

# Role of MRI in Painful Knee

**Sohail Kamran \***  
**Ayesha Haider \*\***  
**Shireen Khalid\*\*\***  
**Zahir Shah\*\*\*\***  
**Ambreen Shahid\*\*\*\***  
**Rehana Baseer \*\*\*\***

## ABSTRACT

**Objective:** To assess the effectiveness of MRI in Knee Injurers.

**Place and Duration:** From January 2015 to June 2015 at Diagnostic Imaging at NIRM Islamabad

**Materials and Methods:** A total of 60 consecutive patients were recruited in this retrospective study, MRI of the knees was done using four channel knee coil and a 1 Tesla superconducting magnet.

**Results:** The sample population comprised of 60 outpatients with knee joint pain or swelling. Their ages ranged between 16 to 50 years, the peak age was 41 to 50 years representing Males (66.7%) while (33.3%) were females. Joint pain without swelling was the commonest presenting clinical complaint by 70%, while painful swollen knee was in 30%. Anterior cruciate ligament injury was partial in 9 patients(15%), complete in 4 patients (6.7%), posterior cruciate in 2( 3.3%), collateral ligament in 10(16.7%) medial meniscal lesions was detected in 38 patients( 63.3%), lateral meniscal lesions in 9 (15%), joint effusion in 41 ( 68.3%), bone marrow edema 17 (28.3%), osteoarthritis 22(36.7), Baker cyst were diagnosed in 6 (10%).

**Conclusion:** MRI evaluation in patients with painful knee is of vital importance, as MRI can demonstrate the exact nature and extent of bony as well as soft tissue abnormality.

**Keywords:** Painful Knee; MRI; Ligaments, Imaging.

*\*Radiologist NIRM Islamabad*  
*\*\*Assistant Professor Forensic Medicine Federal Medical College Islamabad*  
*\*\*\*Registrar NIRM Islamabad*  
*\*\*\*\*Medical officer NIRM Islamabad*

## Address for Correspondence

*Dr. Sohail Kamran Radiologist*  
*NIRM Islamabad*  
*drsohail65@hotmail.com*

## Introduction

Knee pain accounts for more than one million emergency department and 1.9 million primary care outpatient visits annually.<sup>1</sup> High prevalence of knee joint pain was reported by various authors.<sup>2,3</sup> In 2003, patients made about 19.4 million visits to the doctor because of knee problems.<sup>4</sup> Menisci are commonly injured in knee trauma especially in road traffic accidents and amongst young males in the sports field.<sup>5</sup> Knee injuries can be acute or chronic in nature. A direct blow or twisting of the knee accounts for most acute injuries. Chronic problems arise from overuse of the joint and often involve the surrounding ligaments or tendons. These problems are likely when pain develops gradually or discomfort is recurrent over a period of time. Chronic problems are often triggered by prior injuries, especially

if original injury was not allowed to heal completely. Osteoarthritis is the most prevalent medically treated arthritic condition worldwide (for example, 3532 per 100 000 people in the United States).<sup>7,8</sup> Diagnosis of osteoarthritis is made on the basis of clinical examination or radiography. Population based longitudinal studies in the US<sup>9</sup> and the United Kingdom.<sup>10</sup> showed the lifetime risk of knee osteoarthritis increases with age and with the risk highest in obese people.<sup>9,10</sup> Radiography can show osteophytes, bony outgrowths at the joint margin, and narrowing of the joint space, but it cannot visualize soft tissue pathology.<sup>11</sup> In contrast, MRI can visualize various tissues that are clinically relevant and have an important role in regard to structural progression not seen on radiography. MRI can also show incidental findings in otherwise asymptomatic people.<sup>12,13</sup>

In the knee, MRI visualizes most components of the joint, including articular cartilage, menisci, intra-articular ligaments, bony structure abnormalities, which are not detectable by radiography.<sup>14</sup>

We used MRI to evaluate the presence of bony and soft tissue abnormality in painful knee joints so as to improve the clinical outcome.

## Materials and Methods

This retrospective study was performed during the period of January 2015 to June 2015. A total of 60 consecutive patients referred to the Department of Diagnostic Imaging at NIRM Islamabad with knee joint symptoms were recruited. Inclusion criteria: Patients of either sex with age more than 16 years, having acute or chronic painful knee. Exclusion criteria: Patients, who could not cooperate for MRI examination, have undergone prior surgical procedures and who had metallic implants or metallic clips in situ. Siemens magnetom impacta 1Tesla High Gradient MRI Scanner was used for evaluating 60 consecutive patients. After written consent socio-demographic data, clinical history and physical examination findings were recorded on proforma and Data entered into SPSS version 15 for Statistical analysis

## Results

The sample population comprised of 60 outpatient's complaining of knee joint pain and or swelling were recruited in the study. Their ages ranged between 16 to 50 years, the peak age was in 41 to 50 years which accounted 40(66.7%) Males (Table I) of the study population, while 20 (33.3%) were females.

A joint pain without swelling was the commonest presenting clinical complaint by (70%), while painful swollen knee was the second symptom in incidence (30%). Common knee injuries in our study was left knee (53.3%) followed by right knee (46.7%)

From the 60 knees investigated by MRI, Ligament lesions were demonstrated as anterior cruciate injury partial (9; 15%) complete (4; 6.7%) of knees (Table II) posterior cruciate injury (2; 3.3%) (Table III) collateral ligament injury (10; 16.7%) (Table IV) medial meniscal lesions (38; 63.3%) (Table V), lateral meniscal lesions (9; 15%) (Table VI) joint effusion (41; 68.3%) (Table VII), bone marrow edema (17; 28.3%), osteoarthritis (22; 36.7%), Baker cyst were diagnosed in (6; 10%).

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	16-20 Years	6	10.0	10.0
	21-25 Years	8	13.3	23.3
	26-30 Years	5	8.3	31.7
	31-35 Years	11	18.3	50.0
	36-40 Years	6	10.0	60.0
	41-45 Years	12	20.0	80.0
	46-50 Years	12	20.0	100.0
	Total	60	100.0	100.0

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Normal	47	78.3	78.3
	Partial Tear	9	15.0	93.3
	Complete Tear	4	6.7	100.0
	Total	60	100.0	100.0

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Normal	58	96.7	96.7
	Partial Tear	2	3.3	100.0
	Total	60	100.0	100.0

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Normal	50	83.3	83.3
	Sprain	7	11.7	95.0
	Tear	3	5.0	100.0
	Total	60	100.0	100.0

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Normal	22	36.7	36.7
	Anterior Horn Grade Tear Complex	1	1.7	38.3
	Posterior Horn Tear Grade I,II Mucoïd	5	8.3	46.7
	Posterior Horn Tear Grade III	27	45.0	91.7
	Posterior Horn Grade Tear Complex	5	8.3	100.0
	Total	60	100.0	100.0

**Table VI. Lateral Meniscus**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Normal	51	85.0	85.0	85.0
	Mucoid	5	8.3	8.3	93.3
	Grade III	3	5.0	5.0	98.3
	complex	1	1.7	1.7	100.0
	Total	60	100.0	100.0	

**Table VII Joint Effusion**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No Effusion	19	31.7	31.7	31.7
	Mild Effusion	32	53.3	53.3	85.0
	Sever Effusion	9	15.0	15.0	100.0
	Total	60	100.0	100.0	

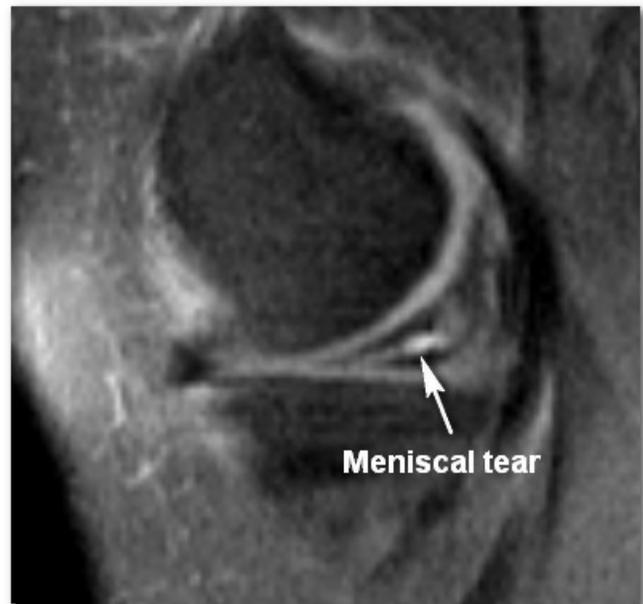
## Discussion

The purpose of this study was to demonstrate the diagnostic value of MRI in diagnosing the presence or absence of knee injuries like meniscus tears, cruciate ligament ruptures, chondral and bony defects and their relation with the age and sex of the patients.

In this study MRI examination was performed on (60) patients with various complaints. Most common age group affected was (41-50) in our study which correlates with Magda A. M. Mansour and Englund M, et al.<sup>15,16</sup> The commonest clinical complaint was knee joint pain and swelling. This was similar to observations in study "Evaluation of Patients Presenting with Knee Pain".<sup>17</sup> And Mahmoud et al.<sup>18</sup> In our series of 60 patients who undergone MRI of their knees, more males presented for MRI of the knee than females. Which is similar to that observed by Magda A. M. Mansour and Hannan MT, Felson DT, Dawson B, et al.<sup>15,19</sup> Commonest knee injuries in our study was left knee (53.3%) followed by right knee (46.7%). Ligament lesions were diagnosed anterior cruciate partial (9; 15% complete (4; 6.7%) of knees posterior cruciate (2; 3.3 %) collateral ligament (10; 16.7%) medial meniscal lesions detected in (38; 63.3%) lateral meniscal lesions (9; 15%) joint effusion in (41; 68.3%), bone marrow edema (17; 28.3%) osteoarthritis (22; 46.7) Baker cyst were diagnosed in (6; 10%). The American Academy of Orthopedic Surgeons supports MRI as an effective tool for evaluating knee injury. The Academy states that MRI is valuable in preventing unnecessary surgery, and recommends it whenever Ligamentous injury is suspected (American Academy of orthopedic surgeons,

2009).<sup>20</sup> A lot of surgeons tend to suppose that MRI is an accurate, non-invasive diagnostic method of the knee injuries, adequate to lead to decisions for conservative treatment and save patient from unnecessary arthroscopy (Major et al.2003 and Zhang et al.<sup>21, 22</sup>

The meniscal injuries appeared on MRI as an increased signal in all pulse sequences applied T1 weighted and T2 weighted fast spin-echo, proton density and fat suppression techniques) (Figure 1) and this is also in agreement with Uppal et al<sup>23</sup> Stoller et al<sup>24</sup>, Kaplan et al<sup>25</sup>, Cheung et al[26]. There are studies that support the view that the diagnostic accuracy of the MRI could affect in a critical way the treatment pathway of knee injuries.<sup>27</sup>



**Figure 1 Medial meniscal tear on T2W**

Regarding ligamentous injuries, there were 13 patients (21.7%) that showed anterior and posterior cruciate ligamentous injuries on MRI, 11 were male (19.4%) and the other 2 were females (3.3%).

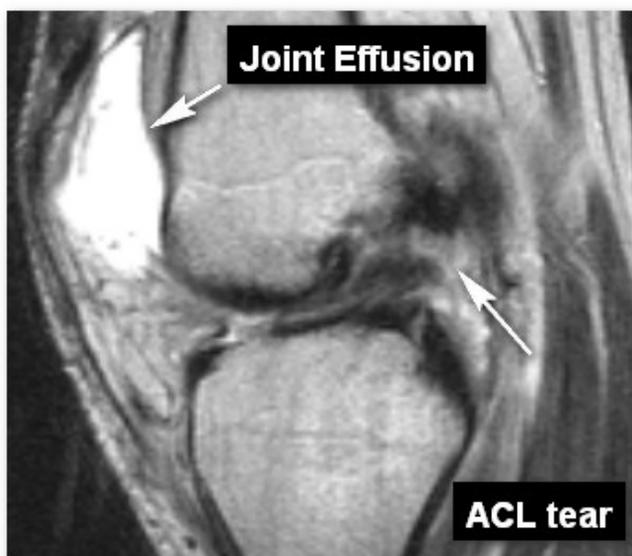
Those injuries appeared as an increased signal intensity on T 2 weighted images in the acute tears or strains because of fluid or edema others appeared as discontinuity of the low signal intensity with or without loss of normal taut parallel margin, especially in the complete tears.

This is in agreement with MRI findings in anterior cruciate ligamentous injuries of Uppal et al [23] who reported cruciate ligament injuries in incidence of 27% in Males and 10% in Females. In our study 10 patients (16.7 %) showed collateral ligament injuries, 7 of them (11.7 %) were males and 3 (5%) were females. Those

injuries demonstrated increased signal intensity on T2 weighted images because of edema and hemorrhage and others demonstrated displacement or complete loss of continuity of ligamentous fibers, depending on the severity of the injury.

It was in agreement with findings of Uppal et al<sup>23</sup> who reported collateral ligament injuries, in incidence of (7%).

Robertson et al<sup>28</sup> reported that the diagnosis accuracy of MRI in assessment of ligamentous and cartilaginous injuries in the knee has been well documented and provides a legitimate standard on which to base any statistical observation<sup>29</sup>



**Figure 2 shows anterior cruciate ligamentous injuries and joint effusion on T2W images**

In our study, 17 patients (28.3%) showed bone marrow edema (bone contusion, bone bruises), 11 of them were males (18.7%) and 6 were females (10.2%). This result was in agreement with findings of Maurer et al<sup>30</sup> and Uppal et al<sup>23</sup> who reported bone contusions and bruises in Incidences of 19% and 15% respectively.

Osteoarthritis (OA) was detected in 22 (36.7 %) patients; 9 (15 %) males while female 13 (21.7%). This is in agreement with Silman et al.<sup>31</sup>, Zhang et al.<sup>22</sup> Who reported that males are affected more often than females below age 45, while females are affected more frequently after age 55 and OA is not reversible. Other study reported that osteoarthritis of knee was more common in obese female and advanced age (Symmons et al.2000,<sup>32</sup> Ismail et al.<sup>33</sup> and Azam et al.<sup>34</sup>

Regarding Joint effusion there were 41 patients that showed Joint effusion on MRI;

32(16.5%) males and 9(9.8%) in female. This result is supported by Nasir et al,<sup>35</sup> who reported that Joint effusion was detected in 10 patients (20%), male (14%) and Female patients (6%).

In our study Baker's cysts was detected in only 6 patients (10 %) arising from the semimembranosus bursa. These findings were proved in studies reported an incidence of Baker cysts on MR images done for the internal derangement of the knee with an increase in the prevalence with age, presence of arthritis, internal derangement and/or effusion Miller et al<sup>36</sup> and Fritschy et al.<sup>37</sup>

## Conclusion

The present study supports that MRI is very helpful in diagnosing knee joints disorders (meniscal and cruciate ligament injuries, osteoarthritis). It is the beginning of new thoughts and actions one must follow to achieve accurate prognosis and correct treatment. The most common MRI finding in the present study are meniscal tear, joint effusion and osteoarthritis. MRI can accurately diagnose the ligament injuries of knee joint, which is an ideal technique in the diagnosis of ligament injuries, and should be used as a routine examination method. So MRI affect the diagnosis and management of the knee injuries by decreasing the number of arthroscopic procedures, improving clinician diagnostic certainty, and assisting in management decision. MRI of the knee provides the potential for the rapid, definitive diagnosis with a noninvasive examination

## References

1. McCraig LF. National Hospital Ambulatory Medical Care Survey (1994): emergency department summary. 245: 1-12.
2. Dawson J.,Linsell L, Zondervan K, Rose P, Randall T, Carr A, Fitzpatrick R.(2004):Epidemiology of hip and knee pain and its impact on overall health status in older adults. Journal of Rheumatology (Oxford); 43(4): 497-504.
3. Saraswathi KP. (2009): Analysis of the problems of the aged above 60 years in a selected urban community in Hyderabad. Nursing Journal of India; 91(4): 86-88.
4. American College of Radiology (2009): Manual on Contrast Media .Http://www.acr.org/ Secondary Main September 11, 75.
5. Ahmad M, Ayub Z, Hadi N(2005):Prevalence of various types of intra-articular injuries detected by Magnetic resonance imaging in trauma to the knee joint. J Med Sci: 13:136-9.
6. Schiffert Health Center( 2010): Knee Injury, [www.healthcenter.vt.edu](http://www.healthcenter.vt.edu)
7. Sacks JJ, Luo YH, Helmick CG. Prevalence of specific types of arthritis and other rheumatic conditions in the ambulatory health care system in the United States, 2001-2005. Arthritis Care Res (Hoboken) 2010; 62:460-4.

8. Bedson J, Jordan K, Croft P. The prevalence and history of knee osteoarthritis in general Practice: a case-control study. *Fam Pract* 2005; 22:103-8.
9. Murphy L, Schwartz TA, Helmick CG, Renner JB, Tudor G, Koch G, et al. Lifetime risk of symptomatic knee osteoarthritis. *Arthritis Rheum* 2008; 59:1207-13.
10. Wills AK, Black S, Cooper R, Coppack RJ, Hardy R, Martin KR, et al. Life course body mass index and risk of knee osteoarthritis at the age of 53 years: evidence from the 1946 British birth cohort study. *Ann Rheum Dis* 2012; 71:655-60.
11. Amin S, LaValley MP, Guermazi A, Grigoryan M, Hunter DJ, Clancy M, et al. The relationship between cartilage loss on magnetic resonance imaging and radiographic progression in men and women with knee osteoarthritis. *Arthritis Rheum* 2005; 52:3152-9.
12. Englund M, Guermazi A, Gale D, Hunter DJ, Aliabadi P, Clancy M, et al. Incidental meniscal findings on knee MRI in middle-aged and elderly persons. *N Engl J Med* 2008; 359:1108-15.
13. Vernooij MW, Ikram MA, Tanghe HL, Vincent AJ, Hofman A, Krestin GP, et al. Incidental findings on brain MRI in the general population. *N Engl J Med* 2007; 357:1821-8.
14. Guermazi A, Roemer FW, Hayashi D. Imaging of osteoarthritis: update from a radiological perspective. *Curr Opin Rheumatol* 2011; 23:484-91.
15. Magda A. M. Mansour Magnetic Resonance Imaging diagnostic procedures for knee *Journal of Nursing and Health Science* 2320-1940 Volume 4, Issue 2 Ver. II (Mar.-Apr. 2015), PP 37-46
16. Englund M, Guermazi A, Gale D, Hunter DJ, Aliabadi P, Clancy M, et al. Incidental meniscal findings on knee MRI in middle-aged and elderly persons. *N Engl J Med* 2008; 359:1108-15
17. Walter L and Mark H. Evaluation of Patients Presenting with Knee Pain: Part II. Differential Diagnosis. *AmFam Physician* 2003; 68: 917-922.
18. Mahmoud Z.M., Fagiri A.M., Al-Motrfi F.A., Sulieman A. (2013): Magnetic Resonance Imaging Findings in Knee Joint Pain at King Saud Medical City, Saudi Arabia, *International Journal of Science and Research (IJSR)*, Volume 2 Issue 6
19. Hannan MT, Felson DT, Dawson B, et al. Risk for Longitudinal bone loss in elderly men and women. The Framingham Osteoporosis study. *Journal of Bone and Mineral Research* 2000; 15: 710-720
20. American Academy of Orthopedic Surgeons (2009): Common knee injuries. Available at: <http://orthoinfo.aaos.org/topic.cfm?topic=A00325>.
21. Major MM, Beard LN, Helms CA. (2003): Accuracy of MRI of knee in adolescent. *AJR. Am J Roentgenol*; 180:17-9.
22. Zhang Y, Jordan JM, (2010): Epidemiology of Osteoarthritis. *Clin Geriatr Med* 26: 355-369.
23. Uppal A., Disler D.G. and Short W.B. et al., Internal derangements of the knee: Rates in patients referred by physicians who are not orthopedic surgeon, *Radiology*, 207, 633-636 (1998)
24. Kaplan P.A., Nelson N.L., Garvin K.L., et al., MR of the knee: The significance of high signal in the meniscus that does not clearly extend to the surface, *AJR*, 156, 333-336 (1991)
25. Cheurg L.P., LI KCP and Hollett M.D., Meniscal tears of the knee: Accuracy of detection with fast spin-echo MR imaging and arthroscopic correlation in 293 patients, *Radiology*, 203, 508-512 (1997)
26. McCauley T.R., Moses M. and Kier R. et al., MR diagnosis of anterior cruciate ligament of the knee: Importance of ancillary finding, *AJR*, 162, 115-119 (1994)
27. Schweitzer M.E., Tran D. and Deely D.M. et al., Medial collateral ligament injuries: Evaluation of multiple signs, prevalence and location of associated bone bruises, and assessment with MR imaging, *Radiology*, 194, 825-829 (1995)
28. Robertson P., Schweitzer M. and Bartolozzi A. et al., Anterior cruciate ligament tears: Evaluation of multiple signs with MR imaging, *Radiology*, 193, 829-834 (1994)
29. Heron C.W. and Calvert P.T., Three-dimensional gradient echo MR imaging of the knee: comparison with arthroscopy in 100 patients, *Radiology*, 183, 839-844 (1992)
30. Maurer E.J., Kaplan P.A., Dussault R.G. et al., Actually injured knee: Effect of MR imaging on diagnostic and therapeutic decisions, *Radiology*, 204, 799-805 (1997)
31. Silman AJ, Hochberg MC. (1993): *Epidemiology of the rheumatic diseases*. Oxford: Oxford University Press
32. Symmons D., Mathers C. and Pflieger B. (2000): *Global burden of osteoarthritis in the year 2000*.
33. Ismail I.A., Ahamed H.A. and Almulhim S. A. (2006): Osteoarthritis of knee and obesity in eastern Saudi Arabia, *Saudi Med J*, vol. 27(11), PP: 1742-1744.
34. Azam Md Q, Al-Othman A A., Sadat-Ali M and Tantawy A A. (2013): Topical herbal analgesic and anti-arthritis (max-relief) versus Diclofenac in symptomatic treatment of osteoarthritis of the knee: a randomized controlled trial, *Indian Journal of Research in Pharmacy and Biotechnology*, Volume 1(4), July-August, PP: 875-878.
35. Nasir A. (2013): The role of magnetic resonance imaging in the knee joint injuries, *international research journal of medical sciences*, vol. 1 (5), June, PP: 1-7.
36. Miller TT, Staron RB, Koenigsberg T, et al. MR imaging of Baker's cyst: association with internal derangement, effusion and degenerative arthropathy. *Radiology* 1996; 201: 247-250
37. Fritschy D, Fasel J, Imbert JC, Bianchi S, Verdonk R, Wirth CJ. The popliteal cyst. *Knee Surg Sports Traumatol Arthrosc.* 2006; 14:623-8.