ORIGINAL RESEARCH PAPER

Volume-8 | Issue-8 | August - 2019 | PRINT ISSN No. 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

CORRELATION BETWEEN MRI AND ARTHROSCOPY IN MENISCAL AND CRUCIATE LIGAMENT INJURIES

Radiodiagnosis

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ABSTRACT

Knee is a complex, compound type of synovial joint. Knee joint is supported by menisci and ligaments which are prone to injuries due to direct and twisting injuries to knee joint. The purpose of this study is to establish the accuracy of MRI in the diagnosis of meniscal and cruciate ligament injuries and to compare the findings with arthroscopy. A retrospective study was carried out in 30 patients presenting with traumatic knee injury who underwent diagnostic or therapeutic arthroscopy. Our study showed that MRI has high accuracy for diagnosis of meniscal and cruciate ligament injuries, especially when performed after the acute oedema of trauma has subsided. We concluded that MRI being a non-invasive diagnostic method can be used a first line diagnostic modality for traumatic knee injuries and arthroscopy can be reserved for those patients who need a therapeutic repair.

KEYWORDS

BACKGROUND:
Knee joint is anatomically supported by soft tissue and ligaments. These structures are commonly injured with trivial trauma. Hence knee joint is a commonly involved joint by direct or twisting injuries. MRI is the diagnostic modality to evaluate injury to the knee ligaments and menisci. Arthroscopy is the invasive modality to diagnose the ligamentous and meniscal injuries and at the same time can prove to be of therapeutic value.

AIMS AND OBJECTIVES:
The objective of this study was to evaluate the validity of MRI in the assessment of injuries of menisci and cruciate ligaments and compare with arthroscopic findings.

MATERIALS AND METHOD:
Retrospective study was carried out in Radiology department of Sardar Vallabhbhai Hospital, NHL medical college. The study included 30 patients attending OPD / IPD with knee injuries from the month of February to July 2019. Detailed history included duration of pain, type of injury, clinical examination. Radiological investigations like radiography and MRI were obtained.

INCLUSION CRITERIA:
- Patients who were referred to the Department of Radiodiagnosis for MRI of knee of traumatic etiology.
- Those who gave consent to participate in the study.

EXCLUSION CRITERIA:
- Patients not willing to participate in the study.
- H/O meniscal or ligamentous repair surgery in the same limb.

MRI knee study was done on SIEMENS 3T Magnetom Skyra machine. The specifications of the machine are as follows:

Field strength	3T, superconductor
Bore size	70 cm open bore design
Magent length	163 cm
Helium composition	Zero helium boil off technology
Shimming	Passive and active shimming. Passive shimming during installation. Higher order shim standard.
Gradient strength	XQ gradients (45 mT/m @200T/m/s)
Maximum number of channels	204
Number of independent receiver channels that can be used simultaneously in one single scan and in one single FOV, each generating an independent partial image	24, 48, 64, 128
System length	173 cm
System width	7.3 tons
Power requirement	84 Kva

MRI was reported by an experienced radiologist. Arthroscopy was performed by an experienced arthroscopic surgeon in the Orthopaedic department at our institute.

The criterion used to diagnose meniscal tear on MRI was the presence of hyperintense signal in the meniscus with or without extension to the articular surface. Other findings in our study were a full thickness longitudinal tear leading to the development of bucket handle tear. In a bucket handle tear, the inner fragment gets displaced either centrally giving a "fragment in notch sign" or "Double PCL sign" or it gets displaced anteriorly giving a "large anterior horn" or flipped fragment" sign.

Meniscal tears are graded as follows:
Grade 1: Small focal area of hyperintensity, not extending to articular surface.
Grade 2: Linear area of hyperintensity, no extension to articular surface.

- 2a: linear abnormal hyperintensity with no extension to articular surface.
- 2b: abnormal hyperintensity reaches the articular surface on single image.
- 2c: globular wedge shaped abnormal hyperintensity with no extension to articular surface.

Grade 3: abnormal hyperintensity extends to atleast one articular surface (superior or inferior) and is referred as a definite meniscal tear.

Partial tear of PCL gives a buckling appearance and complete tear of ACL is seen as disruption of its fibres with hyperintense signal.

ETHICAL CONSIDERATION:
Considering the research has human respondents involved in it, we have made sure that ethical considerations has been strictly complied with. These include-Voluntary participation, Informed consent, Confidentiality and protection of information.

RESULTS:
Among the 30 patients included in our study, 27 patients had ACL injury, 2 patients had complete tear of PCL, 21 patients had medial meniscal injury and 6 patients had lateral meniscal injury.

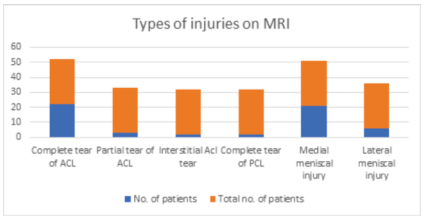

Table 1

On arthroscopy, among these 30 patients, 26 patients had injury of ACL, 2 patients had complete tear of PCL, 20 patients had medial meniscal injury and 8 patients had lateral meniscal injury.

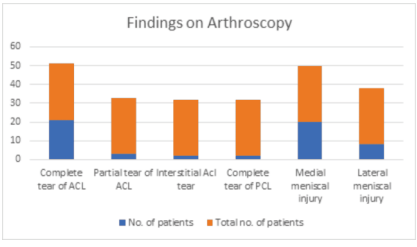

Table 2

Comparison between the distribution of injuries on MRI and Arthroscopy among the 30 patients included in the study.

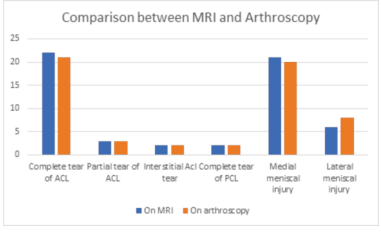

Table 3

ANTERIOR CRUCIATE LIGAMENT:

Of the 30 patients included in our study, 27 patients had ACL injury on MRI. 22 patients had complete tear of ACL, 3 patients had partial tear and 2 patients had interstitial tear. Of the 22 patients who were reported on MRI to have complete tear of ACL, 21 patients had arthroscopy findings correlating with MRI. 1 patient had intact ACL with fibrotic changes and mucoid degeneration within its substance on arthroscopy. The arthroscopy findings in patients who were reported to have partial or interstitial tear on MRI correlated with the report. Thus, MRI was proven to have sensitivity and negative predictive value of 100%, specificity of 93.3% and a positive predictive value of 96.3%.

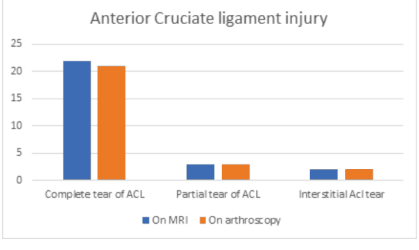

Table 3

POSTERIOR CRUCIATE LIGAMENT:

Of the 2 patients reported on MRI to have complete tear of PCL also had the same findings on arthroscopy. Thus, MRI had 100% sensitivity, specificity, positive predictive value and negative predictive value in our study.

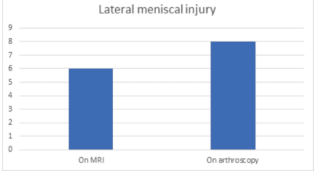

Table 4

MEDIAL MENISCAL INJURY:

In our study, among the 30 patients, 21 patients had injury of the medial meniscus- either bucket handle tear or Grade 2/3 intensity in anterior or posterior horn. Arthroscopy findings were found to correlate with the MRI report in 19 patients. 2 patients who were reported to have grade 2 tear and Grade 3 tear of posterior horn had normal medial meniscus on arthroscopy. One patient with normal MRI report underwent diagnostic arthroscopy and was found to have Grade 2 tear of posterior horn. Hence, MRI had a sensitivity of 95%, specificity of 84.6%, positive predictive value of 90.7% and negative predictive value of 91.6%.

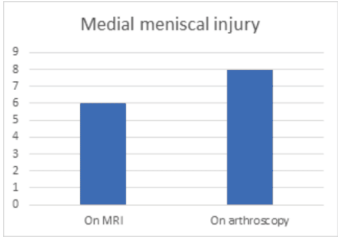

Table 5

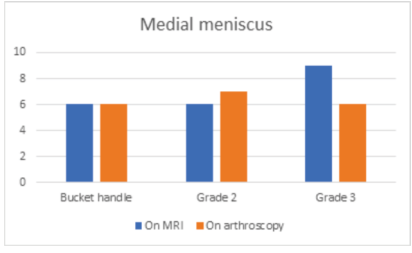

Table 6

LATERAL MENISCUS:

Of the 30 patients, 6 patients were found to have either grade 2 or 3 signal intensity in the anterior or posterior horn of lateral meniscus. These findings correlated with arthroscopy findings in all 6 patients. However, 2 patients who were reported normal lateral meniscus on MRI, 1 had Grade 2 tear of anterior horn and one had grade 3 tear of posterior horn. Thus MRI had sensitivity of 75%, specificity and positive predictive value of 100% and negative predictive value of 92.3%.

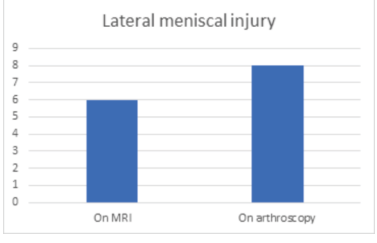

Table 7

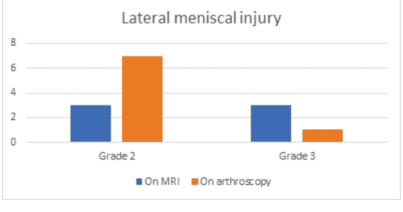

Table 8

DISCUSSION:

Although intra articular knee injuries are common, their correct diagnosis is still a challenge. Injuries to menisci and cruciate ligaments can be diagnosed on MRI with a high degree of sensitivity and specificity, but accuracy of MRI decreases in patients with multiple injuries.

In our study, the reported sensitivity and accuracy of ACL injuries was 100% which corresponds to previous studies carried out by Barronian et al[11]. The specificity was found to be 93.3 %. This is because one patient reported with near complete tear of ACL was found to have

degenerated ACL on arthroscopy. Thus MRI is highly sensitive and specific for ACL tear. The negative predictive value in our study was 93% which is close to the study reported by Barronian et al[1]. The findings also corresponds with the study by Gupta K[2].

Diagnostic accuracy of MRI was 90.47% for medial meniscus and 100% for lateral meniscus in our study which corresponds to study done by Glashow et al[3], Kinnunen et al[4] and Incesu et al [5]. Diagnostic accuracy of MRI for lateral meniscal injury might be due to the lesser number of patients in our study.

There was high negative predictive value of MRI for meniscal injuries (91.6% for medial meniscus and 92.3% for lateral meniscus). The positive predictive value for medial meniscus was 90.47% and 100% for lateral meniscus in our study which corresponds to the findings in the study by Barronian et al[1]. It is the high negative predictive value of MRI for meniscal injuries which makes it the investigation of choice. In our study the specificity of MRI for anterior and posterior horn injuries was found to be low i.e. 84.6%. There were two patients in our study who were reported to be having Grade 3/2 tear on MRI but turned out to be normal on arthroscopy which might be due to MRI study being done in the acute stage of trauma when the changes due to inflammation or oedema may lead to misinterpretations. Most of the patients in which the findings of MRI correlated with arthroscopy findings underwent MRI 4-6 weeks after trauma, when the changes of inflammation or oedema has subsided. Also there was lack of specificity in grade of injury in 3 patients which were found to have either : A) higher grade of injury which might be due to continuous stress on the meniscus till the patient goes for arthroscopy weeks later OR B) lower grade of injury which might be due to reporting error or faults in arthroscopic evaluation.

Similarly in lateral meniscus injuries, the negative predictive value is 92.3% in our study which is because 2 patients reported to be normal were found to have Grade 2 injury of anterior horn. 2 patients reported to have Grade 3 tear on MRI were found to have Grade 2 injury on arthroscopy which might be again due to reporting error or faults in arthroscopic evaluation.

We had 2 patients in our study with PCL tear for which MRI proved to have high sensitivity, specificity, positive predictive value and negative predictive value.

Also many of the patients with traumatic injuries of knee joint have associated injuries like bone contusions and collateral ligament tear which can be diagnosed on MRI before planning for an arthroscopic repair.

Hence we can say that one can rely on MRI as the investigation of choice for traumatic injuries of knee to avoid diagnostic arthroscopy in all patients and to proceed for arthroscopy for therapeutic purposes only in patients planned for ligament or meniscal repair surgery. Also MRI study of knee should be done after about 4-6 weeks after the trauma when the changes of oedema due to trauma has subsided and misinterpretation errors are less.

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