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Original Research Article

Clinical, MRI, and Arthroscopic Correlation in Meniscal and Anterior Cruciate Ligament Injuries

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Abstract: The aim of this prospective study is to compare and correlate clinical, magnetic resonance imaging (MRI), and arthroscopic findings in cases of meniscal tear and anterior cruciate ligament (ACL) injuries. MRI scan results and clinical diagnosis are compared against the arthroscopic confirmation of the diagnosis. Twenty-five patients had suspected traumatic meniscal or anterior cruciate ligament (ACL) injury. Clinical examination had better sensitivity (85.71% vs. 77.78%), predictive values, and diagnostic accuracy (92% vs. 90%) in comparison to MRI scan in diagnosis for medial meniscal tears. These parameters showed only marginal difference in lateral meniscal and anterior cruciate ligament injuries. We conclude that carefully performed clinical examination can give equal or better diagnosis of meniscal and ACL injuries in comparison to MRI scan. MRI may be used to rule out such injuries rather than to diagnose them.
Keywords: Magnetic Resonance Imaging, Arthroscopy, Meniscal Tear, Anterior Cruciate Ligament Injury, Clinical

INTRODUCTION

MRI scanning of the knee joint has often been regarded as the noninvasive alternative to diagnostic arthroscopy. In day to day clinical practice, MRI scan is routinely used to support the diagnosis for meniscal or ACL injuries prior to recommending arthroscopic examination and surgery. Identification of meniscal tears can be difficult to interpret and can be observer dependent as well as dependent upon the sensitivity of the scanner. Similar difficulties may exist in clinical examination as well. Our objective is to compare and correlate clinical, MRI, and arthroscopic findings in the diagnosis of meniscal and anterior cruciate ligament (ACL) injuries. Review of the available literature suggests that there are a number of studies looking at two out of the three diagnostic tools (clinical examination, MRI scan, and arthroscopy), so our study is designed to identify correlation of all three methods for all cases in this study.

MATERIAL AND METHODS

Fifty cases of traumatic meniscal or ACL injuries were identified and prospectively reviewed clinically, with MRI scan followed by arthroscopic surgery. Out of 50 cases, 25 cases were excluded from the study where clinical findings were equivocal and/or MRI scan was inconclusive. Twenty five patients at hospital were clinically assessed and operated upon by consultants in this prospective study. All of the 25 patients had suspected traumatic meniscal injury or anterior cruciate ligament injury. Inclusion criteria were all patients with history of injury who underwent both MRI and arthroscopy, patients who failed to show clinical improvement after 3 months, and those who had no additional injury to the knee between the time of

MRI/clinical diagnosis and surgery. Patients with degenerative changes or evidence of loose bodies in plain radiographs, any prior surgery for the index diagnosis, and patients treated non - operatively were excluded from the study.

Clinical criteria used were history, tender joint line, and positive McMurray's test for meniscal injury. Lachman test and anterior drawer test were considered to be essential for clinical diagnosis of anterior cruciate ligament injury. Arthroscopic examinations were carried out as day case procedures under general anaesthesia. Examination under anaesthesia was carried out once again to check for any signs of instability. Record of clinical, MRI, and arthroscopic findings were kept and compared. Arthroscopic findings were regarded as the gold standard.

OBSERVATIONS AND RESULTS

Twenty-five cases of ACL insufficiency & meniscal injuries were identified and were prospectively reviewed with clinical examination, MRI scan and then followed by arthroscopic surgery

Clinical criteria used were tender joint line, positive Apley's and positive McMurray's test for meniscal injury. Positive Lachman test, anterior drawer test and/or Pivot Shift test were considered to be confirmatory for clinical diagnosis of anterior cruciate ligament injury.

MRI scans of the entire patient were collected & were reported by a single radiologist, who was blinded for both clinical & arthroscopic findings.

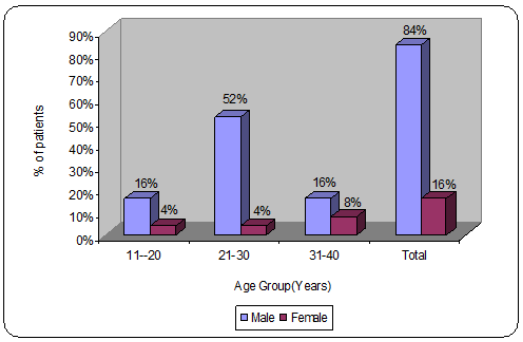
Arthroscopic examinations were carried out during definitive procedures under anesthesia. Record of clinical, MRI and arthroscopic findings were evaluated and compared. The data was analyzed to calculate true positive, true negative, false positive and false negatives.

Using these numbers the specificity, sensitivity, positive and negative predictive values were calculated with arthroscopic examination as the gold standard for comparison.

Most common age group involved ware between 21 to 30 years in our study.

Table-1: Age wise and Gender wise distribution of patients

Age Group(yrs)	Male	Female	Total	Percentage (%)
16-20	4(16%)	1(4%)	5	20.00
21-30	13(52%)	1(4%)	14	56.00
31-40	4(16%)	2(8%)	6	24.00
Total	21(84%)	4(16%)	25	100.0

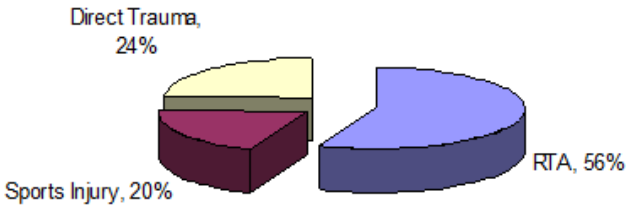


Graph-1: Age wise and Gender wise distribution of patients

Mode of injury

Table-2: Distribution of patients according to mode of injury

Mode of injury	No of patients	Percentage (%)
RTA	14	56.00
Sports Injury	5	20.00
Direct Trauma	6	24.00
Total	25	100.00



Graph-2: Distribution of patients according to mode of injury

Road traffic accident was most common mode of injury in our study, accounting for about 56%.

Table-3: The correlation between MRI and arthroscopic diagnoses for lesions of

3.1 Medial Meniscal Tear

		MRI		Total
		Positive	Negative	
Arthroscopy	Positive	7	0	7
	Negative	2	16	18
Total		9	16	25

3.2 Lateral Meniscal Tear

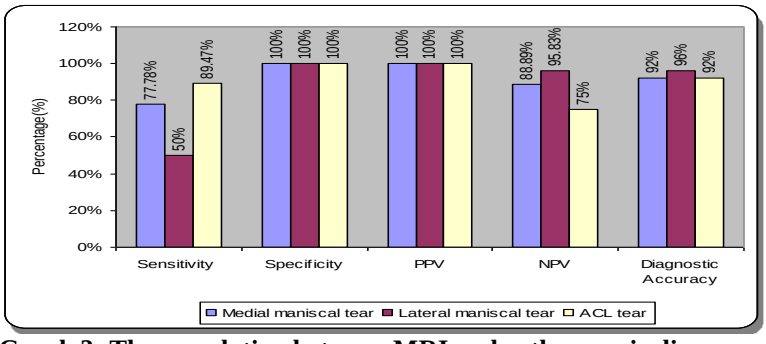
		MRI		Total
		Positive	Negative	
Arthroscopy	Positive	0	0	0
	Negative	2	23	25
Total		2	23	25

3.3 ACL Tear

		MRI		Total
		Positive	Negative	
Arthroscopy	Positive	17	0	17
	Negative	2	6	8
Total		19	6	25

3.4 Results of all three.

%	Medial meniscal tear	Lateral meniscal tear	ACL tear
Sensitivity	77.78%	50%	89.47%
Specificity	100%	100%	100%
PPV	100%	100%	100%
NPV	88.89%	95.83%	75%
Diagnostic Accuracy	92%	96%	92%



Graph 3: The correlation between MRI and arthroscopic diagnoses

Table-4: The correlation between clinical and arthroscopic diagnoses for lesions of

4.1 Medial Meniscal Tear

		Clinical Examination		Total
		Positive	Negative	
Arthroscopy	Positive	6	1	7
	Negative	1	17	18
Total		7	18	25

4.2 Lateral Meniscal Tear

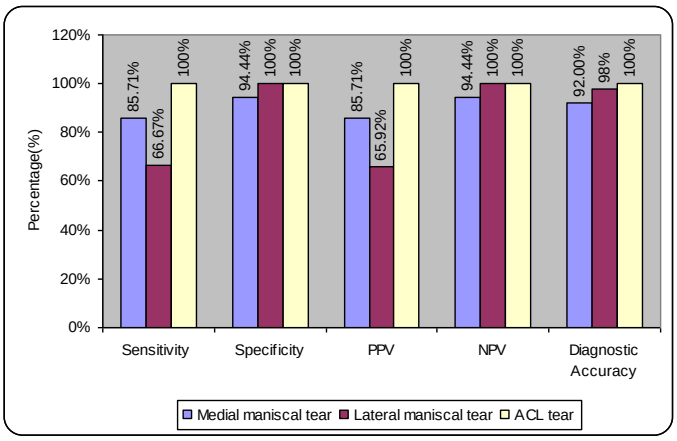
		Clinical Examination		Total
		Positive	Negative	
Arthroscopy	Positive	0	0	0
	Negative	1	24	25
Total		1	24	25

4.3 ACL Tear

		Clinical Examination		Total
		Positive	Negative	
Arthroscopy	Positive	17	0	17
	Negative	0	8	8
Total		17	8	25

4.4 Results of all three

%	Medial maniscal tear	Lateral maniscal tear	ACL tear
Sensitivity	85.71%	66.67%	100%
Specificity	94.44%	100%	100%
PPV	85.71%	65.92%	100%
NPV	94.44%	100%	100%
Diagnostic Accuracy	92.00%	98%	100%



Graph 4: The correlation between clinical and arthroscopic diagnoses

RESULTS

Medial meniscal injuries

Out of these 25 cases there were 7 cases where both MRI and arthroscopy were positive in confirming the diagnosis. From a total of 9 cases where MRI scan showed torn medial meniscus, 7 cases with positive arthroscopic evidence.

Clinical examination had better sensitivity (85.71% vs. 77.78%) in comparison to MRI scan in diagnosis for medial meniscal tears. Similarly −ve predictive values (94.44% vs.88.89%) were found to be higher in clinical diagnosis than MRI scan diagnosis for these injuries. Diagnostic accuracy of clinical examination was considerably equal in comparison to MRI (92% vs. 92%)

Lateral meniscal injuries

Out of these 25 cases two cases where MRI scans showed torn lateral meniscus. Arthroscopy was

not positive in any cases for lateral meniscus tear.One case where clinical examination showed torn lateral meniscus. MRI scan diagnosis had better sensitivity (50% vs. 66.7%) for lateral meniscal injuries than clinical diagnosis. Between clinical examination diagnosis and MRI scan diagnosis there was no difference in specificity (100% vs. 100%), and -ve predictive value (100% vs. 95.83%). Diagnostic accuracy was almost same for both the modalities (98 %vs. 96%).

Anterior cruciate ligament injuries

There were 17 cases where ACL injury was suspected clinically, whereby all of them had ACL injury evident on arthroscopy as well (100%). Out of 19 cases where ACL was found damaged on MRI scan, 17 cases had arthroscopic evidence of ACL injury. ACL injury diagnosis using clinical examination and MRI scan, there was difference in sensitivity (100% vs. 89.47%, respectively), specificity (100% vs 100%), +ve predictive value (100% vs.100%), −ve predictive value (100% vs.75%), and diagnostic accuracy (100% vs. 92%).

DISCUSSION

Earlier clinical examination was the only modalities to examine the ligamentous injury of the knee joint. The usefulness of MRI in evaluating the knee was first recognized in the early 1980s. It has also been shown to determine the extent of an injury and help in the planning of its management. Even when a particular diagnosis is clinically apparent, MRI can be used to delineate associated abnormalities and more fully demonstrate the extent of the injuries.

MRI scanning of the knee joint has often been regarded as the non-invasive alternative to diagnostic arthroscopy. In day-to-day clinical practice, MRI scan is routinely used to confirm the diagnosis for meniscal or ACL injuries prior to recommending arthroscopic examination and surgery. Identification of meniscal tears can be difficult to interpret and can be observer dependent as well as dependent upon the sensitivity of the scanner. Similar difficulties may exist in clinical examination as well.

Our objective was to compare and correlate clinical, MRI and arthroscopic findings in the diagnosis of chronic anterior cruciate ligament (ACL) & meniscal injuries.

The disruption of the anterior cruciate ligament, a major stabilizer of the knee, leads to loss of stability of the knee and potentially significant dysfunction [1]. Although the ACL is the most frequently torn ligament of the knee, the ACL tear has remained clinically elusive. These injuries account for a large no. of referral to hospitals. The evaluation of these lesions remains a difficult clinical problem.

The MRI is a frequently used diagnostic modality for these internal derangements because of being non-invasive, painless and unassociated with risk of radiation [2]. The accuracy, sensitivity and specificity values for knee lesions vary widely in literature.

Rubin *et al.* [3] reported 93% sensitivity for diagnosing isolated ACL tears. 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 Fisher [4] reported an accuracy of 78 – 97% for the chronic anterior cruciate ligament and 64 – 95% for meniscal tears.

Jee *et al.* concluded that MRI in the presence of ACL tears has lower sensitivity for detecting meniscal tears due to missed lateral meniscal tear [5].

Rose *et al*. Found better diagnostic accuracy clinically than with MRI scans in a series of 100 patients [6].

The menisci are composed of fibro cartilage and appear as low-signal structures on all pulse sequences. Chang *et al*. studied findings of 148 patients with figures of 92% for sensitivity and 87% for specificity for meniscal tears [7]. The conclusion was that MRI is a reliable diagnostic tool for displaced meniscal tears. Lundberg *et al*. found sensitivity and specificity of 74% and 66%, respectively, for medial and 50% and 84% for lateral meniscus [8]. They found that MRI could not replace arthroscopy in diagnosis of acute knee injuries. Barronian *et al*. found 100% sensitivity for medial meniscal tears and 73% for lateral thus finding MRI to be a reliable tool [9]. The sensitivity and specificity of MRI in detecting meniscal tears exceeds 90%. For Mohan *et al*., in their retrospective series of 130 patients, diagnostic accuracy of clinical examination was 88% for medial meniscal tears and 92% for lateral meniscal tears; they concluded that clinical diagnosis of meniscal tears is as reliable as the magnetic resonance imaging (MRI) scan [10]. Ryan *et al*. [11] 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 a sensitivity and specificity of 80% and 71% respectively. In a prospective study reported by Imhoff *et al*. [12], the negative predictive value was 94% but the positive predictive value was only 54%. They concluded that due to a high negative predictive value, a normal MRI scan allows eliminating a meniscal lesion

and so there is no need for a diagnostic arthroscopy. They suggested that due to low positive predictive value of MRI it should not be routinely used to confirm clinical diagnosis and its use should be limited to those cases where clinical examination is inconclusive. A diagnostic arthroscopy would be a better choice in those cases.

We studied 25 patients of ACL insufficiency with/without meniscal injury by doing clinical examination, MRI scan and then, based on the findings and clinical indications, therapeutic arthroscopic procedures.

In our study clinical examination had better sensitivity (85.71%) compared to MRI scan (77.78%) for diagnosing medial meniscal tears. Similarly −ve predictive values (94.44% vs.88.89%) were found to be higher in clinical diagnosis than MRI scan diagnosis for these injuries. Diagnostic accuracy of clinical examination was considerably higher in comparison to MRI (92% vs. 90%)

Out of these 25 cases two cases where MRI scan showed torn lateral meniscus. Arthroscopy was not positive in any cases for lateral meniscus tear. One case where clinical examination showed torn lateral meniscus. MRI scan diagnosis had better sensitivity (50% vs. 66.7%) for lateral meniscal injuries than clinical diagnosis. Between clinical examination diagnosis and MRI scan diagnosis there was no difference in specificity (100% vs. 100%), and -ve predictive value (100% vs. 95.83%). Diagnostic accuracy was almost same for both the modalities (98 %vs. 96%).

Table-5: Comparison of diagnostic accuracy

	CLINICAL DIAGNOSTIC ACCURACY			MRI DIAGNOSTIC ACCURACY		
	MEDIAL MENISCUS	LATERAL MENISCUS	ACL	MEDIAL MENISCUS	LATERAL MENISCUS	ACL
F. Rayan *et al*	79	85	96	63	85	93
Ali Akbar EsmailiJah *et al*	96.9	85.5	91.4	85.9	73.8	88.5
Our study	92	98	100	90	96	92

Comparing the diagnostic accuracy of clinical examination and MRI of our study with previous studies, our study has similar or better results for ACL and Meniscal tear injury.

Diagnosis of ACL injury using clinical examination and MRI scan, clinical examination had better sensitivity (100% vs. 89.47%, respectively), specificity (100% vs 100%), +ve predictive value (100% vs.100%), −ve predictive value (100% vs.75%), and diagnostic accuracy (100% vs. 92%).

CONCLUSION

By obtaining correlation between clinical examination, MRI scan, and arthroscopy for meniscal and ACL injuries we conclude that carefully performed clinically examination can give equal or better diagnosis of meniscal and ACL injuries in comparison to MRI scan. MRI scan may be used to rule out such injuries rather than to diagnose them. MRI scan has much better positive predictive value than negative predictive value in both meniscal and ACL injury diagnosis. When clinical signs and symptoms are inconclusive, performing an MRI scan is likely to be more beneficial in avoiding unnecessary arthroscopic surgery. When clinical diagnosis is in favour of either meniscal or ACL injuries, performing an MRI scan prior to arthroscopic examination is unlikely to be of significance. MRI scanning should not be used as a primary diagnostic tool in meniscal and ACL injuries. Bypassing MRI scans and performing arthroscopic examination in suspected cases will be helpful providing earlier treatment of the condition.

Accurate diagnosis of chronic ACL injury can be solely made on the basis of clinical examination. Therefore we do not recommend MRI scan of the knee joint to diagnose ACL injury. This will probably reduce the cost of treatment of ACL insufficiency.

REFERENCE

1. Tait GR, Maginn P, Macey AC, Beverland DE, Mollan RAB; Unnecessary arthroscopies. Injury, 1992; 23(8): 555-556.
2. Shasriaree, Heshmat (Editor): O' Conners Textbook of Arthroscopic Surgery. Philadelphia – J.B Lippincot, 1984.
3. Rubin DA, Kettering JM, Towers JD, Britton CA; MR Imaging of knee having isolated and combined ligament injuries. AJR, 1988; 170: 1207 – 1213.
4. Lee JK, Yao L, Pheps CT, Wirth CR, Czajka J, Lozman J; Anterior Cruciate Ligament Tears. MR Imaging compared with Arthroscopy and clinical tests. Radiology, 1988; 166:861–864.
5. Jee WH, McCauley TR, Kim JM; Magnetic Resonance diagnosis of Meniscal Tears in patients

with acute anterior cruciate ligaments tears. J Comput Assist Tomogr, 2004; 28(3):402 – 406

6. Rose NE, Gold SM; A comparision of accuracy between clinical examination and magnetic resonance imaging in diagnosis of meniscal and anterior cruciate ligament tears. Arthroscopy, 1996; 12(4):398 – 405.
7. Chang CY, Wu HT, Huang TF, Ma HL, Hung SC, Imaging evaluation of Meniscal injury of the knee joint : a comparitive MR imaging and arthroscopic study. Clin Imaging, 2004; 28(5): 372 – 376.
8. Lundberg M, Odesten M, Thomas KA, Messner K; The diagnostic validity of magnetic resonance imaging in acute knee injuries with hemarthrosis. A single – blinded evaluation in 69 patients using high – field MRI before arthroscopy. Int J Sports Med, 1966; 17(3): 218 – 222.
9. Barronian AD, Zoltan JD, Bucon KA; Magnetic Resonance Imaging of the knee: correlation with arthroscopy. Arthroscopy, 1989; 5(3): 187 –191
10. Mohan BR, Gosal HS; Reliability of clinical diagnosis in medial meniscal tears. Int Orthopaedics, 2007; 31(1): 57–60.
11. Ryan PJ, Reddy K, Fleeteroft J; A prospective comparision of Clinical examination, MRI, Bone Spect, and arthroscopy to detect meniscal tears. Clin Nucl Med, 1999; 23: 803–06
12. Imhoff A, Buess E, Hodler J, Fellmann J; Comparision between magnetic resonance imaging and arthroscopy for the diagnosis of knee meniscal lesion. Rev Chir Orthop, 1997; 83(3): 229-236.