

CLINICAL AND MRI PROFILE OF KNEE INJURIES AND CORRELATION OF MRI WITH ARTHROSCOPIC FINDINGS.

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ABSTRACT

Introduction: MRI is radiation free modality and has ability to understand the soft tissue, anatomy and musculoskeletal system pathologies. MRI has the advantage of demonstrating the cartilages, bones, soft tissue in detail.

Objectives: Evaluation of ligaments and meniscal injuries using magnetic resonance imaging, to study the pattern and spectrum of knee injuries in relation to mechanism of injury and to correlate MRI findings with that of arthroscopic findings.

Methods: All the MRI studies were done using a 1.5 T MRI scanner (Siemens Magnetom) in our department, department of radiodiagnosis, ACS Medical college, chennai. Patient taken up for arthroscopy and the arthroscopic findings were collected. The data of MRI collected was compared with arthroscopy findings.

Results: On correlation of the overall findings the sensitivity of MRI versus arthroscopy was 90.62% Specificity was 84.55 % Positive Predictive Value was 92.06%, Negative Predictive Value was 80.00 % Between them with a kappa 0.059

Conclusion: MRI of knee is considered efficacious especially in the setting of indeterminate clinical finding and can stratify patients, thereby increasing the diagnostic confidence of the clinicians leading to appropriate surgical planning and management

Key words: MRI, Knee joint, arthroscopy, ligament injuries

INTRODUCTION

The knee joint is a synovial and weight bearing type of joint. The stability of joint is dependent on its supporting ligamentous and tendinous structures.¹

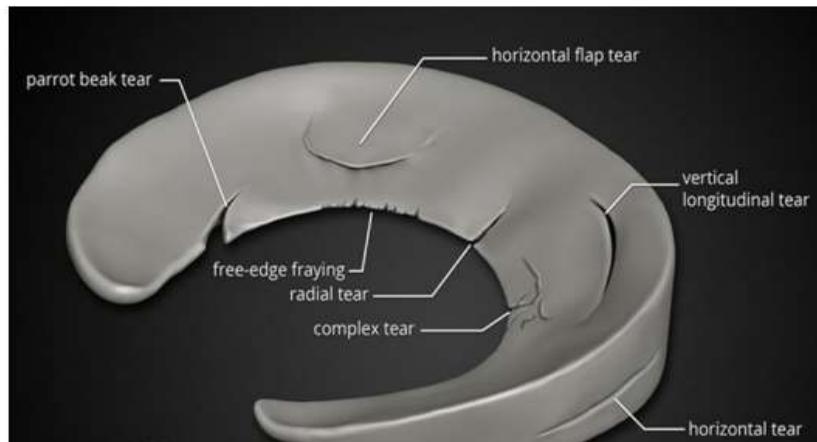
Trauma to the knee joint is a significant cause of morbidity in the young active individuals. An accurate diagnosis, grading and extent of injuries are essential for further management of the patient.^{2,3}

Complete evaluation of the internal structures of the knee is not possible with other modalities like conventional radiography, arthrography, ultrasonography and computed tomography. Even with arthroscopy, complex and inferior surface tears are difficult to detect. Multi planar MR images provide significant improvement in assessing these structures. It is also being used for pre and postoperative evaluation.⁴⁻⁹

The role of MRI in imaging of knee has progressively augmented over the years and is frequently the foremost or sole imaging modality that is used for assessment of suspected knee pathology.¹⁰

Knee injuries are among the most common injuries in the athletic population. In a study of injuries involving the knee joint, they stated that approximately half of the injuries were related to sports or recreation, with soft-tissue injuries accounting for the bulk of the injuries.¹¹

Awwad et al stated that in professional rugby league team players the average age at the time of injury was 24.1 years with an average BMI of 29.2kg/ m2 with knee injury being the commonest at 616.7 injuries / 1000 players. The most frequently occurring knee injuries were MCL and chondral/meniscal injuries accounted for 56.2% of all knee injuries.¹²



METHODS

Study design: Observational validation study.

Duration: 6 months (january 2022 to June 2022).

Equipment: Imaging was done by a 1.5 T MRI scanner (Siemens Magnetom).

Inclusion criteria: The patients who will present with injury to knee.

Exclusion criteria: Those who do not have subsequent MRI. Those who do not have subsequent arthroscopy. Those not giving consent for participating in the study. Age related degenerative/infective arthrosis of knee joint. Those having history of knee arthroscopy in the past.

Plan of study: Informed and written consent taken from each of the patients. All the MRI studies were done using a 1.5 T MRI scanner (Siemens Magnetom) in our department, department of radiodiagnosis ,ACS Medical college and hospital, chennai. The field strength, coil (volume surface phased array), slice thickness, field of view, matrix size, and other select imaging parameters are optimized with the goal of increasing the signal to noise ratio and decreasing scan time, thereby decreasing motion artifact. Metal artifact reduction can be achieved by orienting the long axis of metallic prosthesis parallel to both magnetic field and frequency encoding axis, employing fast spin echo techniques with increased echo train length, increasing receiver band width, decreasing field of view, and increasing the matrix size in the direction of the frequency encoding gradient. All images were viewed in the workstation settings. Patient taken up for arthroscopy by orthopedician and the arthroscopic findings were collected. The data of MRI collected was compared with arthroscopy findings. Clinical details / arthroscopic findings and Magnetic resonance imaging findings of the case were recorded as per the proforma.

Sequences taken: The following sequences were taken PDW STIR TRANSVERSE, T2W TSE TRANSVERSE, T2W TSE CORONAL, PDW STIR CORONAL, PDW TSE, T2W TSE SAGITTAL, T1W TSE SAGITTAL, PDW STIR SAGITTAL, T2W TSE THIN TRANSVERSE.

Sample size estimation: 75 patients. Where in the sample size was determined based on the overall agreement (p=87.2%) according to the study on “Can MRI replace diagnostic arthroscopy in evaluation of internal derangement of knee joint” and allowable error being 7%

The formula used for calculation is $n = Z\alpha^2p(1-p) / e^2$

Where n = sample size

$Z\alpha = 1.96$ at 95% confidence interval and e = allowable error

RESULTS:

Table 1. Age distribution of the study.

AGE	NO OF PATIENTS	PERCENTAGE
Less than 20 years	7	9.33%
21-30 years	28	37.33%

31-40 years	23	30.67%
41-50 years	10	13.33%
51-60 years	5	6.67%
More than 60 years	2	2.67%
Total	75	100.00%
Mean / SD	33.30667	

The total number of cases was 75. Maximum number of subjects were in the age group of 21-30 years, which constitute about 37.33% About 30.6% of cases were in the age of 30-40 years.

Table 2. Mode of injury.

Mode of injury	Cases	Percentage (%)
RTA	17	22.6
Self-fall	20	26.6
Sports injury	38	50.6%
total	75	

Out of 75 subject's sports injury was the commonest mode of injury of knee joint.

Table 3. MRI findings in medial meniscus

MEDIAL MENICUS MRI FINDINGS	no of patients	percentage
No Tear	41	54.67%
Vertical Tear	6	8.00%
Horizontal Tear	5	6.67%
Radial Tear	1	1%
Flap Tear	3	4.00%
Bucket Handle Tear	12	16.00%
Complex Tear	7	9.33%

Medial Meniscus MRI Findings	75	100.00%
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As per the MRI findings when the medial meniscus was evaluated, no tear was the commonest seen on 41 cases that accounted for 54.6% , vertical tear was 6 cases that accounted for 8 percent, horizontal tear in 5 cases accounted for 6.6 percent ,complex tear in 7 cases accounted for 9.3% , and bucket handle tear seen in 12 cases accounted for 1.33 % each accounted for 16% , radial tear in 1 cases accounted for 1% , flap tear in 3 cases accounted for 4%

Table4. Arthroscopy findings of medial meniscus

Arthroscopic findings in MM	No. of patients	Percentage %
No tear	42	56
Vertical tear	5	6.6
Horizontal tear	3	4
Radial tear	2	2.6
Flap tear	5	6.6
Bucket handle tear	12	16
Complex tear	6	8

As per the arthroscopy findings when the medial meniscus was evaluated, no tear was the commonest seen on 42 cases that accounted for 56%, vertical tear in 5 cases that accounted for 6.6 percent, horizontal tear in 3 cases accounted for 4 percent, complex tear in 6 cases accounted for 8%, and bucket handle tear seen in 12 cases accounted for 16%, radial tear in 2 cases accounted for 2.6%, flap tear in 5 cases accounted for 6.6%

Table 5. MRI findings of lateral meniscus

LATERAL MENICUS MRI FINDINGS	NO OF PATIENTS	PERCENTAGE
No Tear	39	52.00%
Vertical Tear	6	8.00%
Horizontal Tear	9	12.00%
Radial Tear	13	17.33%
Flap Tear	2	2.67%
Bucket Handle Tear	1	1.33%
Complex Tear	5	6.67%
Total	75	100.00%

As per the MRI findings when the lateral meniscus was evaluated, no tear was the commonest seen on 39 cases that accounted for 52.00% , vertical tear in 6 cases percent, horizontal tear in 9 cases 12 percent complex tear in 5 cases

6.67% , and bucket handle tear seen in 1 cases 1.33 % each , radial tear in 13 cases , 17.33%% , flap tear in 2 cases 2.6

Table 6. Arthroscopy findings of lateral meniscus.

Arthroscopic findings in LM	No. of patients	Percentage %
No tear	38	50.6
Vertical tear	5	6.6
Horizontal tear	7	9.3
Radial tear	7	9.3
Flap tear	8	10.6
Bucket handle tear	1	1.3
Complex tear	9	12

As per the arthroscopy findings when the lateral meniscus was evaluated, no tear was the commonest seen on 38 cases that accounted for 50% , vertical tear in 5 cases accounted for 6.6percent, horizontal tear in 7 cases accounted for 9.3% , complex tear in 9 cases accounted for 12%, and bucket handle tear seen in 1 cases accounted for 1.33 % , radial tear in 7 cases accounted for 9.3% and flap tear in 8 cases accounted for 10.6%.

Table 7. MRI findings of PCL

MRI FINDINGS PCL	NO OF PATIENTS	PERCENTAGE
NO TEAR	40	53.33%
intact	2	2.67%
low grade partial	4	5.33%
HIGH GRADE PARTIAL,	2	2.67%
COMPLETE TEAR	5	6.67%
BUCKLING OF PCL	22	29.33%

As per the MRI findings when the PCL was evaluated, no tear was seen in 40 cases ,PCL was intact(sprain) in 2 cases , low grade partial tear was noted in 4 cases , high grade partial tear was noted in 2 cases , buckling of PCL in 22 and complete tear was noted in 5 cases.

Table 8. Arthroscopy findings of PCL

findings inPCL	No. of patients	Percentage %
No tear	40	53.3
Intact (sprain)	2	2.6

Low grade partial tear	4	5.3
High grade partial tear	3	4
Complete tear	4	5.3
Buckling	22	29.3

As per the arthroscopy findings when the PCL was evaluated, no tear was seen in 40 cases, PCL was intact (sprain) in 2 cases, low grade partial tear was noted in 4 cases, high grade partial year was noted in 3 cases, buckling of PCL in 22 and complete tear was noted in 4 cases.

Table 9. MRI findings of ACL

ACL MRI	NO OF PATIENTS	PERCENTAGE
No Tear	28	37.33%
intact	5	6.67%
low grade Partial	8	10.67%
High Grade Partial,	9	12.00%
Complete Tear	25	33.33%
Total	75	100.00%

As per the MRI findings when the ACL was evaluated, no tear was seen in 28 cases, ACL was intact (strain) in 5 cases, low grade partial tear was noted in 8 cases, high grade partial tear was noted in 9 cases and complete tear was noted in 25 cases

Table 10. Arthroscopy findings of ACL

ic findings inACL	No. of patients	Percentage %
No tear	27	36
Intact (sprain)	6	8
Low grade partial tear	6	8
High grade partial tear	11	14.6
Complete tear	25	33.3

As per the arthroscopy findings when the ACL was evaluated, no tear was seen in 27 cases, ACL was intact (sprain) in 6 cases, low grade partial tear was noted in 6 cases, high grade partial tear was noted in 11 cases and complete tear was noted in 25 cases

Overall on correlation of the overall findings the sensitivity of MRI versus arthroscopy was 90.62% Specificity was 84.55 % Positive Predictive Value was 92.06%, Negative Predictive Value was 80.00 % Between them with a kappa 0.0595.

DISCUSSION

Maximum number of subjects were in the age group of 21-30 yrs. which constitute about 37.3% and about 30.6% of cases were in the age group of 31-40yrs. this study is showing same age predilection as study by Atul bucha et al. ¹⁶

Lateral meniscus is more involved (35 cases) compared to medial meniscus (34 cases). which does not correlate with a study by Drosos et al. ¹⁷ which showed lateral meniscus less prone to involve due to its loose attachment to the joint capsule. This could be due to smaller sample size in our study and the difference being only one patient more than medial meniscus.

In the present study, between MRI and arthroscopic findings for medial meniscus had a sensitivity of 96%, Specificity was 95.83 %, Positive Predictive Value was 92.86%, Negative Predictive Value was 97.87 %. the most common tear was bucket handle tear this is because of subjective variations. Somashekhar Reddy et al. In his study that was done in the year 2019 on cases with knee injury concluded that the diagnostic sensitivity, specificity of Medial Meniscus (MM) as 100%, 93.3%, 98.2% respectively

In the present study, between MRI and arthroscopic findings for lateral meniscus had a sensitivity of 69.09% %, Specificity was 64.29 % Positive Predictive Value was 16.67 %, Negative Predictive Value was 47.37 %. the most common tear seen was radial tear followed by horizontal tear this is due to subjective variations. Few earlier studies conducted by Rayan F et al and Bari AA et al. ¹⁹, also showed low sensitivity of MRI in detecting lateral meniscus tears

In the present study, between MRI and arthroscopic findings for ACL findings had a sensitivity of 89.36%, Specificity was 96.43% Positive Predictive Value was 97.67% Negative Predictive Value was 84.37 %. the most common tear seen was complete tears which was associated with buckling of PCL in 45.8%

In the present study, between MRI and arthroscopic findings for PCL had a sensitivity of 97.73%, Specificity was 96.77 % Positive Predictive Value was 97.73%, Negative Predictive Value was 96.77%

CONCLUSION

MRI is the best non invasive modality used to evaluate the patient with internal derangement of the knee for the diagnosis of meniscal and ligament tear.

Further the overall MRI diagnosis of internal derangement of knee correlates with arthroscopy findings and showed good correlation.

We have seen different pattern of meniscal and ligament injury in knee and its association so radiologist while reporting should be aware of these patterns of associations.

With the arthroscopy findings turning out to be negative, suspecting these injuries from MRI help in directing the patient to specific management.

REFERENCES

1. Rayan, F., Sachin Bhonsle, and Divyang D. Shukla. "Clinical, MRI, and arthroscopic correlation in meniscal and anterior cruciate ligament injuries." *International orthopaedics* 33.1 (2009): 129-132.
2. Martin England, M.D., Ph.D., Ali Guermazi, M.D., Daniel Gale, M.D., David J. Hunter, M.B., B.S., Ph.D., Piran Aliabadi, M.D., Margaret Clancy, M.P.H., and David T. Felson, M.D., M.P.H. *N Engl J Med* 2008; 359:1108-1115 September 11, 2008.
3. Munshi M, Davidson M, MacDonald PB, Froese W, Sutherland K. The efficacy of magnetic resonance imaging in acute knee injuries. *Clinical Journal of Sport Medicine*. 2000 Jan 1;10(1):34-9.
4. R. Mackenzie, A.K. Dixon, G.S. Keene, W. Hollingworth, D.J. Lomas, R.N. Villar; MRI of the knee assessment of effectiveness.
5. Prickett William D, Ward S, Matthew M. Magnetic resonance imaging of the knee. *Sports medicine* vol 31(14), 2001:997-1019
6. Blackburn TA, Craig E. Knee Anatomy A Brief Review. *Physical therapy* 1980;60: 1556-1560

7. Watanabe Y, Moriya H, Takahashi K, Yamagata M, Sonoda M, Shimada Y et al.. Functional anatomy of the posterolateral structures of the knee. *Arthroscopy: The Journal of Arthroscopic Related Surgery* 1993;9: 57-62
8. Wilson DR, Feikes JD, Zavatsky AB, O'connor JJ. The components of passive knee movement are coupled to flexion angle. *Journal of Biomechanics* 2000;33: 465-473.
9. Müller W. *The knee: form, function, and ligament reconstruction*. Springer Science & Business Media; 1983
10. Blackburn TA, Craig E. Knee anatomy: a brief review. *Physical therapy*. 1980 Dec 1;60(12):1556-1560
11. Muthuri SG, McWilliams DF, Doherty M, Zhang W. History of knee injuries and knee osteoarthritis: a meta-analysis of observational studies. *Osteoarthritis and Cartilage*. 2011 Nov 1;19(11):1286-93
12. Awwad GE, Coleman JH, Dunkley CJ, Dewar DC. An Analysis of Knee Injuries in Rugby League: The Experience at the Newcastle Knights Professional Rugby League Team. *Sports medicine-open*. 2019 Dec 1;5(1):33
13. . Miranda H, Viikari-Juntura E, Martikainen R, Riihimäki H. A prospective study on knee pain and its risk factors. *Osteoarthritis and cartilage*. 2002 Aug 1;10(8):623-30.
14. O'Kane JW, Gray KE, Levy MR, Neradilek M, Tencer AF, Polissar NL, Schiff MA. Shoe and field surface risk factors for acute lower extremity injuries among female youth soccer players. *Clinical journal of sport medicine: official journal of the Canadian Academy of Sport Medicine*. 2016 May;26(3):24
15. comparison to knee arthroscopy in diagnosing cruciate ligament tear and meniscal tears in organized sports and physical exercise related knee injuries in armed forces personnel. *International Journal of Advances in Medicine*. 2018 Nov;5(6):1407.
16. comparison to knee arthroscopy in diagnosing cruciate ligament tear and meniscal tears in organized sports and physical exercise related knee injuries in armed forces personnel. *International Journal of Advances in Medicine*. 2018 Nov;5(6):1407.