RESEARCH ARTICLE

PREVALENCE OF ABNORMALITIES DETECTED BY MAGNETIC RESONANCE IMAGING (MRI) IN PATIENTS WITH KNEE TRAUMA AT A TERTIARY CARE TEACHING HOSPITAL OF SOUTHERN RAJASTHAN

[1,*]Dr. Ritu Mehta, [2]Dr. Sanjeev Agarwal, [3]Dr. Gagan Jaiswal, [4]Dr. Neha Singh Agrahari and [5]Dr. Abhishek Bhargava

[1,3,4,5]Department of Radiodiagnosis, Geetanjali Medical College and Hospital, Udaipur, Rajasthan, India
[2]Department of Surgery, Geetanjali Medical College and Hospital, Udaipur, Rajasthan, India

ABSTRACT

Background: Magnetic Resonance Imaging (MRI) is the most commonly used imaging modality in the evaluation of knee injuries. So, this study was planned to use MRI in determining the incidence of knee lesions in traumatic knee patients and their relation with the age and sex of the patients.
Materials and Methods: This prospective study was performed for a period of 1 year after taking the permission from institutional ethics committee in a tertiary care teaching hospital. Patients referred to the Department of Radiology with post traumatic knee joint symptoms were recruited. Patients' socio-demographic data, clinical history and physical examination findings were recorded to correlate the findings. MRI Acquisition Knees were imaged by using Siemens Avanto MR machine with a superconducting magnet and field strength of 1.5 tesla using dedicated knee coil (Flex).
Results: Total 63 patients were examined by MRI and the most common age group was found to be 21-30 years. 88.89% knee lesions were found in male. Joint Effusion was found to be most frequent lesion in symptomatic knee constituting 94.64%. Amongst the ligament injury, ACL was found be highest approximately 50% in patients with complete tear in 57.14%. Amongst the menisci injury medial meniscus injury was found be highest approximately 72.72 % with grade III in 43.75%.
Conclusion: MRI was found to be good diagnostic tool for evaluation of traumatic knee lesions.

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INTRODUCTION

The knee joint is the largest and most heavily loaded joint of the human body (Potocnik *et al*., 2008). In the knee joint, the bones, cartilage, menisci, joint capsule, ligaments, muscles, and tendons interact in a unique manner, providing both stability and mobility (Brantigan and Voshell, 1941). The knee is one of the most frequently injured joints and at the time of injury to knee joint these structures are vulnerable to be affected, some are easily and frequently affected during injury and some are rarely (Beynnon, 1998; Ryder *et al*., 1997). Different techniques have provided a tremendous amount of information about degeneration, prevention and treatment of disorders and injuries in the knee. (Potocnik *et al*., 2008; Pena *et al*., 2006)

Corresponding author: Dr. Ritu Mehta,
Department of Radiodiagnosis, Geetanjali Medical College and Hospital, Udaipur, Rajasthan, India.

Compared to arthroscopy, which is considered the reference standard, the sensitivity and specificity of MR images are high for detecting abnormalities in knee joints (Oei *et al*., 2003; Vincken *et al*., 2002). So, MRI is the most commonly used imaging modality in the evaluation of the knee joint, and has an acceptable accuracy in the detection of menisci and anterior cruciate ligament (ACL) injury (Crues *et al*., 1987). MRI produces excellent pictures of articular cartilage, synovium and bone marrow that might be expected to produce information that correlates better with the patient experience of symptoms and guides treatment planning. From all knee soft tissue structures, the ligaments and joint capsule are the most frequently injured structures (Beynnon, 1998). Knee pain and related symptoms may come as a result of damage to one or more of the soft tissue structures that stabilize and cushion the knee joint. Post traumatic knee complaints are the most common reason for patients to come in hospital. Traumatic knee complaints can be caused by e.g. bone bruise, fracture,

and/or soft tissue injuries such as lesions of menisci, cruciate ligaments, collateral ligaments and muscles (Oei *et al*., 2003; Belo *et al*., 2010). MRI showed a sensitivity of 86%, 91%, 76%, a specificity of 95%, 81%, 93% and an accuracy of 93%, 86%, 89% for anterior cruciate ligament, medial and lateral meniscus lesions respectively (Crawford *et al*., 2007). There are no data available on prevalence of such lesions in our institute and also this type of study was not conducted in this region of Rajasthan. So, this study was planned to determine the incidence of common knee lesions in symptomatic knee injury patients by using MRI.

MATERIALS AND METHODS

This prospective study was carried out for a period of 1 year after taking the permission from institutional ethics committee. A total of 63 patients referred to the Department of Radiology with post traumatic knee joint symptoms were recruited. Informed consent was obtained after explaining about the nature of exam and also the socio-demographic data, clinical history and physical examination findings were recorded to correlate the findings. Patients who had no clinical evidence of knee joint involvement were not included in this study.

Procedure

MRI Acquisition Knees were imaged by using Siemens Avanto MR machine with a superconducting magnet and field strength of 1.5 tesla using dedicated knee coil (Flex). Each examination consisted of the following: coronal intermediate-weighted (repetition time msec/echo time msec, 2200/20) and T2- weighted (2200/80) dual spin-echo images (number of signals acquired, two; section thickness, 5 mm; intersection gap, 0.5 mm; field of view, 160 mm; acquisition matrix, 205×256; and number of sections, 18), sagittal intermediate-weighted (2200/20) and T2- weighted 4 (2200/80) dual spin-echo images (number of signals acquired, two; section thickness, 4 mm; intersection gap, 0.4 mm; field of view, 160 mm; acquisition matrix, 205×256; and number of sections, 20), sagittal three dimensional T1- weighted spoiled gradient-echo frequency-selective fat suppressed images (46/2.5; one signal acquired; flip angle, 40º; section thickness, 3 mm; section overlap, 1.5 mm; no gap; field of view, 180 mm; acquisition matrix, 205×256; and number of sections, 80), and transverse intermediate weighted (2500/7.1) and T2-weighted (2500/40) turbo spin echo fat-suppressed images (number of signals acquired, two; section thickness, 2 mm; no gap; field of view, 180 mm; acquisition matrix, 205×256; and number of sections, 62). Total acquisition time, which included the initial survey sequence, was 30 minutes. Protocol of examination was in line with European society of musculoskeletal radiology (ESSR). It starts with the patient in supine position and slightly externally rotates the foot by about 10-15 degrees to stretch the anterior cruciate ligament. Pack some cushions around the knee to help it stay motion free. A small cushion under the ankle helps to keep the leg straight. Evaluation of the knee including the patello-femoral joint, medial and lateral compartments as well as related tendons and ligaments and the popliteal fossa is performed with a high resolution proton density sequence acquired in 3 planes: Axial, Sagittal and Coronal. Evaluation of bone marrow for contusion requires a T2 fat saturation

sequence in either coronal or sagittal planes. If the patient has a suspicious mass then T1 fat saturation images are helping to determine if the mass is benign or malignant and better delineate its full extent. Obtained MRI images were diagnosed by an experienced musculoskeletal radiologist for the presence of ligament injury, tear, strain and laxity, as well as menisci degeneration and tear, Joint effusion, subchondral and bone marrow edema, bony contusion, bursitis, baker cyst and tumor were noted in all patients.

Statistical analysis

Data were expressed in percentages in comparison tables and graphs. Statistical analysis was performed using Microsoft Excel Software and the standard Statistical Package for the Social Sciences version 15 for windows.

RESULTS

Total 63 patients were recruited with in a study period of 1 year. MRI of symptomatic or traumatic injured knee was conducted. Of these 63 patients 56(88.89%) were male and 7 (11.11%) were female, with male to female ration of 8:1. Mean age of the patients was 31 years (range 11 to 59 years). They were classified into age groups and out of these groups 28 were found to be in age group between 21-30 years. In this age group 2 were female and 26 were male patients. Table 1 Effusion was most frequently found in symptomatic knee constituting 94.64% followed by bone marrow edema (69.64%), and ACL (50%). Patello femoral ligament injury (1.79%) was found to be least affected Table 2. Figure 1 shows the incidence of ligament lesion in the form of partial/complete tear or medial/lateral side injury and figure 2 shows menisci injury in different grades. These injuries are distributed according to sex.

Table 1. Distribution of patients according to age and sex

Age group	Male	Female
<10	0	0
11-20	8	2
21-30	26	2
31-40	13	1
41-50	6	2
51-60	3	0
>60	0	0

Table 2. Incidence of all lesion detected by MRI in traumatic knee injury patients

Sr. No.	Knee lesion	Male	Female	Total Patients (56)
1	Anterior Cruciate Ligament (ACL)	25	3	28 (50%)
2	Posterior Cruciate Ligament (PCL)	2	2	4 (14%)
3	Menisci injury (MI)	21	1	22 (39.29%)
4	Collateral ligament (CL)	19	2	21 (37.5%)
5	Patello femoral ligament (PFL)	1	0	1 (1.79%)
6	Bone Contusion/ marrow edema	36	3	39 (69.64%)
7	Joint effusion	48	5	53 (94.64%)

Figure 1: Incidence of ligament lesion in traumatic knee injury patients with distribution based on sex

Figure 2: Incidence of menisci lesion in traumatic knee injury patients with distribution based on sex
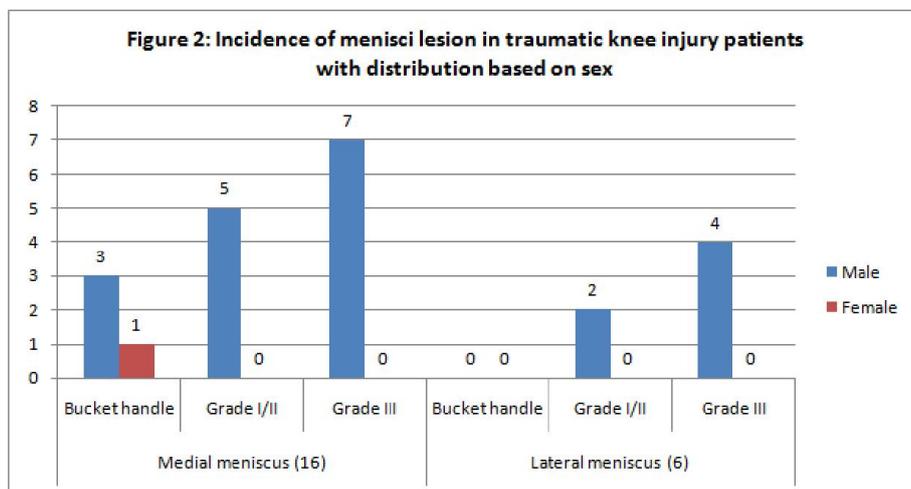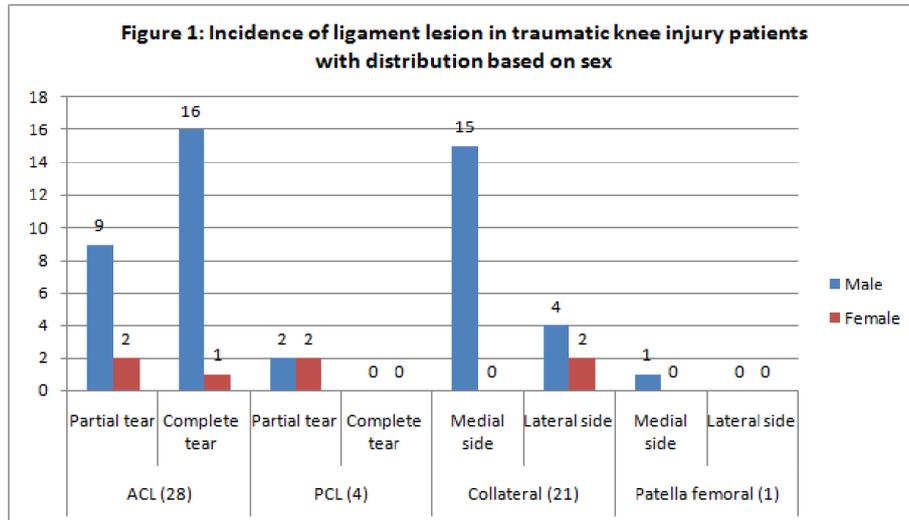
DISCUSSION

MRI is invaluable in preventing unnecessary surgery, and recommends it whenever ligamentous injury is suspected. Also, 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. 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 a patient from unnecessary arthroscopy (Zhang and Jordan, 2010). This could be because of more activities in young males as compared to females and are more prone to road traffic accidents and frequent injuries during sports. Fifteen percent of physical activity–related injuries are found in the knee, and the risk of sustaining a knee injury is especially high in the age group of 15 to 25 years (Haapasalo *et al.*, 2006). Joint Effusion was found to be most frequent lesion in symptomatic knee constituting 94.64%. In another study joint infusion was reported in 63.8% (Mansour *et al.*, 2015). Higher percentage of joint effusion in our study shows that we tried to include even small effusion where predominant injury could be ligament or menisci and one another could be that in our study most of the patients were of recent history of trauma.

Amongst the ligament injury ACL was found be highest approximately 50% in patients with complete tear in 57.14%. This much percentage of ACL injury in our study could be explained because in our study most of the injury found in young male patients and this type of injuries are mostly found in sports person (Gianotti *et al.*, 2009). One study conducted in 2006 also shown ACL as the most common injured ligament. (Majewski *et al.*, 2006) Collateral ligament injury was found in 37.5% patients with medial side injury represents in 71.43%. One study has also shown that highest incidence of complete tear in ACL (Oei *et al.*, 2005). Menisci injury was found in 39.29% patients. In our study most of the menisci injury was found in young male as compared to female only one. Similar results have reported by other studies too of higher incidence of menisci injuries in young male (Nikolaou *et al.*, 2008; Khanda *et al.*, 2008). Amongst the menisci injury medial meniscus injury was found be highest approximately 72.72 % with grade III in 43.75%. Lateral meniscus injury was found in 27.28 % patients with grade III in 66.67%. This results are consistent with another study where medial menisci lesion were common than lateral menisci (Boks *et al.*, 2006). Grade I/II injury (signal changes) are less common in our study because these are not true tear and mostly occur with degeneration changes in

knee joint and more common in 3rd and 4th decade (Stoller *et al.*, 1987) and in our study most of the patients were in age group 21-30.

Conclusion

To conclude, amongst ligament injury ACL was found to be most affected ligament and medical meniscus was found to be most commonly affected menisci in traumatic knee injury patients. Joint effusion and marrow edema were found to be associated in most of the cases.

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