ORIGINAL ARTICLE

CORRELATION OF MRI VS ARTHROSCOPIC CORRELATION OF INTERNAL DERANGEMENT OF KNEE (IDK)

T. Bhavani Prasad[1], B. Sasibhushan Reddy[2], Sandeep Saraf[3], Dinesh[4], Ravi Teja[5], Rajesh Reddy[6]

HOW TO CITE THIS ARTICLE:
T. Bhavani Prasad, B. Sasibhushan Reddy, Sandeep Saraf, Dinesh, Ravi Teja, Rajesh Reddy. "Correlation of MRI Vs. Arthroscopic Correlation of Internal Derangement of Knee (IDK)". Journal of Evidence based Medicine and Healthcare; Volume 1, Issue 13, December 01, 2014; Page: 1649-1659.

ABSTRACT: PURPOSE: It is to prove the validness of MRI in diagnosing the internal structural pathology in IDK with confidence compared to gold standard arthroscopy. **MATERIALS AND METHODS:** Ours is prospective study. We took arthroscopy as gold standard and took systematic review of MRI and arthroscopy in diagnosing IDK in 54 pts. **RESULTS:** MRI is 100% sensitive in diagnosing ACL PCL, meniscal injuries and hence the best screening tool. But many of grade 1/2 tears of meniscal tears in MRI are normal at arthroscopy. Majority of false positives occur in posterior horn of lateral meniscus.
KEYWORDS: Arthroscopy, MRI, ACL, PCL, Meniscus, Internal Derangement of Knee.

INTRODUCTION: Earlier arthroscopy was used mainly for diagnosis and saved many knees from unnecessary arthrotomy. Today MRI is available to solve knee joints from unnecessary arthroscopy.

Many studies have been published in which MRI has comparable diagnostic performance in comparison to gold standard arthroscopy.(1) but how accurately MRI is diagnosing ligamentous and meniscal injuries and why false positives and negatives are occurring and how to minimize them is still under debate.(2-4) My study is mainly to assess the diagnostic efficacy of MRI in IDK and analyzing the false positives and negatives.

AIMS AND OBJECTIVES:

1. Does MRI of knee joint allow accurate diagnosis to be made in comparison to the gold standard arthroscopy
2. Does MRI of knee changes the diagnostic confidence and displaces diagnostic arthroscopy
3. Do the results in imaging contribute in planning the correct treatment of internal derangement of knee

MATERIALS AND METHODS: Ours is a prospective study of 54 patients who came to OPD from Jan 2012 to Dec 2013 with symptoms suggestive of internal derangement of knee and these patients after clinical evaluation subjected to MRI followed by arthroscopy after required investigations and consent.

INCLUSION CRITERIA(1): Patients who had experienced at least 8 weeks of symptoms following trivial trauma;

- Pain.
- Swelling.

- Instability.
- Locking of the knee joint.

EXCLUSION CRITERIA:

- Patients with known joint disease
- Contraindications to MRI
- Locked knee at presentation
- Previous knee surgeries
- Presence of radio-graphically confirmed fractures
- Patients with only MCL/LCL injuries

MRI TECHNIQUE USED: 1.5 TESLA scanner GE Medical systems, Milwaukee, USA.

PATIENT POSITION: Patient lying supine with knee joint placed in 10 to 20 degrees of external rotation.[5-10]

Sequences used are T1, T2, Fat suppressed and proton density.

PROCEDURE: Arthroscopy was performed under strict aseptic precautions in operation theatres under spinal anaesthesia. Each knee joint is thoroughly examined and arthroscopy procedures are videotaped.

DOCUMENTATION: The MRI investigations soft copies and arthroscopy videos were documented and stored for later retrieval. The composite data was tabulated and studies for correlation of MRI findings with arthroscopy findings grouped into 4 categories.

1. TRUE POSITIVE
2. TRUE NEGATIVE
3. FALSE POSITIVE
4. FALSE NEGATIVE

Statistical analysis was used to calculate the sensitivity, specificity, PPV, NPV and Accuracy in order to assess the reliability of MRI results.

RESULTS FORMULAS:

	ARTHROSCOPY POITIVE	**ARTHROSCOPY NEGATIVE**	
MRI positive	True Positive	False Positive	Row Total
MRI negative	False Negative	True Negative	Row Total
	Row Total	Row Total	Grand Total

Formulas for:

Sensitivity =true positive/true positive + false negative.
Specificity= true negative/true negative + false positive.
Positive Predictive Value = true positives/true positives + false positives.
Negative Predictive Value = true negatives/true negatives + false negatives.
Accuracy = true positives + true negatives.
Truepositives + truenegatives + falsepositives + falseneagatives.

ANALYSIS AND RESULTS:
SEX DISTRIBUTION:

SEX	NO. OF PTS	%
MALE	48	88.89
FEMALE	6	11.11

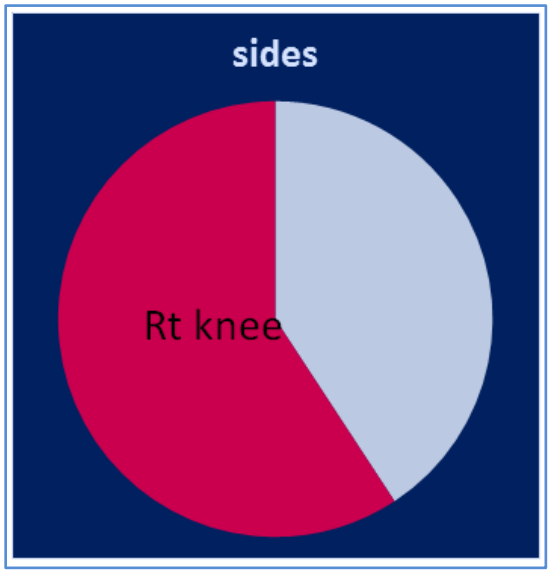
Significant no of patients were males.

AGE DISTRIBUTION:

Age	Male	Female	Total	%
20-24	15	0	15	27.78
25-29	12	2	14	25.93
30-34	11	1	12	22.22%
35-39	2	1	3	5.55%
40-44	7	0	7	12.96
44-49	1	2	3	5.55%

The mean age=30.33y.

SIDE INVOLVED:

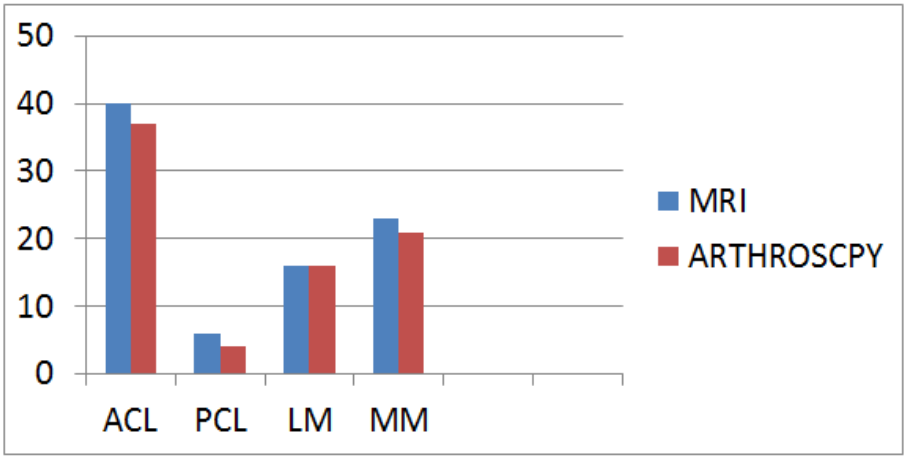


MODE OF INJURY:

MODE OF INJURY	NO. PTS	%
Motor vehicle accidents	35	64.81%
Sports injury	8	14.81%
Trivial trauma	11	20.38%

Motor vehicle injury is the most common mode.

STRUCTURES INJURED:



% of cases positive in MRI for each category.

ACL TEARS:

	Arthroscopy +ve	Arthroscopy –ve	TOTAL
MRI+VE	37	3	40
MRI –VE	0	14	14
TOTAL	37	17	54

SENSITIVITY -100
SPECIFICITY -87.5
PPV -92.5
NPV -100

PCL TEARS:

	Arthroscopy +ve	Arthroscopy – ve	TOTAL
MRI+VE	4	2	6
MRI –VE	0	48	48
TOTAL	**4**	**50**	**54**

SENSITIVITY -100%.
SPECIFICITY -96%.
PPV -66.67%.
NPV -100%.

MM TEARS:

	Arthroscopy +ve	Arthroscopy – ve	TOTAL
MRI+VE	19	4	23
MRI –VE	3	28	31
TOTAL	21	32	54

SENSITIVITY -86.36 %.
SPECIFICITY -87.5% if we take grade 3 tears as tears.
PPV -86.61 %.
NPV -90.32 %.

Taking only grade 3 tears as positives sensitivity is 86.36%. But all false negatives were given as grade 2 tears in MRI.

LM TEARS:

	Arthroscopy +ve	Arthroscopy –ve	TOTAL
MRI+VE	13	3	16
MRI –VE	3	35	38
TOTAL	16	38	54

SENSITIVITY -81.25%
SPECIFICITY -92.10%if we take only grade 3 tears as tears.
PPV -81.25%
NPV -92.10

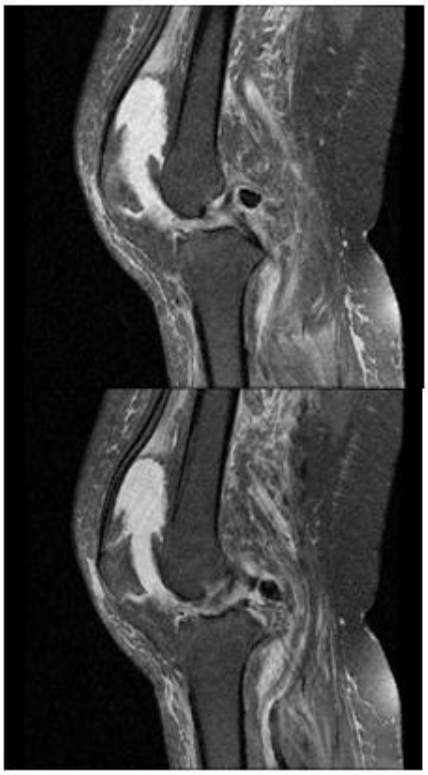
All 3 false positives were given either grade 2/1 tears in MRI. If we take all grades the sensitivity is 100%.

STATISTICAL VALUES

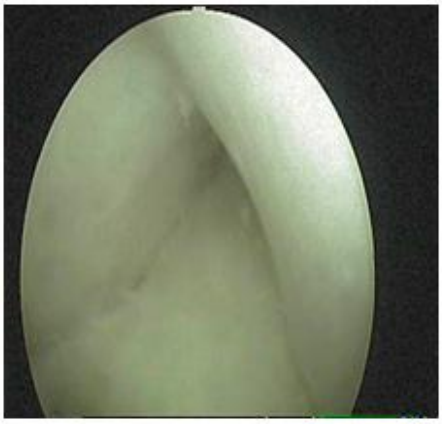
	Sensitivity	specificity	PPV	NPV
ACL	100%	87.5%	92.5	100
PCL	100%	96	66.67	100
MM	86.36%	87.5	86.61	90.32
LM	81.25%	92.10	81.25	92.10

DISCUSSION-ACL: Out of 40 ACLs diagnosed completely ruptured at MRI 31 were confirmed to be completely ruptured, 6 were partial ruptures and 3 were normal.

In one of my false positive case it was found retrospectively that the MRI was taken within 2 weeks. MRI showed positive ACL TEAR may because it was obscured by hemarthrosis.[11]



MRI CORONAL IMAGES OF KNEE SHOWING FEATURES S/O ACL TEAR



ATHROSCOPIC PICTURE OF THE SAME PATIENT SHOWING INTACT ACL

Out of 3 false positives two ACLs that were classified to be thickened, edematous or seen to show intra-substance tears were all seem to be normal at arthroscopy.

Overall sensitivity of ACL tears was 100% with specificity of 87.5.

Out of 40 pts showing tears of ACL on MRI 13 pts also showed grade 2/3 tears of posterior horn of lateral meniscus

Our study correlated with the study by Bui-Mansfeild et al who showed that complete ACL tears were found to be associated with posterior horn of lateral meniscus.[12]

In another study conducted by MURRAY A. Reicher et al showed that out of 20 pts with ACL tear on MRI 12 were found to be completely ruptured and 4 cases were falsely positive on MRI. In these cases it was found that the ACL was obscured by the presence of a joint effusion with similar signal intensity (hemarthrosis).[11]

Our study correlated to these two studies.

	Bui-Man field	Christine W Heron et al	My study
SENSITIVITY	94	92	100
SPECIFICITY	93	96	87.5

PCL: In our study we reported 6 cases of PCL on MRI of which 4 were proved on arthroscopy.

So we had 66% correlation.

However 48 cases reported negative on imaging were also found to be negative on Arthroscopy giving MRI 100%NPV for PCL tears.

In a study performed by Christine W Herons showed that partially ruptured PCL were found to be normal on Arthroscopy.[13] The reason attributed by Reicher et al was that presence of fluid around PCL with same signal intensity as PCL making visualization difficult.

On retrospective analysis we also found the same reason as mentioned by Reicher et al[11]

MEDIAL MENISCUS:

MRI GRADE	Arthroscopy +ve	Arthroscopy -ve	Total
1	0	10	10
2	4	8	12
3	19	4	23

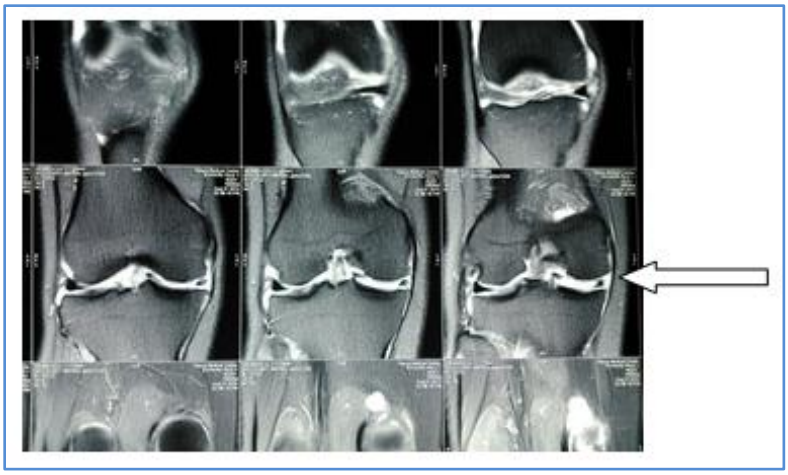
On MRI 23 cases were reported as grade III tears of posterior horn of MM of which 19 showed positive correlation with arthroscopy.

Out of 12 grade II tears of MM 4 cases were found to be positive on arthroscopy.

The sensitivity of MRI for MM is 86.36% specificity is 87.5% if we take only grade 3 tears as tears.

But if all grade 2 and grade 3 tears are included the sensitivity is 100%.But the specificity decreases further.

The MRI of a patient shown below is showing bucket handle tear of medial meniscus with inner portion of medial meniscus separated from outer part and get displaced into the inter-condylar notch.



The arthroscopic picture of the same patient shown below is showing the displaced inner portion of medial meniscus in the inter-condylar notch.

LATERAL MENISCUS:

MRI GRADE	Arthroscopy +ve	Arthroscopy -ve	Total
1	1	8	9
2	2	10	12
3	13	3	16

In a study by John V cures et al (13) 91.3% of grade 3 tears in MRI are arthroscopically positive.

And 89 % of grade 1/2 tears are arthroscopically negative.

Our study also has similar findings

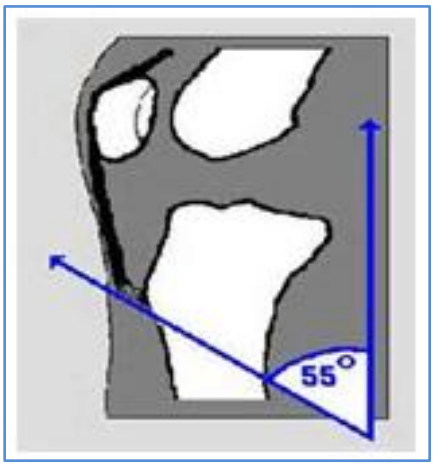
MRI is highly sensitive in diagnosing meniscal and ACL tears. it is a most appropriate screening tool before therapeutic arthroscopy.

Although MRI is being used with increasing frequency it is unlikely to replace clinical diagnosis.

Clinical examination combined with MRI provides the most accurate source of non-invasive information.

Most of false positive meniscal tears in our study were found in posterior horn of lateral meniscus.

This may be due to the so called "MAGIC ANGLE PHENOMENON."



CONCLUSIONS:

1. MRI of knee has the potential for rapid, definitive diagnosis with a noninvasive examination in comparison to gold standard arthroscopy
2. It reduces need for diagnostic arthroscopy.
3. MRI of knee contributed in planning the correct treatment of IDK.
4. Many of grade 1/2 tears of meniscal tears in MRI are normal at arthroscopy.
5. majority of false positives occur in posterior horn of lateral meniscus

RECOMMENDATIONS:

1. Entities that mimic meniscal tears like popliteus tendon, meniscofemoral ligaments, intermeniscal ligaments should be considered.
2. Errors can be avoided by closely following the anatomical structures.
3. Separate portions of posterior horn of LM may be mistaken for bucket handle tear on coronal images. Then normal mensical signal in sagittal images must be seen.

REFERENCES:

1. Patrice. W. J. Vincken et al. Effectiveness of MR imaging in selection of arthroscopy of knee. Radiology June 2002, 223: 738-746.
2. Rubin DA, Kettering JM, Towers JD<MR imaging of knees havingisolated and combined ligament injuries. AJR 1998, 170: 027-1213.
3. Resnik D. Diagnosis of bone and joint disorders. Philalelperia: saunders, 195: 3135-308.
4. De Smet AA Graf BK, Meniscal tears missed on MR imaging: relationship to meniscal tear patients and ACL taers, AJR AMJ Roengenol 1994; 162: 905-911.
5. Reicher MA. Rausching W.Gold RH Bassett L W, Lufkin RB, Glen W; High resolution MR imaging of knee joint normal anatomy. AJR 1985; 142: 895-902.

6. Reicher MA. Rausching W. Gold RH Bassett L W; High resolution MR imaging of knee joint, pathological correlations: AJR 1985: 145: 903-909.
7. Likc. Henkelman M, poompy, Robenstein J: MR imaging og normal knee. J comput Assist Tomogr 1984, 8: 1147-1154.
8. Kean DM, Worthington BS, Preston BJ Et al. NMR imaging of knee, example of normal anatomy and pathology. British Journal of Radiology. 1983; 56; 355-364.
9. Turner DA, Prodromoscc, Petasnick JP clark Ju, acute injuries of ligaments of knee magnetic resonance imaging evaluation, Radiology 1985; 134; 717-723.
10. Reicher MA Hartzmans, Duck willer GR, Basket L. W. Anderson LJ. Gold RH; Meniscal injuries Deection of using MR imaging, Radiology 1986; 1986; 159; 753-757.
11. Murray A. Reicher, Steren Hartzman, Lawrence W. Bassett. MR imaging of knee in Transmaticdisorders; Radiology 1897: 162: 547-551.
12. De Smet A. GrafB. relationship to meniscal tear patterns and ACL tears:1994. 162: 905-911.
13. Pedowitz R, Feagin J. Rajagopalan S, A surgical algorithm for treatment for cystic degeneration of meniscus, Arthroscopy 1996; 12; 202-216.

AUTHORS:

1. T. Bhavani Prasad
2. B. Sasibhushan Reddy
3. Sandeep Saraf
4. Dinesh
5. Ravi Teja
6. Rajesh Reddy

PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Orthopaedics, Andhra Medical College.
2. Post Graduate, Department of Orthopaedics, Andhra Medical College.
3. Post Graduate, Department of Orthopaedics, Andhra Medical College.
4. Senior Resident, Department of Orthopaedics, Andhra Medical College.
5. Senior Resident, Department of Orthopaedics, Andhra Medical College.
6. Senior Resident, Department of Orthopaedics, Andhra Medical College.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. T. B. Bhavani Prasad,
Vijaya Krishna Nilayam,
49-26-9 & 10,
2nd Floor, Madhura Nagar,
Visakhapatnam-530016.
E-mail: tadikonda.bhavani@gmail.com

Date of Submission: 08/11/2014.
Date of Peer Review: 11/11/2014.
Date of Acceptance: 15/11/2014.
Date of Publishing: 28/11/2014.