Comparison Of Clinical Examination, MRI And Arthroscopy In Knee Injuries.

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Abstract

Objective: To compare accuracy of clinical examination and MRI taking Arthroscopy as Standard in knee injuries. Patients and Methods: 60 patients with knee injury were subjected to clinical examination, MRI and then Arthroscopy. The results were compared and analysed using various statistical tests. Results: Diagnostic accuracy of MRI was 66.67% for medial meniscus and 90% for lateral meniscus GR 1 and 2 meniscal tears have low sensitivity 50% as compared to GR 3 and 4 with 88%. In the case of ACL tears, diagnostic accuracy for both clinical examination and MR examination came out to be 90% Conclusion: We can avoid diagnostic arthroscopy in patients with ACL and PCL injuries having equivocal clinical and MRI examination and go on for therapeutic modality. In case of meniscal injuries graded as 1 and 2 on MRI, are rarely seen on arthroscopy hence arthroscopy is not required for these meniscal injuries.

INTRODUCTION

The knee is one of the most frequently injured joints because of its anatomical structure, its exposure to external forces and the functional demands placed on it.[1]

Orthopaedic surgeons relied completely on clinical examination in the late 1960 & early 70's till numerous reports suggested the role of arthroscopy in diagnosis and treatment of various knee disorders.[2]

The development of magnetic resonance imaging (MRI) in late 1980's helped in the diagnosis of internal derangements of knee without arthroscopy. MRI of knee has several advantage over arthroscopy .

It is noninvasive, poses minimal risk if any, produces minimal patient discomfort and posterior cruciate ligament is easily seen on MRI. Advantages of arthroscopy far outweigh the disadvantages. The advantages are smaller incisions, reduced post operative morbidity (where patient can return to work in 1-2 weeks after most arthroscopic procedures), less intense inflammatory response than standard arthrotomy.[3]

The disadvantages of arthroscopy are intra-articular damage to surface, hemarthrosis, thrombophlebitis, infection, tourniquet paresis.[4]

Many factors affect the accuracy of MRI in detecting meniscal lesions like experience of radiologist in interpreting studies. Many pitfalls occur in interpretation e.g. in studying the central portion of menisci, the meniscofemoral ligament and transverse meniscal ligament, elderly patients often exhibit increased intrameniscal signal that can be mistaken for tear. In case of ACL tears, MRI often is not helpful in differentiating partial from complete tears. In case of medial collateral ligament injury, mild degrees of injury corelate well; imaging is less accurate in grading more severe injuries.[5]

In the acute phase of knee injury, the indication of MR imaging depends upon severity of pain and/or swelling of knee joint. Although clinical examination is most important for the diagnosis of ligament injury. Painful stress examinations are not always accurate in the acute phase of injury. For that reason MR imaging is indicated for early diagnosis of the acutely injures knee.

So comparison of clinical examination, MRI and arthroscopy becomes important as it can help us diagnose and treat lesions of knee in a better way.

MATERIAL AND METHODS

The study was a prospective study correlating the findings of MRI with that of arthroscopy in knee injuries after a thorough clinical examination by a senior consultant.

A total of 60 patients with recent knee injuries were included

from indoor/outdoor. All these patients had clinical examination, MRI followed by arthroscopy. Diagnosis with Arthroscopy was taken as the final diagnosis.

INCLUSION CRITERIA

1. Patient in age group of 18-45 years.

2. Patients who had recent knee injuries (within 2 months) to either or both knee joints.

EXCLUSION CRITERIA

1. Patients with contraindication to MRI like intracerebral aneurysmal clips, cardiac pacemaker, metallic foreign body in eye, implants in middle ear.

2. Patients who had recent knee injury but who on clinical examination had no instability in any plane and negative McMurray test .

3. Patients who had prior arthroscopy or surgical intervention to knee joint.

On clinical examination various tests were done after taking thorough history. In case of meniscal tears McMurray test and Apley grinding test were done. In case of ACL and PCL disruption Lachman test and drawer test were done. In case of collateral ligament injury varus or valgus stress test were done to evaluate it.

Each MRI was performed using the MR protocol of 1.5 Tesla on PHILIPS GYROSCAN ACHIEVA 1.5T MRI. T1 & T2 weighed sequences were done on coronal and sagital planes

MR films were be read by a senior radiologist. The status of menisci, cruciate ligament, cartilage and subchondral bone were registered. A meniscal tear was classified according to MAYO 2000 classification.[6].

Grade I tear: Meniscal lesion globular in nature, not communicating with articular surface.

Grade II tear: Linear in nature and remain within the substance of meniscus, there is no evidence of communication with the articular surface of meniscus.

Grade III tear: Increased signal intensity within the meniscus that extends to the articular surface.

Grade IV tear: Distorted tears in addition to findings of grade III tears.

Arthroscopy was performed under regional or general anaesthesia with patient in supine position with lateral post around proximal thigh. Proximal thigh tourniquet were used in each case. The operating surgeon was not told about the MRI findings.

To classify the location of meniscal tear arthroscopicaly each meniscus was divided into three equal segments:

1.The anterior 1/3 or anterior horn

2. The middle 1/3 or body

3. Posterior 1/3 or posterior horn

The collateral ligaments, ACL and PCL were classified as partial disruption or complete ligament injury. The results were compared and analysed using various statistical tests.

Out of the 60 patients there were 52 males and 8 females. Right knee was involved in 32 patients and left knee in 28 patients.

All patients had normal MCL and LCL.

Figure 1

LATERAL MENISCUS FINDINGS

	CLINICAL[McMURRAY AND APLEY GRINDING POSITIVE]	MRI	ARTHROSCOPY
NUMBER	12	14	14
SITE ANTERIOR 1/3 MIDDLE 1/3 POSTERIOR 1/3		0 10 4	0 10 4'
OTHER FINDINGS/ MRI GRADE		GR I 0 GR II 6 GR III 6 GR IV 2	

Figure 2

MEDIAL MENISCUS FINDINGS

	CLINICAL[McMURRAY AND APLEY GRINDING POSITIVE]	MRI	ARTHROSCOPY
NUMBER	22	28	12
SITE ANTERIOR 1/3 MIDDLE 1/3 POSTERIOR 1/3		0 14 14	0 6 6
OTHER FINDINGS/ MRI GRADE		GR I 0 GR II 8 GR III 18 GR IV 2	

Figure 3

ACL & PCL FINDINGS

	CLINICAL (DRAWER TEST & LACHMAN TEST)	MRI	ARTHROSCOPY
ACL –COMPLETE TEAR	18	18	16
PCL- COMPLETE TEAR	4	4	4

Figure 4

STATISTICAL ANALYSIS

MODALITY	TRUE POSITIVE	TRUE NEGATIVE	FALSE POSITIVE	FALSE NEGATIVE	SENSITIVITY	SPECIFICITY	PPV	NPV	ACCURACY
JOINT LINE TENDERNESS	22	28	10	0	100%	73.68%	68.75	100	83.33
McMURRAY	20	24	14	2	90.9%	63.15%	58.82	92.30	73.33
ANTERIOR DRAWER	16	38	4	2	88.89	90.48	80.00	95.00	90.00
POSTERIOR DRAWER	4	56	0	0	100%	100%	100%	100	100
LACHMAN	16	38	4	2	88.89	90.48	80.00	95.00	90.00
APLEY GRINDING TEST	20	24	14	2	90.9%	63.15%	58.82	92.30	73.33

PPV=positive predictive value

NPV=negative predictive value

Figure 5

MODALITY	TP	TN	FP	FN	SENS %	SPEC %	PPV %	NPV %	ACCURACY %
MEDIAL MENISCUS	10	28	20	2	83.33	58.33	33.34	93.34	66.67
LATERAL MENISCUS	10	44	4	2	83.33	91.67	71.42	95.65	90.00
GR 1+2	2	40	16	2	50	71.43	11.11	95.23	70.00
GR3+4	16	32	10	2	88.88	76.19	61.53	94.11	80.00
ACL	16	38	4	2	88.89	90.48	80.00	95.00	90.00
PCL	4	56	0	0	100	100	100	100	100

DISCUSSION

The analysis of age distribution in the study showed a narrow range of 15-45 years. The youngest subject was 15

years of age and oldest subject was of 45 years of age. Similar results have been shown by Clayton et al[7], LaPrade et al[8], Incesu et al[9] with mean age varying from 24-36 years.

On analysing sex distribution of the subjects with knee injuries it was found that 52 were male and 8 were female. So males outnumbered the females. Right side was affected more than the left side as we had 32 patients who had pathology in the right knee joint. These ratios are similar to the ones in the study done by Clayton et al[7] on the epidemiology of musculoskeletal tendinous and ligamentous injuries.

In case of ACL tears diagnostic accuracy for both clinical examination and MR examination came out to be 90% both MR and clinical examination were equally sensitive and specific in diagnosing ACL lesions which made us interpret that in hands of a good clinician MR does not give any advantage over clinical examination. This finding is similar to that off Yavuz Kocabey[10] who found that there was no statistical difference between MRI and clinical examination in diagnosing ACL tears ($P > .05$). The accuracy of the clinical examination and MRI evaluation was equal for diagnosing ACL ruptures.

There were two false positive examinations by MRI. These might be explained by the presence of partial tears which are missed on arthroscopy. Dowdy et al[11] concluded that a positive MRI for an ACL tear combined with a normal arthroscopy did not represent a false positive MRI and that an intrasubstance tear may be present that is difficult to detect with arthroscopy.

In a study done by Winters et al[12] of 63 patients MRI showed a tendency to overdiagnose tears with five false positive giving an overall predictive value of only 76%. This probably reflects the difficulty in distinguishing between complete and partial tears on MRI and the fact that arthroscopy is not the best tool for diagnosing cruciate ligament tears.

Specificity of MRI and clinical examination was nearly 90%. Thus whenever there was a clinical suspicion of ACL tear on clinical examination like on Anterior drawer and lachman test and was suspected on MRI the patient invariably had a ACL tear on arthroscopy.

Overall in case of ACL tears we suggest that in the patients where MRI and clinical examination is equivocal; we might prevent the patient from undergoing a invasive diagnostic procedure. We can take up the patient for therapeutic procedure.

Barronian et al[13] in their study of 22 patients showed results similar to ours. They calculated positive predictive value and negative predictive value and concluded that negative predictive value was 92% (ours is 95%). The negative predictive value is very important and indicates that negative MRI is quite reliable for cruciate ligaments. In this study PPV was calculated as 50% and in our study it was 80%. Two possible reasons explain the low PPV. First arthroscopy has a high false negative rate. Pathology missed at the time of surgery but visualised with MRI would constitute a false positive.

Diagnostic accuracy of MRI was 66.67% for medial meniscus and 90% for lateral meniscus which corresponds to study done by Glashow et al[14] (74% for medial and 94% for lateral meniscus), Rappepor et al[15] (77% for medial and91% for lateral meniscs), Kinnuen et al[16] (82 % for medial and 88 % for lateral), Incesu et al[9] (86% accuracy for meniscus).

GR1 AND 2 tears have low sensitivity 50% as compared to GR 3 and 4 88% as tears in GR 1 and 2 do not extend to articular surface and are difficult to detect on Arthroscopy

Diagnostic accuracy of clinical examination was relatively low. It has been found to be similar to previous studies like Rose et al[17] , Miller et al[18] that showed accuracy of 75 to 80%.

There is a high negative predictive value of MR examination in diagnosing meniscal tear as was case with ACL tear; whereas PPV was low. In study by Barronian et al[13] the negative predictive value was 91% for meniscus whereas PPV was 65% .

In our study there have been high number of false positive results that have lead to decrease in the PPV. The reason that is possible is MRI seems to overdiagnose tears of menisciresulting in a low predictive value. Munk et al[19] reported a total of 47 false positive results with MRI. The degenerative changes that tend to increase the signal intensity are also a major cause of having high false positive results.

In our study we had two patients who had increased signal intensity on MRI and gave impression of tear but on diagnostic arthroscopy they were found to have fibrillations which might have caused the increased signal intensity

mimicking as tear.

In our study we achieved a high accuracy with both clinical and MR examination in PCL injuries in both accuracy was 100%. However only 4 patients with pcl deficiency were part of the study.

CONCLUSION

We can avoid diagnostic arthroscopy in patients with ACL and PCL injuries having equivocal clinical and MRI examination and go on for therapeutic modality. In case of meniscal injuries graded as 1 and 2 on MRI, are rarely seen on arthroscopy hence diagnostic arthroscopy is not required for these meniscal injuries. In case of meniscal injuries graded as 3 and 4 on MRI, arthroscopy should be carried out.

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