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COMPARISON OF MRI WITH DIAGNOSTIC KNEE ARTHROSCOPY FOR EVALUATING MENISCAL TEARS

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Abstract:
This study compares the results of MRI and diagnostic arthroscopy of the knee joint to assess meniscal tears.

Patients and Methods
A total of 32 patients who underwent knee MRI from March 2020 to May 2021 and subsequently underwent arthroscopy were included in the study. All knees were evaluated for possible meniscal tears. The results of the MRI were compared to the results of the arthroscopy. The arthroscopic findings were used as the gold standard for determining the presence or absence of a meniscal tear. Of the 32 patients, 24 were male and 8 were female. The average age was 31 years (range, 22 to 45 years). Patients with a discoid lateral meniscus, history of meniscus surgery, or history of knee surgery were excluded from the study. The sensitivity, specificity, and accuracy were calculated based on the results of arthroscopy.

Results: The time between MRI and arthroscopy was 7-10 weeks (average of 8 weeks). In some cases, there was a difference between MRI and arthroscopy data in detecting meniscal tears. A false positive MRI result was detected in 1 (3.1%) patient, a false negative MRI result – in 5 (15.6%). MRI accuracy in assessing meniscal tears was 90.58%.

Conclusions: MRI is a non-invasive and extremely sensitive method of investigation that can detect early and minor anomalies of the menisci. However, MRI does not give one hundred percent accuracy; if the MRI result is reported as negative, but the patient continues to complain of persistent symptoms, arthroscopy should be consideredартроскопии.

Keywords: arthroscopy, knee joint, meniscus, MRI.

Introduction

Meniscal injuries are common, with the medial meniscus being damaged more often than the lateral meniscus. Patients usually complain of pain and swelling as the main clinical signs. Sometimes the clinical picture is also confusing, and a delay in diagnosis can lead to a worse prognosis. Therefore, further evaluation of meniscal tears should be confirmed byMRI or arthroscopy. Arthroscopy by direct visualization and probing of the menisci and anterior cruciate ligament (ACL) allows us to consistently assess the degree of

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damage. However, this is invasive and requires an experienced surgeon. Arthroscopy is considered the "gold standard" for evaluating knee injuries. Although the overall complication rate of diagnostic arthroscopy is moderately low, it is an invasive and relatively expensive procedure, and itseffectiveness ranges from 35 to 70%. Arthroscopy should ideally only be performed for therapeutic purposes if alternative non-invasive diagnostic methods, such as MRI, are available. MRI is a non-invasive method, does not pose a risk and does not expose the patient to radiation, since MRI does not use ionizing radiation. MRI is a valuable diagnostic tool for detecting radial posterior horn medial meniscus tears, which are common in older patients who also often have osteoarthritis, which masks their symptoms, which can definitely be improved after the tear is treated. MRI is indicated when considering surgery, such as arthroscopy. Several reports have documented that a large number of arthroscopic procedures can be avoided if patients have previously been examined by MRI. MRI is highly indicated in acute knee injuries, when the history and clinical presentation of orthopedic surgeons show questionable results, as well as in sports athletes who require direct treatment, as well as in patients with high surgical risk.

Feller and Websterreported that a negative MRI result is very helpful in avoiding unnecessary diagnostic arthroscopy. However, although MRI is highly sensitive and specific for assessing acute knee injury, some reports have documented a high incidence of false-positive PR resultsand detection of meniscaltears. Some false-positive MRI results that were found within the posterior horn of the medial meniscus are often attributed to insufficient visualization of the meniscus during surgery, and tears extending to the lower surface of the meniscus may also be difficult to visualize and, accordingly, the assessment of a meniscal tear may be subjective. Therefore, a general reliance on MRI for guidance should lead to unnecessary diagnostic arthroscopies. Identification of meniscal tears will be difficult to interpret and may depend on the viewer, as well as on the sensitivity of the scanner. Similar difficulties may arise during a clinical examination.

The aim of the present study was to compare the results of MRI and diagnostic arthroscopy of the knee joint for the diagnosis of meniscal tears.

Patients and Methods:

From March 2020 to May 2021, 32 patients were selected for the study after obtaining written informed consent from all patients. We prepared for this study after approval from the local ethics committee. MRI and arthroscopy of the knee joint were performed on all patients. All knees were examined for possible meniscal injury. All MRIs were evaluated by the same radiologist, and all arthroscopies were performed by the same surgeon. The results of arthroscopy were used as the gold standard for determining the presence or absence of meniscal tears. Patients with discoid lateral meniscus, a history of meniscus surgery, or a history of knee injury surgery were excluded from the study. The records of each patient were analyzed independently. Of the 32 patients, 24 were male and 8 were female, with a mean age of 31 years (range 22-45 years). In all cases, the injuries were unilateral, with 14 cases in the right knee and 18 cases in the left knee. 10%

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had no history of injury, and another 15%, although their knee was injured, could not remember the nature of the injury. In the remaining 75%, the most typical mechanism of injury was twisting.

MRI scans of all patients were performed by a qualified musculoskeletal radiologist without providing any clinical details of the cases. A high-signal area in the body of the meniscus was considered a tear if it extended to one or both articular surfaces or in which a deformity of the meniscus was detected, including shortening or blunting. These criteria are considered sensitive and specific signs ofmeniscal rupture. If the articular surfaces were not reached, a high signal was interpretedas the area of mucoid degenerationand, accordingly, the signs of the meniscus wereclassified as torn or not ([Figure 1]). Spinal anesthesia was used for all arthroscopic procedures. Standard anterolateral and anteromedial ports were used for the procedure. Details of surgical findings were documented, which included the anatomical structure associated with the presence or absence of a meniscus tear, its location, and other features, if available. In each case, MRI results were compared with arthroscopy data.

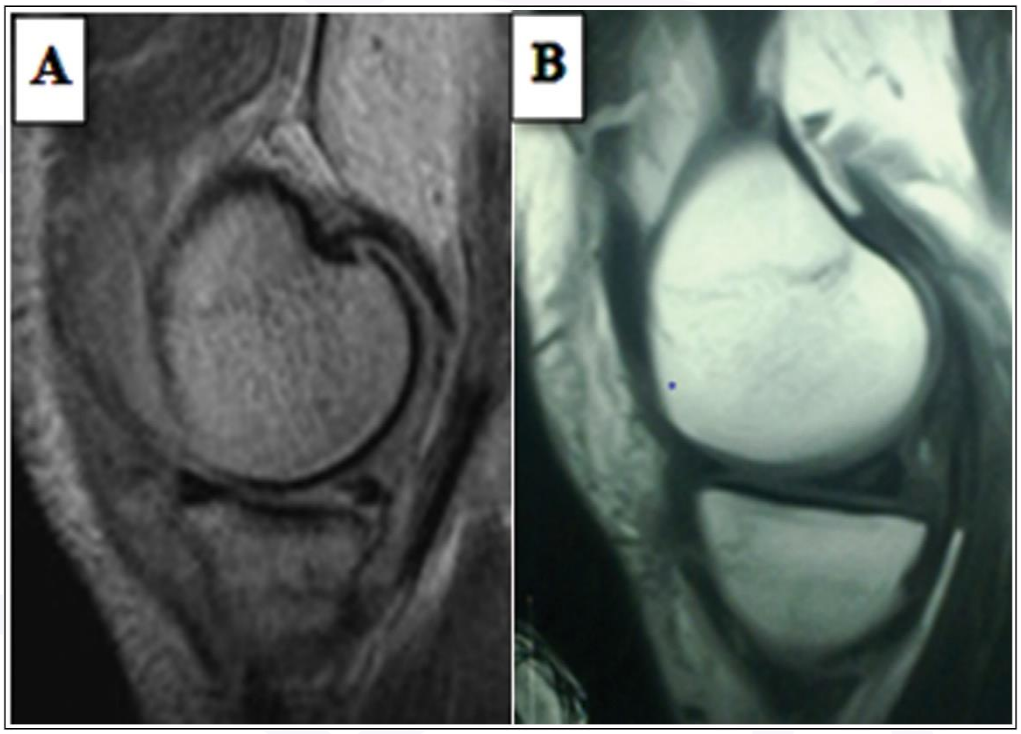

Figure 1: (a) Rupture of the posterior horn of the medial meniscus, which appears to be shortened. (b) If the articular surfaces were not reached, the high signal was interpreted as an area of mucoid degeneration rather than rupture.

The true positive result was an abnormal detection of the meniscus, documented by MRI andconfirmed by arthroscopy ([Figure 2]). The true-negative result was the absence of abnormalities detected by MRI or arthroscopy. A false positive result was determined if the MRI recorded an anomaly, but was not confirmed by arthroscopy ([Figure 3]).

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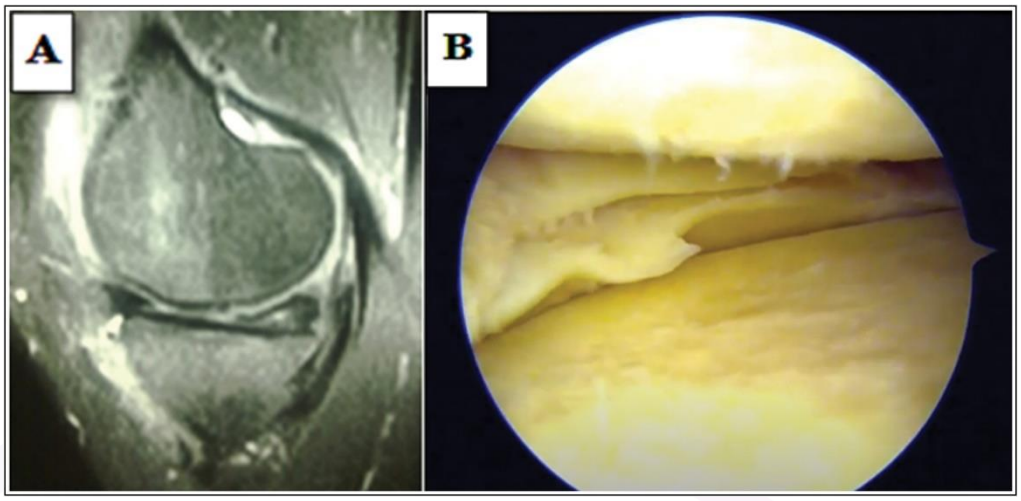

Figure 2: True positive MRI result. (a) An MRI scan revealed a horizontal tear in the posterior horn of the medial meniscus. (b) The rupture was confirmed by arthroscopy.

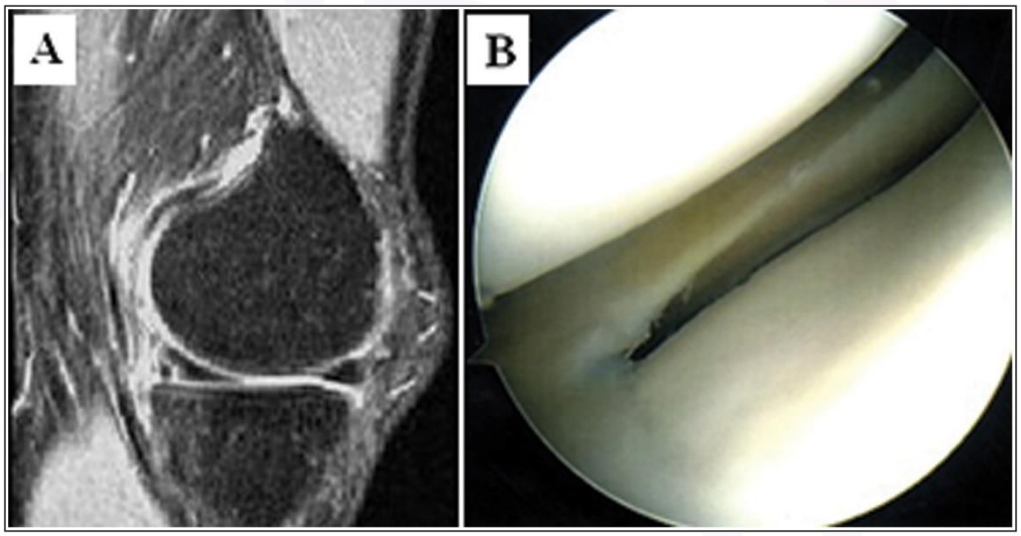

Figure 3: False positive MRI. Rupture of the posterior horn of the lateral meniscus on MRI (a), whereas in arthroscopy the meniscus is not damaged (b).

Arthroscopy was considered the gold standard for accurate diagnosis of meniscal tears, and to assess the sensitivity, specificity, and accuracy of MRI, the results of arthroscopy were considered a confirmed diagnosis. Sensitivity was determined from the number of true positive results divided by the sum of true positive results and false negative results. Specificity was determined by the number of true-negative results divided by the sum of true-negative and false-positive results. Accuracy was determined by the sum of true positive and true negative results divided by the total number of patients who underwent arthroscopy.

Results:

In 24 (75%) of 32 patients, indications for arthroscopy were signs of meniscal rupture on MRI. MRI results: isolated medial meniscus tears in 15 patients, isolated lateral meniscus tear in seven patients, a combination of anterior cruciate ligament and medial meniscus

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tears in two patients, and isolated anterior cruciate ligament tears in two patients. The menisci registered as normal included those that showed internal mucoid degeneration on MRI scans or wear on arthroscopic examination.

In eight (25%) patients, arthroscopy was performed according to clinical indications, despite negative MRI results of the meniscus. The time between MRI and arthroscopy was 7-10 weeks (average 8 weeks). The manifested signs were non-specific in 11 patients. Pain was the main complaint in 21 patients. A total of 17 patients had one or more episodes of locking up. In certain cases, the difference between MRI and arthroscopy data was obviousартроскопии. A false positive MRI result was detected in 1 (3.1%) patient. The tear was diagnosed on MRI and was considered to be present in the posterior horn of the lateral meniscus, but was not confirmed by PRand arthroscopy (case # 27). In eight patients, arthroscopy was performed according to clinical indications, despite the normal appearance of the menisci on MRI. Three of these eight patients had true negative results, while five patients had false negative MRI meniscal lesions. The menisci were considered normal on MRI, but subsequent arthroscopies revealed a tear. One patient had a horizontal fracture of the medial meniscus (case # 11), two patients had small radial ruptures of the posterior horn of the lateral meniscus (case # 30 and 32), and two patients had a combination of anterior cruciate ligament and lateral meniscus rupture (case # 14 and 19). These meniscal tears were not detected on MRI, but were only visible on arthroscopy. In four patients, anterior cruciate ligament rupture was clinically suspected and confirmed by MRI and arthroscopy. In knees with a combination of anterior cruciate ligament tear and meniscal tear, the indicative accuracy of MRI for diagnosing meniscal tears reached the level of 100% for medial meniscal injuries, while for lateralmeniscal injuries it was 50%. The accuracy of MRI in detecting medial meniscal tears was 96.8%, while in detecting lateral meniscal tears-84.37%, on average for the entire study — 90.58%. Arthroscopy It was associated with a complication rate of 3.12%. One knee required repeated hospitalization for treatment of hemarthrosis.

Discussion:

Arthroscopy provides an accurate diagnosis of 84% to 98.6% of cases and allows the treatment of meniscal tears. As a diagnostic method, arthroscopy exposes the patient to the discomfort and risks associated with anesthesia and surgery. Arthroscopy is associated with surgical risks, with a 2.5% complication rate in arthroscopicmeniscal surgery, including subcutaneous and peroneal nerve damage, deep infections, superficial infections, vascular damage, and pulmonary embolism. Sometimes arthroscopy does not reveal abnormalities or probably minor non-pathological lesions, such as patellar folds or chondromalacia. This means that the patient may be at surgical risk without improving symptoms. MRI is overused to assess knee diseases and is not a cost-effective methodfor assessing knee injuries. However, MRI can effectively identify most internal knee disorders because it has more specificity (i.e., accurately detects the absence of internal knee disorders) than sensitivity (i.e., accurately detects internal knee disorders). The reliability of a negative MRI result is higher than the reliability of a positive MRI result. Thus, if a patient is given a negative MRI result, the high specificity and reliability

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of the negative MRI result means that it is probablya real negative result. MRI avoids pointless diagnostic arthroscopic surgeries for acute knee injuries, gives a multi-plane image and gives images of soft tissues, which other imaging methods cannot. Some patients (1-2%) experience claustrophobia. False positives and false negatives The MRI report provides guidance for clinical decision-making and has medico-legal implications. If the surgeon relies solely on the MRI report to decide on surgery, false-positive reports can lead to unnecessary arthroscopic procedures. A bright signal in the meniscus substance is considered a tear if it extends to oneor both articular surfaces.

The results of the current study suggest that it is unwise to trust negative MRI reports in the face of high clinical suspicion. In the current study, false-negative MRI scans were detected in five patients. One patient had a horizontal medial meniscal tear, and two false-negative MRI studies failed to delineate the small radial tears found in the posterior horn of the lateral meniscus. Only the intra-meniscal signal was visible, and the posterior horn of the lateral meniscus remains a challenging area for MRI evaluation. Two other patients had a combination of ACL and lateral meniscus tears. De Smet and Grafexplained the low sensitivity of the MRI results of a meniscal tear on the basis of a co-existing PKC anomaly, especially if the tear affected the lateral meniscus. This was confirmed in the current study, as two patients with a combination of ACL and lateral meniscus tears had false negative results. De Smet and Grafalso analyzed a series of 400 MRI scans from patients who subsequently underwent arthroscopic examinations to identify possible causes of MRI refinement errors. They found that factors that increase the likelihood of missing identification of a meniscal tear on MRI include the presence of concomitant anterior cruciate ligament tear, as wellas peripheral meniscal tears. False positive MRI results were found in one patient. This discrepancy was an over-specification of the presence of elevated signal artifacts on the MRI. Peterfi et al. concluded that the increased signal was mainly related to the "magic angle" phenomenon and not related to meniscus rupture. They also reported signal amplification in the medial posterior horn of the lateral meniscus in 74% of patients. This phenomenon is usually associated with the orientation of the medial part of the lateral meniscus at an angle of 55° to a static magnetic field, which causes artifacts of an increased signal, which was not associated with meniscal rupture. The inner edge of the posterior horn of the lateral meniscus is a classic site for a magic angle artifact due to the ascending nature of this area of the meniscus in many patients. This was confirmed in the current study, because the only false positive result was found within the posterior horn of the lateral meniscus, while the meniscus was found intact by arthroscopy. Typically, other possible explanations for false positive MRI results are also associated with incorrectinterpretation of normal anatomy or inadequate arthroscopic technique. Most of the ruptures were diagnosed within the posterior horn of the meniscus, where they were missed by an arthroscopist in 5% of cases. The appearance on MRI of a small or insufficient meniscus in a patient who had not previously had a meniscectomywas in all cases associated with a rupture. This MRI result should be considered as positive evidence of a meniscus tear, and not as an unsatisfactoryMRI result. In the current study, MRI had high sensitivity in the medial meniscus area, where it was absolutely accurate

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in detecting a tear in 94.4% of patients, while its sensitivity in detecting a lateral meniscus tear was 60%, and damage to the medial meniscus (64.28%). It was found to be more common than a lateral meniscus tear (35.7%). This was similar to the results of a study by Crawfordet al. Only eight of these 32 patients артроскопияunderwent clinically indicated arthroscopy after a negative MRI result. This concludes that MRI is a vital examination before deciding on surgery to prevent unnecessary diagnostic arthroscopies in a significant number of cases. The results of this study show that meniscal ruptures can be accurately diagnosed by MRI, and are consistent withthe results of other studies. Winkenet al. We conducted a study to understand the success of MRI in patients with high clinical suspicion before rushing into артроскопиейknee arthroscopy, and documented that MRI is a successful imaging technique in selecting patients for arthroscopy from the general population. However, regular use of MRI to verify the diagnosis is not recommended, as the positive prognostic value is low; However, it can be used to exclude pathology, since a significant number of injuries have a high prognostic valueof a negative result. Recently, Shah et al. It has been reported that the classification of ISAKOS can be very valuable both in clinical work and during regular MRI scans. The use of this single strategy, which has recently been precisely approved, would guarantee gradual interdisciplinary compliance and should guide patient treatment and лlong-term evaluation of outcomes. The strengths of this study are due to its initial prospective and randomized design. However, the current study has some limitations, such as a small number of patients. Future studies should examine the correlation between MRI and arthroscopy results when assessing meniscal tears with a large sample size. All MRIs were evaluated by the same radiologist. To improve accuracy, more testers could be used and their results compared, but practicallimitations did not allow this. The accuracy of diagnosing a meniscus tear will depend on the superior imaging equipment, as well as on the experience and skills of an orthopedic surgeon, radiologist, and arthroscopist. The results of this study show a strong association between MRI and arthroscopic assessment. The accuracy of MRI allows you to alternatively decide on arthroscopy among patients who may benefit from it, for example, eliminating the need for arthroscopy. from one-third to at least one 1/2 of those clinicallydiagnosed with a meniscus. injuries. This reduction in the number of invasive procedures should result in a corresponding reduction in the financial and human resources required to treat knee injuries.

Conclusions:

(1) Although MRI is a valuable adjunct to clinical decision-making, it is neither 100% sensitive nor specific. Therefore, it is important that if the MRI shows a negative result, but the patient continues to complain of persistent mechanical symptoms, an arthroscopic examination should be considered.

(2) The strength of the correlation between MRI and arthroscopy results confirms the value of MRI for evaluating the internal structures of the knee joint. However, it is important to consider the economic burden of MRI on patients, especially in countries with poor health and poor insurance coverage.

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