



ORIGINAL ARTICLE

Prevalence and Structural Abnormal Findings of Injured Knee Joint among Adult Patients detected by Magnetic Resonance Imaging Study of 70 Cases in a tertiary hospital of Bangladesh

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Abstract

Background: Magnetic resonance imaging is a very useful diagnostic tool for the detection of abnormalities of injured knee joint. **Objective:** This present study was performed to see the different abnormalities of injured knee joint detected by MRI among adult patients. **Methodology:** This cross-sectional study was conducted in the Department of Radiology and Imaging at Bangabandhu Sheikh Mujib Medical University (BSSMU), Dhaka, Bangladesh from January to June 2021 for a period of six months. The patients in the age group of equal or more than 18 years with both male and female who were visiting Department of Orthopaedics at BSSMU, Dhaka with history of knee injuries were subjected to MRI were selected as study population. MRI findings of the knee joint were analyzed for the presence of any signal changes or lesions of varying severity for the structures of menisci, cartilage, bone marrow, tendons and ligaments of injured knee joint. **Results:** A total number of 65 cases of knee joints were analyzed. The mean with the SD of age of the study population was 35.34±13.371. The left knee (60.0%) was more involved than right knee (40.0%). The lesion in femur and tibia were found in 10(15.4%) cases and 8(12.3%) cases respectively. Out of 65 knee joints there were 41 joints were found the tear of anterior cruciate ligament. The complete, interstitial tear in the anterior cruciate ligaments were 26(40.0%) and 15(23.1%) knee joints respectively. However, anterior cruciate ligaments of 24(36.9%) knee joints were found normal. Medial meniscus (36.9%) was more involved than lateral meniscus (18.5%). **Conclusion:** In conclusion young adult male are more commonly affected their left knee joint with the tearing of complete tear of anterior cruciate ligaments and involvement of medial meniscus. [Journal of Current and Advance Medical Research, July 2021;8(2):80-84]

Keywords: Prevalence; Abnormalities; knee joint; MRI

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Introduction

Magnetic resonance imaging (MRI) is the highly accurate modality of choice. It is a noninvasive test used to diagnose different medical conditions¹. It uses a powerful magnetic field to produce detailed internal body structures. Furthermore, MRI does not use radiation. MRI of the knee provides detailed images of structures within the knee joint, including bones, cartilage, tendons, ligaments, muscles and blood vessels, from many angles². Now a days MRI of Knee is increasingly used to proper clinical management³.

MRI of knee joint is the most reliable non-invasive diagnostic modality to assess internal derangement of the knee joint⁴. Increasing MRI availability has resulted in a rapid rise in its utilization to help the clinical management of patients with knee symptoms⁵. Over billion dollar is spent on diagnostic imaging in the USA annually. Findings such as meniscal tears, cartilage defects, bone marrow lesions, osteophytes and other features suggestive of knee osteoarthritis are often interpreted as causes of pain and symptoms, triggering medical and surgical interventions⁶⁻⁷.

Since its introduction into clinical use, magnetic resonance imaging (MRI) has become well established in the diagnosis of injuries of the knee joint and MR Arthroscopy has replaced conventional arthroscopy as the primary evaluation method⁸. Traumatic lesions of the ligaments, menisci, and articular surfaces are common injuries that can be confidently detected using MRI. Anterior cruciate ligament tears are most commonly sustained sports injury, often occurring in association with meniscal tears and trauma to other ligamentous structures around the knee⁹. Magnetic resonance imaging is vital in assessing acute knee injuries and plays an important role in deciding treatment options and planning surgical intervention. Magnetic Resonance (MR) imaging has emerged as very useful investigation of choice to evaluate the status of the ACL, PCL, Minisci injury associated with other structures in the knee¹⁰.

It is highly appreciating modality of choice for a variety of disorders including knee joint injury. The use of a surface coil and thin-section, high-resolution scanning techniques in multiple planes has enhanced the depiction of structural details¹¹. The inherent high soft tissue contrast of MRI differentiates structures such as fat, bone marrow, muscle, hyaline cartilage, joint fluid, menisci, and tendons⁷. Now-a-days MR arthrography is replacing the conventional

arthrography in evaluating the internal derangements due to knee joint injury. This present study was to see the abnormalities of knee joint detected by MRI among adult patients who were presented with pain due to injury.

Methodology

This descriptive cross-sectional study was conducted in the Department of Radiology and Imaging at Bangabandhu Sheikh Mujib Medical University (BSSMU), Dhaka, Bangladesh from January to June 2021 for a period of six months. The patients in the age group of equal or more than 18 years with both male and female who were visiting Department of Orthopaedics at BSMMU, Dhaka, Bangladesh with history of pain in knee joint due to injury were subjected to MRI were selected as study population. Patients who presented knee pain other than injuries and patients unwilling to do MRI were excluded from this study. MRI of knee joint was done using 3 Tesla machine (Siemens Healthcare GmbH, Henkestr, Germany). Different sequences were performed like PDW-sag, PDW-SPiR-sag, STIR-coronal, T2-coronal, T1-coronal, T1-axial, STIR-axial and STIR-axial with thin cuts and 3D WATSSag. All MR images were reviewed using a picture archiving and communications system (PACS) workstation by the researcher herself as well as by a senior radiologist with experience at consultant level. In case of discrepancies between the radiologists' reports concerning the findings, agreement was achieved by radiologists with a consensus reading in a second MRI reporting session. MRI findings of the knee joint were analyzed using different validated for the presence of any signal changes or lesions of varying severity for the structures of menisci, cartilage, bone marrow, tendons, ligaments. Other findings were also specified, including effusion, synovial collections (prepatellar bursitis, pes anserine bursitis, Hoffa's synovitis) and cysts (Baker's cyst, other ganglion cysts). The tibia was divided into medial and lateral regions. The femur was divided into medial, lateral and trochlea regions and the trochlea was further divided into medial, central and lateral. The medial and lateral menisci were each divided into sub-regions: anterior horn and posterior horn. The study received ethical approval and all volunteers provided written informed consent before participation. Analyses was performed with SPSS software, versions 22.0 (IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.). Continuous data that were normally distributed were summarized in terms of the mean, standard deviation, median, minimum, maximum and number of observations. Categorical or discrete data were

summarized in terms of frequency counts and percentages. Continuous variables were summarized as a mean (with SD), and a minimum, maximum.

Results

A total number of 65 cases of knee joints were analyzed. The most common age group was 20 to 40 years which was 39(60.0%) cases followed by 40 to 60 Years, Less Than 20 Years and More Than 60 Years age group which were 16(24.6%) cases, 7(10.8%) cases and 3(4.6%) cases respectively. The mean with the SD of age of the study population was 35.34±13.371 with the range of 11 to 74 years (Table 1).

Table 1: Distribution of Socio-demographic characteristics among Study Population

Variables	Frequency	Percent
Age Group		
Less Than 20 Years	7	10.8
20 to 40 Years	39	60.0
40 to 60 Years	16	24.6
More Than 60 Years	3	4.6
Mean±SD (Range)	35.34±13.371(11 to 74)	
Gender		
Male	52	80.0
Female	13	20.0
Religion		
Islam	63	96.9
Hindu	2	3.1

The MRI reports were analyzed and had found that the left knee was more involved than right knee which were 39(60.0%) cases and 26(40.0%) cases respectively. The effusion of knee joint was found in 43(66.2%) cases and the rest of 22(33.8%) cases were presented without joint effusions. The lesion in femur and tibia were found in 10(15.4%) cases and 8(12.3%) cases respectively (Table 2).

Table 2: MRI Profiles of Knee Joints with Ligaments and Menisci Study Population

Variables	Frequency	Percent
Knee Involved		
Right	26	40.0
Left	39	60.0
Joint Effusion		
Present	43	66.2
Absent	22	33.8
Lesion in Femur		
Present	10	15.4
Absent	55	84.6

Lesion in Tibia		
Present	8	12.3
Absent	57	87.7

Out of 65 knee joints there were 41 joints were found the tear of anterior cruciate ligament. The complete, interstitial tear in the anterior cruciate ligaments were 26(40.0%) and 15(23.1%) knee joints respectively. However, anterior cruciate ligaments of 24(36.9%) knee joints were found normal. Posterior cruciate ligament tear was found in 6(9.2%) knee joints of this study. Regarding menisci involvement medial meniscus was more involved than lateral meniscus which was 24(36.9%) and 12(18.5%) joints respectively. Involvement of both medial and lateral menisci were found in 12(18.5%) knee joints. Bucket handle tear of menisci was found in 7(10.8%) knee joints. The most common involved of horn of menisci was posterior horn of medical meniscus which was 19(86.4%) knee joints followed by posterior horn of lateral meniscus which was 2(9.1%) knee joints (Table 3).

Table 3: Involvement of Anterior and Posterior Cruciate Ligaments as well as Menisci

Variables	Frequency	Percent
Type of Anterior Cruciate Ligament Tear		
Complete	26	40.0
Interstitial	15	23.1
Absent	24	36.9
Posterior Cruciate Ligament Tear		
Present	6	9.2
Absent	59	90.8
Meniscus Involved		
Medial	24	36.9
Lateral	12	18.5
Both	12	18.5
Bucket Handle Tear		
Present	7	10.8
Absent	58	89.2
Involvement of Horn of Menisci		
Posterior Medical	19	86.4
Posterior Lateral	2	9.1
Both of Lateral	1	4.5

Different grades of menisci tear were found more in medial meniscus than lateral meniscus which were 25 and 12 knee joints respectively. In medial meniscus the most common tear was grade II which was 14(56.0%) knee joints followed by grade III and grade I which were 9(36.0%) and 2(8.0%) knee joints respectively. However, in lateral meniscus the most common tear was grade I which was 6(50.0%)

knee joints followed by grade II and grade III which were 5(41.7%) and 1(8.3%) knee joints respectively (Table 4).

Table 4: Grade of Menisci Tear Based on MRI Findings among the Study Population

Grade Tear	Meniscus	
	Medial	Lateral
Grade I	2(8.0%)	6(50.0%)
Grade II	14(56.0%)	5(41.7%)
Grade III	9(36.0%)	1(8.3%)
Total	25(100.0%)	12(100.0%)

Discussion

Magnetic resonance imaging (MRI) is the highly accurate diagnostic modality of choice for the imaging evaluation of the knee¹². Moreover, advances in magnetic field strength, gradient strength, and coil design have facilitated the development of new pulse sequences, which have transformed knee MRI from routine morphologic imaging to metabolic imaging and imaging of ultrastructure¹⁰. Pathologies of the knee joint increase with age and may be already existing on magnetic resonance imaging (MRI) before middle age, even without symptoms¹³. In fact, both well and poorly functioning knees can have similar damage, making it difficult to correlate relevant MRI findings with the patients' knee pain^{5,8}. However, MRI has high sensitivity for the detection of subtle changes of joint structures. The estimated prevalence of MRI lesions in asymptomatic knees varies significantly between studies and this is due to varying study designs including different MRI field strengths and sequences employed as well as varying size and levels of physical activity¹³⁻¹⁴.

A total number of 65 cases of knee joints were analyzed. The most common age group was 20 to 40 years which was 39(60.0%) cases followed by 40 to 60 Years, Less Than 20 Years and More Than 60 Years age group which were 16(24.6%) cases, 7(10.8%) cases and 3(4.6%) cases respectively. The mean with the SD of age of the study population was 35.34±13.371 with the range of 11 to 74 years. From this result it is clear that the young adult are more commonly presented with the knee injury. Similar findings have been reported by Seshadri et al¹³ and have added that most of the knee injury patients are young adult and the reason is due to more hard working and movements outside the home.

In this study out of 65 knee joints there were 41 joints were found the tear of anterior cruciate ligament. The

complete, interstitial tear in the anterior cruciate ligaments were 26(40.0%) and 15(23.1%) knee joints respectively. However, anterior cruciate ligaments of 24(36.9%) knee joints are found normal. Posterior cruciate ligament tear was found in 6(9.2%) knee joints of this study. Regarding menisci involvement medial meniscus was more involved than lateral meniscus which was 24(36.9%) and 12(18.5%) joints respectively. Involvement of both medial and lateral menisci were found in 12(18.5%) knee joints. Bucket handle tear of menisci was found in 7(10.8%) knee joints. The most common involved of horn of menisci was posterior horn of medial meniscus which was 19(86.4%) knee joints followed by posterior horn of lateral meniscus which was 2(9.1%) knee joints. MRI is an excellent, non-invasive, radiation free imaging modality with multiplanar capabilities and excellent soft tissue delineation¹⁴. It can accurately detect, localize and characterize various internal derangements of the knee joint and help in arriving at a correct anatomical diagnosis, thereby guiding further management of the patient¹⁵. Medial meniscal tears are more commonly associated with ACL tear. Various patterns of meniscal injuries are identified in this study, out of which bucket handle pattern is more common among medial meniscal tears and radial pattern is common in the lateral meniscal injuries¹⁷. Radiologists while interpreting MR studies of knee injuries, should be aware of these associations. The normal meniscus is homogeneously black. A meniscal tear is identified on MR images by the presence of an intrameniscal signal that extends to the meniscal surface¹⁸. A globular or linear focus of signal in the meniscus that does not extend to the joint surface will not represent a tear at arthroscopy.

Magnetic resonance imaging has an enormous impact on musculoskeletal imaging and in this area the knee is the most frequently imaged joint¹¹. The steadily increasing availability of magnetic resonance imaging is moving the investigation from the realms of the last resort of the hospital specialist to part of the diagnostic evaluation by the general practitioner. Similarly magnetic resonance imaging is more sensitive than plain films in detecting stress fractures, particularly in the early stages, and should replace isotope bone scans¹³. In patients suspected of having soft tissue masses ultrasonography is recommended as an initial screening test, followed by magnetic resonance imaging should a mass be found.

Different grades of menisci tear were found more in medial meniscus than lateral meniscus which were 25 and 12 knee joints respectively. In medial meniscus the most common tear was grade II which

was 14(56.0%) knee joints followed by grade III and grade I which were 9(36.0%) and 2(8.0%) knee joints respectively. However, in lateral meniscus the most common tear was grade I which was 6(50.0%) knee joints followed by grade II and grade III which were 5(41.7%) and 1(8.3%) knee joints respectively. Magnetic resonance imaging of the knee is most commonly indicated in patients with suspected injuries of the menisci and cruciate ligaments¹⁹. Plain radiographs have little value unless there has been an injury due to direct impact. In teaching centres where dedicated musculoskeletal radiologists report on images, diagnostic accuracy of 90% can be achieved for damage to the medial meniscus and anterior cruciate ligaments, slightly less for the lateral meniscus and slightly more for the posterior cruciate ligament^{17,19}.

This present study was performed in 3 tesla MRI machine. Existing literature demonstrates that 3.0 Tesla MRI provides important clinical benefits over 1.5 Tesla, as the stronger field strength increases signal-to-noise ratio allowing improved visualization of anatomical and pathological structures. Additionally, using a multichannel coil improves sensitivity and diagnostic quality.

Conclusion

In conclusion the young adult age group are most commonly presented with pain in the knee joint due to injury. It has been found that male is predominant than female. The left knee joints are frequently presented with pain than right joint. The complete tear of anterior cruciate ligaments is mostly found than interestial tear. The involvement of medial meniscus is more commonly found than lateral meniscus. Considering the grade of menisci tear MRI findings has found that grade II tear and grade I tear are most common in medial and lateral menisci respectively. A large scale multicenter study should be carried out to see the real scenario.

References

1. Major NM, Helms CA. MR imaging of the knee: findings in asymptomatic collegiate basketball players. *American Journal of Roentgenology* 2002;179(3):641-4
2. Boxheimer L, Lutz AM, Treiber K, Goepfert K, Crook DW, Marincek B, Weishaupt D. MR imaging of the knee: position related changes of the menisci in asymptomatic volunteers.

- Investigative Radiology. 2004;39(5):254-63
3. Major NM, Beard Jr LN, Helms CA. Accuracy of MR imaging of the knee in adolescents. *American Journal of Roentgenology* 2003;180(1):17-9
4. Cotten A, Delfaut E, Demondion X, Lapègue F, Boukhelifa M, Boutry N, Chastanet P, Gougeon F. MR imaging of the knee at 0.2 and 1.5 T: correlation with surgery. *American Journal of Roentgenology*. 2000;174(4):1093-7.
5. Helms CA. The meniscus: recent advances in MR imaging of the knee. *American journal of roentgenology*. 2002;179(5):1115-22.
6. Hash TW. Magnetic resonance imaging of the knee. *Sports Health*. 2013;5(1):78-107.
7. Potter HG, Weinstein M, Allen AA, Wickiewicz TL, Helfet DL. Magnetic resonance imaging of the multiple-ligament injured knee. *Journal of Orthopaedic Trauma*. 2002;16(5):330-9
8. Helito CP, Helito PV, Costa HP, Demange MK, Bordalo-Rodrigues M. Assessment of the anterolateral ligament of the knee by magnetic resonance imaging in acute injuries of the anterior cruciate ligament. *Arthroscopy: Journal of Arthroscopic Related Surgery* 2017;33(1):140-6.
9. Munshi M, Davidson M, MacDonald PB, Froese W, Sutherland K. The efficacy of magnetic resonance imaging in acute knee injuries. *Clinical Journal of Sport Medicine*. 2000;10(1):34-9
10. Frobell RB, Lohmander LS, Roos HP. Acute rotational trauma to the knee: poor agreement between clinical assessment and magnetic resonance imaging findings. *Scandinavian Journal of Medicine & Science in Sports*. 2007;17(2):109-14.
11. Chen WT, Shih TF, Tu HY, Chen RC, Shau WY. Partial and complete tear of the anterior cruciate ligament: Direct and indirect MR signs. *Acta Radiologica* 2002;43(5):511-6.
12. Guenoun D, Le Corroller T, Amous Z, Pauly V, Sbihi A, Champsaur P. The contribution of MRI to the diagnosis of traumatic tears of the anterior cruciate ligament. *Diagnostic and Interventional Imaging*. 2012;93(5):331-41.
13. Seshadri BM, Ashwathappa S, Swamy IN. Magnetic resonance imaging evaluation of ligamentous tears of the knee joint and association of meniscal tears with anterior cruciate ligament tears. *Journal of Evolution of Medical and Dental Sciences*. 2016;5(43):2664-9
14. Van Dyck P, Gielen JL, Vanhoenacker FM, Wouters K, Dossche L, Parizel PM. Stable or unstable tear of the anterior cruciate ligament of the knee: an MR diagnosis?. *Skeletal radiology*. 2012;41(3):273-80.
15. Prince JS, Laor T, Bean JA. MRI of anterior cruciate ligament injuries and associated findings in the pediatric knee: changes with skeletal maturation. *American Journal of Roentgenology* 2005;185(3):756-62
16. Klass D, Toms AP, Greenwood R, Hopgood P. MR imaging of acute anterior cruciate ligament injuries. *The Knee*. 2007;14(5):339-47
17. Stevens KJ, Dragoo JL. Anterior cruciate ligament tears and associated injuries. *Topics in Magnetic Resonance Imaging*. 2006;17(5):347-62
18. Kalegowda A, Ahmed J, Mehtri G. Anterior translation of the tibia at MR imaging as a predictor of degree of anterior cruciate ligament tear. *IJARS*. 2018;7(3)
19. Ng WH, Griffith JF, Hung EH, Paunipagar B, Law BK, Yung PS. Imaging of the anterior cruciate ligament. *World journal of orthopedics*. 2011;2(8):75