

Characterization of knee joint injuries in traumatic patients using magnetic resonance imaging

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Submitted

April 11, 2022

Accepted

May 29, 2022

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Citation: Kiran W, John A, Ali A, Naeem MA, Iqbal S, Mubbarka M. Characterization of knee joint injuries in traumatic patients using magnetic resonance imaging. J Rehman Med Inst. 2022 Apr-Jun;8(2):3-6.

ABSTRACT

Introduction: The knee is a complex joint with numerous components and is susceptible to a wide range of injuries such as sprains, ligament rips, fractures, and dislocations.

Objective: To characterize the knee joint injuries in traumatic patients using magnetic resonance imaging (MRI).

Materials & Methods: A descriptive study based on retrospective data was conducted within the Radiology Department of Private Hospital Lahore, Pakistan, from September 01, 2021, to January 30, 2022, on 85 patients with knee joint injuries resulting from road traffic accidents and falls from heights. The data were analyzed for descriptive statistics using SPSS version 20.

Results: The highest frequency of trauma was in male patients of age group 21 to 30 years. The common knee injuries were Joint Effusion 32(26.2%), Anterior Cruciate Ligament Tear 26(21.3%), and Posterior Horn of Medial & Lateral Meniscal Tear 16(13.1%). The most common cause for trauma was road traffic accidents.

Conclusion: Magnetic Resonance Imaging was able to provide high quality images to diagnose knee joint status in patients suffering from traumatic injuries.

Keywords: Knee Joint; Magnetic Resonance Imaging; Wounds and Injuries; Ligaments, Articular; Accidental Falls; Accidents, Traffic.

The authors declared no conflict of interest. All authors contributed substantially to the planning of research, data collection, data analysis, and write-up of the article, and agreed to be accountable for all aspects of the work.

INTRODUCTION

The knee joint is the largest joint in the human body. The knee is also called the patellar joint, giving movements between the bones including the femur, tibia, and patella. The load forces on such three articular components are assumed to be normally distributed in both the tensile stress and during walking under usual conditions.¹ The knee joint has two articulations named tibiofemoral, between tibia and femur, and patellofemoral, between femur and patella.² The anterior cruciate (ACL) and posterior cruciate ligaments (PCL), which assist to stabilize the knee joint, are present in it with medial and lateral cruciate ligaments.^{3,4} The anterolateral ligament (ALL) is a distinct structure in the knee's anterolateral region. It has typical ligament features and attaches to the femur

around the lateral epicondyle.⁵ The knee joint is composed of cruciate and collateral ligaments and different muscles named quadriceps, lateralis, vastus medialis, and rectus femoris muscles.⁶ The knee handles a significant proportion of our body weight in everyday routines, allowing for a large variety of flexion, extension, and rotation.⁷ The knee joint is supplied by the network of femoral, popliteal, circumflex tibular, and recurrent branches of fibular arteries and veins while its nerve supply is femoral, obturator, tibial, and common fibular nerves.^{8,9}

Tears of the anterior cruciate ligament (ACL), posterior cruciate ligament (PCL) and collateral ligaments, fractures, effusions of joint, contusions of bone marrow, arthritis, tearing of medial and lateral meniscal horns, bone marrow edema, fluid in bursae, bone bruises, and others are some common traumatic injuries of the knee joint.¹⁰ Traumatic knee injuries can be associated with valgus, pivot shifts, hyper-extensions, etc.¹¹ Sports (football, basketball, etc.) injuries are also the common cause of knee joint injuries including ACL and PCL tearing, meniscal injuries, and muscular pathologies;¹² 72% of knee joint injuries are sport-related, out of which ACL injuries contribute 52%, meniscal tearing 41%, and lateral patella dislocation (LPD) 17%. Traumatic knee joint injuries are seen to be more in boys at the age of 10-19 years rather than in girls.¹³ Physical examination is the first thing to do in patients who come to the hospital after knee joint trauma.¹⁴ Knee joint injuries are equally noted in both children and adults.¹⁵

In children the common traumatic knee joint injury is patellar dislocation and mostly occurs in young females.¹⁵ Magnetic Resonance Imaging (MRI) should be performed after the physical examination because some serious complications can be missed in the physical examination. MRI can accurately diagnose ligament, muscular, meniscal, and bone fractures of the knee joint.¹⁶ Different imaging modalities can be used for diagnosing knee joint injuries including ultrasound, X-rays, multi-slice computed tomography (CT), arthroscopy, and magnetic resonance. McMurray and Apley tests can be useful for diagnosing meniscal

injuries.¹⁵ MRI is the gold standard modality for diagnosing knee joint injuries.^{17,18} Greyscale and Doppler ultrasound can also be used to detect knee joint injuries¹⁹ but MRI is more sensitive in the case of knee fractures and meniscal injuries by producing high-quality tomographic images.²⁰ It is the sensitive, safe, and, non-invasive procedure for diagnosing ACL and PCL injuries accurately.^{21,22} The accuracy of diagnosing ligament injuries on MRI is 90% to 100% and meniscal injuries are 76% to 97%.²³ The incidence of knee joint injuries including ACL rupture in the United States is 100,000 to 200,000 per year. Compared to adults, differences are present in open physes, ligament support, and the mechanics of changing in children.^{24,25}

Early detection of knee joint injuries is important to prevent further complications. MRI can be the gold standard and accurate tool for diagnosing knee joint injuries. It can accurately diagnose traumatic ligament, muscular, meniscal, and bone fractures of the knee joint

MATERIALS & METHODS

This was a descriptive study based on retrospective data conducted within the Radiology Department of Private Hospital Lahore, Pakistan. Data were obtained from hospital records for the duration of 01 September 2021 to 30 January 2022. The traumatic and fall injuries of the knee were diagnosed on MRI 1.5 Tesla in which Axial fat, spin-echo (FSE), T2-Weighted Fat saturation, and proton density-weighted (PDW) sequences were used. The patients were included after consent. A sample size of 85 patients was considered based on a previously published article.²⁶ This study included patients with knee joint injuries from road traffic accidents and falls from height and excluded other bone accidents. The data were entered and analyzed using SPSS version 20. Descriptive statistics were obtained such as frequencies and percentages for age groups, gender, and types of injuries.

RESULTS

A total of 85 patients were included with knee joint traumatic injuries. In Table 1 demographic data are presented; the age group with the highest frequency was 21 to 30 years 38(44.7%) followed by 31 to 40 years with 19(22.4%) and two age groups 10 to 20 and 41 to 50 years have the same frequency as 14(16.5%). The evaluation of gender showed the majority of the male patients as 66(77.6%) while females were 19(22.4%).

Table 1: Demographic data of patients (n=85).

#	Demographic Variables	Frequency	Percentage
1	Age Groups (years)		
	10-20	14	16.5
	21-30	38	44.7
	31-40	19	22.4
2	Gender		
	Male	66	77.6
	Female	19	22.4

Table 2 shows the history of the patients from which they were presented to the hospital specifically from road traffic accidents 60(70.6%) and falls from heights were 25(29.4%). The frequency of injuries resulting in the right and left knee (Table 2) shows that injuries in the right knees were more common as 53(62.4%) and left knee as 32(37.6%).

Table 2: History of Traumatic Patients (n=85).

#	Traumatic history	Frequency	Percentage
1	Cause of trauma		
	Road traffic accident	60	70.6
	Fall	25	29.4
2	Side of trauma		
	Left	32	37.6
	Right	53	62.4

Table 3 gives the MRI findings in patients suffering from traumatic knee joint injuries.

Table 3: MRI Findings of Knee Joint Injuries in Traumatic Patients (n=85).

#	MRI Findings	Frequency	Percent
1.	Joint Effusion	32	26.2
2.	Anterior Cruciate Ligament Tear	26	21.3
3.	Posterior Horn of Medial & Lateral Meniscal Tear	16	13.1
4.	Posterior Cruciate Ligament Tear	8	6.6
5.	Anterior Horn of Medial & Lateral Meniscal Tear	7	5.7
6.	Lateral Collateral Ligament Tear	6	4.9
7.	Bone Bruises of Medial & Lateral Condyle of Femur & Tibia	6	4.9
8.	Fluid in Supra, Pre & Infra Patellar Bursae	4	3.3
9.	Bony Fractures	3	2.5
10.	Knee Joint Space Narrowing	2	1.6
11.	Bone Marrow Edema	2	1.6
12.	Medial Collateral Ligament Tear	2	1.6
13.	Fluid in Popliteal Bursae	2	1.6
14.	Bone Contusion	2	1.6
15.	Others	4	3.3
Total		122	100.0

The most common injury was Joint effusion 32(26.2%), following ACL tear 26(21.3%), posterior horn tear of the medial and lateral meniscus 16(13.1%), PCL tear 8(6.6%), anterior horn tear of the medial and lateral meniscus 7(5.7%), LCL tear 6(4.9%), bone bruises 6(4.9%), Fluid in Supra, Pre & Infra patellar bursae 4(3.3%), fractures 3(2.5%), MCL 2(1.6%), bone marrow edema 2(1.6%), knee joint space narrowing 2(1.6%), Fluid in Popliteal Bursae 2(1.6%), bone contusion 2(1.6%) and others 4(3.3%).

DISCUSSION

The objective of the current study was to characterize knee joint injuries in traumatic patients using MRI. A sample size of 85 patients was considered from a private hospital in Lahore, Pakistan. The highest frequency of trauma is noted in male patients having the most frequent age group of 21 to 30. The common knee injuries were Joint Effusion 32 (26.2%), Anterior Cruciate Ligament Tear 26(21.3%), and Posterior Horn of Medial & Lateral Meniscal Tear 16(13.1%). The most common cause for trauma was Road traffic accidents. MRI is the most accurate imaging modality for diagnosing knee joint injuries in traumatic patients.

In a recently published study, Khan MD⁴ (2021) determined the frequency of knee joint pathologies on Magnetic Resonance Imaging (MRI) in Lahore, Pakistan. Meniscal Injuries were the most prevalent knee injuries. In the Collateral Ligaments, MCL had 7% Menisco-femoral Ligament Injuries and LCL had 5.7% Menisco-femoral Ligament Injuries. Complete rupture occurred in 21.4% of ACL injuries and partial rupture occurred in 10% of PCL injuries, which is relevant to the current

investigation. Previous and current studies both concluded that MRI is a reliable imaging modality and can be a substitute for arthroscopic interventional contrast procedures.

A study by Saeed IO²⁶ (2018) was done to find the diagnostic value of Magnetic Resonance Imaging (MRI) in the evaluation of post-traumatic knee joint condition. He had similar results as the current study with traumatic findings in common with current study, such as joint effusion, tears of menisci, Anterior Cruciate Ligament, Posterior Cruciate Ligament, Medial Collateral Ligament, and Lateral Collateral ligament. The previous study²⁶ included 85 patients complaining of trauma-related knee joint issues; 6 patients had normal MRI findings and 79 patients had abnormal findings, the major ones being ACL in 20 patients, and meniscal tears in 17 patients, which are completely relevant to the current study.

Another study by Pezeshki S et al (2016)⁹ had findings similar to the current study showing that the existence of fracture is associated with a low risk of tearing of the anterior cruciate ligament and medial meniscal ligament. Pathologic joint effusion was significantly more common in ACL and MCL tearing. The previous study⁹ concluded that joint effusion, bone bruise, and fracture may require MRI for better assessment of injuries in traumatic patients.

CONCLUSION

Magnetic Resonance Imaging provided high quality images of the status of knee joints to aid accurate diagnosis in patients suffering from a variety of traumatic knee joint injuries resulting from road traffic accident and falls from height.

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