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ORIGINAL ARTICLE

Comparison of clinical examination & MRI against arthroscopy in diagnosis of Meniscal and anterior cruciate ligament injuries of knee joint

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ABSTRACT

Introduction: The most frequent internal instability of the knee is a meniscal tear. Most cost-effective and the primary diagnostic method is a physical examination of the knee joint. MRI is a non-invasive and extremely sensitive method of study and it frequently detects subtle and early alterations in the soft tissues. Arthroscopy is a highly specific and sensitive method which is useful for both diagnosis and treatment but it is an invasive treatment.

Objective

1. To assess the accuracy for clinical examination and arthroscopy to diagnose the anterior cruciate ligament and meniscal injuries in knee joint.
2. To examine how accurate MRI is, as compared to arthroscopy in diagnosing anterior cruciate ligament and meniscal injuries in knee.
3. Anassociation of diagnostic accuracy of MRI and clinical examination in diagnosis of anterior cruciate ligament and meniscal injuries in knee joint.

Material and Methods: A Cross-sectional study conducted at Department of Orthopedic Surgery, Services Institute of Medical Sciences (SIMS). This study completed in one year and two months after the acceptance of synopsis. A sample of 120 patients was calculated for this study. A clinical diagnosis of meniscal, posterior cruciate ligament, anterior cruciate ligament, lateral collateral ligament, and medial collateral ligament injury of the knee has made after these patients gave their up-to-date consent. These patients were evaluated on the basis of MRI and Arthroscopy. We used SPSS to evaluate all data, with arthroscopy serving as the gold standard.

Results: The study contained 120 patients. The mean age of these patients is between 30.8 ± 6.93 years. Most of the patients are male. The most common ligament involved in this study found to be ACL followed by medial Meniscal injury. Findings from clinical examination are correlated with Arthroscopic findings and it found more sensitive for ACL injuries (97.5%) while it is most specific for ACL as well as Medial Meniscal injuries (100%). Findings from MRI are also correlate with Arthroscopy, MRI found most sensitive to detect ACL injuries (95.8%) and it is most specific for ACL injuries also (100%). We also compare the MRI findings with clinical examination finding and found that, clinical examination is almost equally accurate as MRI to detect the injuries of ACL injuries with sensitivity of clinical examination 97.5% and MRI 95.8% and found 100% for ACL injuries.

Conclusion: We concluded that the clinical examination is batter for diagnosing cruciate ligamentous injury while MRI is batter for diagnosis of meniscal injury, in case of knee injuries. So we may skip MRI for patients with cruciate injury &directly proceed towards arthroscopy. In difficult cases and the cases which are involving meniscal injury both MRI and arthroscopy may be considered.

Keywords: Meniscal tear; MRI; Arthroscopy; knee joint; clinical examination.

INTRODUCTION

Meniscal tear is the most common internal derangement of the knee. (LaPrade and Wijdicks-2012, Abbott-2003). Male patients aged between 31-40 years old are more prone to have injuries of menisci. Male female reported ratio is 2.5:1. Peak incidence in female is younger than 20 years.(Abbott et al., 2003). Anterior cruciate ligament (ACL) tears are frequently associated with meniscal injuries. Meniscal injuries are related with a wide range of relative frequency, comprising sport-specific and sex injury patterns. Meniscal injury has a wide range of prevalence, ranging from 16 percent to 82 percent in acute ACL tears to up to 96 percent in chronic ACL tears.(Kilcoyne et al., 2012)

Being common and typically due to sports activities, road traffic accidents and domestic falls, it becomes troublesome for young patients who attend to perform strenuous tasks e.g sports etc. It is one of the leading causes of physical impairment and has considerable financial implications.(Marchant et al., 2011) A study of 1236 patients with arthroscopically verified meniscal injury found that 32 percent had sports injuries, 38 percent had non-sporting injuries, and the other 28 percent had no specific history of injury. In the non-sporting injury group, about 50 percent of the injuries occurred when rising from a squatting position. (LaPrade and Wijdicks, 2012).

The primary and most cost-effective diagnostic method is a physical examination of the knee joint. Clinical tests used to diagnose cruciate ligament and meniscal damage have limits, and objective signs may not be elicited frequently, especially in a crowded orthopedic clinic and when the patient is in pain in an acute or sub-acute presentation.(Nickinson -2010)Some authors claim that clinical assessment is more accurate as compared to MRI, while others claim that there is no difference. Clinical diagnosis of meniscal tears is typically 75 percent to 80 percent accurate, compared to MRI's 88 percent to 90 percent accuracy. (Dandy, 1997)

Arthroscopy is a very specific and sensitive diagnostic and therapeutic procedure that is considered gold standard. However, it is an invasive procedure. Ligamentous injuries and Intra-articular pathology can now be diagnosed and managed using magnetic resonance imaging (MRI). Because MRI is a non-invasive and extremely sensitive tool of investigation, it frequently detects subtle and early alterations in the soft tissues.(Madhusudhan et al., 2008)In 2009, Behairy et al. recommended MRI as the main diagnostic technique for internal knee impairments; however, arthroscopy should be performed if the MRI findings do not match the patient's clinical symptoms or if the patient has a full ACL tear that requires reconstruction surgery.(Behairy et al., 2009)

According to a study, the sensitivity, specificity, and diagnostic accuracy of clinical examination for medial meniscal tear were 96.1 percent, 33.3 percent, and 73.1 percent,

respectively; for lateral meniscal tear, the sensitivity, specificity, and diagnostic accuracy were 38.4 percent, 96.4 percent, and 78.1 percent, respectively. For a medial meniscal tear, MRI had 92.3 percent sensitivity, 100 percent specificity, and 95.1 percent diagnostic accuracy; for a lateral meniscal tear, it had 84.6 percent sensitivity, 96.4 percent specificity, and 92.6 percent diagnostic accuracy.(Sharma et al., 2012). Nickinsosn reported 77% sensitivity of arthroscopy compared to clinical and MRI findings. (Nickinson et al., 2010a)

In light of the above statistics, clinical tests used in the diagnosis of cruciate ligament and meniscal damage have limitations and variable diagnostic accuracy, and objective signs may not be elicited repeatedly, especially in a busy orthopedic clinic and when the patient is in pain in an acute or sub-acute presentation. Although difficult to quantify, proper clinical diagnosis necessitates experience. Ligamentous injuries and intra-articular pathology can now be diagnosed and managed using magnetic resonance imaging. Because clinical examination and MRI are non-invasive and extremely sensitive tools of study, MRI frequently detects subtle and early changes in the soft tissues. Arthroscopy is a specific and sensitive method that is useful for both diagnosis and treatment, but it is an invasive procedure. (Madhusudhan et al., 2008). As a result, the purpose of this research is to compare MRI and clinical examination to arthroscopy in the diagnosis of anterior cruciate ligament and meniscal injuries in the knee joint.

MATERIAL AND METHODS

In this study 120 patients full filling the inclusive were selected form OPD of SIMS.All included patients gave their informed consent, and a clinical diagnosis of meniscal, anterior cruciate ligament, medial collateral ligament, posterior cruciate ligament, and lateral collateral ligament injury of the knee was made, confirmed by clinical examination, and those patients were then evaluated on an MRI scan of the affected knee, with the results recorded. The patients were called for a follow up during which the gold standard Arthroscopy was performed by the orthopedic surgeon team, with an above knee tourniquet, using standard anteromedial and anterolateral portals and the findings were recorded along with demographic details of the patient. Depending on whether the patient requires further surgical intervention, the procedure was proceeded with the required intervention or suspended.The results of the clinical examination, MRI, and arthroscopy were recorded on a Performa. The researcher conducted a clinical evaluation of the patient with the assistance of a consultant orthopedic surgeon, a consultant radiologist did an MRI and reported on it, and a consultant orthopedic surgeon performed an arthroscopy. The researcher assisted the consultant orthopedic surgeon in selection of patients from out-patient department (OPD) assist the orthopedic surgeon in Operation Theater and to record intra operative findings, data collection and statistical analysis. The procedure was performed under general or spinal anesthesia, with a preoperative antibiotic and a bloodless field regulated by a tourniquet.

SPSS version 25 was used to analyze the data. All qualitative variables were given in the form of frequency (percent). For graphical presentation, bar charts or pie charts are used. The continuous variable was expressed using the standard deviation and mean. According to the operational definition, specificity, sensitivity, negative predictive value and positive predictive value tests were employed for clinical examination and MRI against Arthroscopy.

RESULTS

A total of 120 patients were included in the study. The mean age of patients was found as 30.8 ± 6.93 years. The distribution of patients according to age is summarized in table 1. In this study, most of the patients were male (Figure 1).The most common ligament involved in this study was found to be ACL followed by Medical Meniscal injury. Findings of clinical examination, MRI and Arthroscopy according to our study protocol are summarized in Table 3. All the frequency and number of TP, TN, FP and FN after both clinical examination and MRI findings taking Arthroscopic findings as gold standard are summarized in table 4 and 5 respectively. Also clinical examination findings were correlated with Arthroscopic findings and it was found most sensitive for ACL injuries (97.5%) while it was most specific for ACL as well as Medial Meniscal injuries (100%) (Table 6). MRI findings were also correlate with arthroscopic findings, MRI was found most sensitive to detect ACL injuries (95.8%) and it was most specific for ACL injuries also (100%) (Table7).

Also concordance of findings of musical & cruciate ligament injuries was calculated. Regarding meniscal injuries best concordance was found for lateral menisci. Arthroscopy and MRI (K=0.652, P=0.00) and for medical meniscal injury, concordance between arthroscopy was best, (K=0.420, P=0.00). How're for ACL injuries they were equal, details are summarized in (table NO.8). The comparison of clinical examination & MRI in terms of senility and specificity are summarized in (table No 9). It was found that clinical examination almost equally accurate as MRI to detect the injuries.

Table 1: Age distribution of patients in the study

Age group	Number of Patients	Percentage
18-30 Years	68	56.7%
31-40 Years	38	31.7%
41-45 Years	14	11.7%
Total	120	100%

Figure 1: Gender distribution of patients.

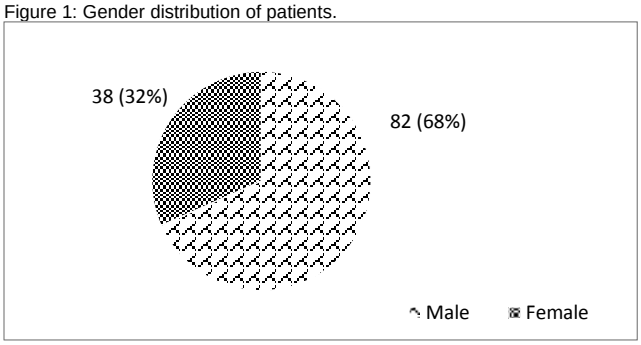

Table 2: Findings of the Clinical Examination, Magnetic Resonance Imaging, and Arthroscopic Examination

	Normal findings	Lateral Meniscal Injury	Medial Meniscal Injury	ACL Injury	PCL Injury
Clinical Examination	0	23	9	117	0
MRI	0	19	36	115	0
Arthroscopy	0	10	48	120	0

Table 3: Findings of Clinical Examination and compared with Arthroscopy

	True Positive	True Negative	False Positive	False Negative
Normal Findings	0	120	0	0
Lateral Meniscal Injury	10	101	9	0
Medial Meniscal Injury	26	62	10	22
ACL Injury	115	0	0	5
PCL Injury	0	120	0	0

Table 4: Findings of MRI and compared with Arthroscopy

	True Positive	True Negative	False Positive	False Negative
Normal Findings	0	120	0	0
Lateral Meniscal	0	87	23	10
Medial Meniscal Injury	9	72	0	39
ACL Injury	117	0	0	3
PCL Injury	0	120	0	0

Table 5: Correlation of Clinical Examination with arthroscopy

	Sensitivity	Specificity	Negative Predictive Value	Positive Predictive Value
Lateral Meniscal Injury	0%	79.1%	89.69%	0%
Medial Meniscal Injury	18.8%	100%	64.86%	100%
ACL Injury	97.5%	100%	100%	100%

Table 6: Correlation of MRI findings with arthroscopy

	Sensitivity	Specificity	Negative Predictive Value	Positive Predictive Value
Lateral Meniscal Injury	100%	91.8%	52.63%	100%
Medial Meniscal Injury	54.2%	86.1%	73.81%	72.22%
ACL Injury	95.8%	100%	0%	100%

Table 7: Concordance of meniscal & cruciate ligament

	Diagnostic examination	Kappa	Concordance	P-Value
Medial menescii	Arthroscopy vs. MRI vs. Clinical examination Arthroscopy vs. MRI Arthroscopy vs. Clinical examination	0.217 0.420 0.217	Fear Moderate Fear	0.000 0.000 0.000
Lateral menescii	Arthroscopy vs. MRI vs. Clinical examination Arthroscopy vs. MRI Arthroscopy vs. Clinical examination	0.131 0.652 0.131	No Substantial No	0.108 0.000 0.108
ACL	Clinical examination MRI Arthroscopy	0.000 0.000 0.000		

Table 8: comparison of MRI &clinical examination for diagnosis of knee injuries:

Sensitivity			Specificity	
	MRI	Clinical examination	MRI	Clinical examination
Lateral menisci Injuries	100%	0%	91.5%	79.1%
Medial menisci Injuries	54.2%	18.8%	86.1%	100%
ACL Injuries	95.8%	97.5%	100%	100%

DISCUSSION

Knee injuries are quite a common units being encountered during, orthopedic practice. The Ligamentous injuries of the knee joint are suspected by the Orthopedic Surgeons on the basis of history and clinical examinations (Navali, A.M. et al., 2013). Furthermore, MRI is done after the introduction of Arthroscopy it diagnoses and made management very easy (Muhle, C. et al., 2013). The fundamental objective of this study was to determine the specificity and sensitivity of clinical examination and MRI results in diagnosing ligamentous and meniscal injuries of the knee joint, using arthroscopic findings as the gold standard.

According to Chang et al. (Chang et al., 2004), MRI has sensitivity of 92 percent and a specificity of 87 percent in identifying ligament and meniscal injuries when it is being compared to arthroscopy in knees with meniscal injuries. In acute injuries where a physical examination may be conclusive, MRI aids in the diagnosis and may suggest surgical indications in this population (Munshi et al., 2000). However, no evidence of correlation between arthroscopy in this sample has found.

By the use of a combination of physical examination and MRI to diagnose knee injuries were found to reduce the number of negative arthroscopic surgeries by 5 percent. (Munk and coworkers, 1998). When MRI was used as the gold standard for diagnosis, it was more accurate than arthroscopy, and when MRI was used as the standard, arthroscopy was less accurate, because some injuries identified on MRI were not apparent during arthroscopy in a small percentage of patients. It is advised that MRI can utilize initially to detect knee injuries to reduce the incidence of negative arthroscopic treatments.

Magee et al, in their trial compared MRI findings with Arthroscopic findings and they found that the sensitivity of MRI for meniscal injuries was 89% (Magee et al., 2002). They also mentioned that the MRI provided good information regarding the structural changes in the knee joint due to trauma. Brooks et al found in their trial that the MRI did not prove to decrease the number of negative Arthroscopic Procedures for knee joint injuries (Brooks and Morgan, 2002). In our study, the sensitivity of MRI for ACL injuries was 95.8% while for Medial Meniscal injuries, it was 54.2%. This low sensitivity of MRI for Meniscal injuries may be explained by studies by Shephard et al, who noted that the meniscal injuries usually are diagnosed by an increase in signal intensity in case of tear in the meniscal ligaments. But it has the same sensitivity as the clinical examination of the knee joint (Shepard et al., 2002). Therefore, MRI does not add something new in the diagnosis of Meniscal tear than the clinical examination.

MRI and physical examination both evaluated and compared to arthroscopy in this study. The physical examination had a sensitivity of 18.8% for medial meniscal injuries, while the MRI had a sensitivity of 54.2%. The physical examination had a100% specificity for the medial meniscus, while the MRI had 86.1% specificity. The physical examination's sensitivity and specificity for ACL injuries were determined to be 97.5% and 100%, respectively. The MRI's sensitivity and specificity for detecting ACL injuries determined to be 95.8% and 100%, respectively.

The most common injury found in this study was ACL injury and clinical examination was found highly sensitive and specific to diagnose this injury.

CONCLUSION

Our study concluded that clinical examination is batter for the diagnosing cruciate ligamentous injury while MRI is batter for diagnosis of meniscal injury, in case of knee injuries. So we may skip MRI for patients with cruciate injury & directly proceed towards arthroscopy. In difficult cases and those cases which are involving meniscal injury both MRI and arthroscopy may be considered.

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