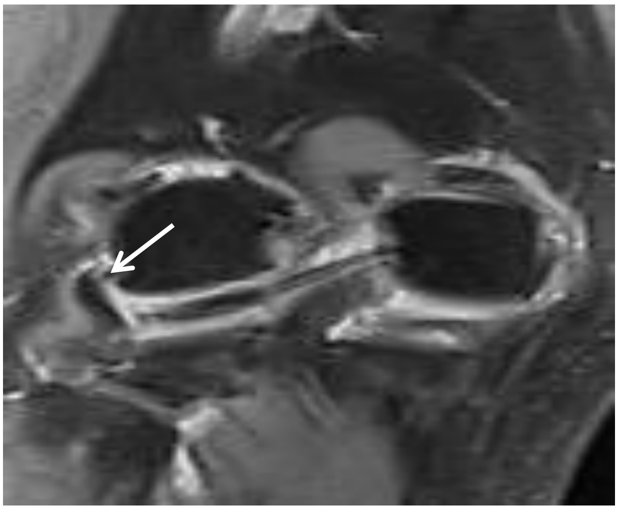

Figure 14: Displaced lateral meniscal tear in a 50-year-old male. Coronal T2-weighted FSE fat-suppressed image show a laterally displaced meniscal fragment (arrow).

In addition, extrusion of a part of the meniscus into the coronary recess below the joint line is seen on coronal as well as sagittal images.[38,49] These tears often present clinically with mechanical locking. It is important to identify the fragments before surgery, as the retention of meniscal flap often results in persistent pain and locking. They commonly involve the medial meniscus, but may also be seen in the lateral meniscus.[4] The displaced and rotated mobile flaps may extend into the meniscofemoral or tibial recess or may produce either double-decker or stacked leaflet meniscal morphology.[4] In 2/3rd of cases of medial meniscal involvement, fragments are displaced posteriorly (near or posterior to the PCL); and in rest, fragments course either into the intercondylar notch or into superior recess.[50] In the lateral meniscus involvement, fragments are equally distributed along the posterior joint line and lateral recess (Figure 14).[51] Complex flap displacement posteriorly and rotation of the posterior horn of the lateral meniscus in the intercondylar notch may be mistaken for ACL ligamentous tissue (double ACL sign).

Bucket handle tear

Displaced longitudinal tear of the meniscus with central migration of separated fragment is called as bucket handle tear, it is a complex and unstable tear resembling the handle of bucket.[52] They are 3 times more common in medial meniscus than the lateral meniscus. There are several MRI signs suggestive of bucket handle tear that refers to the displaced fragment. Bucket-handle tear reduces the width of the meniscus, this leads to the loss of normal bow tie configuration of body of the meniscus in peripheral sagittal images- termed as absent bowtie sign (Figure 15A). The displaced fragment in the intercondylar notch is seen as low-signal intensity band parallel and anterior to PCL, this is termed as double PCL sign (Figure 15B).[53] The inner meniscal fragments flipped to the anterior horn of the donor site, appearing as two triangular structures adjacent to each other anteriorly is referred as double delta /anterior horn sign. Bucket-handle tear of the lateral meniscus can rarely be seen as a double ACL sign when the fragment is located posterior to the ACL.[54] Although these signs are sensitive, they are not specific.

Figure 15: Bucket handle tear in a 22-year-old male. (A) Sagittal T2-weighted FSE fat-suppressed image shows the absent bow-tie sign (arrows) with non-visualization of the medial meniscal body. (B) Sagittal T2-weighted FSE fat-suppressed image shows the double PCL sign, with a displaced fragment from the medial meniscus anterior and parallel to the PCL (arrow).

Secondary signs of meniscal tear

Secondary or indirect signs are MR imaging findings that can be seen in association with the meniscal tears. The indirect signs have a low sensitivity but have high specificity and PPV for underlying tears. These are usually helpful in technically limited or equivocal cases and increases the diagnostic confidence as shown in Figure 16.

Figure 16: Associated ACL tear with meniscal injury in a 30-year-old male. (A) Coronal T2-weighted FSE fat-suppressed image shows medial and lateral meniscal tears (arrows). (B) Sagittal T2-weighted FSE fat-suppressed image shows associated complete tear of anterior cruciate ligament (thick arrow) in the same patient.

Parameniscal cyst

Parameniscal cyst appears as a high-signal-intensity fluid collection overlying a meniscus or adjacent to it with a fluid track connecting to the periphery of a meniscus. Parameniscal cysts are distinguished from ganglion cysts and bursae by their direct contact with the meniscus directly or via a fluid track. This sign has a strong association with meniscal tear with PPV of more than 90%, there is exception to this in the anterior horn of the LM, where the PPV is 67% as shown in Figure 17.[31]

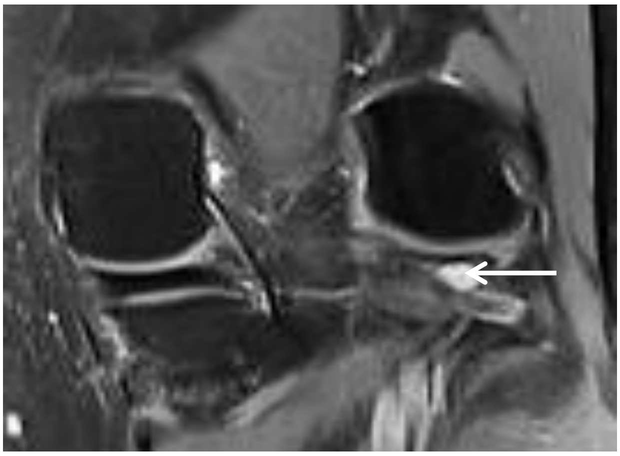

Figure 17: Parameniscal cyst. Coronal T2-weighted FSE fat-suppressed image shows T2 hyperintense fluid collection (arrow) in contact with the lateral meniscus with underlying lateral meniscal tear.

Meniscal extrusion

It is said to be present when the peripheral margin of the meniscus extends beyond 3mm or more to the free edge of tibial plateau, and not from the margins of osteophytes if present. There is an association between meniscal extrusion and other types of meniscal tears, specifically with root tears as shown in figure 18.[38]

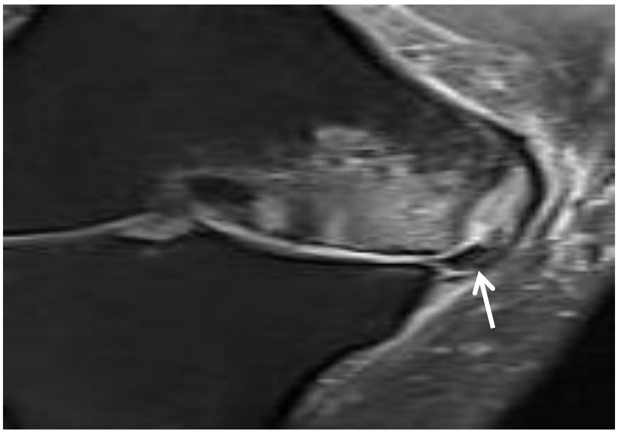

Figure 18: Medial meniscal extrusion. Coronal T2-weighted FSE fat-suppressed image shows extrusion of the meniscal body (arrow) secondary to an underlying meniscal tear.

Subchondral marrow edema

The most common cause of a focal linear subchondral area of high-signal-intensity on T2-W MRI of the knee is reactive edema beneath an area of cartilage degeneration, however, after an episode of acute trauma, it is often caused by bone contusion adjacent to the meniscal attachment site parallel to the meniscal surface. This sign can be seen in more than 60% of medial meniscus tears and more than 90% of lateral meniscus tears as shown in figure 19.[55]

Figure 19: Subchondral marrow edema in medial femoral condyle. Coronal T2-weighted FSE fat-suppressed image shows linear subchondral marrow edema (arrow) associated with an adjacent medial meniscal tear.

CONCLUSION

MRI plays a crucial role in diagnosing meniscal injuries and its management by allowing confident diagnosis of meniscal injury, especially in patients with equivocal physical examination and also provides additional information regarding the injuries of associated ligaments. In addition, MR imaging allows accurate characterization of various tear patterns, which can be instrumental for patient counseling and surgical planning. Knowledge of the normal anatomy, the patterns of meniscal tears and secondary signs can help reduce interpretation errors.

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