

Arthroscopic, Magnetic Resonance Imaging and Clinical Evaluation of Meniscal Tears in Patients with Chronic Anterior Cruciate Ligament Tears



Medical Science

KEYWORDS : Magnetic resonance imaging, Arthroscopy, chronic anterior cruciate ligament tear, meniscus.

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ABSTRACT

Purpose: Ours is a prospective cross sectional study performed to evaluate the incidence of meniscus tears arthroscopically and the effectiveness of magnetic resonance imaging (MRI-1.5 Tesla) and clinical examination in detecting these lesions in patients with chronic anterior cruciate ligament (ACL) tears. **Methods:** We reviewed 99 patients (92 male and 7 female) with a mean age of 28.4 years (range, 15 to 52 years) who underwent ACL reconstruction for chronic ACL tears. Injuries were classified as chronic because arthroscopy was performed after more than 6 weeks of injury. All 99 patients had clinical and MRI evaluation followed by knee arthroscopy. The presence of meniscus tears was analyzed. The sensitivity, specificity, positive predictive value and negative predictive value of clinical examination and MRI was calculated and compared. **Results:** On arthroscopy, a medial meniscus tear was found in 39 patients (39.4%), a lateral meniscus tear is found in 23 patients (23.23%), both meniscus were torn in 16 patients (16.16%) and no meniscus lesions were found in 21 patients (21.21%). The sensitivity, specificity, positive predictive value and negative predictive value for detecting medial meniscus tears in Chronic ACL tears on clinical examination were 85.45%, 65.9%, 75.8% and 78.4% respectively; the sensitivity, specificity, positive predictive value and negative predictive value for detecting medial meniscus tears on MRI were 74.45%, 59.1%, 69.5% and 65%. Similarly the sensitivity, specificity, positive predictive value and negative predictive value for detecting lateral meniscus tears in Chronic ACL tears on clinical examination were 48.7%, 96.7%, 90.5% and 74.35%; the sensitivity, specificity, positive predictive value and negative predictive value for detecting lateral meniscus tears on MRI were 46.15%, 95%, 85.71% and 73%. **Conclusion:** We conclude from our study that in patients on chronic ACL tear patients, the prevalence of medial meniscus tears seems to be high.

INTRODUCTION

The menisci are frequently injured during anterior cruciate ligament (ACL) injury or degenerate over a period of several years.¹ so the prevalence of this disorder is higher in case of chronic deficiencies of ACL as compared to patients having meniscus tears during acute setting of ACL tears.² Studies have highlighted the bio-mechanical changes in the setting of chronic ACL tears in the knee joint which predispose patients to tear of menisci, medial more common than the lateral.^{2,3,4} This is in contrast to those tears which occur during the time of acute ACL tears, where lateral menisci tears are more common.²

The purpose of this cross sectional prospective study is to evaluate the incidence of meniscus tears arthroscopically and the effectiveness of magnetic resonance imaging (MRI-1.5 Tesla) and clinical examination in detecting these lesions in patients with chronic anterior cruciate ligament (ACL) tears. We calculated the sensitivity, specificity, positive predictive value and negative predictive value of clinical examination and MRI in detecting meniscal tears in these patients, considering arthroscopy to be gold standard.

MATERIALS AND METHODS

We prospectively reviewed 99 patients (92 male and 7 female) with a mean age of 28.4 years (range, 15 to 52 years) who underwent ACL reconstruction for chronic ACL tears from May 2011 to November 2013. Patients with previous menisectomies, knee ligament repairs or reconstructions, suspected collateral or posterior cruciate ligament injuries and osteochondral fractures on imaging were excluded from the study. Sixty right knees and thirty nine left knees were treated at more than 6 weeks (range, 2 to 120 months) after injury. All patients had clinical and MRI evaluation done followed by knee arthroscopy. Duration of MRI from arthroscopy was 1.2 months (mean) and ranged from 1 week to 2 months. In all these cases conservative treatment was initially given, but it had failed. Injuries were classified as chronic as arthroscopy was performed 6 weeks after they had occurred.

Clinical examination of the knee joint was performed using

standard tests for anterior cruciate ligament (lachmann test, anterior drawer test and pivot shift test) and for menisci (joint line palpation, McMurray's test and Apley's tests).

Each MRI was performed using standard knee protocol with 1.5 Tesla MR magnet and transmit and receive cylindrical extremity coil. Spin echo T1-weighted, proton density-weighted and T2-weighted sequences were done in sagittal and coronal planes along with axial cuts.

All MR images were reviewed preoperatively by an experienced radiologist employed at our institute. The radiologist was provided clinical summary of all the patients. The operating surgeon was not told about the MRI findings to avoid bias. MRI was interpreted as positive for a meniscus tear if the intrameniscal signal contacted the surface of the meniscus. The arthroscopic findings were recorded intraoperatively. Arthroscopy was considered as gold standard. The results of Clinical examination, MRI and arthroscopy were tabulated in a excel sheet and reviewed independently. A false positive was considered if the clinical diagnosis/ MRI reported an abnormality but was not confirmed at arthroscopic operation. A false-negative result had a negative MRI report/ clinical diagnosis and a positive finding at operation. The sensitivity, specificity, positive predictive value and negative predictive value were calculated. Z test was used to find whether the differences were statistically significant or not. $P < 0.5$ was considered significant.

RESULTS

The age of the patients ranged from 15 to 52 years, with a mean of 28.4 years. The duration of injury ranged from 2 to 120 months, with a mean of 12.8 months. Of the 99 patients 50 patients had a history of fall (including non contact sports injuries) and 49 patients had a history of two wheeler road traffic accident.

Clinical evaluation preoperatively showed that a medial meniscus tear was found in 56 cases (56.56%), a lateral meniscus tear was found in 15 cases (15.15%), both menisci were torn in 6 cases (6.06%) and no tear was present in 22 cases (22.22%).

MRI evaluation preoperatively showed that a medial meniscus tear was found in 49 cases (49.5%), a lateral meniscus tear was found in 10 cases (10.1%), both menisci were torn in 2 cases (2.02%) and no tear was present in 29 cases (29.3%).

On arthroscopy, a medial meniscus tear was found in 39 patients (39.4%), a lateral meniscus tear is found in 23 patients (23.23%), both meniscus were torn in 16 patients (16.16%) and no meniscus lesions were found in 21 patients (21.21%). Most commonly tears were present in posterior horns of menisci and overall horizontal tears were a common pattern.

Cross tabulation counts of clinical examination, MRI and arthroscopy on both menisci are shown in Tables 1 to 4. The sensitivity, specificity, positive predictive value and negative predictive value of clinical examination for detecting menisci tears in chronic ACL tears is given in Table 5, and for MRI is given in Table 6.

Table 1: Medial meniscus tears on clinical examination and arthroscopy

Arthroscopy			
Clinical Examination	Positive	Negative	Total
Positive	47	15	62
Negative	8	29	37
Total	55	44	99

Table 2: Medial meniscus tears on MRI and Arthroscopy

Arthroscopy			
MRI	Positive	Negative	Total
Positive	41	18	59
Negative	14	26	40
Total	55	44	99

Table 3: Lateral meniscus tears on Clinical examination and Arthroscopy

Arthroscopy			
Clinical Examination	Positive	Negative	Total
Positive	19	2	21
Negative	20	58	78
Total	39	60	99

Table 4: Lateral meniscus tears on MRI and Arthroscopy

Arthroscopy			
MRI	Positive	Negative	Total
Positive	18	3	21
Negative	21	57	78
Total	39	60	99

Table 5: Clinical examination correlation (percentage) with Arthroscopic findings in both menisci

Test	Medial meniscus	Lateral meniscus
Sensitivity	85.45%	48.7%
Specificity	65.9%	96.7%
Positive predictive value	75.8%	90.5%
Negative predictive value	78.4%	74.35%

Table 6: Magnetic resonance imaging correlation (percentage) with Arthroscopic findings in both menisci

Test	Medial meniscus	Lateral meniscus
Sensitivity	74.54%	46.15%
Specificity	59.1%	95%
Positive predictive value	69.5%	85.71%
Negative predictive value	65%	73%

DISCUSSION

Chronic ACL tear presents with different instability related lesions such as in case of medial meniscus (posterior longitudinal tear, bucket handle tear, ramp lesion); lateral meniscus (posterior or longitudinal tear, radial tear of posterior horn, bucket handle tear, fraying of anterior horn); cartilage lesions in medial and lateral femoral condyles; lateralization of patella; and notch abnormalities (stenosis, osteophytes, gothic arch shape).⁵ Chronic injuries are those in which MRI and surgery are performed more than 6 weeks after injury.^{6,7} On comparing our findings we found out that although MRI is used commonly for diagnosing ligament and meniscus knee injuries, clinical examination outweighs it many aspects. We found some studies by Sanchis-Alfonso, De Smet and Graf and Sameer Naranje et al which have shed light on this topic.^{8,9,10}

In our study meniscus tears were found in 78.8% of patients, which is comparable to earlier reports of 73 to 98% in similar patients with chronic ACL tears.¹¹⁻¹³ The incidence of meniscus tears in acute ACL tears has been reported from 41% to 77%, indicating that meniscal tears are more commonly associated with chronic ACL tears.^{12,14,15} This is because, in these patients, meniscal injuries can occur at the time of initial injury and some others may result from recurrent "giving way" episodes long after the ACL was disrupted. We also found that medial meniscus tears (39.4% [39/99]) were more common than lateral meniscus tears (23.23% [23/99]). This finding was similar to that of a study carried out in patients with chronic insufficiency,¹⁵ but it is in contrast to that of studies carried out in patients with acute ACL ruptures,^{11,16} where the lateral meniscus is the more common site of the tear. The reason for this is that new medial meniscus tears can occur in these patients as the time since injury increases.¹⁷ There is an increase in translation of the medial femoral condyle in ACL-deficient knees whereas meniscotibial translation remains almost unchanged, and this difference in translation patterns may be responsible for the high rate of secondary medial meniscus tears in patients with ACL deficiency.³ Glashow et al.¹⁷ in 1989 emphasized that meniscus tears with chronic ACL injuries are often degenerative and complex, supporting the concept that chronic instability, seen with chronic ACL tears, leads to or accelerates degenerative meniscus tears. It also predisposes patients to early and accelerated degenerative joint disease.¹⁸

Many reports have had similar results as ours with stressing the importance of history taking and clinical examination and no statistical advantage of MRI in these cases.^{19,20,21,22} Patients in whom meniscus tears are diagnosed on MRI but are not present arthroscopically can be due to misdiagnosed meniscal cysts, or mucoid degeneration or simply misinterpretation of normal anatomy or inadequate arthroscopic techniques. Some lesions could have been missed due to large spacing for imaging. Kreitner et al.²³ report on "over-interpretation of central signal intensities with contact to the meniscal surface, but without disturbance of the meniscal contour" as the prime aetiology of missed meniscal injuries in their study (two cases in our series). Moreover, they mention the "magic angle phenomenon" as a cause of missing tears on MRI. Li et al.²⁴ report a medium risk of magic angle phenomenon for FSE (fast spin echo). The magic angle phenomenon has had an influence in our readings since our MRI centres use FSE. Overlooked MRI sheets can be a cause of the missing tears on the MRI. There is often a time gap between MRI and arthroscopic examination during which tears can occur in menisci which thus can be missed on MRI examina-

tion (averaged 1.2 months in our study). Finally the results of MRI are varied if the radiologist is not a specialist in musculoskeletal radiology.

MRI has superior sensitivity in detecting frank posterior horn tears and intra-substance meniscal tears, bone injuries with acute knee effusion and changes in hidden areas during arthroscopy, i.e., beneath the articular or in extra-articular spaces, deep chondral and sub-chondral lesions. Incidental findings on screening MRI facilitate preoperative planning. Combined injuries may affect the diagnosis of meniscus injuries, as there is a tendency to miss menisci injuries clinically on examination, especially lateral ones.²⁵

The correlation between clinical versus arthroscopy and MRI versus arthroscopy findings was evaluated using Z test. In medial meniscus injuries we observed that there was statistically significant difference between clinical Vs arthroscopy and MRI Vs arthroscopy group in negative predictive value (78.4 Vs 65, $p=0.03$) but with no statistical difference in specificity (65.9 Vs 59.1, $p>0.05$), sensitivity (85.45 Vs 74.54, $p>0.05$) and positive predictive value (75.8 Vs 69.5, $p>0.05$). In lateral meniscus injuries we observed that on comparison between the two groups there was no statistical significant difference in sensitivity (48.7 Vs 46.15, $p>0.05$), specificity (96.7 Vs 95, $p>0.05$), positive predictive value (90.5 Vs 85.71, $p>0.05$) and negative predictive

value (74.35 Vs 73, $p>0.05$). All of the above statistical values are lower than other similar studies that we came across.^{8,9,10}

Limitations of this study were that although arthroscopic examination has been used as a gold standard in detecting meniscal tears and tear shapes, posterior horn tears and longitudinal small tears especially on undersurface of menisci can be missed if special attention is not given by the surgeon. Also posterior horn tears of lateral meniscus extending into orifice of popliteus tendon can be missed by some surgeon. MRI's have not been evaluated by musculoskeletal radiologist so decreasing the accuracy of their examination of MRI images.

CONCLUSION

The strength of correlation between MRI and arthroscopic findings confirms the value of MRI in assessing internal knee structures. Whereas modern imaging techniques can be invaluable in diagnosis, a competent and preferably repeated physical examination is essential. MRI(s) have a definitive role in planning for arthroscopic surgeries in these patients, helps in reducing the time of arthroscopy and in finding meniscus injuries not picked up in clinical examination. We also conclude that the prevalence of medial meniscus injuries is more than lateral meniscus tears. Although MRI correlates well with arthroscopy, clinical examination has overall better accuracy in picking up menisci injuries in chronic ACL deficient knees.

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