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Research Article

**DIAGNOSTIC EFFECTIVENESS OF MAGNETIC  
RESONANCE IMAGING IN ASSESSING AN INJURED KNEE**Dr. Atiq Ahmad<sup>1</sup>, Dr. Maryam Latif<sup>2</sup>, Dr. Pervez Rashid Birmani<sup>3</sup><sup>1</sup> Medical Officer, DHQ Hospital, Vehari<sup>2</sup> Ganga Ram Hospital Lahore<sup>3</sup> DHQ Hospital, DG Khan

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**Abstract:**

**Aim:** To correlate the results of clinical evaluation, radiographic and MRI (magnetic resonance imaging) results with surgical results. Recommend some approaches in the diagnostic assessment of a damaged knee.

**Study design:** A comparative diagnostic study.

**Headquarters:** In the Department of Diagnostic Radiology, Nishtar Hospital Multan for six months duration from September 2019 to February 2020.

**Patients and methods:** Fifty patients (41 men and 9 women) were enrolled in this study with clinical suspicion of internal damage in the injured knee. Clinical evaluation, normal x-ray and MRI were recorded for each patient. Reports on surgical results were collected in all cases. In each case, a correlation was made between clinical results, normal X-ray and MRI, and surgical results.

**Results:** Normal x-rays had a very limited role in assessing knee soft tissue damage. Clinical evaluation raised suspicions of certain internal disorders, but did not detect a precise change. There was no significant difference between MRI and surgical results. Magnetic resonance imaging was found to have a sensitivity of 92%, a specificity of 50% and an accuracy of 89.28% to visualize damage to ACL (anterior cruciate ligament). It had a sensitivity of 89.28%, a specificity of 66.67% and an accuracy of 87.09% in detecting meniscus tears. It had an overall sensitivity of 93.18%, a specificity of 16.67% and an accuracy of 84% for imaging an internal disorder.

**Conclusions:** Magnetic resonance imaging is much better than ordinary radiography and is better than clinical evaluation and has high sensitivity, precision and positive predictive value.

**Key words:** damaged knee, flat radiography, clinical evaluation, magnetic resonance imaging.

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**INTRODUCTION:**

The knee is often an injured joint in the body. Although physical examination and ordinary radiography give an indication for diagnosis. Accurate diagnosis of a knee injury is often difficult due to the complexity of the joint. Although arthroscopy is seen as a diagnostic tool in the hands of experts, it is an invasive test. Since magnetic resonance imaging (MRI) in the early 1980s, it has proved to be an excellent technique for assessing patients with knee problems, including acute or chronic trauma cases. Magnetic resonance imaging has a high contrast of soft tissues. It provides direct visualization of soft tissue structures, including ligaments, tendons, joint capsules, menisci and articular cartilage, which are often not clearly visible on ordinary radiographs. TCE. Studies have shown that this is a very sensitive, specific and accurate non-invasive method of diagnosing an internal knee disorder, including meniscus, ligaments, patellofemoral joints and other soft tissue structures and bones in the knee. Magnetic resonance imaging has a high negative predictive value, so a normal MR knee test is quite accurate in ruling out an internal disorder. A clinical examination of an acute traumatic knee is important, but its value in detecting specific injuries is low. Magnetic resonance imaging works better than a clinical trial. Magnetic resonance imaging can reveal many clinically silent changes in the knee, even after minor injuries. The importance of these magnetic resonance imaging (MRI) results should await further research. In patients with acute injuries, magnetic resonance imaging helps create accurate diagnosis and can replace diagnostic arthroscopy in emergencies. Magnetic resonance imaging is the only method that can show bone-cartilaginous injuries and injuries associated with soft tissues of traumatic knees. Magnetic resonance imaging, in sports medicine, radiologically and arthroscopically veiled cartilage, meniscus, ligaments and broken tendons can accurately diagnose the patient. Magnetic resonance imaging can therefore help select patients who need therapeutic arthroscopy.

**METHODS:**

This study was held in the Department of Diagnostic Radiology, Nishter Hospital Multan for six months duration from September 2019 to February 2020.

Fifty patients (41 men and 9 women) were enrolled in this study with clinical suspicion of internal damage in the injured knee. Clinical evaluation, normal x-ray and MRI were recorded for each patient. Reports on surgical results were collected in all cases. In each case, a correlation was made between clinical results, normal X-ray and MRI, and surgical results.

**RESULTS:**

The dominance of men was mainly due to physical and external activities. The age range was 14-64 and the average age was 39 years. In addition to pain, the least common complaints were swelling in 15 patients (30%), instability in 9 patients (18%), locking in 5 patients (10%), difficulty walking in 2 patients (4%) and limited movement in one patient (2%). Joint effusion was clinically suspected in 28 patients (56%), while MRI showed joint effusion in 46 patients (92%). ACL injury was clinically suspected in 13 patients (26%), while MRI showed that it occurred in 28 patients (56%). Medial meniscus tear was suspected in 12 patients (24%) and 20 patients (40%) developed medial meniscus rupture on MRI. Lateral meniscal tear was clinically suspected in five patients (10%), while MRI showed that it was present in 11 patients (22%). In 6 patients (12%) with suspected clinical tear of the medial meniscus and 2 patients (4%) with suspected tear of the lateral meniscus only intracellular meniscus degeneration was detected, so there was no evidence of meniscus tear. In all cases, simple anterior-posterior and lateral x-rays of the knee were taken. Incorrect results were observed in 14 patients (28%). Soft tissue inflammation (joint exudate) was observed in three patients (6%). ACL result of anterior tibial subluxation was observed in 7 patients (14%). Lateral fracture was observed on the tibia plateau in 3 patients (6%) with bite fracture in one. One patient had sclerotic changes: an accidental finding. Magnetic resonance imaging also showed all these bone finds, and also showed internal abnormalities in these cases. One case characterized the nature of the sclerotic change and showed that it has chondromatosis. The surgical results of these 50 patients showed joint exudate in 44 patients (88%). ACL damage was confirmed in 26 patients (52%). Meniscal tears were present in 28 patients (56%), out of which 19 patients (36%) were having medial meniscal and 10 patients (20%) lateral meniscal involvement. Other results include LCL tear in 1 patient (2%), MCL tear in 1 patient (2%), tibial plateau fracture in 3 patients (6%), type I bone damage and cyst in 5 patients (10%). Baker cyst in 1 patient (2%). Magnetic resonance imaging showed joint effusion in 46 patients (92%), and surgical intervention showed effusion in 44 patients (88%). The p value was 0.50 for joint exudate. ACL injury was observed in 28 patients (56%) in the MRI examination, the operation showed that it occurred in 26 patients (52%) (P-value 0.68). Meniscus injury was seen on MRI in 31 patients (62%). The operation confirmed meniscus damage in 28 patients (56%) (P-value 0.54). Of the remaining 11 results (22%), all were confirmed surgically (P value 1.0). Therefore, there was no significant difference between the MRI results and the surgical results in this study. Out of 50 patients, 41 patients were those in which both MRI and surgery showed presence of

lesion. MRI showed symptoms in five patients, but surgery did not show such trauma. The injury occurred surgically in three patients, but MRI did not detect it. One patient had no surgically confirmed MRI results. In my study, magnetic resonance imaging turned out to be 93.18% sensitive and 16.67% specific for the representation of internal disorders in a damaged knee. The positive predictive value was 89.13% and the negative predictive value was 25%. Internal abnormalities in the injured knee were 92% in MRI and 88% in surgery. MRI sensitivity for the representation of internal disorders was 84%. Magnetic resonance imaging detected ACL damage in 28 patients. In 24 patients MRI showed ACL injury that was confirmed on surgery, while in 1 patient MRI showed ACL injury but surgery proved it to be absent. MRI failed to show ACL injury in 2 cases that were proved to have ACL injury on surgery. One patient was found to have no evidence of ACL injury on both MRI and surgery. Magnetic resonance imaging showed a sensitivity of 92.30%

and a specificity of 50% to visualize ACL damage. It showed a positive predictive value of 96% and a negative predictive value of 33.3%. ACL injury showed 89.28% incidence based on MRI and 92.85% incidence by surgery. Magnetic resonance accuracy was 89.28% to detect ACL damage. MRI detected a meniscus tear in 31 patients. Comparison with the surgical result showed that of these 31 patients, tear was confirmed during surgery in 25 patients, while it was found that it was absent in 1 patient. In 3 patients, MRI did not choose the meniscus tear observed during surgery. In two patients the lack of meniscus tears demonstrated by MRI was confirmed by MRI. It was found that magnetic resonance imaging had a sensitivity of 89.28% for meniscus tear imaging and a specificity of 66.67%. Has a positive predictive value of 96.15% and a negative predictive value of 40%. Meniscus tears were found 83.87% on MRI and 90.32% on surgical examination. MRI accuracy in detecting meniscus tears was found to be 87.9%.

**Table 1: Sex distribution of patients (n=50)**

Sex	=n	%age
Male	41	82
Female	9	18

Male to female ratio 4.55:1

**Table 2: Age distribution of patients**

Age (years)	=n	%age
11 – 20	8	16
21 – 30	12	24
31 – 40	14	28
41 -50	8	16
51 – 60	6	12
61 – 70	2	4

**Table 3: Presenting complaint at time of MRI examination**

Presenting complaints	=n	%age
Pain knee	50	100
Swelling knee	15	30
Instability	9	18
Locking	5	10
Difficulty to walk	2	4
Rebicked knee movements	1	2

**Table 4: Nature of knee injury**

Nature of Knee Injury	=n	%age
Road traffic accident	22	44
Sports injury	10	20
Types of injuries e.g., twisting, fall etc.	18	36

**Table 5: Abnormal findings in MRI**

Detail of MRI lesion	No.	%age	Statistical analysis (95% confidence limits)
Joint effusion	46	92	79.88% to 97.40%
Anterior cruciate ligament injuries	28	56	41.34% to 69.73%
Meniscal injuries	31	62	47.16% to 75%
Others	11	22	12% to 36.33%

**Table 6: Comparison between clinical suspicion and MRI findings for joint effusion**

MRI Findings	Clinical suspicion		Total
	Yes	No	
Positive	28	18	46
Negative	0	4	4

**Table 7: Comparison between clinical assessment and MRI findings for medial meniscal tear**

MRI Findings	Clinical suspicion		Total
	Yes	No	
Positive	12	8	20
Negative	6	24	30

**Table 8: Comparison between clinical assessment and MRI findings for lateral meniscal tear**

MRI Findings	Clinical Suspicion		Total
	Yes	No	
Positive	5	6	11
Negative	2	37	39

**Table 9: Validation analysis (2x 2 analysis) of MRI findings**

MRI findings	Surgical findings		Total
	Lesion Yes	Lesion No	
Lesion Positive	41	5	46
Lesion Negative	3	1	4

**Table 10: Validity of MRI for depicting the internal derangement of knee joint**

Validation parameters	%age	Statistical Analysis (95% Confidence limits)	
		Lower limit	Upper limit
Sensitivity	93.18	85.73	100
Specificity	16.67	0.00	46.40
Predictive value positive	89.13	80.13	98.12
Predictive value negative	25	0.00	67.43
Prevalence by MRI	92	84.48	99.52
Prevalence by surgery	88	78.99	97
Accuracy	84	70.13	92.88

**Table 11: Validity of MRI for depicting anterior cruciate ligament Injuries**

Validation parameters	%age	Statistical analysis (95% confidence limits)	
		Lower limit	Upper limit
Sensitivity	92.30	82.06	100
Specificity	50	0.00	100
Predictive Value positive	96	88.31	100
Predictive Value negative	33.3	0.00	86.67
Prevalence by MRI	89.28	77.82	100
Prevalence by surgery	92.85	83.31	100
Accuracy	89.28	70.62	97.19

**DISCUSSION:**

This comparative diagnostic study was conducted at the Department of Diagnostic Radiology Nishtar Hospital Multan, in about 12 months. 50 patients were selected for this study. The choice of this number is based on the average rotation of patients with damaged knees for MRI examination in our ward. Of these 50 patients, 41 (82%) were male and 9 (18%) were female. 29 (58%) patients had a right knee and 21 (42%) had a left knee. Another study published in the literature and conducted by Bari and Murad<sup>3</sup> 2003 examined 56 patients, 36 were men (72%) and 20 women (40%), right knee in 33 patients (59%) and 47 patients on the left side (84%). The age range was 14-64 and the average age was 39 years. Therefore, the majority of patients were men and young. This is probably due to a greater number of physical and external activities and travel in these age and sex groups. In addition, young men more often participate in sporting events, which further increases the risk of injury. A 2004 study by Jeemer, Riemer, also claims to be between 16 and 76 years old, with an average age of 38.5. In my study, the most common MRI finding was joint exudate observed in 46 patients (92%). Meniscus lesions were the second most common finding in 31 patients (62%). ACL damage was found in 28 patients (56%). This phenomenon is comparable and similar to the Bari and Murad<sup>3</sup> 2003 study, which examined 56 patients and found joint exudate in 84%, meniscus damage in 45% and ACL damage in 41% of patients. In this study, a correlation was made between clinical evaluation and MRI results. Magnetic resonance imaging was found to give better results than clinical evaluation of a damaged knee. Although clinical evaluation is a clue to the presence of an internal disorder, limited value has been found in detecting final lesions. Similar observations were published in the literature by LeVot, Solcroup 1994. A comparison between normal radiography and MRI results in my study showed that MRI outperforms ordinary radiography to identify not only soft tissue damage, but also very well-detected bone discoveries. Including bone

hematoma in 5 patients (10%) who were not seen on regular radiography. These comparative results are very similar to those described in the literature by Duncan, Hunter 1996. My study showed that MRI is sensitive to bone and soft tissue damage. MRI results were finally compared with the surgical results of 50 cases. There was no significant difference between MRI and surgical results. In magnetic resonance imaging, the sensitivity was 93.18% and the specificity was 16.67% to show internal abnormalities in the damaged knee. A positive predictive value was shown as 89.13% and a negative predictive value as 25%. MRI sensitivity in detecting internal diseases was 84%. In my study, the occurrence of internal magnetic resonance imaging was 92%. Colletti 1996 conducted a study showing that the incidence of an internal MRI disorder in a damaged knee is 97%. In this study, MRI was found to have 92.30% sensitivity and 50% specificity for the representation of anterior cruciate ligament injuries. A positive predictive value of 96% and a negative predictive value of 33.3% and 89.28% were normal for ACL injuries. A study published by Ghanem, Abou 2002 in the literature showed that the magnetic resonance sensitivity to represent ACL damage was 95.39%. In another study by Bari and Murad in 2003, MRI had 95% sensitivity, 96% specificity and 96% accuracy in the event of ACL damage. This study showed that magnetic resonance imaging sensitivity for meniscus change representation was 89.28%, specificity 66.67%, positive predictive value 96.15% and accuracy 87.9%. In the literature, Manco and Berlow 1989 reported that MRI has 89.5% accuracy in detecting meniscus tears. It has been observed that MRI cannot detect meniscus tears in 3 patients (6%). These patients also had ACL injuries. This observation is well correlated with a similar observation that is well correlated with a similar observation reported in the literature by DeSmet and Graf 1994, which showed that MRI sensitivity significantly decreased due to meniscus tears when ACL burst. Steatosis was detected on MRI in 5 patients (10%). Co-existing ACL injuries

were detected in each of them. Of these 5 patients, 3 (60%) had a bruise associated with the lateral tibial plateau. In another study by Murphy, Smith, Uribe 1992, it was found that the ACL tear is associated with lateral bruising associated with the tibial plateau in more than 90% of cases. In this study, the MRI specificity for the representation of internal disorders was low, i.e. 50% for ACL damage and 66.67% for meniscus rupture. Therefore, the cases selected for this study have already been clinically studied and some internal disorders of the injured knee are suspected.

### CONCLUSIONS:

Clinical examination and assessment of post-traumatic knee is important, and although its value in detecting certain injuries is low, it gives some clues about a possible internal disorder. Magnetic resonance imaging gives much better results than the clinical assessment of a damaged knee. The performance of ordinary radiography on a damaged knee suspected of an internal disorder is very low. You cannot directly injure a ligament or meniscus. Magnetic resonance imaging shows bone and soft tissue damage. Magnetic resonance imaging has high sensitivity, positive predictive value and sensitivity in assessing a damaged knee.

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