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DIAGNOSTIC ACCURACY OF MAGNETIC RESONANCE IMAGING IN ASSESSMENT OF MENISCAL, ANTERIOR CRUCIATE LIGAMENT AND CHONDRAL INJURY: CORRELATION WITH ARTHROSCOPY

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Abstract

Background: The knee is one of the most susceptible joints to injury as factors such as its anatomical structure, exposure to external forces and functional demand lead to its demise. Among knee ligaments ACL is the most commonly injured including associated meniscal injuries. Common causes leading to intervention are trauma, sporting activities that lead to 'wear and tear'. Along with this, knee ligament injuries, meniscal injuries and cartilage lesions also commonly occur. Diagnosis of knee ligament injuries are made by clinical and radiological assessment, most commonly achieved through magnetic resonance imaging (MRI). The gold standard in diagnosing knee ligament pathology is diagnostic arthroscopy which supports the direct visualisation of intra-articular structures. MRI is a non invasive imaging technique, more equipped to analysing soft tissues; furthermore contrast remains the main imaging modality of excellence for accurately depicting abnormalities of articulate cartilage and soft tissue injuries including tendon, ligaments, and the menisci compared to that of any other imaging modality. **Materials and Methods:** This is a prospective study conducted in the Department of Orthopedic of K.S.Hegde Charitable hospital from SEPTEMBER 2015 to AUGUST 2017 are included in the study. All the patients with ACL, meniscal and cartilage injuries presenting to the included in the study. Intra-articular fractures of knee bone, MRI scans taken 3 months before the proposed procedure were Excluded. Patients presenting with knee instability and injury to knee are initially evaluated clinically. When suspected ACL, meniscal and chondral injuries made, patients are further evaluated with MRI. MRI is taken with knee positioned 10-15 degrees of external rotation with T1, proton density, T2 weighed sequence done in routine sagittal, coronal and axial planes are taken with 1.5 T machine. Diagnostic arthroscopy is performed under spinal anaesthesia. MRI reports and arthroscopic findings are collected and compared, with consideration of arthroscopy as the gold standard. **Result:** This study included 85 patients of which both MRI and arthroscopy was done for all patients found sensitivity of 100 % and specificity of 62.5% Positive predictive value of 92% and Negative predictive value of 100%. Diagnostic accuracy of 92.94%. The Kappa value of 0.73 indicates highly qualified agreement with a p value of <0.001 for ACL, Sensitivity of 66.7 % and specificity of 96.2% Positive predictive value of 57.1% and Negative predictive value of 97.4% Diagnostic accuracy of 94.11%. The Kappa value of 0.584 indicates Good agreement with a p value of <0.001 for lateral femoral condyle. Sensitivity of 41.7 % and specificity of 97.3% Positive predictive value of 71.4% and Negative predictive value of 91% Diagnostic accuracy of 89.41%. The Kappa value of 0.471 indicates Good agreement with a p value of <0.001 for medial femoral condyle. sensitivity of 68.6 % and 87.1 % specificity of 70% and 53.7%, diagnostic accuracy of 69.41 and 65.88, positive predictive value of 61.5% and 51.9%,

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negative predictive value of 87.9% and 98.8% with moderate and very good agreement for lateral and medial meniscus respectively. Sensitivity of 75 % and 25 % specificity of 98.8% and 98.6% positive predictive value of 75% each and negative predictive value of 98.8% and 88.9% with diagnostic accuracy of 97.64 and 88.23 % for lateral and medial patellar facets with Very Good and Moderate agreement respectively. **Conclusion:** We concluded that MRI shows high accuracy and should be used as a primary diagnostic tool for selection of candidates for arthroscopy.

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] The ligament injuries are among the common injuries occurring in the knee due to contact sporting events like football, hockey, kabbadi, however road traffic accidents and occupational injuries also account.[2,3] The anterior cruciate ligament (ACL) is the most commonly injured ligament among others which results in knee pain and instability.[4,5] Meniscal injuries may be associated with trauma or chronic as a result of instability occasioned by anterior cruciate ligament injuries, long standing ACL injuries are associated with meniscal and cartilage lesions in the knee joint.[6]

Clinical evaluation of knee helps in assessment of the extent of knee damage, but the advent of magnetic resonant imaging (MRI) helps in more accurate assessment of the soft tissue and cartilage lesions of the knee. MRI established itself as fast and non-invasive imaging alternative complementing physical examination in the evaluation of knee injuries. The knee derangement detected in MRI have higher sensitivity and specificity other than any imaging modality, which avoids needless diagnostic arthroscopy and better surgical planning leading to decreased procedural time.[7-9]

The primary stability of the knee is dependent on static stabilisers and dynamic stabilisers. Static comprises of the bony articulations and the medial and lateral ligaments, ACL, PCL, both the menisci, joint capsule, oblique.[10]

The ACL originates from the medial side of the lateral femoral condyle to insert on the anterior tibial spines, approximately 10mm behind the anterior articular surface of the tibia. It is usually 11 – 13 mm thick and is enveloped by a thin sheath. ACL courses at a shallow angle from lateral to medial. It is often not imaged in its entirety on a single sagittal image and must be evaluated on two or three contiguous images. While the ACL is best visualised on sagittal images, the coronal and axial images are often helpful for thorough assessment of the integrity of this structure.[11]

The normal ACL is relatively low in signal intensity, primarily at its femoral attachment. However, a striated appearance of the distal portion of the ACL on sagittal images is a common appearance and should not be mistaken for a tear.

MRI is highly accurate for detection of ACL tears.[12]

The PCL arises from the posterolateral aspect of the medial femoral condyle and inserts into the posterior intercondylar portion of the tibia. The PCL is thicker than the ACL, varying from 12 – 20mm in thickness. The PCL is diffusely low in signal intensity and has a hockey stick configuration.[13]

The ligament is visualised on sagittal and coronal images of the knee. PCL tears appear on the MRI as a bright signal within the substance of the ligament or as a disruption of the ligament fibres. Chronic tears of PCL can result in thinning or non visualisation of the ligament or abnormal angulation (buckling) of this structure.[14]

The menisci are low signal (black) structures with little or no internal signal owing to their lack of mobile protons. Meniscal tears appear on MRI as abnormal – signal intensity within the meniscus that touches as articulating surface of the meniscus or abnormal meniscal morphological features.[15]

In MRI chondral pathologies are depicted as areas of focal defects or deeper fractures involving the subchondral bone, and graded upon the thickness of the articular cartilage disruption according to the modified Outerbridge classification. Common MRI sequences for cartilage constitute T1-weighted, proton density, and T2-weighted imaging sequences, with or without fat saturation. T2 weighted image shows excellent contrast difference due to the cartilage-fluid interface but slightly reduced signal from the articular cartilage.[16]

Diagnostic arthroscopy is performed under anaesthesia, after preoperative evaluation. Patient is positioned and knee marking are done for portal entry. Standard Anterolateral and anteromedial portals are used for the diagnostic procedure. After tourniquet elevation portal are made, telescope is introduced and arthroscopy is performed in the order of spurapatellar pouch, medial gutter, medial compartment, intercondylar notch, posteromedial compartment, lateral compartment, lateral gutter and posterolateral compartment.[17-19]

MATERIALS AND METHODS

This is a prospective study and patients with pain or instability of the knee presenting to the orthopaedic department of K.S.Hegde Charitable Hospital from SEPTEMBER 2015 to AUGUST 2017 are included in the study after explaining the procedure.

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Methods

I. Patients with pain or instability of the knee are selected and a detailed history was sought followed by clinical examination with special tests (Lachmann test, anterior drawer test, posterior drawer test, valgus and varus stress test, pivot shift test, mcMurray's test) and MRI evaluation.

II. MRI was taken with knee positioned in extension and 10-15 degrees of external rotation with T1, proton density, T2 weighed sequence done in routine sagittal, coronal and axial planes are taken with 1.5 T machine(Siemens MAGNETOM Avanto). MRI was reported by senior consultants from the Department of Radiology.

III. Diagnostic arthroscopy is performed after pre anaesthetic evaluation, under spinal anaesthesia patient is positioned supine with knee in 90 degrees. Routine Anterolateral and anteromedial portal are made and a 30 degree arthroscope (Smith&Nephew) is introduced into the joint after filling the joint with normal saline. Arthroscopic findings are recorded by a floor person.

IV. The MRI results are compared with arthroscopy and statistically analysed for accuracy, positive predictive value, negative predictive value, sensitivity and specificity. Kappa score were calculated to assess the statistical significance and agreement.

RESULTS

	Para-meter	True negative	True positive	False negative	False positive	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Diagnostic accuracy	Gold standard	Kappa statistics	P value
OVERALL	MRI	455	136	35	54	79.50%	89.40%	71.60%	92.90%	86.91%	Arthroscopy	0.6650	<0.001
ACL	MRI	10	69	0	6	100.00%	62.50%	92.00%	100.00%	92.94%	Arthroscopy	0.7300	<0.001
Femoral Condyles Lateral	MRI	76	4	2	3	66.70%	96.20%	57.10%	97.40%	94.12%	Arthroscopy	0.5840	<0.001
Femoral Condyles Medial	MRI	71	5	7	2	41.70%	97.30%	71.40%	91.00%	89.41%	Arthroscopy	0.4710	<0.001
Lateral Meniscus	MRI	35	24	11	15	68.60%	70.00%	61.50%	76.10%	69.41%	Arthroscopy	0.3790	0.0010
Medial Meniscus	MRI	29	27	4	25	87.10%	53.70%	51.90%	87.90%	65.88%	Arthroscopy	0.3570	<0.001
Patela facets lateral	MRI	80	3	1	1	75.00%	98.80%	75.00%	98.80%	97.65%	Arthroscopy	0.7380	<0.001
Patela facets medial	MRI	72	3	9	1	25.00%	98.60%	75.00%	88.90%	88.24%	Arthroscopy	0.3280	0.0080
Pcl	MRI	82	1	1	1	50.00%	98.80%	50.00%	98.80%	97.65%	Arthroscopy	0.4880	0.0470
Femoral cartilage	MRI	147	9	9	5	50.00%	96.70%	64.30%	94.20%	91.76%	Arthroscopy	0.5180	<0.001
Patelar cartilage	MRI	152	6	10	2	37.50%	98.70%	75.00%	93.80%	92.94%	Arthroscopy	0.4670	<0.001
Knee cartilage	MRI	299	15	19	7	44.10%	97.70%	68.20%	94.00%	92.35%	Arthroscopy	0.4960	<0.001

KAPPA STATISTICS FOR COMPARISON OF THE GRADE

GRADE AS IN MRI * PARTIAL/FULL AS PER ARTHROSCOPY Crosstabulation[a]			PARTIAL/FULL AS PER ARTHROSCOPY			Total
			ABSENT	COMPLETE	PARTIAL	
GRADE AS IN MRI	ABSENT	Count	10	0	0	10
		% within GRADE AS IN MRI	100.0%	0.0%	0.0%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	58.8%	0.0%	0.0%	11.8%
	COMPLETE	Count	3	58	6	67
		% within GRADE AS IN MRI	4.5%	86.6%	9.0%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	17.6%	95.1%	85.7%	78.8%
	PARTIAL	Count	4	3	1	8
		% within GRADE AS IN MRI	50.0%	37.5%	12.5%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	23.5%	4.9%	14.3%	9.4%
Total		Count	17	61	7	85
		% within GRADE AS IN MRI	20.0%	71.8%	8.2%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	100.0%	100.0%	100.0%	100.0%
a. LIGAMENT = ACL						
Symmetric Measures[a]						
		Value	Asymp. Std. Error[b]	Approx. T[c]	Approx. Sig.	Exact Sig.
Measure of Agreement	Kappa	0.533	.090	6.507	.000	.000
N of Valid Cases		85				
a. LIGAMENT = ACL						
b. Not assuming the null hypothesis.						
c. Using the asymptotic standard error assuming the null hypothesis.						

On comparison of the test group MRI with the Gold standard of ARTHROSCOPY the test group has a sensitivity of 100 % and specificity of 62.5%. The test has a positive predictive value of 92% and Negative predictive value of 100%. The test and the gold standard agree on 79 out of 85 having a diagnostic accuracy of 92.9411764705882%. The Kappa value of 0.73 indicates Very Good agreement with a p value of <0.001.

KAPPA STATISTICS FOR COMPARISON OF THE GRADE

GRADE AS IN MRI * PARTIAL/FULL AS PER ARTHROSCOPY Crosstabulationa			Partial/FULL AS PER ARTHROSCOPY			Total
			ABSENT	GRADE II	GRADE IV	
GRADE AS	ABSENT	Count	76	2	0	78

IN MRI		% within GRADE AS IN MRI	97.4%	2.6%	0.0%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	96.2%	40.0%	0.0%	91.8%
	GRADE II	Count	1	2	0	3
		% within GRADE AS IN MRI	33.3%	66.7%	0.0%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	1.3%	40.0%	0.0%	3.5%
	GRADE IV	Count	2	1	1	4
		% within GRADE AS IN MRI	50.0%	25.0%	25.0%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	2.5%	20.0%	100.0%	4.7%
Total		Count	79	5	1	85
		% within GRADE AS IN MRI	92.9%	5.9%	1.2%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	100.0%	100.0%	100.0%	100.0%
a. LATERAL FEMORAL CONDYLES						

Symmetric Measuresa

		Value	Asymp. Std. Errorb	Approx. Tc	Approx. Sig.	Exact Sig.
Measure of Agreement	Kappa	.511	.159	6.259	.000	.000
N of Valid Cases		85				
a. LATERAL FEMORAL CONDYLES						
b. Not assuming the null hypothesis.						
c. Using the asymptotic standard error assuming the null hypothesis.						

On comparison of the test group MRI with the Gold standard of ARTHROSCOPY the test group has a sensitivity of 66.7 % and specificity of 96.2%. The test has a positive predictive value of 57.1% and Negative predictive value of 97.4%. The test and the gold standard agree on 80 out of 85 having a diagnostic accuracy of 94.1176470588235%. The Kappa value of 0.584 indicates Good agreement with a p value of <0.001.

KAPPA STATISTICS FOR COMPARISON OF THE GRADE

GRADE AS IN MRI * PARTIAL/FULL AS PER ARTHROSCOPY Crosstabulationa								
			PARTIAL/FULL AS PER ARTHROSCOPY					Total
			Absent	Grade I	Grade II	Grade III	Grade IV	
Grade AS IN MRI	ABSENT	Count	71	0	2	2	3	78
		% within GRADE AS IN MRI	91.0%	0.0%	2.6%	2.6%	3.8%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	97.3%	0.0%	66.7%	100.0%	50.0%	91.8%
	GRADE I	Count	0	1	0	0	0	1
		% within GRADE AS IN MRI	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	0.0%	100.0%	0.0%	0.0%	0.0%	1.2%
	GRADE II	Count	1	0	1	0	0	2
		% within GRADE AS IN MRI	50.0%	0.0%	50.0%	0.0%	0.0%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	1.4%	0.0%	33.3%	0.0%	0.0%	2.4%
	GRADE IV	Count	1	0	0	0	3	4
		% within GRADE AS IN MRI	25.0%	0.0%	0.0%	0.0%	75.0%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	1.4%	0.0%	0.0%	0.0%	50.0%	4.7%
Total		Count	73	1	3	2	6	85
		% within GRADE AS IN MRI	85.9%	1.2%	3.5%	2.4%	7.1%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
a. MEDIAL FEMORAL CONDYLES								

Symmetric Measuresa

		Value	Asymp. Std. Errorb	Approx. Tc	Approx. Sig.	Exact Sig.
Measure of Agreement	Kappa	.490	.144	6.667	.000	.000
N of Valid Cases		85				
a. MEDIAL FEMORAL CONDYLES						
b. Not assuming the null hypothesis.						
c. Using the asymptotic standard error assuming the null hypothesis.						

On comparison of the test group MRI with the Gold standard of ARTHROSCOPY the test group has a sensitivity of 41.7 % and specificity of 97.3%. The test has a positive predictive value of 71.4% and Negative

predictive value of 91%. The test and the gold standard agree on 76 out of 85 having a diagnostic accuracy of 89.4117647058824%. The Kappa value of 0.471 indicates Good agreement with a p value of <0.001.

KAPPA STATISITCS FOR COMPARISON OF THE GRADE

GRADE AS IN MRI * PARTIAL/FULL AS PER ARTHROSCOPY Crosstabulationa

			PARTIAL/FULL AS PER ARTHROSCOPY						Total
			Absent	Discoid	Grade I	Grade II	Grade III	Partial	
Grade AS IN MRI	ABSENT	Count	35	0	0	5	4	1	45
		% within GRADE AS IN MRI	77.8%	0.0%	0.0%	11.1%	8.9%	2.2%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	68.6%	0.0%	0.0%	31.2%	33.3%	100.0%	52.9%
	DISCOID	Count	0	3	0	0	0	0	3
		% within GRADE AS IN MRI	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	0.0%	75.0%	0.0%	0.0%	0.0%	0.0%	3.5%
	GRADE I	Count	3	0	0	2	0	0	5
		% within GRADE AS IN MRI	60.0%	0.0%	0.0%	40.0%	0.0%	0.0%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	5.9%	0.0%	0.0%	12.5%	0.0%	0.0%	5.9%
	GRADE II	Count	8	0	0	5	0	0	13
		% within GRADE AS IN MRI	61.5%	0.0%	0.0%	38.5%	0.0%	0.0%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	15.7%	0.0%	0.0%	31.2%	0.0%	0.0%	15.3%
	GRADE III	Count	5	1	1	4	8	0	19
		% within GRADE AS IN MRI	26.3%	5.3%	5.3%	21.1%	42.1%	0.0%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	9.8%	25.0%	100.0%	25.0%	66.7%	0.0%	22.4%
Total		Count	51	4	1	16	12	1	85
		% within GRADE AS IN MRI	60.0%	4.7%	1.2%	18.8%	14.1%	1.2%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

a. LATERAL MENISCUS

Symmetric Measuresa

		Value	Asymp. Std. Errorb	Approx. Tc	Approx. Sig.	Exact Sig.
Measure of Agreement	Kappa	.354	.080	5.323	.000	.000
N of Valid Cases		85				

a. LATERAL MENISCUS

b. Not assuming the null hypothesis.

c. Using the asymptotic standard error assuming the null hypothesis.

On comparison of the test group MRI with the Gold standard of ARTHROSCOPY the test group has a sensitivity of 68.6 % and specificity of 70%. The test has a positive predictive value of 61.5% and Negative predictive value of 76.1%. The test and the gold standard agree on 59 out of 85 having a diagnostic accuracy of 69.4117647058823%. The Kappa value of 0.379 indicates Moderate agreement with a p value of 0.001.

KAPPA STATISTICS FOR COMPARISON OF THE GRADE

GRADE AS IN MRI * PARTIAL/FULL AS PER ARTHROSCOPY Crosstabulationa

		PARTIAL/FULL AS PER ARTHROSCOPY				Total
		Absent	Grade I	Grade II	Grade III	

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Grade AS IN MRI	ABSENT	Count	30	1	3	0	34
		% within GRADE AS IN MRI	88.2%	2.9%	8.8%	0.0%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	54.5%	25.0%	25.0%	0.0%	40.0%
	GRADE I	Count	9	0	1	0	10
		% within GRADE AS IN MRI	90.0%	0.0%	10.0%	0.0%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	16.4%	0.0%	8.3%	0.0%	11.8%
	GRADE II	Count	10	2	3	2	17
		% within GRADE AS IN MRI	58.8%	11.8%	17.6%	11.8%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	18.2%	50.0%	25.0%	14.3%	20.0%
	GRADE III	Count	5	1	5	12	23
		% within GRADE AS IN MRI	21.7%	4.3%	21.7%	52.2%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	9.1%	25.0%	41.7%	85.7%	27.1%
	PARTIAL	Count	1	0	0	0	1
		% within GRADE AS IN MRI	100.0%	0.0%	0.0%	0.0%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	1.8%	0.0%	0.0%	0.0%	1.2%
Total		Count	55	4	12	14	85
		% within GRADE AS IN MRI	64.7%	4.7%	14.1%	16.5%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	100.0%	100.0%	100.0%	100.0%	100.0%

a. MEDIAL MENISCUS

Symmetric Measuresa

		Value	Asymp. Std. Errorb	Approx. Tc	Approx. Sig.	Exact Sig.
Measure of Agreement	Kappa	.290	.068	4.578	.000	.000
N of Valid Cases		85				

a. MEDIAL MENISCUS
b. Not assuming the null hypothesis.
c. Using the asymptotic standard error assuming the null hypothesis.

On comparison of the test group MRI with the Gold standard of ARTHROSCOPY the test group has a sensitivity of 87.1 % and specificity of 53.7%. The test has a positive predictive value of 51.9% and Negative predictive value of 87.9%. The test and the gold standard agree on 56 out of 85 having a diagnostic accuracy of 65.8823529411765%. The Kappa value of 0.357 indicates Moderate agreement with a p value of <0.001.

KAPPA STATISTICS FOR COMPARISON OF THE GRADE

GRADE AS IN MRI * PARTIAL/FULL AS PER ARTHROSCOPY Crosstabulationa			Partial/full as per arthroscopy			Total
			ABSENT	GRADE I	GRADE IV	
GRADE AS IN MRI	ABSENT	Count	80	1	0	81
		% within GRADE AS IN MRI	98.8%	1.2%	0.0%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	98.8%	33.3%	0.0%	95.3%
	GRADE I	Count	0	1	0	1
		% within GRADE AS IN MRI	0.0%	100.0%	0.0%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	0.0%	33.3%	0.0%	1.2%
	GRADE II	Count	1	1	0	2
		% within GRADE AS IN MRI	50.0%	50.0%	0.0%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	1.2%	33.3%	0.0%	2.4%
	GRADE IV	Count	0	0	1	1
		% within GRADE AS IN MRI	0.0%	0.0%	100.0%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	0.0%	0.0%	100.0%	1.2%
Total		Count	81	3	1	85
		% within GRADE AS IN MRI	95.3%	3.5%	1.2%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	100.0%	100.0%	100.0%	100.0%

a. LATERAL PATELLA FACETS

Symmetric Measuresa

		Value	Asymp. Std. Errorb	Approx. Tc	Approx. Sig.	Exact Sig.
Measure of Agreement	Kappa	.614	.178	8.677	.000	.000
N of Valid Cases		85				

a. LATERAL PATELLA FACETS
b. Not assuming the null hypothesis.
c. Using the asymptotic standard error assuming the null hypothesis.

On comparison of the test group MRI with the Gold standard of ARTHROSCOPY the test group has a sensitivity of 75 % and specificity of 98.8%. The test has a positive predictive value of 75% and Negative predictive value of 98.8%. The test and the gold standard agree on 83 out of 85 having a diagnostic accuracy of 97.6470588235294%. The Kappa value of 0.738 indicates Very Good agreement with a p value of <0.001.

KAPPA STATISTICS FOR COMPARISON OF THE GRADE

GRADE AS IN MRI * PARTIAL/FULL AS PER ARTHROSCOPY Crosstabulationa

			PARTIAL/FULL AS PER ARTHROSCOPY				Total
			Absent	Grade I	Grade II	Grade IV	
GRADE AS IN MRI	ABSENT	Count	72	6	1	2	81
		% within GRADE AS IN MRI	88.9%	7.4%	1.2%	2.5%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	98.6%	85.7%	50.0%	66.7%	95.3%
	GRADE I	Count	1	0	1	0	2
		% within GRADE AS IN MRI	50.0%	0.0%	50.0%	0.0%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	1.4%	0.0%	50.0%	0.0%	2.4%
	GRADE II	Count	0	1	0	0	1
		% within GRADE AS IN MRI	0.0%	100.0%	0.0%	0.0%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	0.0%	14.3%	0.0%	0.0%	1.2%
	GRADE IV	Count	0	0	0	1	1
		% within GRADE AS IN MRI	0.0%	0.0%	0.0%	100.0%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	0.0%	0.0%	0.0%	33.3%	1.2%
Total		Count	73	7	2	3	85
		% within GRADE AS IN MRI	85.9%	8.2%	2.4%	3.5%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	100.0%	100.0%	100.0%	100.0%	100.0%
a. MEDIAL PATELLA FACETS							

Symmetric Measuresa

		Value	Asymp. Std. Errorb	Approx. Tc	Approx. Sig.	Exact Sig.
Measure of Agreement	Kappa	.211	.114	3.161	.002	.019
N of Valid Cases		85				
a. MEDIAL PATELLA FACETS						
b. Not assuming the null hypothesis.						
c. Using the asymptotic standard error assuming the null hypothesis.						

On comparison of the test group MRI with the Gold standard of ARTHROSCOPY the test group has a sensitivity of 25 % and specificity of 98.6%. The test has a positive predictive value of 75% and Negative predictive value of 88.9%. The test and the gold standard agree on 75 out of 85 having a diagnostic accuracy of 88.2352941176471%. The Kappa value of 0.328 indicates Moderate agreement with a p value of 0.008.

KAPPA STATISTICS FOR COMPARING THE GRADE

GRADE AS IN MRI * PARTIAL/FULL AS PER ARTHROSCOPY Crosstabulationa

			Partial/full as per arthroscopy		Total
			Absent	Complete	
GRADE AS IN MRI	ABSENT	Count	82	2	84
		% within GRADE AS IN MRI	97.6%	2.4%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	100.0%	66.7%	98.8%
	COMPLETE	Count	0	1	1
		% within GRADE AS IN MRI	0.0%	100.0%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	0.0%	33.3%	1.2%
Total		Count	82	3	85
		% within GRADE AS IN MRI	96.5%	3.5%	100.0%
		% within PARTIAL/FULL AS PER ARTHROSCOPY	100.0%	100.0%	100.0%
a. LIGAMENT = PCL					

Symmetric Measuresa

		Value	Asymp. Std. Errorb	Approx. Tc	Approx. Sig.	Exact Sig.
Measure of Agreement	Kappa	.491	.306	5.259	.000	.035
N of Valid Cases		85				
a. LIGAMENT = PCL						
b. Not assuming the null hypothesis.						
c. Using the asymptotic standard error assuming the null hypothesis.						

On comparison of the test group MRI with the Gold standard of ARTHROSCOPY the test group has a sensitivity of 50 % and specificity of 98.8%. The test has a positive predictive value of 50% and Negative predictive value of 98.8%. The test and the gold standard agree on 83 out of 85 having a diagnostic accuracy of 97.6470588235294%. The Kappa value of 0.488 indicates Good agreement with a p value of 0.047.

OVERALL

MRI * ARTHROSCOPY Crosstabulation

			ARTHROSCOPY		Total
			ABSENT	PRESENT	
MRI	ABSENT	Count	455	35	490
		% within MRI	92.9%	7.1%	100.0%
		% within ARTHROSCOPY	89.4%	20.5%	72.1%
	PRESENT	Count	54	136	190
		% within MRI	28.4%	71.6%	100.0%
		% within ARTHROSCOPY	10.6%	79.5%	27.9%
Total		Count	509	171	680
		% within MRI	74.9%	25.1%	100.0%
		% within ARTHROSCOPY	100.0%	100.0%	100.0%

Symmetric Measures						
		Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.	Exact Sig.
Measure of Agreement	Kappa	.665	.033	17.378	.000	.000
N of Valid Cases		680				
a. Not assuming the null hypothesis.						
b. Using the asymptotic standard error assuming the null hypothesis.						

OVERALL KAPPA STATISTICS

GRADE AS IN MRI * PARTIAL/FULL AS PER ARTHROSCOPY Crosstabulation

			Partial/full as per arthroscopy								Total
			Absent	Complete	Discoid	Grade i	Grade ii	Grade iii	Grade iv	Partial	
Grade AS IN MRI	Absent	Count	456	2	0	8	13	6	5	1	491
		% within GRADE AS IN MRI	92.9%	0.4%	0.0%	1.6%	2.6%	1.2%	1.0%	0.2%	100.0%
		% within Partial/FULL AS PER Arthroscopy	89.2%	3.1%	0.0%	50.0%	34.2%	21.4%	45.5%	12.5%	72.2%
	Complete	Count	3	59	0	0	0	0	0	6	68
		% within grade AS IN MRI	4.4%	86.8%	0.0%	0.0%	0.0%	0.0%	0.0%	8.8%	100.0%
		% within partial/full AS PER arthroscopy	0.6%	92.2%	0.0%	0.0%	0.0%	0.0%	0.0%	75.0%	10.0%
	Discoid	Count	0	0	3	0	0	0	0	0	3
		% within grade AS IN MRI	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
		% within partial/full as per arthroscopy	0.0%	0.0%	75.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%
	Grade I	Count	13	0	0	2	4	0	0	0	19
		% within grade as in MRI	68.4%	0.0%	0.0%	10.5%	21.1%	0.0%	0.0%	0.0%	100.0%
		% within partial/full as per arthroscopy	2.5%	0.0%	0.0%	12.5%	10.5%	0.0%	0.0%	0.0%	2.8%
	GRADE II	Count	21	0	0	4	11	2	0	0	38
		% within grade AS IN MRI	55.3%	0.0%	0.0%	10.5%	28.9%	5.3%	0.0%	0.0%	100.0%
		% within partial/FULL AS per arthroscopy	4.1%	0.0%	0.0%	25.0%	28.9%	7.1%	0.0%	0.0%	5.6%
	GRADE III	Count	10	0	1	2	9	20	0	0	42
		% within grade AS IN MRI	23.8%	0.0%	2.4%	4.8%	21.4%	47.6%	0.0%	0.0%	100.0%
		% within partial/full AS per arthroscopy	2.0%	0.0%	25.0%	12.5%	23.7%	71.4%	0.0%	0.0%	6.2%
	GRADE IV	Count	3	0	0	0	1	0	6	0	10
		% within grade	30.0%	0.0%	0.0%	0.0%	10.0%	0.0%	60.0%	0.0%	100.0

		AS IN MRI									%
		% within partial/full AS per arthroscopy	0.6%	0.0%	0.0%	0.0%	2.6%	0.0%	54.5%	0.0%	1.5%
	partial	Count	5	3	0	0	0	0	0	1	9
		% within grade AS IN MRI	55.6%	33.3%	0.0%	0.0%	0.0%	0.0%	0.0%	11.1%	100.0%
		% within partial/full AS per arthroscopy	1.0%	4.7%	0.0%	0.0%	0.0%	0.0%	0.0%	12.5%	1.3%
Total		Count	511	64	4	16	38	28	11	8	680
		% within grade AS IN MRI	75.1%	9.4%	0.6%	2.4%	5.6%	4.1%	1.6%	1.2%	100.0%
		% within partial/full AS per arthroscopy	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Symmetric Measures

		Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.	Exact Sig.
Measure of Agreement	Kappa	.593	.030	26.003	.000	.c
N of Valid Cases		680				

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Cannot be computed because there is insufficient memory.

On comparison of the test group MRI with the Gold standard of ARTHROSCOPY the test group has a sensitivity of 79.5 % and specificity of 89.4%. The test has a positive predictive value of 71.6% and Negative predictive value of 92.9%. The test and the gold standard agree on 591 out of 680 having a diagnostic accuracy of 86.9117647058823%. The Kappa value of 0.665 indicates Very Good agreement with a p value of <0.001.

DISCUSSION

The study which we conducted was a prospective study of 85 patients who were admitted in Justice K. S. Hegde Medical Academy Hospital, in the Department of Orthopaedics with internal knee derangements, with the aim of assessing the diagnostic accuracy of MRI in comparison with the arthroscopy in ACL, PCL, Menisci and Chondral lesions of the knee joint. MRI is a non-invasive and preferred investigation modality in detecting soft tissue and bony structures including articular cartilage of the knee joint.

Here the results of 85 patients are compared with respect to sensitive, specificity, positive predictive value, negative predictive value and diagnostic accuracy. The results of our study found that MRI has high accuracy (>90%) in detecting ACL, PCL and chondral injuries. Out of 85 patients only 6 patients had intact ACL during arthroscopic examination for which MRI results showed partial to complete tear of the ligament. Likewise, only one patient had disparity in agreement of the lesion for PCL, where arthroscopic examination revealed intact ligament and MRI results showed complete tear. Meniscal injuries were often missed in the MRI, especially lateral meniscus lesions. Partial tears (Grade I & II) are less identified compared to Grade III tears of the meniscus, the diagnostic accuracy of MRI in detecting meniscal injuries were less compared to other literature studies. Cartilage lesions in the knee was also compared and found to have high diagnostic accuracy but lacked sensitivity and positive predictive value. Grade II and Grade III osteochondral lesions were misdiagnosed in MRI often commented as degenerative changes in the affected cartilage. However, MRI investigations may not recognise cartilage lesions and meniscal injuries and in such cases, the outcome of arthroscopic surgeries are still more or less the same.

In terms of accuracy, as mentioned previously MRI does have certain limitations, nonetheless, the recognition of ligament injuries proved to be almost more than 90% in this study and in correlation with the literature, the results were similar.

Diagnostic arthroscopy however is the gold standard which has the advantage of direct visualisation of the structures and the lesions involved, but the drawbacks such as surgical risks or increased procedural time, can lead to unmerited results. MRI investigations can lessen the use of diagnostic procedures whilst maintaining accuracy.

CONCLUSION

The conclusion we should arrive to is that MRI investigations are not only necessary but essential to diagnosing and treating patients with undermined knee joints. Instead of discussing the separate impact on each type of knee injury, an overall conclusion can be reached that imaging techniques offer non-invasive results, reduce the use of diagnostic arthroscopic intervention, increased the accuracy of initial diagnosis, and outline management to heightened specificity.

Diagnosis is the ultimate goal in patient care. In order for an orthopaedician to maintain regular standards, the utilization of imaging, in this case magnetic resonance imagining, not only furthers the

end goal, but deters from mistakes such as inaccurate diagnosis and unnecessary treatment plans.

REFERENCES

1. Vishy Mahadevan, Andrew Amis, Anthony Bull, Chinmay M Gupte. Grey's Anatomy 40th edition, Churchill Livingston Elsevier, 2008.
2. Campbell's operative orthopaedics 12th edition, volume III, sports medicine, knee injuries,2013.
3. Campbell's operative orthopaedics 12th edition, volume III, Part XIV-Arthroscopy, General principles of arthroscopy, 2013.
4. M. Majewski, Habelt Susanne, Steinbruck Klaus. Epidemiology of athletic knee injuries: A 10-year study, The knee 13, 2006.
5. Letha Y. Griffin, MD, PhD, Julie Agel, MA, ATC, Marjorie J. Albohm, MS, ATC, Elizabeth, A. Arendt, MD. Non contact Anterior Cruciate Ligament Injuries: Risk Factors and Prevention Strategies. JAAOS 2008.
6. Korula Mani Jacob, Anil Thomas Oommen. A retrospective analysis of risk factors for meniscal co-morbidities in anterior cruciate ligament injuries. IJO sep 2012/vol 46.
7. Romulo Baltazar, Calvin T. Ma, Steven Shankman, Nicholas Bhojwani, and Javier Beltran. John R. Haaga, Daniel T. Boll CT and MRI of whole body sixth edition, volume II, chapter 63 Knee.2008.
8. Paunipagar BK, Rasalkar D. Imaging of articular cartilage. The Indian Journal of Radiology & Imaging. 2014;24(3):237-248. doi:10.4103/0971-3026.137028.
9. Ruth Crawford, Gayle Walley, Stephen Bridgman, and Nicola Maffulli. Magnetic resonance imaging versus arthroscopy in the diagnosis of knee pathology, concentrating on meniscal lesions and ACL tears: a systematic review. British Medical Bulletin 2007.
10. Amreen Abdul Bari , Shivali Vaibhav Kashikar, Bhushan Narayan Lakhkar, Mohammad SaleemAhsan. Evaluation of MRI Versus Arthroscopy in Anterior Cruciate Ligament and Meniscal Injuries.Journal of Clinical and Diagnostic Research. 2014 Dec, Vol-8(12)
11. Yaqoob J, Alam MS, Khalid N. diagnostic accuracy of MRI in assessment of meniscal and ACL tear: Correlation with arthroscopy. Pak J Med Sci 2015;31(2):263-268.
12. F. Rayan, Sachin Bhonsle, Divyang D Shukla. Clinical MRI and arthroscopic correlation in meniscal and anterior cruciate ligament injuries. International Orthopaedics (SICOT) 2009.
13. Arthur A. De Smet, Rajat Mukherjee. Clinical MRI and Arthroscopic findings associated with failure to diagnose a lateral meniscal tear on knee MRI. AJR:190, January 2008.
14. Dhavalakumar K Jain, Rajkumar Amaravati, Gaurav Sharma. Evaluation of the clinical signs of anterior cruciate ligament and meniscal injuries. IJO-oct- dec 2009/vol 43
15. Sachin Gupta, Nitish Bansal, Rohit Sharma, Yogeshwar Saini, Narinderjeet Singh; comparison of clinical examination and MRI findings with Arthroscopy findings of Meniscal lesions occurring in ACL deficit knees. Orthopaedics today vol xvi no 3 july-sep 2014.
16. Reddy OJ, Gafoor JA, Suresh B, et al. Role of MRI in internal derangement of knee joint in correlation with arthroscopy. J. Evolution Med. Dent. Sci. 2016.
17. Bashir Ahmed Mir, Asif Sultan, Arshad Bashir. "Internal derangement of the knee - sensitivity and specificity of an MRI in correlation with a diagnostic arthroscopy." Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 101, December 17.
18. Dr. Ajaykumar SP, Dr. KMK Varma, Dr. Samarth Arya, Dr. Dinesh Manni, Dr. Ranjith AC and Dr. Gutha Sethu Kumar. Correlation of clinical, radiological and arthroscopic findings of meniscal and anterior cruciate ligament injuries of knee. International Journal of Orthopaedics Sciences 2017.
19. Krishna Gopal, Sandeep M. M. R, Prakash A., Ashish Jose. Correlation between magnetic resonance imaging and arthroscopy in internal derangement of knee. International Journal of Research in Orthopaedics, Gopal K et al. Int J Res Orthop. 2017.

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