

Anterior cruciate ligament and meniscal injuries of the knee: MRI and arthroscopic findings

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Abstract

Aim: Study of correlation between MRI and arthroscopic findings in anterior cruciate ligament and meniscal injuries of the knee joint. **Methods:** This cross-sectional study was carried out in the Department of Orthopaedics, Patna Medical College and Hospital, Patna, Bihar, India from July 2018 to March 2019. Total 30 patients with suspicion of traumatic ligament or meniscal injuries of the knee joint and 18-50 years of age group were included in this study. Initially, proper history of the patient was taken, and thorough clinical examination was performed by a qualified orthopaedic surgeon. Plain radiographs of the involved knee joint were taken to rule out degenerative changes, loose bodies and fractures around the knee joint. MRI of 1.5 Tesla was done on the involved knee joint. After the pre-anesthetic check-up and consent, diagnostic arthroscopy of the involved knee was done by an experienced and qualified orthopaedic surgeon. Findings of the MRI and arthroscopy are noted down and compared. **Results:** On MRI all 30 patients showed ACL tear. Comparison between MRI and arthroscopy findings for ACL tear showed 28 patients being true positive and one patient being false positive. The Sensitivity, PPV, Accuracy of MRI scan in detecting ACL injury in our study were 96%, 100% & 96% respectively. Fisher exact test was employed to calculate the statistical significance and p value. Here the p value for ACL tear is 1, which is statistically not significant. MRI showed medial meniscus tear in all 18 patients. Comparison between MRI and arthroscopy findings for ACL tear showed 12 patients being true positive, 3 patients being false positive, 3 patients being false negative and 9 patients being true negative. The Sensitivity, specificity, PPV, NPV, Accuracy of MRI scan in detecting medial meniscal injury in our study were 78.7%, 82.8%, 82.8%, 78.7 & 81.0% respectively. Here the p value for medial meniscal tear is 0.027 and is significant. 7 patients showed lateral meniscus tear on MRI. Comparison between MRI and arthroscopy findings for ACL tear showed 5 patients being true positive, 2 patients being false positive, 6 patients being false negative and 17 patients being true negative. **Conclusion:** Arthroscopy still remains the gold standard in diagnosing the internal knee lesions and is highly useful in patients with persistent symptoms or in case of strong clinical suspicion in spite of normal MRI.

Keywords: Arthroscopy, MRI, ACL tear.

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Introduction

Knee joint is one of the most commonly injured joints because of its anatomical structure, its exposures to external forces and the functional demands placed on it. Because of the difficulty of obtaining an accurate clinical examination in the acute setting, the incidence of such injuries is not well understood[1,2].

Recently, new diagnostic protocols have been developed to improve the diagnosis of knee injuries with high-resolution magnetic resonance imaging (MRI) scans[3-5]. These new imaging protocols have been shown to be both sensitive and specific for most structures[3].

Diagnostic arthroscopy is an important advance, improving diagnostic accuracy from 64 to 94 per cent. However, it is an invasive procedure, with the possible attendant complications of infection, hemarthrosis, adhesions, reflex sympathetic dystrophy[6]. Magnetic Resonance Imaging (MRI) scanning of the knee joint has often been regarded as the non-invasive alternative to diagnostic arthroscopy. MRI scan has now been routinely used to support the diagnosis for meniscal or cruciate ligament injuries prior to recommending arthroscopic examination and surgery[7].

The comparison of MRI diagnosis and surgical/clinical findings has always been a challenge for the health professions. Review of the available literature suggests that there are a number of studies looking at these diagnostic tools and only limited studies are available taking them together[8].

Material and methods

This cross-sectional study was carried out in the Department of Orthopaedics, Patna Medical College and Hospital, Patna, Bihar,

India from July 2018 to March 2019, after taking the approval of the protocol review committee and institutional ethics committee.

Total 30 patients with suspicion of traumatic ligament or meniscal injuries of the knee joint, in the age group 18-50 years were included in this study. Patients with degenerative changes of the knee joint, associated fractures around the knee joint and patients contraindicated for MRI scan were excluded.

Initially, proper history of the patient was taken, and thorough clinical examination was performed by a qualified orthopaedic surgeon. Plain radiographs of the involved knee joint were taken to rule out degenerative changes, loose bodies and fractures around the knee joint. MRI of 1.5 Tesla was done on the involved knee joint. After the pre-anesthetic check-up and consent, diagnostic arthroscopy of the involved knee was done by an experienced and qualified orthopaedic surgeon. Findings of the MRI and arthroscopy are noted down and compared.

Results

This study included 30 patients with age ranging from 18 to 50 years with a mean age of 28.5 years at the time of admission. 20 (66.67%) of them were males and 10 (33.33%) were females.

On MRI all 30 patients showed ACL tear. Comparison between MRI and arthroscopy findings for ACL tear showed 28 patients being true positive and one patient being false positive. The Sensitivity, PPV, Accuracy of MRI scan in detecting ACL injury in our study were 96%, 100% & 96% respectively. Fisher exact test was employed to calculate the statistical significance and p value. Here the p value for ACL tear is 1, which is statistically not significant.

Table 1: Comparison between MRI and arthroscopic findings for ACL tear

MRI	Arthroscopically positive	Arthroscopically negative	Total
MRI positive	28	2	30
MRI negative	0	0	0
Total	28	2	30

Table 2: ACL findings

Test	ACL (%)
Sensitivity	100%
Specificity	-
Positive predictive value (PPV)	96%
Negative predictive value (NPV)	-
Accuracy	96%

MRI showed medial meniscus tear in all 18 patients. Comparison between MRI and arthroscopy findings for ACL tear showed 12 patients being true positive, 3 patients being false positive, 3 patients being false negative and 9 patients being true negative. The

Sensitivity, specificity, PPV, NPV, Accuracy of MRI scan in detecting medial meniscal injury in our study were 78.7%, 82.8%, 82.8%, 78.7 & 81.0% respectively. Here the p value for medial meniscal tear is 0.027 and is significant.

Table 3: Comparison between MRI and arthroscopic findings for medial meniscus tear

MRI	Arthroscopically positive	Arthroscopically negative	Total
MRI positive	15	3	18
MRI negative	3	9	12
Total	18	12	30

Table 4: Medial meniscus findings

Test	Medial meniscus (%)
Sensitivity	82.8%
Specificity	78.7%
Positive predictive value (PPV)	82.8%
Negative predictive value (NPV)	78.7%
Accuracy	81%

7 patients showed lateral meniscus tear on MRI. Comparison between MRI and arthroscopy findings for ACL tear showed 5 patients being true positive, 2 patients being false positive, 6 patients being false negative and 17 patients being true negative. The

Sensitivity, specificity, PPV, NPV, Accuracy of MRI scan in detecting lateral meniscal injury in our study were 58.1%, 93.3%, 81.0%, 81.0% & 81.0% respectively. Here the p value for lateral meniscal tear is 0.033, which is statistically significant.

Table 5: Comparison between MRI and arthroscopy findings for lateral meniscus tear

MRI	Arthroscopically positive	Arthroscopically negative	Total
MRI positive	5	2	7
MRI negative	6	17	23
Total	11	19	30

Table 6: Lateral meniscus findings

Test	Lateral meniscus (%)
Sensitivity	58.1%
Specificity	93.3%
Positive predictive Value (PPV)	81%
Negative predictive value (NPV)	81%
Accuracy	81%

Discussion

Our study spanned over a 12-months period. Prospective evaluation of 30 patients with suspected internal derangements of knee with MRI and subsequently arthroscopy was done. The anterior cruciate ligament and menisci were studied on both the modalities and comparisons were drawn. Arthroscopy was considered as gold standard and the sensitivity, specificity and accuracy of MRI were calculated. Of the 30 patients studied, there were 30 ACL tears, 18 medial meniscal tears and 7 lateral meniscal tears on MRI.

A large percentage of knee pain or disability is caused by pathological condition of menisci. One study reported it to be the cause of two-thirds of all the internal derangements of the knee joint[9]. Likewise, disruption of the anterior cruciate ligament, a major stabilizer of the knee, leads to the loss of stability of the knee and potentially significant dysfunction[10]. Although ACL is the most frequently torn ligament of the knee, the ACL tear has remained clinically elusive. These injuries account for a large number of referrals to hospitals. The evaluation of these lesions remains a difficult clinical problem. The MRI is the frequently used diagnostic modality for these internal derangements because of being non-invasive, painless and unassociated with risk of radiation[11]. The accuracy, sensitivity

and specificity values for knee lesions vary widely in literature. Rubin *et al.*[12] reported 93% sensitivity for diagnosing isolated ACL tears. Similarly several prospective studies have shown a sensitivity of 92- 100% and a specificity of 93-100% for the MR imaging diagnosis of ACL tears[12-14]. The sensitivity for diagnosing isolated meniscal tears in Rubin's series was 98% and it decreased when other structures were also injured. The specificity in isolated lesion was 90%. In a multicentric analysis Fischer[15] reported an accuracy of 78-98% for the chronic anterior cruciate ligament and 64-95% for the meniscal tears.

The sensitivity and specificity of MRI in detecting meniscal tears exceeds 90%. Ryan *et al.*[16] in a prospective comparison of clinical examination, MRI, bone SPECT and arthroscopy to detect meniscal tear reported high diagnostic ability of MRI along with bone SPECT to detect meniscal tears with sensitivity and specificity of 80% and 91% respectively. In the present study, the sensitivity and specificity of MR imaging for knee for medial meniscal lesion was 82.8% and 78.7% respectively. The sensitivity and specificity of MR imaging for knee for lateral meniscal lesion was 58.1% and 93.3% respectively. Therefore, MRI has a high accuracy in diagnosing ACL than lateral meniscus and medial meniscus injury.

However, MRI is statistically significant in case of meniscal tears but not significant in case of ACL tear in present study.

Conclusion

The present study concluded that arthroscopy still remains the gold standard in diagnosing the internal knee lesions and is highly useful in patients with persistent symptoms or in case of strong clinical suspicion in spite of normal MRI.

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