www.jmscr.igmpublication.org
Impact Factor 5.84
Index Copernicus Value: 83.27
ISSN (e)-2347-176x ISSN (p) 2455-0450
crossref DOI: https://dx.doi.org/10.18535/jmscr/v5i1.112

IGM Publication
Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

MRI Evaluation of Collateral Ligaments of Knee

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ABSTRACT
Aim: *To assess the diagnostic accuracy of Magnetic Resonance Imaging in detecting Collateral ligament injuries of knee.*
Methodology:*70 patients referred to the Department of Radiodiagnosis for Magnetic Resonance imaging with clinical suspicion of having ligamentous injuries of knee were included in the study.MR imaging of the knee was done with T2WI,T2WI and PD sequences in axial, sagittal and coronal planes. Arthroscopic correlation and statistical analysis were done for these patients*
Results: *Magnetic resonance imaging was found to be accurate and non invasive modality for the assessment of ligamentous injuries. MRI is an appropriate screening tool for therapeutic arthroscopy, and also the test performance is towards diagnostic side than screening, so that it makes diagnostic arthroscopy unnecessary in most of the patients.*
Keywords: *Medial collateral ligament, LCL, MRI,*

MRI of knee joint was done in all patients who presented with trauma to knee from May 2014 to October 2015.Among them, 70 patients who had done MRI knee joint underwent arthroscopy on follow up. These 70 patients were selected as study population with arthroscopy taken as standard of reference. This study was taken primarily to confirm the role of MR imaging of knee as a substitute for diagnostic arthroscopy.

All the scans were conducted in the department of Radiodiagnosis, using a 1.5 Tesla Siemens Magnetom Avento scanner. They were done prospectively and using a scan protocol which included T1W, T2W and Proton Density images in axial, coronal and sagittal planes.

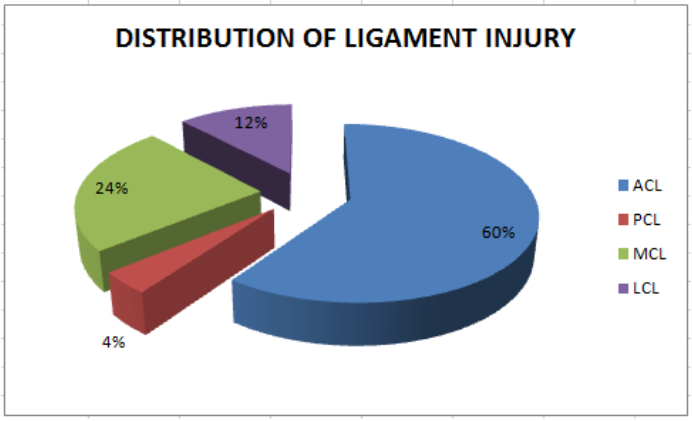
The study population consisted patients in the age group of 18 -61 yrs. Maximum number of subjects were in the age group of18-28years, which constitute about 50% of cases. About 27% of cases were in the age group of 29-39 yrs in this study. Most common age group sustaining ligament injury was young aged, due to increased involvement in sports activities[54].

Results

Among the 70 cases studied, 63 were males and only 7 were females, which is about 90% and 10% respectively. Ligament tears are sustained more by

males due to increased involvement in manual labor and sports activities

Fig; 1.Percentage distribution of ligament injuries of knee



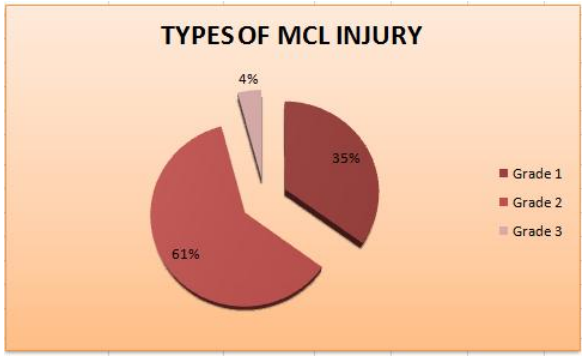
ACL injury was the most common knee ligament injury observed (about 60% Cases). MCL injury noted in 24% of cases. LCL injury constituted 12% of cases and PCL injury in 4% of cases

Medial Collateral Ligament Tears

Table 1- Percentage distribution of types of MCL tears

MCL tear	Number of cases	Percentage
Grade 1	8	35
Grade 2	14	60.8
Grade 3	1	4.2
Total	23	100

Fig 2 Percentage distribution of types of MCL tear



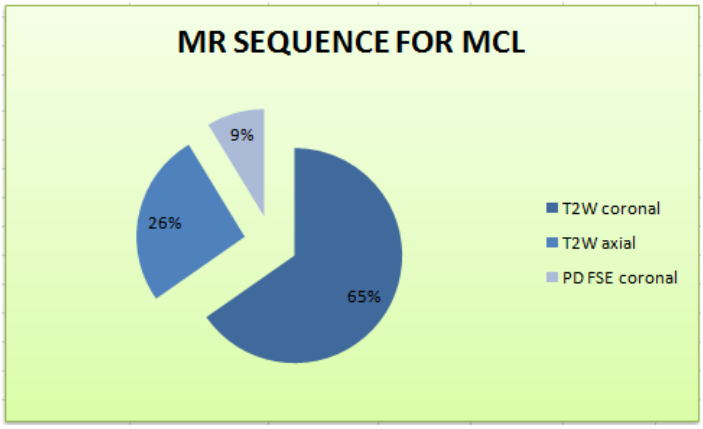
Among the 23 MCL tears reported by MRI, about 60% cases were grade 2 tears , 35% were grade 1 tears and only 4% cases were grade 1 sprain.

MRI Sequences In Detecting MCL Tears

Table 2- Percentage distribution of MCL tears evaluated in various MR sequences

MCL tear	Number of cases	Percentage
T2W coronal	15	65.3
T2W axial	6	26
PD FSE coronal	2	8.7
Total	23	100

Fig 3- Percentage distribution of MCL tears evaluated in various best MR sequences.



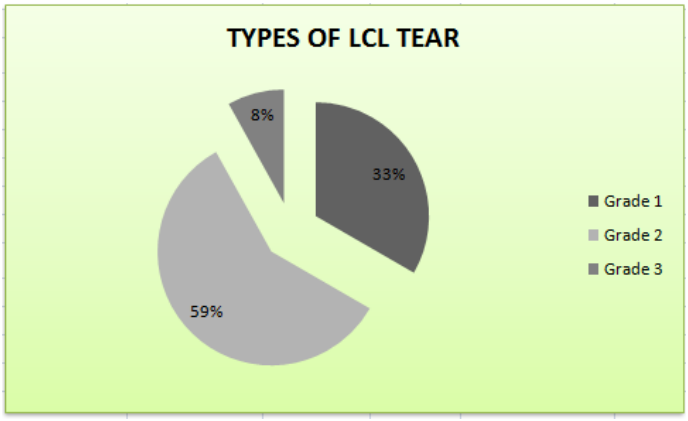
Among the 23 cases of MCL tears reported by MRI, 15 tears (68%) were best visualized in T2W coronal sequence and 6 cases (26%) in T2W axial sequence . Two tears (9%) were diagnosed in PD FSE sagittal sequence.

Lateral Collateral Ligament Tears

Table 3- Percentage distribution of types of LCL tear

LCL tear	Number of cases	Percentage
Grade 1	4	33.3
Grade 2	7	58.4
Grade 3	1	8.3
Total	12	100

Fig 4- Percentage distribution of types of LCL tear



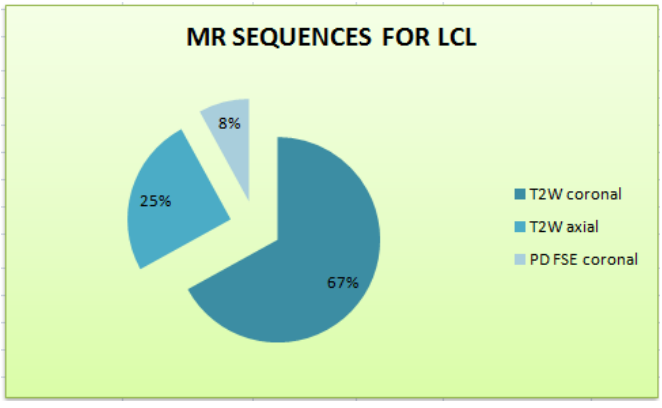
Among the 12 LCL tears reported by MRI, about 58% cases were grade 2 tears, 33% were grade 1 tears. There was only one case of grade 3 tear (about 8%).

MRI Sequences In Detecting LCL Tears

Table 4- Percentage distribution of LCL tears evaluated in various MR sequences

LCL tear	Number of cases	Percentage
T2W coronal	8	66.7
T2W axial	3	25
PD FSE coronal	1	8.3
Total	12	100

Fig 5- Percentage distribution of LCL tears evaluated in various MR sequences.



Among the 12 cases of LCL tears reported by MRI, 8 tears (67%) were best visualized in T2W coronal sequence and 3 cases (25%) in T2W axial sequence. Only one case (8%) was best visualized in PD FSE sagittal sequence.

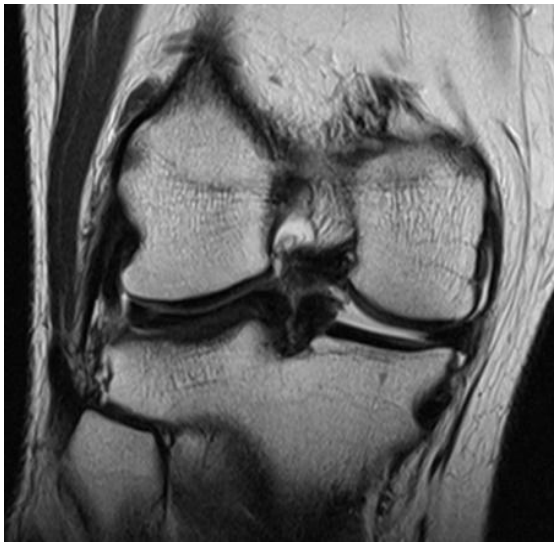


Fig.6.T2W coronal, hyperintensity noted medial to the MCL, Grade 1 tear.

Fig.7. T2W coronal image , Grade 1sprain of LCL noted at the femoral attachment

Fig.8 -T2W coronal image

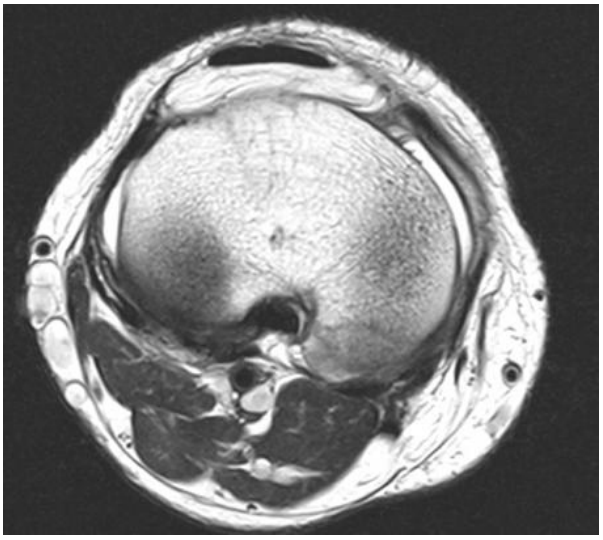


Fig.9 T2W axial image, hyperintensity with wavy fibers of LCL(Grade 2 sprain)

Discussion

Medial Collateral ligament

Normal appearance-The healthy MCL appears as a dark linear band on all MRI sequences. It is one of the primary stabilizers of the knee joint and is the weakest. It is best demonstrated on coronal images just lateral to the medial meniscus.

The potential signs of MCL injury were **a)**Distal or proximal discontinuity in which the entire MCL from the femur to the tibia could not be visualised. **b**)Morphologic disruption in which there were focal abnormalities of some but not all fibres. **C**)Poorly defined internal signal intensity that was not isolated to the joint line.**d**)fluid in MCL bursa that provided a well defined signal intensity of fluid, focal and centered at the joint space because fat normally may be present in this location, signal intensity must have been greater than suppressed fat and similar to articular fluid.**e**)loss of clear demarcation between the MCL and adjacent subcutaneous fat as seen on coronal images.

Classification of MCL tears[1]:-

Three grades of injury have been described clinically which corresponds to three appearances of the MCL seen. **Grade1**- A sprain shows increased signal intensity in the soft tissues medial to the medial collateral ligament(Fig.6).**Grade 2**-A severe sprain or partial tear, shows high signal in the soft tissues medial to the medial collateral ligament but also shows a high signal or partial disruption of the medial collateral ligament itself. **Grade 3**-or complete tear shows disruption of the medial collateral ligament

Lateral Collateral Ligament

Normal appearance-The LCL is best seen on posterior coronal images and appears as a band of low signal intensity .It is located at the level of the popliteus tendon and lateral meniscus and extends along its proximal course to the popliteal fossa and to its distal attachment on the lateral aspect of the fibular head. Peripheral sagittal images demonstrate LCL anatomy at the level of the fibular head.

Tears of LCL also were divided into 3 grades based on MRI appearances. In contrast to MCL which is injured frequently, LCL is relatively a strong stabilizer of the knee joint and is injured only in case of significant knee trauma. There were 13 cases of LCL strain identified in our study in which 4 cases (33%) were grade 1 tear, 7 cases (59%) were grade2 tear (Fig8 & Fig9) and one case (8%) was grade 3 tear. However arthroscopic correlation was not obtained as collateral ligament repair is not done arthroscopically.

Medial collateral ligament tear was seen in 23 patients. Out of these, about 14 (60%)cases were grade 2 tears (Table.2), 8(35%) were grade 1 tears and one case of grade 3 tear. Schweitzer M etal[2],on a study population of 76 patients, found that maximum number of patients with knee pain who had MCL tear belonged to grade 2 which was similar to this study. The collateral ligaments are not well visualized by arthroscopy since they are extrarticular ligaments. Hence, the arthroscopic surgeons do not as a routine, study the collateral ligaments and arthroscopic repair of the collateral ligaments is not done.

In case MR imaging shows significant strain of collateral ligament and clinical tests for tear are also positive, then the orthopedic surgeons perform an open surgery for repair of these ligaments. Hence arthroscopic correlation of collateral injuries was not available in this study.

MR Imaging in coronal plane, in most cases showed entire length of the medial collateral ligament. So out of all the various sequences, T2W images in coronal plane were the most useful sequence used to pick up a MCL tear, which was seen in 15 cases (65%).The presence of increased signal intensity medial to the MCL is an important factor and was picked up well on T2W coronal and axial sequence. Findings were noted in T2W axial sequence in 6 cases (26%) and PD FSE coronal sequence in 2 cases(about 8%). (Table.2)

Different sequences proved to be helpful in diagnosing LCL sprain. These include T2W coronal, T2W axial and Proton Density sequences. In a study done by Rubin et al[3], where increased signal within and around the ligament on T2W images proved to be the most useful indicator of a tear. Similar observation could be made out from this study. Grade 2 tears were more common and disruption of fibres were more easily picked in T2W coronal images. Among the 12 cases of LCL tears reported by MRI, 8 tears (67%) were best visualized in T2W coronal sequence and 3 cases (25%) in T2W axial sequence. Only one case(8%) was best visualized in PD FSE sagittal sequence.

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