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MRI and Arthroscopic Correlation in Meniscal Injuries of Knee

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INTRODUCTION

The knee joint is a common site for injury, mainly due to trauma and sports related injuries.[1]

Diagnostic arthroscopy is a vital tool, providing diagnostic precision to 87-96%. However, it is an invasive procedure with the possibility of infection, hemarthrosis, as well as complications related to anesthesia. MRI is a completely non-invasive diagnostic modality and there is no ionizing radiation.

Furthermore the ligaments of knee are categorized into intra and extra-articular, consequently. MRI plays the most important role in their overall evaluation. The extra-articular ligaments are not visible on routine arthroscopic procedures.[3]

The overall assessment of the entire joint is called composite diagnosis[4], is more relevant and important in overall assessment and evaluation and thus diagnostic arthroscopy can be avoided.

Although magnetic resonance imaging (MRI) scans are often considered to give the ultimate diagnostic certainty, in reality, the performance of MRI as a diagnostic tool of internal derangement of the knee, its accuracy, sensitivity and specificity vary widely in literature[5].

This study is therefore set out for a systematic review and to provide an outline with which MRI and arthroscopy studies can be precisely compared.

The purpose of this study is to find out the efficiency of MRI in the evaluation of knee injuries precisely d meniscal injuries and correlate with arthroscopic findings.

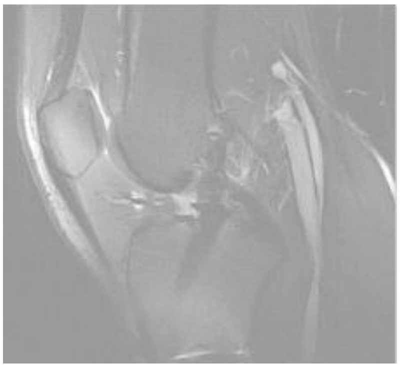
AIM AND OBJECTIVES

To seek correlation between MRI and arthroscopy in patients with meniscal injuries of knee joint.

The purpose of this study is to explore the diagnostic capabilities and advantages of magnetic resonance imaging (MRI) in evaluating meniscal injuries of the knee joint.

REVIEW OF LITERATURE

MENISCI



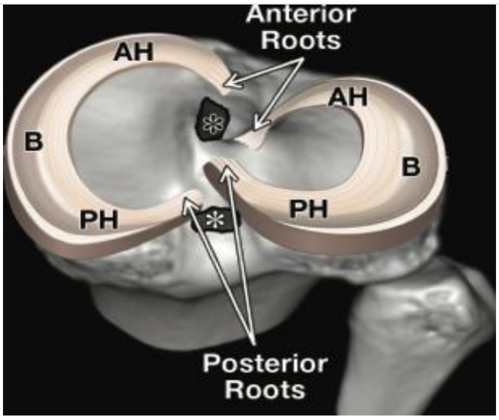
Normal position of tunnel in 18-year-old man

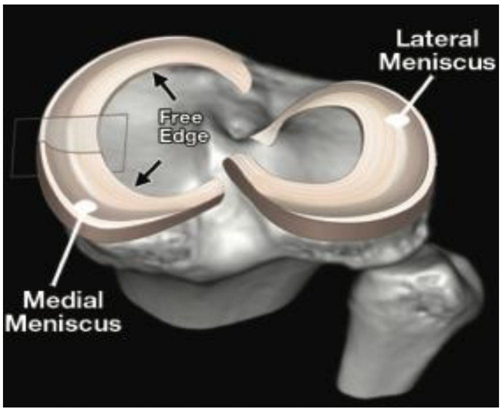
- MR images show normally positioned femoral tunnel. Position is between 10- and 11-o'clock. Entire tunnel opening is positioned posterior to intersection of Blumensaat line and tibia.

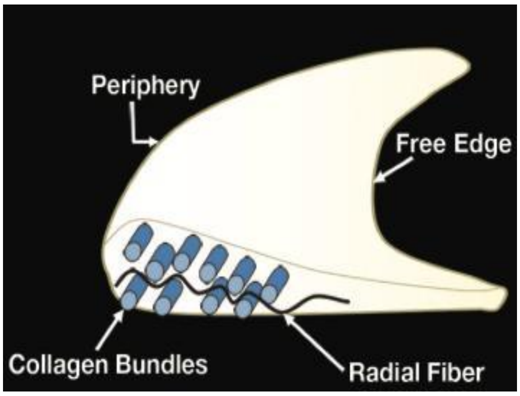
The function of menisci is to absorb shock, distribute axial load, provide joint lubrication, and facilitate nutrient distribution. The MM and LM are wedge-shaped, semilunar, fibro cartilaginous structures. Each meniscus has a superior concave surface that corresponds to the femoral condyle and at base that attaches to tibia via the central root ligaments. This results in a thick peripheral portion and a tapered central free edge. Circumferentially oriented type I collagen bundles provide loop strength and are critical to resist axial load and prevent meniscal extrusion. Thinner radial fibers are interposed perpendicular to the bundles and act to link the bundles together and providing structural support for the menisci.

Each meniscus can be divided into the anterior horn, body, posterior horn, and roots. The anterior and posterior roots attach to the central tibial plateau, serving as anchors and maintaining the normal position and biomechanical function. The association between the anterior root of the LM and the ACL insertion site results in a striated or comb-like appearance at MR imaging. In 2% of the population, an anomalous insertion of the MM counterparts the ACL and can be mistaken for a tear. In addition, the MM anterior root can occasionally insert alongside the anterior margin of the tibia and mimic pathologic subluxation.

In MR imaging, the menisci appear as low- signal-intensity structures. On sagittal images, the menisci appear as a “bow-tie” structure peripherally or opposing triangles centrally. On coronal images, the menisci appear as triangular or wedge-shaped, depending on whether the imaging plane is over the body or horn, respectively. Even though the menisci have a similar structure and signal intensity, they are distinct. The MM is less mobile because of peripheral attachments to the deep fibers of the medial collateral ligament. In addition, the MM has more open C-shaped configuration and increases in width from anterior to posterior.







In newborns, the peripheral of the meniscus is vascularized (red zone) by the peri-meniscal capillary plexus. The degree of vascular-penetration decreases with age, to about 10%–30% in adults. This vascular distribution is associated in the spontaneous healing of peripheral tears and the increased signal intensity seen in children.

Surrounding Anatomy

Common anatomic structures that mimic a tear include the transverse meniscal ligament, meniscofemoral ligaments (MFLs), and meniscomeniscal ligament.

The transverse meniscal ligament is a thin band that is present in 90% of dissection specimens and 83% of MR studies. It connects and stabilizes the anterior horns of the menisci. On sagittal images this can simulate an anterior root tear.

The MFLs originate from the posterior horn of LM and insert on the lateral aspect of the medial femoral condyle. One MFL is identified in 89% of dissection specimens and 93% of MR imaging studies. The MFLs assist the PCL and help to control the mobility of the posterior horn of the LM during knee flexion and extension30. Theyare named as Humphry and Wrisberg ligaments, which course anterior and posterior to the PCL, respectively. Recently, studies have reported that a far lateral insertion of the MFL onto the posterior horn of the LM (seen on four or more images with a 0.5- mm inter- section gap) should be considered a probable peripheral longitudinal tear.[31]

The popliteomeniscal fascicles are synovial lined fibrous bands, which attach to the LM posterior horn and help to form the popliteal hiatus. They steady the posterior horn control its motion.[32] At MR imaging with advanced sensitive sequences, the anteroinferior and posterosuperior fascicles are being visualized in approximately 90.3% of asymptomatic knees.[33] In cadaveric studies, a posteroinferior fascicle can infrequently be identified.[34] These fascicles can mimic a posterior horn tear. A tear of the posterosuperior fascicle is highly associated with tear of the LM, with a sensitivity, and positive predictive value (PPV) of 89%and 79%.

The oblique meniscomeniscal ligament links the anterior horn of one meniscus with the posterior horn of the contralateral meniscus. It is present only 1%–4% of knees. When present, it can simulate a centrally displaced meniscal fragment.

Anatomic Variants and Pitfalls

Anatomic variants and pitfalls that mimic a tear are discoid meniscus, meniscal flounce, ossicle, and chondrocalcinosis.

Discoid Meniscus

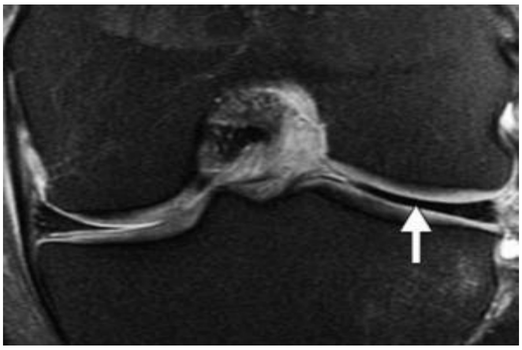
Discoid meniscus signifies an enlarged meniscus with further central extension on the tibial articular surface. It is seen in 1–4.5% of knees and is 10–20 times more common in LM than MM. The Watanabe classification identifies three distinct variants of discoid meniscus: the complete,that has a block- shaped meniscus, the partial that has a meniscus that covers approximately 80% or less of the tibial plateau and, Wrisberg variant that has a thickened posterior horn, lacks the normal posterior meniscal attachments, and may cause snapping knee syndrome.[35,36]

The modified Watanabe classification comprises of a ring- shaped meniscus with relation between the roots. This type can mimic a medially displaced meniscal fragment. When the body of the meniscus measures 15 mm or more on a mid coronal image or when three or more bow- tie shapes are noted on contiguous sagittal (4-mm-thick) images, it is discoid meniscus.[37]

Discoid menisci are often incidentally detected, with treatment only reserved for symptomatic patients suspected of having a tears. Tears are common with the complete discoid meniscus and display horizontal or longitudinal tear patterns.[36-37] MR imaging needs to be focussed on the on morphologic distortion than abnormal signal intensity. However, an area of linear increased signal intensity that is seen to obviously contact the articular surface on two or more images is almost associated with a meniscal tear.

Meniscal Flounce

Meniscal flounce is a rippled appearance in free non-anchored inner edge of the MM, which can be seen in 0.3%–0.35% of asymptomatic knees. Typically, this is secondary to flexion of the knee. This distortion does not imply a tear; however, on coronal images, this may simulate a truncated meniscus and mimic a tear.[38]



A meniscal ossicle is a rare entity with a tendency for the posterior horn of the MM. Its may be due to developmental, degenerative and sometimes post- traumatic.[39,40] On radiographs it can be mistaken for a loose body, while at MR, its increased signal intensity may mimic a tear. A review of the patient's radiographs shall prevent false-positive diagnosis. Symptoms may result from mass effect or from associated tear, which can be treated with resection.

Chondrocalcinosis

Chondrocalcinosis sometimes result in increased meniscal signal intensity, thereby lowering the sensitivity and specificity of MR for detection of tears (82%–89.5% sensitivity and 72%–79.54% specificity in patients with chondrocalcinosis, compared with 93.4%– 100% sensitivity and 93-100% specificity [41].

MR based diagnosis of Meniscal tears

The prevalence of meniscal tears rises with age, and meniscal tears are associated degenerative joint disease. Tears are more common in the posterior horn, particularly favoring MM. In younger patients with an acute injury, LM is more predominant.

Isolated tears in the anterior horn are rare, accounting for 2.3% and 16.3% of MM and LM tears, respectively.[42] In the presence of ACL tears, there is increased prevalence of peripheral tears.[43]

Meniscal Ossicle

MR imaging has proved, highly precise modality for detection of meniscal injuries, with excellent arthroscopic correlation.44 Normal menisci must have low signal intensity at imaging; however, globular /linear increased intrameniscal signal intensity may be seen in children (due to vascularity), in adults with mucinous degeneration, and after trauma due to contusion.

MR criteria for diagnosing a tear include meniscal distortion or increased intrasubstancesignal unequivocally contacting the articular surface. If these criteria are visualized on two or more images, satisfying the "two-slice-touch" rule, then PPV for a tear is 94% and 96.2% in the MM and LM respectively.[45]

The findings must be visualized in the sameregion on any two consecutive MR images, coronal images or sagittal. In contrast, increased intrasubstance signal intensity without extension to articular surface is more often not associated with a tear at arthroscopy.[46]

Although most of the tears can be confidently diagnosed on sagittal, coronal images. Small radial, horizontal tears of the body and bucket-handle tears can be difficult to detect on sagittal images because of volume averaging; and can be better depicted on coronal images.48 In addition, axial images are sometimes helpful in detection of small radial, displaced, and peripheral tears of the posterior horn of LM.[49]

Meniscal tears can be treated by conservative therapy, by surgical repair, namely partial or complete meniscectomy. Longitudinal tears are often better to repair, whereas horizontal or radial tears require partial meniscectomy.[50, 51]When a tear is recognized, accurate evaluation of its morphology and pattern is critical in treatment planning. The most common tear patterns are horizontal, longitudinal, root, radial, displaced, and bucket-handle tears.

Horizontal Tear

A horizontal tear courses parallel to the tibial plateau and involves one of the articular surfaces or the central edge, and extends towards periphery, dividing the meniscus into superior and inferior portions. They usually occur in patients older than 40-45 years without a trauma and are more common in underlying degenerative joint disease.[52]

The MR appearance is a horizontally oriented line of high signal that contacts the meniscal surface or free edge. Parameniscal cyst formation is commonly associated with complete horizontal tears that extend to periphery. Partial meniscectomy with cystectomy has been shown to improve surgical outcomes compared with partial meniscectomy alone.

Classification of meniscal tears

Longitudinal tears course perpendicular to tibial plateau and parallel to long axis of the meniscus and divide them into central and peripheral portions.[52-54] Unlike horizontal or radial tears, longitudinal tears does not involve the free edge of the meniscus. These tears occur commonlyin younger patients after knee trauma[55] and have a propensity to involve the peripheral third and posterior horns. The MR appearance is a vertically oriented line of high signal that contacts one or both articular surfaces.

There is a close connection between peripheral longitudinal tears and ACL tears. Especially, 90% of MM and 83.5% of LM peripheral longitudinal tears have associated ACL tear. Peripheral longitudinal tears of posterior horn of LM are often difficult to recognize because of the complex anatomy and posterior attachments. As discussed, disruption of the posterosuperior popliteomeniscal fascicle has high PPV for tears of the posterior horn of LM.

Radial Tear

A radial tear runs perpendicular to both tibial plateau and long axis of the meniscus. It transects the longitudinal collagen bundles as it extends from free edge towards the periphery. Radial tears disrupt the meniscal hoop strength, resulting in loss of function and possibility of meniscal extrusion. The tears are infrequently repaired because they are localized within the

Longitudinal Tear

Avascular “white zone” and thus have a low possibility of healing and regaining significant function.

They commonly involve the posterior horn of the MM and the junction of anterior horn and body of LM. On axial MR, these tears appear as clefts oriented perpendicular to the free edge.

Root Tear

A root tear is basically a radial-type tear. Complete root tears have a very high connection with meniscal extrusion, predominantly when the tear occurs in the MM.[58,59] Root tears have established increased recognition in recent history, partially because of their previous under-diagnosis in both MR and arthroscopy. However, if attention is focused to the roots, the sensitivity and specificity in detection of tear at MR imaging increase to 86.4%–90.7% and 94.4%–95.5%, respectively.[60]

Coronal MR imaging sequences allow better delineation of the roots, which partially balances for magic-angle and pulsation artifacts. In coronal MR images, the root should course over its particular tibial plateau in at least one image. On sagittal MR images, if the posterior root of the MM is not detected just medial to the PCL, a root tear should be suspected. In addition, when an ACL tear is existent, there is an increased incidence of lateral root tears.[58,60] Acute root tears without substantial underlying degenerative changes are more often promptly repaired because the surrounding rich blood supply which facilitates postoperative healing.[61,62]

Complex Tear

A complex tear comprises of combination of radial, horizontal, and also longitudinal components (any 2 or all). The meniscus appears fragmented, with tear extending in more than one plane.

Displaced Tear

Displaced tears involve free fragments, displaced tears and bucket-handle tears. These tears frequently manifest with mechanical obstruction and demand surgical reattachment or debridement. Small free fragments can be missed at arthroscopy. Therefore, identification of these fragments prior surgery is vital, as retention of a meniscal flap results in persistent pain and possible knee locking.

Awareness of these typical displacement patterns are instrumental. Flap tears occur 6 to 7 times more frequently in the MM, where in two-thirds of cases, fragments are displaced posteriorly; in the remaining cases, fragments path into the intercondylar notch or superior recess.[63]

Bucket-Handle Tear

A bucket-handle tear is a type of longitudinal tear with central migration of the inner fragment. This tear pattern occurs more frequently in the MM [64-65] and has different MR imaging signs: i) an absent bow tie, ii) fragment within the intercondylar notch, iii) double PCL, iv) a double anterior horn, and v) a disproportionally small posterior horn.[66-67]

A bucket-handle tear of the LM rarely manifest with a double ACL sign, where the fragment is located posterior to the ACL [67-70]. Although these signs may be sensitive, they are not specific. Mimics of the double PCL sign comprise a prominent ligament of Humphry and meniscomeniscal ligament.[71]

Fraying

Frayingis a surface irregularity along the meniscal free edge without a discrete tear. Equivocal and discordant cases are commonly recognized in the LM than in the MM.[72] At MR imaging, the free edge demonstrate loss of sharp tapered central edge, and the posterior root ligaments show subtle, ill-defined, horizontally angled increased intrameniscal signal contacting the articular surface. Although further investigation to distinguish fraying from partial-thickness tears is warranted, a differential of synovitis, partial tear, or fraying can be used for equivocally in patients older than 40 yrs without a traumatic event.

However, in younger patients after an acute injury, posterior root of LM increased signal intensity contacting the articular surface should be reported as a possible tear.

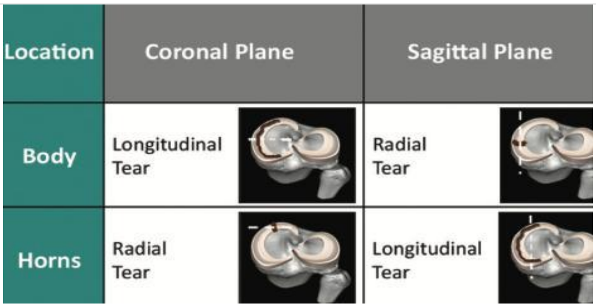
Oflate, the accuracy of MR in diagnosing meniscal injuries in patients more than 50 years has been evaluated, and reported sensitivities and specificities are similar to those in younger patients, when only definitive MR findings were considered as a tear (the “two-touch-slice” rule). Specificity decreased if equivocal or possible findings were considered a tear.

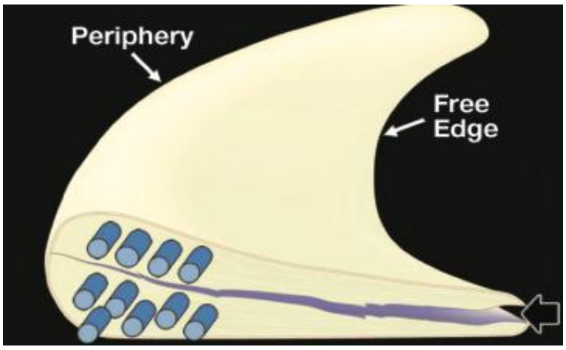
Indirect Signs of Meniscal Tear

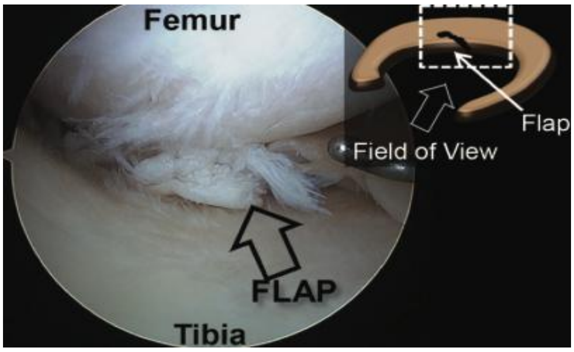
Indirect signs of a meniscal tear are Parameniscal cyst, meniscal extrusion, and subchondral marrow edema but not specific.

Parameniscal Cyst

Parameniscal cysts have to be distinguished from bursae and ganglion cysts.







They exhibit direct contact with the meniscus. They represent the peripheral escape of joint fluid through a meniscal tear, which typically comprises a horizontal component.[73]

Meniscal Extrusion

Disruption in the circumferentially oriented collagen bundles results in loss of the meniscal hoop strength and subsequent extrusion. Extrusion is diagnosed when the peripheral margin of the meniscus extends more than 3 mm beyond the tibial plateau.

In the setting of hypertrophic bone spurs, the osteophyte must be excluded for determination of outer margin of the tibial plateau. There is a close relationship between meniscal extrusion and root tears. It is noted that 76% of medial root tears have extrusion, and 39.45% of extrusions have medial root tears. However, meniscal extrusion may be seen with complex tears and severe meniscal degeneration.[74, 75]

Subchondral Marrow Edema

Linear subchondral bone marrow edema, in comparison to more nonspecific edema often seen with degenerative changes, is indeed as superficial edema which is adjacent to the meniscal attachment site, parallels the articular surface, and is less than 5 mm deep. This sign can be seen in more than 65% of MM tears and more than 90% of LM tears, with a sensitivity and specificity of 64.45%–70.3% and 94.3%–100% for the MM; and 88.3%–89.4% and 98.3%– 100% for the LM, respectively. [76] Similarly, Kaplan et al[77] established that 64% of bone bruises of the posterior medial tibial plateau have associated tear of the MM posterior horn.

Diagnostic Errors

Diagnostic errors shall be divided into false-negative and false-positive errors. False negative commonly involve the LM, particularly when the tear is very small and involves the posterior horn. These errors are anatomic (tears mistaken for normal anatomic structures) or technical related (artifacts that mimic a tear). False- positive errors involve mistaking normal anatomic structures and variants for a tear. Other causes include the magic-angle artifact and healed tears. The magic-angle artifact occurs when collagen fibers are oriented 55.45° relative to the magnetic field, which is often seen in the upslope medial segment of the posterior horn of LM.

The basic principle of meniscus surgery is to preserve the meniscus. Tears with a high possibility of healing with intervention are repaired.

Surgical options include partial/ subtotal meniscictomy. One study found that arthroscopic pullout repair of a medial meniscus root tear provided improved results than partial meniscectomy.

Partial meniscectomy is the treatment of choice in the avascular portion of the meniscus or complex tears that are not possible to repair. Torn part is removed, and the remaining healthy meniscal tissue is contoured to a stable peripheral rim.

Meniscus repair is recommended in tears that occur in the vascular region (red zone or red-white zone Surgical repair of root tears, poses a unique challenge in that the meniscus must be repaired to bone. The root is fixed to bone by arthroscopically assisted bone suture anchors or an intraosseous suture technique ("pullout technique").

Human allograft transplantation is a relatively new procedure but is being performed more recently frequently. Indications and long-term results have not been clearly established. Meniscus transplantation requires further investigation to evaluate its efficacy in restoring normal meniscus function and to preventarthrosis.

- De Smet and Graf analysed 410 records and concluded that sensitivity of MRI scans were abridged for meniscal tears in the occurrence of ACL injury. Drop in sensitivity shown to be 94% to 69% for medial meniscal tears.[81]
- Munshi et al. studied 23 patients of haemarthrosis who underwent MRI followed by arthroscopy. Higher sensitivity were found and the conclusion was made that prospective use of MRI would have prevented 22% of diagnostic arthroscopic procedures.[82]
- Jee et al. concluded that MRI with presence of ACL tears had lower sensitivity for evaluating meniscal tears due to missed lateral meniscal tear.[83]
- Lundberg et al. proved that sensitivity, specificity about 74% , 66%, for medial and 50% , 84% in lateral meniscus . They found that MRI could not substitute arthroscopy in diagnosis of acute knee injuries.[84]
- Barronian et al. found about 100% sensitivity for medial meniscal tears and 73% in lateral therefore finding MRI to be a reliable pre arthroscopy tool.[85]
- For Mohan et al., in their retrospective series of 130 patients, diagnostic accuracy of clinical examination were 88% for medial meniscal tears and 92% for lateral meniscal tears; they clinched that clinical diagnosis of meniscal tears are as

reliable as the magnetic resonance imaging (MRI) scan.[86]

- Rose et al. found a better diagnostic accuracy clinically than with MRI scans in a series of 100 patients.[87]
- Abdon et al., proved that clinical examination had only 61% accuracy for meniscal tears.[88]
- Cheung et al. interpreted a chain of 293 patients finding 89% sensitivity and 84% specificity in medial meniscus injuries. For lateral meniscus, the sensitivity was 72% and specificity 93%.[89]
- Kelly et al. found to have a high negative predictive value in a series of 60 patients for MRI when compared to arthroscopy.[90]
- Rangger et al. studied 120 patients and concluded that MRI should be essential diagnostic tool before arthroscopy.[91]
- Barronian et al. found 88.5% sensitivity and 72% specificity in meniscal injuries concluding that a selective role exists for MRI.[92]
- Kreitner et al. reevaluated discrepancies in MRI reports and arthroscopic findings. Inadequate arthroscopic evaluation was identified as further cause for discrepancy.[93]
- Rubin et al. reported 93% sensitivity in evaluating isolated ACL tears. Several prospective studies have shown a sensitivity of about 92-100% and specificity of 93-100% for the MR imaging diagnosis of ACL tears.[94]
- M.Schurz et al., reviewed patients with clinical diagnosis of meniscal tears and acclaimed MRI as a clarifying diagnostic tool in the evaluation of meniscal tears, especially LM ruptures.[95]
- Ruth Crawford et al stated that, MRI is highly accurate in diagnosing meniscal and anterior cruciate ligament (ACL) tears and is the most appropriate screening tool before therapeutic arthroscopy. It is preferable to diagnostic arthroscopy in most of the patients because it avoids the risks of arthroscopy. The results of MRI differ for medial and lateral meniscus and ACL, with only 85% accuracy, british medical bullitanjuly 2007.[96]

MATERIALS AND METHODS

The study has been conducted at Saveetha Medical college and hospital after obtaining Permission from Institutional ethical committee of Saveetha University in the meeting conducted on 28/05/2015.

Sample size, sampling technique and statistical analyses

41 patients Sampling technique- 41 consecutive patients Statistical analyses - simple percentage and chi square test.

Inclusion criteria

Patient with knee trauma suspected to have meniscal injuries.

Exclusion criteria

Patients with contraindication of MRI Patients with femoral condyle, tibial plateau fractures Patients with associated dislocations.

Patients with knee trauma of any age group were included in the study. The patients were clinically evaluated and referred from orthopedics department of our hospital for MRI of knee. The patient's with ligament and meniscal injuries diagnosed in MRI underwent arthroscopy as a diagnostic or therapeutic procedure. The patients with fracture of femur, tibial plateau and dislocation; contraindications for MRI imaging and previous knee surgeries were excluded. The sensitivity, range of curve, specificity, positive predictive value (PPV) and negative predictive values (NPV) were calculated from patients in whom the arthroscopy was done.

ACL tears are common sporting injuries. On MRI, complete tears appear as discontinuity of the fibers, increased signal and/or laxity. The mid-substance of the ligament is injured more frequently than the proximal or distal portions. Partial tears or sprains of the ACL were recognized on MRI by altered signal and/or laxity in the presence of continuity of some fibers.

The menisci are two-semi lunar fibro cartilaginous structures located between the articular cartilage of the femoral and tibial condyles. They each have a crescent shape with an anterior and posterior horn and a body. The tips of the horns are attached to the tibial plateau adjacent to the intercondylar eminence. These attachments are known as the meniscal roots. A tear is diagnosed on MRI when high signal is demonstrated extending to the articular surface of the meniscus. Tears may be horizontal or vertical depending on whether they reach one meniscal surface or two. A complex tear is diagnosed when two /more tear configurations are present.

An informed consent was obtained prior to study after explaining the procedure of the examination to the patient. The examinations were be carried out in a Philips 1.5 TESLA MRI machine. The patient was placed in supine position on the table. The knee was kept in extension fifteen to twenty degrees external rotation (gives better imaging of ACL). The knee was secured in the coil by centering the joint. MRI sequences include Proton density weighted sagittal, coronal, T1, T2 coronal, fat saturation and high resolution axial oblique.

MRI images were acquired digitally with the use of a picture archiving and communication system (PACS) in DICOM (digital imaging and communications in medicine) format. The assessment of images were be performed by the use of software by the radiologist. The ACL was evaluated on sagittal, coronal & axial images and categorized as intact or torn. It is a normal ACL when a hypointense band of anteromedial and posterolateral bundles are seen. The presence of focal discontinuity or complete absence of ligament, abnormal signal intensity of the ligament, poor definition of its ligamentous fibers were considered as ACL tear, primary signs include deep femoral notch sign, femorotibial translation, PCL line sign, secondary signs are segond fracture, bone contusions, O'Donoghue's triad together medial collateral ligament tear and medial meniscal tear.

A hypointense meniscus without any altered signal intensity is considered normal. Presence of an intrameniscal high signal intensity reaching the articular surface will be regarded as a tear.

High signal intensities that doesn't extend to the periphery are categorized as degenerative.

Associated other ligament injuries of knee joint effusions, intraarticular loose bodies, contusions were evaluated.

The patients with positive findings on MRI underwent arthroscopy. The Orthopedician performed all the arthroscopies under spinal anaesthesia.

In arthroscopy the joint is divided into suprapatellar pouch, patellofemoral joint, medial gutter, medial compartment intercondylar notch, posteromedial compartment, lateral compartment and posterolateral compartment. Through anteromedial and posterolateral ports ACL and meniscus are visualized. Findings are evaluated and further surgical intervention was be carried out accordingly, ACL reconstruction for ACL tears and partial/subtotal menisectomy for meniscal tears.

The sensitivity, specificity, positive predictive values (PPV), negative predictive values (NPV) range of curve and pain score were calculated between MRI and arthroscopic findings.

DISCUSSION

The Main objective of the study is to determine the accuracy and efficacy of MRI in detecting meniscal injuries of knee joint. The study group consisted of 45 patients who were clinically suspected to have meniscal injuries. All the patients underwent arthroscopic knee surgery. The findings on MRI were correlated with arthroscopic findings and sensitivity; specificity, positive predictive value, negative predictive value and range of curve were calculated.

Of the 45 patients in this study, 42 were male and 3 were female. The study showed a male predominance of about 93.3% due to associated sports injuries. The age groups were ranging from 17 to 45 years. The average age was 24.5 years.

In our study, in case of lateral meniscus tears, MR had sensitivity of 93.34 % and specificity of 93.33%, PPV of 87.5% and NPV of 96.6% and 93.3 % ROC .Two patients were diagnosed to have tear in the anterior horn, which was diagnosed as normal on arthroscopy.

Regarding medial meniscus tear sensitivity for MR was about 93.7%, specificity is 93.1%, PPV of 88.2 %, NPV of 96.4 % and 93.4 % ROC. There were two false positive MR examinations in our study accounting for low PPV of MR examination. Out of these two false positive examinations, site of the tears were located predominantly in the posterior.

Due to high signal intensity and edema it was diagnosed as tear but arthroscopy finding turned out to be degenerative and also posterior horn tears of menisci are sometimes difficult on arthroscopy as suggested by studies.

In a study conducted by Kamini et al stated that were four false positive MR examinations in the study accounting for low PPV of MR examination. Out of these four false positive examinations, three tears were located predominantly in the posterior and one was in the anterior horn.98

Posterior horn tears of menisci are sometimes likely to be missed on arthroscopy especially if anterior approach is used and if the menisci are not probed. Inferior surface of meniscus is in particular, vulnerable to this flaw in arthroscopy.

The reason of false positive and false negative meniscal lesion diagnosis was related to diagnostic errors in MRI as well as faults in arthroscopic evaluation.

Levinsohn et al. stated that MRI seems to over-diagnose tears of the menisci resulting in a low PPV.[98] Mink et al stated that meniscal degeneration has been suggested to over-diagnosis because of the increased signal intensity.

The high NPV of 96.6% in lateral meniscus and 96.4 % in medial meniscus makes it a reliable test in evaluating meniscal pathologies.

In the study by Barronian et al. the NPV was 91% for menisci, whereas the PPV was 65%. Thus it is evident again that MRI's NPV makes it the investigation of choice.92

The average pain score for ACL and meniscal injuries taken from a scale of 1- 10 yielded results as follows, average score of about 7 – 8 with patients diagnosed with ACL and meniscal injuries and pain score of about 5-6 in patients with negative findings.

Contusion was present in 46.6 % of the patients and effusion was present in 35.5 % of the patients in this study.

Range of activity was also evaluated and was found that persons with only meniscal injury (13.33 %)were able to perform moderate to strenuous activities without pain when compared to people with ACL injuries (86.67%) who were only able to do mild activity.

In this study we have compared the results of MRI to that of arthroscopy keeping that as gold standard. This presupposes that arthroscopy is 100% accurate allows for the diagnosis of every possible intraarticular knee pathology, but is not always the case.

Arthroscopy is a technically demanding and an invasive procedure and has limited technical abilities.

Our study revealed a high sensitivity and specificity for ACL and meniscal injuries of knee joint in comparison with arthroscopy. Findings of this study population are consistent with other studies in this field.

So we have sufficient evidence to conclude that MRI is highly accurate in the diagnosis of ACL and meniscal injuries. MRI is an appropriate screening tool for therapeutic arthroscopy, making diagnostic arthroscopy unnecessary in most patients.

Magnetic resonance imaging is accurate and non-invasive modality for the assessment of ligamentous injuries. It can be used as a first line investigation in patients with soft tissue trauma to knee. MRI is advantageous overall in conditions where arthroscopy is not useful like peripheral meniscus tears and inferior surface tears and also associated contusions extra articular pathologies etc.

CONCLUSION

Thus this study concludes that MRI is a useful non-invasive modality having high diagnostic accuracy, sensitivity and negative predictive value making it a very reliable screening test for diagnosing internal derangements of knee joint.

One can rely on MRI to avoid diagnostic arthroscopy as MRI has a high sensitivity and specificity.

Almost all the ligament injuries can be diagnosed with high level of confidence.

Pathological entities need to be carefully differentiated from normal variants and artifacts of imaging.

Despite the fact that arthroscopy is the gold standard modality in evaluating knee pathologies, there lies limitations of the procedure such as associated extra-articular pathologies, posterior and inferior meniscal tears.

Other shortcomings of arthroscopy include its invasiveness, and possible complications associated with the procedure.

Hence performing an MRI prior to arthroscopy is necessary in overall evaluation of internal derangements of knee joint.

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ABBRREVATIONS

MRI – MAGNETIC RESONANCE IMAGING
ACL- ANTERIOR CRUCIATE LIGAMENT
PCL-POSTEIOR CRUCIATE LIGAMENT
LM – LATERAL MENISCUS
MM- MEDIAL MENISCUS
LCL-LATERAL COLLATERAL LIGAMENT
MCL-MEDIAL COLLATERAL LIGAMENT
PD-PROTON DENSITY
SAG-SAGGITAL
AMB-ANTEROMEDIAL BUNDLE
PLB- POSTEROLATERAL BUNDLE
ATS-ANTERIOR TIBIAL SUBLUXATION
LFC-LATERAL FEMORAL CONDLYLE
MFC-MEDIAL FEMORAL CONDYLE
PPV-POSTIVE PREDICTIVE VALUE
NPV-NEGATIVE PREDICTIVE VALUE
ROC-RANGE OF CURVE