

ORIGINAL RESEARCH

Radiological Study of Type and Grade of the Ligament Injuries Following Knee Trauma, with the Help of Appearances on MRI Study

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ABSTRACT

Background: Within a decade of its clinical introduction, Magnetic Resonance Imaging became the imaging test of choice for ligament pathologies in knee. Present study was aimed to study type and grade of the ligament injuries following knee trauma, with the help of appearances on MRI study. **Material and Methods:** Present study was single-center, prospective, observational study, conducted in patients referred with clinically suspected internal derangement of knee following trauma to knee, underwent MRI study at our hospital. **Results:** In present study 97 patients satisfying study criteria were included. Majority were from 21-30 years age group (31.96 %) followed by 31-40 years age group (23.71 %). Male (61.85 %) outnumbered female (38.15 %). Joint effusion was present in 57 cases (58.76 %). In present study ACL tear was noted in 36 patients (37.11 %), majority had complete ACL tear (72.22 %). PCL tear was noted in 3 patients (66.67 %), majority had partial PCL tear (66.67 %). In present study MCL tear was noted in 25 patients (25.77 %), majority had grade I tear (64 %). LCL tear was noted in 10 patients (10.3 %), majority had grade I tear (60 %). MM tear was noted in 58 patients (59.79 %), majority had grade III tear (51.73 %). LM tear was noted in 10 patients (10.3 %), majority had grade II/III tear (40 %). In present study osseous or other injuries were noted in 48 patients (49.48 %). Arthroscopy was done in 23 patients (23.71 %). MRI Arthroscopy correlation was noted in 19 patients out of 23 patients (82.60 %). **Conclusion:** MRI is valuable diagnostic tool for evaluation of pathology of knee joint and is recommended investigation to make decision for further management of patient.

Keywords: MRI, soft tissue delineation, knee joint, knee trauma

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INTRODUCTION

Within a decade of its clinical introduction, Magnetic Resonance Imaging became the imaging test of choice for ligament pathologies in knee. Early success for ligament pathologies helped to promote MR imaging from new modality used to diagnose marrow abnormalities to its present position as primary noninvasive technique for joint imaging.^{1,2} Today MR Imaging of ligaments is one of the most efficient uses of the technology. Magnetic Resonance Imaging provides a digital representation of tissue characteristics based on chemical composition of tissue types. It takes advantage of abundant supply of

hydrogen atoms (protons) in the body and their interaction with magnetic fields. The basic technique involves the application of a strong magnetic field to the region of interest and imaging the resultant effect on hydrogen ions nucleus.³ Advantages of MRI over other include lack of radiation, lack of beam hardening artifacts, excellent soft tissue contrast and multi planar imaging capabilities, non invasive and do not require manipulation of knee as in arthrogram.^{4,5} Present study was aimed to study type and grade of the ligament injuries following knee trauma, with the help of appearances on MRI study.

MATERIAL AND METHODS

Present study was single-center, prospective, observational study, conducted in department of radiodiagnosis, at Saraswati Medical Foundation And Research Centre, Kolhapur, Maharashtra, India. Study duration was of 16 months (Sept 2014– Dec 2015). Study approval was obtained from institutional ethical committee.

Inclusion criteria

- All the patients referred with clinically suspected internal derangement of knee following trauma to knee, underwent MRI study at our hospital, willing to participate in present study

Exclusion criteria

- Patients with ferromagnetic implants, pacemakers, and aneurysm clips.
- Patients with major injuries like liver/ splenic rupture and flail chest and patients with unstable vital parameters especially in the setting of trauma
- Patients not willing to participate in present study.

Study was explained to patients in local language & written consent was taken for participation & study. Baseline data such as demographic details, clinical complaints, medical history, physical examination findings were collected & entered in case record proforma. All patients were subjected to MR imaging and followed by arthroscopy in selected cases.

Patients underwent MRI as per, by Siemens Magnetom Symphony Maestroclass 1.5 Tesla. Whole-body MR scanner following protocols:

- T1 & PD weighted sequences in sagittal and coronal planes.
- T2-weighted in axial, coronal and sagittal planes.
- Fat suppressed T2 or STIR sequences wherever indicated.

MRI were evaluated for joint effusion, anterior cruciate ligament tear, posterior cruciate ligament tear, medial collateral ligament tear, lateral collateral ligament tear, medial meniscal tear, lateral meniscal tear & osseous/osteochondral lesions.

Arthroscopy/ knee surgery was carried out by orthopedic surgeon in selected cases where indicated for diagnostic or therapeutic purposes. Data was tabulated and presented in graphical forms at appropriate places. The statistical analysis was done using computer assisted statistical software SPSS Package Version - 20. Statistical test used was Chi-square test for proportions. Probability was calculated at 0.05 level of critical significance.

RESULTS

In present study 97 patients satisfying study criteria were included. Majority were from 21-30 years age group (31.96 %) followed by 31-40 years age group (23.71 %). Male (61.85 %) outnumbered female (38.15 %). Mean age was comparable among males (30.68 ± 9.69) & females (34.94 ± 10.47), difference was not significant statistically ($X^2=3.88, df=3, p=0.37$).

Table 1: General characteristics

Age (years)	Male		Female		Total	
	Number	%	Number	%	Number	%
≤ 20 years	11	18.33	6	16.22	17	17.53
21 -30 years	23	38.33	8	21.62	31	31.96
31 -40 years	13	21.67	10	27.03	23	23.71
>40 years	13	21.67	13	35.13	26	26.80
Total	60	100.00	37	100.00	97	100.00
Mean age	30.68 ± 9.69		34.94 ± 10.47		32.31 ± 10.15	

Joint effusion was present in 57 cases (58.76 %).

Table2: Distribution of cases according to presence of joint effusion

Joint effusion	Number	Percentage
Present	57	58.76
Absent	40	41.24

In present study ACL tear was noted in 36 patients (37.11 %), majority had complete ACL tear (72.22 %). PCL tear was noted in 3 patients (66.67 %), majority had partial PCL tear (66.67 %).

Table3: ACL & PCL tear

Tear	ACL tear		PCL tear	
	Number	Percentage	Number	Percentage
Yes	36	37.11	3	3.10
Partial	10	27.78	2	66.67
Complete	26	72.22	1	33.33
No	61	62.89	94	96.90

In present study MCL tear was noted in 25 patients (25.77 %), majority had grade I tear (64 %). LCL tear was

noted in 10 patients (10.3 %), majority had grade I tear (60 %). MM tear was noted in 58 patients (59.79 %), majority had grade III tear (51.73 %).LM tear was noted in 10 patients (10.3 %), majority had grade II/III tear (40 %).

Table 4: Distribution of cases according to MCL,LCL, MM & LM tear

	MCL tear		LCL tear		MM tear		LM tear	
	Number	%	Number	%	Number	%	Number	%
Yes	25	25.77	10	10.30	58	59.79	10	10.30
Grade I	16	64.00	6	60.00	10	17.24	2	20.00
Grade II	4	16.00	2	20.00	18	31.03	4	40.00
Grade III	5	20.00	2	20.00	30	51.73	4	40.00
No	72	74.23	87	89.70	39	40.21	87	89.70

In present study osseous or other injuries were noted in 48 patients (49.48 %). Arthroscopy was done in 23 patients (23.71 %). MRI Arthroscopy correlation was noted in 19 patients out of 23 patients (82.60 %).

Table 5: Other characteristics

	No. of patients	Percentage
Osseous or other injuries	48	49.48
Arthroscopy done	23	23.71
MRI Arthroscopy correlation		
Yes	19	82.60
No	4	17.40

DISCUSSION

The role of magnetic resonance imaging has steadily increased and now it has become the first line investigation for most of the lesions of knee. It is also being used for pre and post operative evaluation. Complete evaluation of all the internal structures of the knee was not possible with other modalities like conventional radiography, arthrography, ultrasonography and computed tomography. Even with arthroscopy, lesions such as peripheral meniscal tears, inferior surface tears and osteochondritis dissecans without articular cartilage damage are most often not detected. Multiplanar MR images provide significant improvement in assessing these structures. In our study joint effusions were the most common finding affecting 57 patients (58.76%). Among the ligamentous and meniscal injuries, Medial Meniscal injuries seen in 58 patients (59.79%) with grade 3 type injuries being commonest in Medial Meniscal injuries seen in 30 patients (51.73%) to be followed by the ACL injuries seen in 36 patients (37.11%) Singh JP *et al.*,⁶ in their series of 173 patients, 78 patients (45.08%) showed ACL tears, among these 52 (66.67%), are partial, 16(20.51%) are complete and 10 (12.82%) cases showed non visualization of ACL. The authors concluded that ACL tears are more common than other ligamentous injuries with partial tears being commoner. However in our study ACL tear was found in 36 patients (37.11%) among these 10 (27.78%) were partial tears and 26 (72.22%) were complete. Mucoid degeneration of ACL was present in 7 patients. Four cases with positive findings on MRI were found negative on arthroscopy. These were partial tears of ACL. Discordant appearance of ACL (when one MR sequence shows disrupted or poorly seen ACL fibres and other sequence shows intact ACL) was the reason for this. Smith *et al.*,⁷ and Umans *et al.*,⁸ have proved

that when discordant appearance of ACL was seen, they appeared normal on scopy. There are several reasons for this appearance on routine MRI sequences as like mucoid or eosinophilic degeneration with partial or volume averaging of ACL with lateral femoral condyle or periligamentous fat and suboptimal selection of sagittal imaging plane to view the ACL continuity. In this cases secondary signs were useful like PCL buckling, uncovering of posterior horn of lateral meniscus and bony contusions. Posterior cruciate ligament injuries were found to be relatively uncommon, in our study found in only 3 patients (3.10%) of which 2 cases (66.67 %) were partial tears and one case of complete tear was found. Sonin *et al.*,⁹ found the incidence of PCL tear to be 3 percent; in series of study analyzing 350 case of knee injury only 10 patients had PCL tear.⁹ In a study by Grover *et al.*,¹⁰ where they analyzed findings of 510 consecutive MRI of knee joints with an emphasis on PCL tear; 11 (2%) patients had different grades of tear on MRI which was confirmed correctly by arthroscopy. Of the other 202 patients who had undergone MRI as well as arthroscopy for internal derangement of knee none of the patients had any PCL injury as predicted correctly by MRI. In our study, a correlation of MRI findings with arthroscopic / surgical findings was performed in 23 patients (23.71 %). Among which in 19 patients (80.41%) MRI findings are well correlated with arthroscopic findings. The present study revealed the ability of magnetic resonance imaging in evaluation of the various internal derangements, including their detection, localization, characterization and assessment of extent of damage and the strength of correlation between MRI and arthroscopic findings confirms the value of MRI in assessing internal knee structures. Limitations of present study were includes sample size of patients referred by orthopedicians

which were mainly of high grade of trauma. So grading of injuries was higher. Arthroscopy was not done in our institute. Cases were advised arthroscopy & follow up was available in limited number of cases.

CONCLUSION

MRI is an excellent, noninvasive, radiation free imaging modality with multiplane capabilities and excellent soft tissue delineation. It can accurately detect, localize and characterize various internal derangements of the knee joint and help in arriving at a correct anatomical diagnosis thereby guiding further management of the patient. MRI is valuable diagnostic tool for evaluation of pathology of knee joint and is recommended investigation to make decision for further management of patient.

Conflict of Interest: None to declare

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