CO-RELATION OF MRI AND ARTHROSCOPY IN SOFT TISSUE INJURIES OF KNEE JOINT

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ABSTRACT

Introduction: Knee is most frequently injured joints among because of its anatomical structure and its exposure to external forces and the functional demands placed on it. Magnetic resonance imaging (MRI) helped in the diagnosis of intra articular soft tissue injury without arthroscopy. Advantages over MRI are non-invasive, minimal patient discomfort and easy visibility of posterior cruciate ligaments. So comparison and correlation of MRI and arthroscopy becomes important as it can help us diagnose and treat lesions of knee in a better way. Material and method: The study was a prospective study correlating the MRI findings with that of arthroscopy in knee injuries after proper clinical examination. This study consist of 30 patients of soft tissue injury of the knee joint who presented 6 weeks post injury with age group 15-50 years. Each MRI was performed using the standard MR protocol in 1.5 Tesla with proper patient positioning in surface coils after taking informed consent. Arthroscopy was performed by senior consultants under regional with patient in supine position and lateral post around upper thigh. Results: The study shows that, the sensitivity of MRI for ACL injuries was 95.2% with the specificity of 42.2%. A positive predictive values of 74.1% and negative predictive value of 66.7%. With regards to the medial meniscus injury the sensitivity of MRI was found to be 87.5% and specificity of 85.1%. Positive predictive value of 63.6% and negative predictive value of 95.8%.

KEYWORDS: knee joint, anterior cruciate ligaments, menisci, MRI, arthroscopy.

INTRODUCTION

Most frequently injured joints among large joints in human skeleton is knee because of its anatomical structure and its exposure to external forces and the functional demands placed on it.1 The principal intrarticular structures consisting two menisci and the two cruciate ligaments with supporting medial and lateral collaterals and their injury coined as “Internal derangement of knee” by William Hey in 17842 Orthopaedics surgeons relied completely on clinical examination in the late 1960 & early 70’s till role of arthroscopy was described in diagnosis and treatment of various knee disorders.3 Arthroscopy is a key-hole surgery performed as a day care procedure. The advantages are small incisions, less post operative morbidity, less intense inflammatory response than standard arthrotomy. The disadvantages of arthroscopy are damage to articular surface, bleeding, infection, tourniquet palsy.4 Thorough clinical examination provide an almost 70% diagnostic accuracy5 but having limitation of being subjective, nonreproducible, time consuming and painful presentation. Magnetic resonance imaging (MRI) helped in the diagnosis of intra articular soft tissue injury without arthroscopy. Advantages over MRI are non-invasive, minimal patient discomfort and easy visibility of posterior cruciate ligaments. Accuracy of MRI in detection of intraarticular injury depends on experience of radiologist in interpreting studies and subjected to many pitfalls in interpretation e.g. in study of body of menisci, the meniscofemoral and transverse meniscal ligaments. Elderly patients often exhibit increased intrameniscal signal that can be mistaken for tear. So comparison and correlation of MRI and arthroscopy becomes important as it can help us diagnose and treat lesions of knee in a better way. The objectives of this study are to compare the accuracy of M.R.I. in detecting internal derangement of knee, confirmed subsequently on arthroscopy and to categorize the discrepancies in findings of the menisci and cruciate ligaments between arthroscopy and M.R.I.
MATERIALS AND METHODS

The present protocol of study consist of 30 patients of soft tissue injury of the knee joint who presented 6 weeks post injury to the out patients department of Orthopaedics, Sir Sundarlal Hospital, Banaras Hindu University with age group 15-50 years. The study was conducted from July 2014 to June 2016 on patients admitted from outpatient department. The study was a prospective study correlating the MRI findings with that of arthroscopy in knee injuries after proper clinical examination. Patients with MRI contraindications, fracture, dislocation or previous knee interventions were excluded. All these patients had clinical examination, MRI followed by arthroscopy. Diagnosis with Arthroscopy was taken as the final diagnosis.

Various clinical examination tests were done after taking history. In case of meniscal tears McMurray test and Apley grinding test were done. In case of ACL and PCL disruption Lachman test, drawer test and Pivot shift test were done.

Each MRI was performed using the standard MR protocol in 1.5 Tesla with proper patient positioning in surface coils after taking informed consent. MR films were read by a senior radiologist unaware of clinical findings. ACL classified as normal, complete tear and partial tear. The status of menisci, cartilage and subchondral bone were reported. MAYO 2000 classification was used for menisci status which is based on high intensity signals in T2 sequences and extension upto articular surface.

Arthroscopy was performed by senior consultants under regional with patient in supine position and lateral post around upper thigh. Proximal thigh tourniquet were used in each case. To classify the location of meniscal tear arthroscopically, each meniscus was divided into three equal segments. The anterior 1/3 or anterior horn, middle 1/3 or body, posterior 1/3 or posterior horn. The ACL and PCL tears were classified as normal, partial or complete tear. Various statistical tests were used for comparision and analysis of results.

OBSERVATIONS AND RESULTS

The present protocol of study consist of 30 patients of soft tissue injury of the knee joint who presented 6 weeks post injury to the out patients department of Department of Orthopaedics, Sir Sundarlal Hospital, Banaras Hindu University. The study was conducted from July 2014 to June 2016.

In our study 20 patients with complete tear of ACL on MRI, the arthroscopic finding was in congruence with MRI findings. 5 patients who were reported complete tear of ACL on MRI had partial tear on arthroscopic examination, suggested by laxity on probing during arthroscopy. 1 patient who was reported with normal ACL on MRI had complete tear of ACL on arthroscopy which was repaired during the arthroscopic examination. 1 patient who had normal ACL finding on MRI had partial tear of ACL diagnosed on arthroscopy. In 4 patients with grade-II tear of body and posterior horn of meniscus, no tear was found on arthroscopy. Hence, in asymptomatic patients of grade-I and II tear of meniscus, arthroscopic should be avoided. The MRI findings of all cases of grade-III and IV meniscal tear were in congruence with arthroscopic findings. 18 patients with normal meniscal finding on MRI, arthroscopy could not detect any tear (i.e. MRI has high negative predictive value for meniscal injuries).

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DISCUSSION

The analysis of age distribution in the study shows a narrow range of 15-47 years with mean age of 29.87 year in the study. On analysis of the sex distribution of the subjects in the study, male (28) outnumbered females (2) with ratio of M:F = 14:1. This can be related to the less involvement of females in outdoor sports related activities in this part of world. These ratios are in congruence with the study done by Clayton et al., on the epidemiology of musculoskeletal tendinous and ligamentous injuries.[7]

The outcome of the study shows that anterior cruciate ligament is the structure most commonly involved in the internal derangement of knee joint (70%) either in isolation or with the involvement of other structures, followed by medial meniscus (23.3%) followed by lateral meniscus (10%). In a similar study Kashikar et al., found that ACL tear affected 74.8% subjects followed by medial meniscus 47.4% and lateral meniscus 28.3%. [8]

In this study out of 30 patients 29 patients had either complete or partial tear of ACL and 1 patients had complete tear of PCL in arthroscopy. A ratio of 29:1 which can be explained on the basis of greater tensile strength.
of PCL and twice at much force required for PCL disruption compared to ACL disruption.

On arthroscopic examination 5 out of 29 patients who had ACL tear, also had tear of medial meniscus, and 3 out of 29 patients had concomitant injury to the posterior horn of lateral meniscus.

Repeated incidence of injury causing recurrent infusions result in marked laxity of capsule and ligaments and quadriceps in sufficiency as well. The anterior cruciate and medial collateral ligaments may have been torn at the original injury, the resulting in stability of joint predisposes to injury of lateral meniscus.

On arthroscopic examination medial meniscus injury (23.3%) was more common than lateral meniscus injury (10%). Kashikar et al., reported medial meniscus injury (32.9%) and lateral meniscus injury in (16.1%).

In this study the MRI findings are correlated with arthroscopic findings in 30 patients and sensitivity, specificity, positive predictive value and negative predictive value were calculated taking arthroscopy as gold standard. There were few false positive and false negative cases in the study. As the accuracy in the diagnosis of menisci and cruciate ligaments depend on quality of imaging equipment and the skill the expertise of the clinical examiner, radiologist and arthroscopist. It also depends on the technical factors (imaging parameters, coil strength, surface coil used and planes of image).

The study shows that, the sensitivity of MRI for ACL injuries was 95.2% with the specificity of 42.2%. A positive predictive values of 74.1% and negative predictive value of 66.7%.

The high sensitivity (95.2%) (i.e. the ability of correctly identify presence of an ACL tear) of MRI suggests the high accuracy of MRI in identifying a true positive case. Thus an arthroscopist can prepare for a diagnostic as well as therapeutic intervention with a positive report of ACL tear on MRI and high index of suspicion after a positive clinical examination for ACL tear.

The specificity (i.e. ability of correctly identify absence of ACL tear) in the study was 42.2%. This is attributed to the higher number of false positive cases of ACL tear detected on MRI. In this study 6 patients out of 30 patients who were reported complete tear of ACL in MRI had a partial tear on arthroscopic examination (suggested by laxity on probing the ACL). This suggests the difficulty in differentiating a complete tear from a partial tear on MRI.

Dowdy et al., concluded that an intrasubstance tear may not be detected with arthroscopy due to synovial reaction which can be seen in MRI so should not be concluded as MRI false positivity. Winters et al., showed tendency of over diagnose tears with a positive predictive value of 76%.

In this study only 2 patients had PCL tear identified on MRI. On arthroscopy, no tear was found in the patient who’s MRI finding was suggestive of partial PCL tear, while the arthroscopy finding was in congruence with MRI finding in complete PCL tear. As only 2 patients were part of the study no statistical conclusion could be achieved confidently about PCL tears.

With regards to the medial meniscus injury the sensitivity of MRI was found to be 87.5% and specificity of 85.1%. Positive predictive value of 63.6% and negative predictive value of 95.8%.

The high negative predictive value (95.8%) of MRI for medial meniscus injury suggests high reliability of a negative MRI result and thus if a patient is given a negative scan report than this is likely to be a true negative result and unnecessary arthroscopy can be avoided.

There were 4 false positive cases of medial meniscus injury in the study all of which had grade II tear in the body or posterior horn. Grade I and Grade II tears do not extend to the articular surface and hence difficult to detect on arthroscopic examination. The degenerative changes that tend to increase the signal intensity are also a cause of high false positive results.

Increase in the number of false positive results lead to decrease in positive predictive value of MRI (63.6%) in the study. Similar results were found by Barronian et al., and Gupta et al. (positive predictive value of 65% and negative predictive value of 95%).

With regards to the lateral meniscus tear the sensitivity of the MRI in study was 100% with a specificity of 96.4%. A positive predictive value of 60% and negative predictive value of 100%.

As found in the cases of medial meniscus, the high negative predictive value of MRI in injuries of lateral meniscus can prevent unnecessary arthroscopic intervention.

The decrease in positive predictive value denotes the inability of arthroscopy in detecting grade II tears.

The sensitivity in detecting lateral meniscus tear was 100% in the study i.e. all true positive cases were detected correctly.

The high sensitivity of MRI in detecting lateral meniscus tear in this study should be interpreted cautiously as the number of true positive cases with lateral meniscus injury in this study were less.
2 patients in the study had tear of post horn of lateral meniscus and 5 patients had tear of posterior horn of medial meniscus detected on MRI, which were found to have negative result on arthroscopic examination.

Arthroscopic examination of posterior horn of menisci has inherent difficulties and many a times the examination of these sites is difficult even in hand of an expert arthroscopist.

The diagnostic accuracy of MRI in detecting meniscal tear in this study was 85.71% (with a sensitivity of 90.99% and specificity of 93.3%). This is in congruence with study done by Incesu et al., (86% accuracy), Kinnuen et al., (82% for medial meniscus and 88% for lateral meniscus), Glashow et al., (74% for medial meniscus and 94% of lateral meniscus).[11,12,13]

CONCLUSION

MRI has high sensitivity for ACL tears. In patients with positive clinical examination and a positive MRI report for ACL tear and arthroscopist can go for a therapeutic arthroscopy directly.

MRI has difficulty differentiating a full thickness ACL tear from a partial tear. Patients with MRI reports of complete ACL tear must be examined carefully on arthroscopy for any partial tear in the ACL enveloped by synovium.

MRI has high negative predictive value for meniscal tears. For patients with negative scan report for meniscal tear arthroscopy should be done only on very high clinical suspicion.

Meniscal injuries graded as I and II on MRI are rarely seen on arthroscopy hence diagnostic arthroscopy is not required for these meniscal injuries.

For meniscal injuries graded III & IV on MRI, arthroscopy should be carried out.

Arthroscopic examination of the posterior horn of the meniscus has inherent difficulties and tear at these sites reported on MRI can be missed on arthroscopic examinations. Hence tear at these sites should be carefully sought for, if MRI report is suggestive of tear at these sites.

REFERENCES