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Correlation of clinical, radiological and arthroscopic findings of meniscal and anterior cruciate ligament injuries of knee

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Abstract
Background: Orthopaedic surgeons commonly see soft tissue injuries of the knee including meniscal and ligament injuries. In the past diagnosis of these injuries was based on accurate clinical examination alone as plain radiographs were unable to detect these soft tissue injuries. Clinical examination alone produced false diagnosis rates between 40-85%. Aim of the study was to correlate clinical, radiological and arthroscopic findings of meniscal and anterior cruciate ligament injuries of knee.
Methods: A Prospective observational study was conducted for a period of two year and all patients admitted to Manipal hospital who were scheduled to undergo arthroscopic surgery of the knee for either meniscal or ACL injury based on clinical and Magnetic Resonance Imaging (MRI) findings were included in the study.
Results: 65 patients were studied comparing clinical examination, MRI with arthroscopy and were analyzed. Clinical examination showed sensitivity, specificity, Positive Predictive value (PPV), Negative Predictive value (NPV), accuracy of 76.47%,48.65%, 52.50%, 93.72%, 60% respectively for medial meniscus tear, 84.62%, 100%, 100%, 96.30%, 96.92% respectively for lateral meniscus tear and 76.47%, 87.50%, 68.42%, 91.30%, 84.62% respectively for Anterior Cruciate Ligament (ACL) tear. MRI findings showed sensitivity, specificity PPV, NPV, accuracy of 92.86%, 81.08%, 78.79%, 93.75%, 86.1% respectively for medial meniscus, 92.31%, 100%, 100%, 98.11%, 98.46% respectively for lateral meniscus tear, 82.35%, 91.67%, 77.78%, 93.62%, 89.23% respectively for ACL tear.
Conclusion: Clinical tests to detect ACL and lateral meniscus injuries have a high degree of correlation when compared to arthroscopy and MRI. Clinical tests to detect medial meniscus injuries have a lower degree of correlation compared to MRI and arthroscopy.

Keywords: Knee, correlation, clinical, radiological, arthroscopy

Introduction
A meniscus is usually torn by a rotational force incurred while the joint is in a partially flexed position. During vigorous internal rotation of the femur on the tibia with the knee in flexion, the femur tends to force the medial meniscus posteriorly and towards the center of the joint. A strong peripheral attachment posteriorly may prevent the meniscus from being injured, but if this attachment stretches or tears, the posterior part of the meniscus is forced towards the center of the joint and is caught between the femur and the tibia, and is torn longitudinally when the joint is suddenly extended. If this longitudinal tear extends anteriorly beyond the medial collateral ligament, the inner segment of the meniscus is caught in the intercondylar notch and cannot return to its former position; thus a classic bucket-handle tear with locking of the joint is produced. Numerous classifications of tears of the menisci have been proposed on the basis of location or type of tear, etiology, and other factors [1, 2].
Diagnosis of a meniscal tear is difficult and hence diagnosis is based on collective history which includes complaints, trauma history, mode of injury, findings on physical examination and special modality of imaging which is MRI [3, 4].
The cruciate ligaments function as stabilizers of the joint and axes around which rotary motion, both normal and abnormal, occurs. They restrict the backward and forward motion of the tibia on the femur and assist in the control of both medial and lateral rotation of the tibia on the femur.

ACL is taut in knee flexion of 70 degrees to 90 degrees and in full extension and is usually injured in this position. Diagnosis depends on history and physical findings and imaging modality is MRI [5, 6].

Fig 1a: Tear in Posterior horn of lateral meniscus;

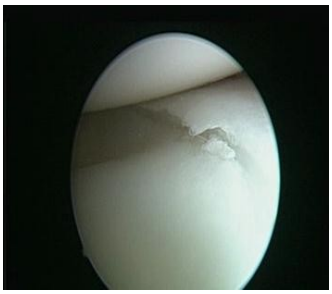


Fig 1b: Tear in body of medial meniscus;

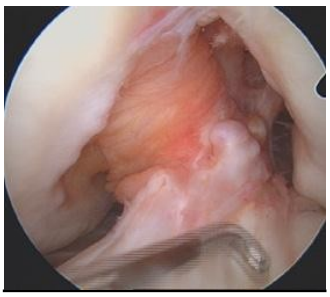


Fig 1c: Compete tear of ACL

Methodology

The objective of our study was to correlate clinical, MRI and arthroscopic findings of meniscal injuries and anterior cruciate ligament injuries at Manipal Hospital, Bangalore. Sixty-five cases aged from 18-65 years were selected for the study and the study was be carried out from June 2014 to May 2016.

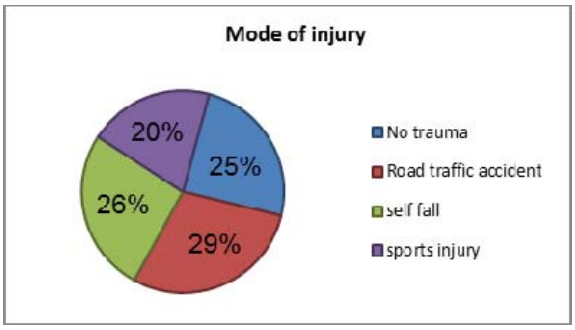


Table 1: Mode of Injury

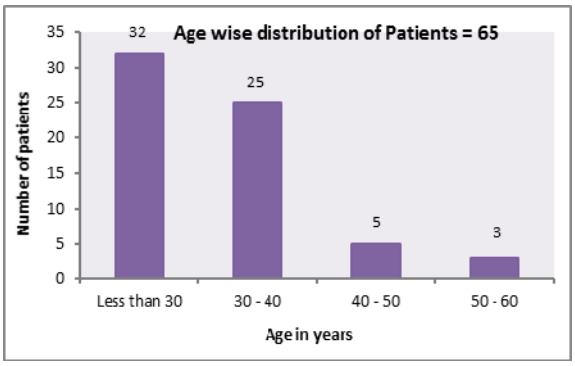
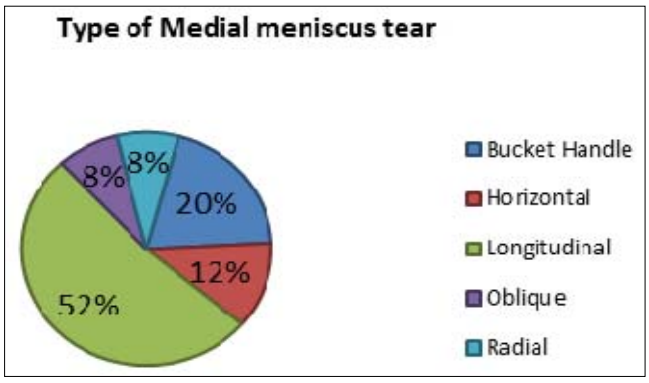


Table 2: Age distribution of Patients

Patients with Posterior Cruciate Ligament Injury and other knee injuries were excluded from the study. A detailed history was taken for all these patients followed by clinical examination and MRI evaluation. They patients were subjected to standard pre-operative work up. Arthroscopic surgeries were performed under spinal or general anaesthesia. Operative findings were documented in the operation theatre by operating Orthopedic Surgeon, which included the anatomical structure involved with the presence or absence of tear, its location, the degree of tear and additional procedures done (Figure 1a, 1b and 1c).

Results

The results were presented in number and percentage for dichotomous data in Table and Figure. Statistical analysis was used to calculate sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV), accuracy in order to assess the reliability of the Arthroscopy and MRI results. To evaluate the sensitivity, specificity and accuracy of MRI, the findings at arthroscopy were taken to be the true diagnosis. The data was analyzed using R software version 3.2.2.



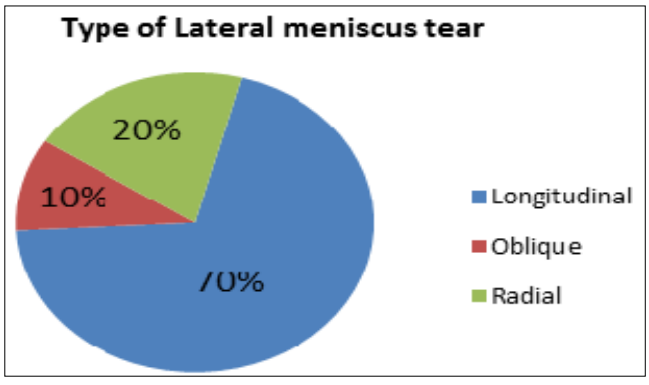
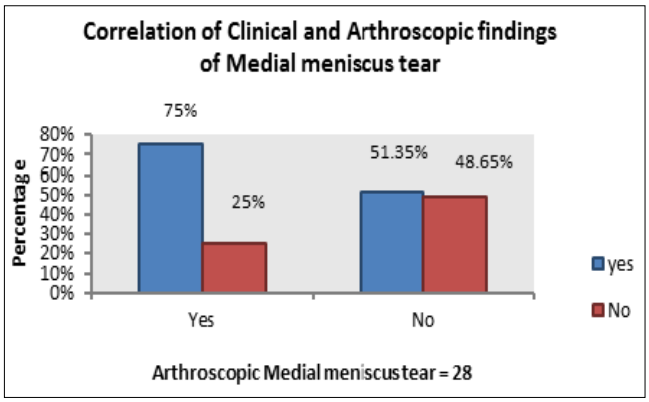


Table 3: Classification of Meniscal Tears

Clinical examination showed sensitivity, specificity, Positive Predictive value (PPV), Negative Predictive value (NPV), accuracy of 76.47%,48.65%, 52.50%, 93.72%, 60% respectively for medial meniscus tear, 84.62%, 100%, 100%, 96.30%, 96.92% respectively for lateral meniscus tear and 76.47%, 87.50%, 68.42%, 91.30%, 84.62% respectively for Anterior Cruciate Ligament (ACL) tear.



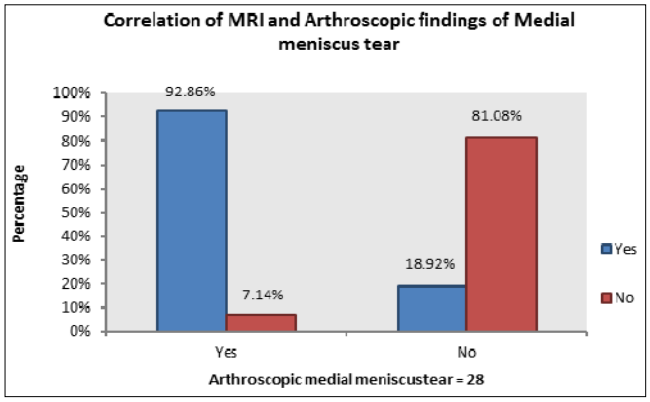
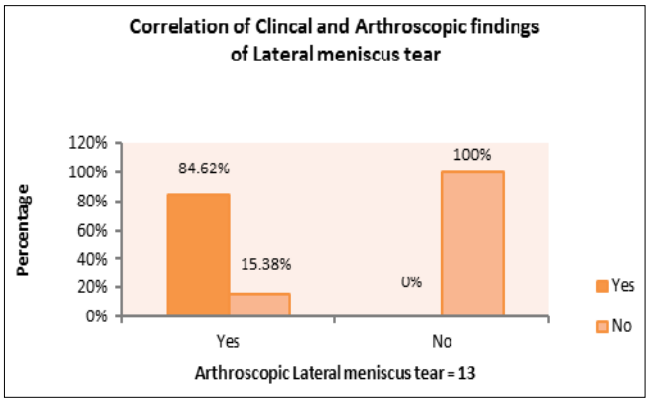


Table 4: Correlation of Clinical, MRI and Arthroscopic findings of Medial meniscus Tear

MRI findings showed sensitivity, specificity PPV, NPV, accuracy of 92.86%, 81.08%, 78.79%, 93.75%, 86.1% respectively for medial meniscus, 92.31%, 100%, 100%, 98.11%, 98.46% respectively for lateral meniscus tear, 82.35%, 91.67%, 77.78%, 93.62%, 89.23% respectively for ACL tear.



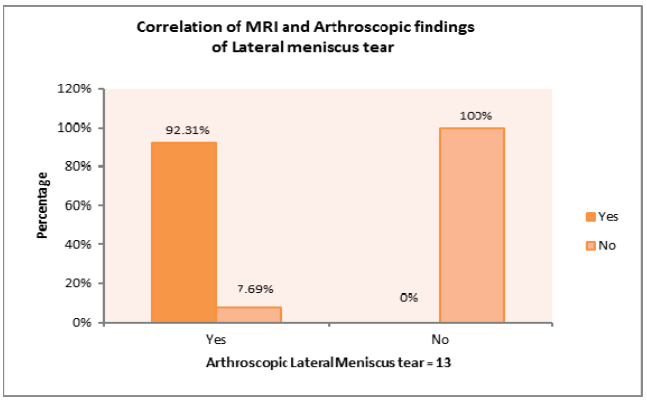


Table 5: Correlation of Clinical, MRI and Arthroscopic findings of Lateral meniscus Tear

Discussion

Although meniscal and anterior cruciate ligament injuries are commonly seen and clinically evaluated by Orthopedic Surgeons, the management of these injuries largely depends on MRI findings followed by arthroscopy.

MRI of the knee has become a reliable tool in the detection of knee injuries and is the preferred investigative modality, as it is non-invasive and allows evaluation of all the soft tissue and bony structures, including articular cartilage. However MRI detection of meniscal and ACL injury depends on the observer. Similarly clinical examination is also examiner dependent and subjective.

A review of literature suggests a good correlation for ACL injuries diagnosed clinically and then evaluated by MRI and Arthroscopy [7-10]. However, when evaluating clinically suspected meniscal injuries, there is a decrease in correlation as compared by MRI and arthroscopy [8-12]. We decided to compare and correlate the findings found in MRI and clinical examination, keeping arthroscopy as the gold standard.

In our study of 65 patients, results are compared to other studies. The results are compared with respect to accuracy, sensitivity, specificity, positive predictive value and negative predictive value. These results are compared to results of similar studies.

The results of our study are comparable to other studies in ACL and lateral meniscus injuries, so a patient diagnosed clinically with ACL or lateral meniscus injury can be counseled for definitive management of these injuries with greater degree of confidence, relying solely on clinical examination. However, it has become a standard practice to do preoperative MRI before subjecting the patient to surgery.

The accuracy of clinical tests done to detect medial meniscus injuries in our study (60%) is less than that found in similar studies. This can be explained by the fact that many of our cases in which tests for medial meniscus was positive had an osteochondral injury on arthroscopy, which was also missed by the Radiologists on MRI. All the patients in our study underwent MRI evaluation in a 1.5 Tesla machine with no special sequences for cartilage imaging. This partly explains our low accuracy rate for medial meniscus injuries.

Based on our findings, when evaluating medial meniscal injuries and counseling the patient about their management, osteochondral injury should be kept in mind and imaging techniques specific for cartilage should be done prior to arthroscopy. If cartilage imaging modalities are not available then the possibility of finding these injuries at arthroscopy should be explained to the patient and the surgeon should also be prepared to handle these injuries during arthroscopy.

Conclusion

Clinical tests to detect ACL and lateral meniscus injuries have a high degree of correlation when compared to arthroscopy and MRI. Clinical tests to detect medial meniscus injuries have a lower degree of correlation compared to MRI and arthroscopy. Clinical tests done to detect medial meniscus injury can be false positive in case of osteochondral defect of medial compartment. When evaluating medial meniscus injuries the surgeon should be prepared to treat unsuspected osteochondral injuries found at arthroscopy.

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