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MRI EVALUATION OF LIGAMENTOUS AND MENISCAL INJURY OF THE KNEE JOINT

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ABSTRACT The knee is one of the most frequently injured joint in the body. The stability of the knee joint owes greatly to the presence of its ligaments and menisci. MRI has emerged as a primary imaging tool in assessment of meniscal and ligament injuries. It can show both internal external meniscal abnormalities. A prospective cross-sectional case study was done on 75 patients including both sexes in all age groups, with h/o trauma to knee & clinically suspected to have meniscal or ligament tears were studied. In our study Anterior cruciate ligament tear was the commonest lesion detected and Medial meniscus tear was more common than lateral meniscal tear. The collateral ligaments were sprained in the majority of the cases and were always associated with cruciate ligament injury, MRI is excellent non invasive modality in imaging of knee and noninvasive replacement for arthrography and non therapeutic arthroscopy.

KEYWORDS : Anterior Cruciate Ligament, Medial Meniscus, Tear, MRI

INTRODUCTION

The knee joint is the largest joint in the body, consisting of bones and an extensive network of ligaments and muscles. The knee is one of the most frequently injured joint in the body. The stability of the knee joint owes greatly to the presence of its ligaments and menisci.

MRI has emerged as a primary imaging tool in assessment of meniscal and ligament injuries. It can show both internal external meniscal abnormalities.

MRI is a diagnostic test in which pictures are taken of the structures inside the body. MRI, unlike CT scans, does not use radiation or X-rays to generate the pictures. Instead, MRI scanners use a magnetic field, and different radio waves to create images.Magnetic resonance imaging (MRI) uses magnetic fields and radio waves to create detailed images of the body's soft tissue structures, such as ligaments, tendons, and cartilage, which do not appear on an x-ray image of the same part of the body. A computer converts signals from the MRI scan into frontal, lateral, and cross-sectional images.

The reports in 1983 by Kean and coworkers[1] and Moon and associates[2] were the first to describe the potential of MRI in assessing the knee. Since then because of its improved signal to noise ratio (SNR), higher resolution, reduced artifacts, shorter imaging times and improved accuracy.

MRI is an excellent noninvasive modality in imaging of the knee and a noninvasive replacement for arthrography and non therapeutic arthroscopy. It is useful in conditions where arthroscopy cannot detect peripheral meniscal tears. Being noninvasive, MR does not involve morbidity associated with arthroscopy and helps in planning the treatment of meniscal and ligament injuries.

Aim of this study was to assess the diagnostic usefulness of MRI in patients with ligamentous and meniscal injuries of knee.

MATERIALS AND METHODS

A prospective cross-sectional case study was done on 75 patients including both sexes in all age groups, Patient attending OPD or indoor in NSCB medical college hospital, Jabalpur, with h/o trauma to knee & clinically suspected to have meniscal or ligament tears were studied using Signa Profile HDX(GE) MR machine with a superconducting magnet & field strength of 1.5 Tesla, using a Quadknee coil (transmit + receive coil).

We used SE, fast sequences such as GRE, FSE STIR and for ACL&PCL PD FAT SAT sequences. The 3 standard imaging planes used are the direct coronal, sagittal & axial views. Examination of the knee is done in these three planes using a FOV of 18 cm & 4 mm slice thickness.

An axial acquisition through patella-femoral joint is used as an initial localiser for subsequent sagittal and coronal plane images.

The coronal plane optimally evaluates the collateral ligament and body of the menisci. The sagittal plane reveals the Cruciate Ligaments. Menisci and synovial anatomy especially the suprapatellar pouch. Overall the bones, muscles tendons, neurovascular structures are fully evaluated with integration of all three planes.

Patient is placed in supine position with the knee in a closely coupled extremity coil. The knee is externally rotated 15-200, in order to facilities the visualization of ACL completely on sagittal images. The knee is flexed slightly 5-100, to increase the accuracy of assessing the patella-femoral compartment and patellar alignment.Excessive flexion or hyperextension does not permit accurate evaluation of patellar alignment.

RESULTS

Among total seventy five patients 50(66.6%) were males and 25(33.3%) were females. So in this study male preponderance in distribution of knee injury was found.

TABLE-1
(DISTRIBUTION OF LESION (TOTAL NO OF CASES 75)

CASES	NUMBER OF PATIENTS	PERCENTAGE (%)
ACL TEARS	36	48
PCL TEARS	11	14.67
MEDIAL MENISCUS TEARS	33	44
LATERAL MENISCUS TEARS	12	16
MCL INJURIES	13	17.33
LCL INJURIES	2	2.67

Hence most of the patients were found with ACL tears or MM tears.

TABLE:2
DISTRIBUTION OF PATIENTS ACCORDING TO AGE

AGE(YEARS)	NUMBER	PERCENTAGE
0-20	5	6.67
21-40	42	56
41-60	26	34.7

61-80	2	2.67
Total	75	

Hence most of patients were young between age of 21-40 years and least affected group was 61-80 years.

The gender wise distribution, however, showed anterior crucite ligament and medial meniscus tears to be of equal occurrence in females. Males continued to show increased incidence of ACL tears, PCL tears, MM tears and MCL tears.

Maximum injuries were of road traffic accidents 40% followed by sports related injuries 32%, followed by minor trauma 28%.Minor trauma were maximum in age group 41-60 yrs of age group and sports related injuries and road traffic accidents in 21-40 yrs of age group.

TABLE:2 LOCATION OF MENISCAL TEARS

MENISCUS	ANTERIOR HORN	POSTERIOR HORN	BODY
MEDIAL	10	20	3
LATERAL	4	7	1
TOTAL	14	27	4

Posterior horn was the most commonly injured part of a meniscus (in both medial (60.61%) and lateral 63.63%). Involvement of anterior horn and body was next in decreasing order of frequency.

TABLE:3 GRADE-WISE DISTRIBUTION OF MENISCAL TEARS

GRADE	MEDIAL	LATERAL	TOTAL	PERCENTAGE(%)
I.	9	4	13	28.89
II.	6	3	9	20
III.	18	5	23	51.11
TOTAL	45			

According to above table out of 45 cases of meniscal tears, Grade lll meniscal tears were found in 23 (51.11% patients), grade ll tears were found in 9(20%) patients and grade-l tears were found in 13 (28.89%) cases.

TABLE: 4 FINDINGS IN ACL TEARS

ACL TEARS	NUMBER	PERCENTAGE(%)
Signs		
Hyperintensity	22	61.11
Discontinuty	10	27.78
Non- visualizaion	4	11.11
Location		
Midsubstance	25	69.44
Femoral attachment	8	22.22
Tibial attachment	3	8.33

According to this table out of 36 case of ACL tears, 22(61.1%) cases showed sign of hyperintensity, 10(27.78) cases showed sign of discontinuity and ACL were not visualized in 4 (11.1%)cases.

For these cases of ACL tears lesion were found mid substance in 25(69.44%) and at the femoral attachment in 8(22.22%) and at tibial attachment were found in 3 (8.33%) cases.

TABLE: 5 SITES OF POSTERIOR CRUCIATE LIGAMENT TEARS

SITES	NO OF CASES	PERCENTAGE(%)
FEMORAL	3	27.27
MIDSUBTANCE	7	63.64
TIBIAL	1	9.091
TOTAL	11	100

In our study most tears of posterior cruciate ligament tears were noted in midsubstance (63.64%) followed by femoral (27.27%) and tibial attachment site.

FINDINGS IN PCL TEARS

PCL tears were found in 11in which discontinuity were seen in 6(54.55%) cases, hyperintensity were seen in 3(27.27%) cases and buckling were seen in 2(18.18%) cases.

DISTRIBUTION OF COLATERAL LIGAMENT INJURI

Out of total 15 cases of collateral ligament injuries 13(86.67%) cases were of medial collateral ligament injury and 2(13.33%) case were of lateral collateral ligament injury.

DISCUSSION

In this study, done at Department of Radio diagnosis, N.S.C.B. Medical college hospital Jabalpur, we studied 75 patients; this included 50(66.67%) cases of males and 25 cases of females (33.33%).

The most common age range affected was 21-40 years. This is in accordance with the study of ***Shetty et al.*** [3]

CRUCIATE LIGAMENT LESION

In our study out of seventy five patients with the history of knee injury, the most common lesion found in symptomatic knee, was anterior cruciate ligament tear, closely followed by medial meniscus tear. **Mink JH**[4] also found anterior cruciate ligament tear to be the commonest lesion detected.

In our study ACL tears were more among male cases (52%) than female 40% as against study by **Cimino et al.**[5] Out of 36 cases of ACL tears most common tear location was mid substance. In our study mid substance tears were in 25(69.44%) and the femoral attachment tears were in 8(22.22%)

and tibial attachment tears were found in 3 (8.33%) cases. **Berquist et al** [6] in their study reported mid substance tears as the most common type.

According to our study sign of hyper intensity was most common finding seen in ACL tears 22(61.1%) cases, followed by sign of discontinuity 10(27.78%), cases followed by non visualization in 4 (11.1%) cases, which corresponds with **Gentil et al**[7] study. Secondary signs such as PCL buckling, anterior tibial displacement, uncovered meniscus sign and bone contusions assisted in diagnosis in intermediate cases.

Associated meniscal tears were seen in 20 cases (55.5%) as against (70%) seen by **Robertson et al**.[8] **Thomas S**.[9].in the evaluation of MRI in ACL injuries found that MRI was more useful as a negative diagnostic tool.

In our study PCL tears were found in 11(14.67%) which is comparable to study by **Sonnin et al**[10] who found in their study an incidence of PCL injury (2-23%).

Among these discontinuities were seen in 6(54.55%) cases, hyperintensity were seen in 3(27.27%) cases and buckling were seen in 2(18.18%) cases.

MENISCAL TEARS:

Out of seventy five patients 45 (60%) patients were seen with meniscal tears in which 33 (73.33%) cases were of medial meniscus tears and 12 (26.67%) were of lateral meniscal tears.

Among 45 cases of meniscal tear, 33 cases were of medial meniscal tear and 12 cases were of lateral meniscus tear. Among 45 cases of meniscal tear, Grade lll (increased signal intensity extending to articular surface)meniscal tears were found in 23 (51.11% patients), grade ll (Linear intra-substance tear) tears were found in 9(20%) patients and grade-l(Focal/ globular intra-substance tear) tear were found in 13 (28.89%) cases, means Grade 3rd meniscal tears were found to be most common type which is in accordance with the study of **Crues et al**.[11]

Our study corresponds with **Singh JP et al** [12] reported in their study medial meniscal tear more common then lateral meniscal tear.

The tears of menisci demonstrated high signal intensity due to imbibed synovial fluid. These tears were better demonstrated on short TE images like T1, PD and GRE images. This was explained by **Stoller et al**[13] in their study as the interaction of synovial fluid with large macromolecules in menisci, slows rotational rates of proton s and shortens T1 and T2 values.

In our study we found that T2 weighted GRE image clearly depict the meniscal tear than FSE images as supported by **Rubin et al**[14] study.

Posterior horn was the most commonly injured part of the meniscus in our study, which is in tandem with study by **Lakhkar et al** [15] who also found posterior horn to be commonly torn, followed by anterior horn tear and tear of body.

Of the 7 cases with meniscal tears which were followed by arthroscopy one case had been falsely reported as positive of MRI because of pseudo tear appearance of; lateral meniscus caused by menisco femoral ligament

In our study out of 4 cases Bucket handle tears 3 were found in medial meniscus tear which were confirmed by subsequent arthroscopy. This is corresponding with study by **Sighson et al**[16] who reported that medial meniscus Bucket handle tears were more common than lateral meniscal tears.

Of the four cases with Bucket handle tears, one case showed double PCL sign. **Watts et al** [17] described that double PCL sign is 98% specific but 32% sensitive.

COLLATERAL LIGAMENT

Out of total 15 cases of collateral ligament injuries 13(86.67%) cases were of medial collateral ligament injury and one of these showed associated LCL injuries, which correlated with the study by **Berg et al** [18].

The collateral ligaments were sprained in the majority of the cases and were always associated with cruciate ligament injury.[19]

CONCLUSIONS

Our study sought to define the role of MRI imaging in evaluation of knee injuries.

- MRI is excellent non invasive modality in imaging of knee and noninvasive replacement for arthrography and non therapeutic arthroscopy
- MR is unique in ability to evaluate the internal structure as well as the surface of the meniscus.
- MR is advantageous in conditions where arthroscopy is not useful like peripheral meniscal tears, inferior surface tear, osteochondritis without apparent damage to cartilage.
- MR is more sensitive in detection of multiple meniscal tear that may be overlooked in arthroscopy
- MR being noninvasive does not involve morbidity associated with arthroscopy

But some pitfalls occur in evaluating the knee are related to normal anatomy or variants and artifacts created by flow, motion and software problems.

MR can be concluded as best noninvasive preoperative modality in assessment & treatment planning of meniscal and ligament injuries& the only method for subtle fracture /bone contusion.

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