

Magnetic Resonance Imaging diagnostic procedures for knee joint injuries at Taif hospital, Saudi Arabia

Magda A. M. Mansour^{1, 2}, Rania Mohammed Ahmed^{2, 3},
Alaa Ibrahim⁴, Nagwan Elhussein⁴, Saud Ali Aljuaid⁵

¹Adult nursing, Nursing Department, faculty of nursing, Assuit University.

²Adult nursing, Nursing Department, College of Applied Medical Science –Taif university.

³Radiological Science Department, College of Applied Medical Science –Taif University, Saudi Arabia.

⁴Radiological Science and Medical Imaging College, –Alzaiem Alazhary University, Khartoum, Sudan.

⁵Radiology Department, College of Applied Medical Science –Taif University, Saudi Arabia.

⁵Radiology Department, King Abul-Aziz Specialist Hospital (KAASH), Taif City, Saudi Arabia.

Abstract: Magnetic Resonance Imaging (MRI) is the most commonly used imaging modality in the evaluation of knee injuries.

Aim Of Study: Was to demonstrate the diagnostic value of MRI in diagnosing the presence or absence of the most common injuries of the knee; the meniscus tears, the cruciate ligament ruptures and their relation with the age and sex of the patients in taif -hospital Saudi Arabia, and investigate role of the nurse in preparing patient for MRI.

Methods: Retrospective study was performed in the period from Sep 2013 to Oct 2014. One hundred and fifty patients' medical records, who presented with various knee joint problems, referred from Orthopedic and Rheumatology Departments in king Abdul Aziz Specialist hospital after physical examination. Moreover, fifteen out of twenty (75 %) nurses working at the same above setting were included in the study.

Tool Of Study: An observation checklist, for data collection from medical records, in addition , designed questioner for nurses' participated about MRI procedure .

Results: The most common age 10-29 y, and male represent 72.7%. Swelling and pain (35.3%) more common Clinical diagnosis, followed by Joint effusion (24.7) , there are statistical significance difference between Clinical diagnosis and MRI finding $P=0.00$, Also statistical significance difference between MRI finding with age and sex $P\leq 0.05$. Most of nurses perform patient preparation before MRI reasonably , but more than half of the nurses have poor performance regarding patient preparation during and after procedure.

Conclusion And Recommendation: MRI can accurately diagnose the ligament and meniscal injuries of knee joint, which is an ideal technique in the diagnosis of ligament injuries of knee joint. In service training is essential for all nurses working at KAASH.

Keywords: Joint injuries, MRI, Meniscus injury, Osteoarthritis (OA), King Abdul Aziz Specialist (KAASH).

I. Introduction

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 (Schiffert Health Center, 2010).

Knee pain, a common subset of all knee pain, accounts for more than one million emergency department and 1.9 million primary care outpatient visits annually (McCraig, 1994).

High prevalence of knee joint pain was reported by various authors (Dawson et al. 2004 and Saraswathi, 2009). In 2003, patients made about 19.4 million visits to the doctor because of knee problems (American Academy of orthopedic surgeons, 2009).

Menisci are commonly injured in knee trauma especially in road traffic accidents and amongst young males in the sports field (Thornton et al. 2000 and Ahmad et al. 2005).

are risk factors for knee Osteoarthritis and that the risk correlates with the intensity and duration of exposure. Although this systematic review investigated a broad range of different types of activity, including daily life, exercises, sports, and occupational activities. Osteoarthritis of the knee is common among Saudi Arabian men and women (Azam et al. 2013).

In Saudi Arabia, all populations in Taif are living in altitude area. Taif city located at high altitude of an around 1.879 meters above the sea level. There are three altitude regions that reflect the lowered amount of

oxygen in the atmosphere (high altitude 1,500-3,500 meters, very high altitude 3,500-5,500 meters and extreme altitude above 5,500 meters), (Zubieta et al. 2007, Brenner et al. 2011 and Sobhy, 2014).

Altitude area causes Decompression Sickness (DCS) became a commonly observed problem associated with high-altitude area. Causing a variety of signs and symptoms. The most common symptom is joint pain, which is known as “the bends.” account for about 60 to 70% of all altitude DCS cases, with the most common site are the shoulders, elbows, knees, and ankles. Today, research on Articular cartilage is even more important due to the rising numbers of people suffering from the Articular diseases such as osteoarthritis and rheumatoid arthritis (Hughes et al. 2005).

Magnetic Resonance Imaging (MRI) is the most commonly used imaging modality in the detection, evaluation, assessment, staging, and follow-up of disorders of the knee, and has an acceptable accuracy in the detection of meniscal and anterior cruciate ligament (ACL) injury (Rubin, 1997 and HaTP et al. 1998 and American College of radiology, 2014)

MRI has several advantages compared with other modalities in evaluation the internal architecture of the knee. MRI is non-invasive and painless and provides excellent soft tissue contrast, moreover; it allows imaging in multiple planes and incurs no radiation dose to the patient. The clinical relevance of preoperative MRI is also determined by its value to select patients for therapeutic arthroscopy (Major et al. 2003, Khandal et al. 2008 and Nasir, 2013).

The potential of MRI in assessing the knee joint was first described by Kean and Moon in 1983. No imaging modality has had as great an impact on the current practice of orthopedics as MRI. With the availability of the specialized extremity coil, the knee has become the most frequently studied articulation (Major et al. 2003).

Magnetic resonance imaging can reduce the need for arthroscopy and the number of negative arthroscopic examinations in patients for whom arthroscopy is considered after physical examination (Vincken et al. 2002 and Holling et al. 2011).

Arthroscopy of the knee has been used since 1970s as a diagnostic and therapeutic tool in the management of Meniscal injuries. Arthroscopy is considered as ‘the gold standard’ for diagnosing intra Articular knee problems. However, arthroscopy is an invasive procedure that requires hospitalization, general or local anesthesia and has certain risks and discomfort for the patient. Arthroscopy should preferably be performed only for treatment purposes, provided that alternative non-invasive diagnostic modalities such as MRI are available (Ryan et al. 1999, Thornton, 2000 and Shetty et al. 2002).

Primary indications for MRI of the knee include, diagnosis, exclusion, and grading of suspected: Meniscal disorders, Ligament abnormalities, Extensor mechanism abnormalities, Articular cartilage abnormalities, Muscle and tendon disorders, also. MRI of the knee may be indicated to further clarify and stage conditions diagnosed clinically and/or suggested by other imaging modalities: Arthritis's, Primary and secondary bone and soft tissue tumors. MRI of the knee may be useful to evaluate specific clinical scenarios, including, unexplained knee pain, Acute knee trauma, mechanical knee symptoms: catching, locking, snapping, crepitus, limited or painful range of motion, Swelling, enlargement, mass, or atrophy (Ramnath et al. 2006, Hoyy et al. 2007, Duc et al. 2008, and American College of Radiology, 2009).

A magnetic resonance imaging (MRI) test is usually done by an MRI technologist. The resulting pictures are usually interpreted by a radiologist. But some other types of doctors, such as an orthopedic surgeon, can also interpret a knee MRI scan (Knee Pain Health Center, 2012). The physician performing MRI interpretation must have a clear understanding and knowledge of the anatomy and path physiology relevant to the MRI examination. The written or electronic request for MRI of the knee should provide sufficient information to demonstrate the medical necessity of the examination and allow for its proper performance and interpretation (knee pain health center, 2012 and American College of Radiology, 2014).

The use of MRI is still limited, partly due to its costs and partly due to technical demands. The assessments need standardized procedures and methods to interpret results. Examination of patients could be sometimes difficult, eg. Because of the subject's obesity or feeling of claustrophobia. It is also difficult to compare results obtained from different systems, which is relevant for longitudinal multicenter investigations (Guermazi et al. 2011 and Koster et al. 2011).

The physician and nurse must have complete understanding of the indications, risks, and benefits of the MRI investigation, as well as alternative imaging procedures. The physician and nurse must be familiar with potential hazards associated with MRI, including potential adverse reactions to contrast media (Shellock, 2009 and Avcu et al. 2010).

The purpose of this study was to demonstrate the diagnostic value of MRI in diagnosing the presence or absence of the most common injuries of the knee; the meniscus tears, the cruciate ligament ruptures and their relation with the age and sex of the patients in Taif -hospital Saudi Arabia, and investigate role of the nurse in preparing patients for MRI.

II. Materials And Methods

2.1.Operational definition (Nasir, 2013 and Suzanne and Smeltzer et al. 2010 and Tomasz, 2014)

Joint injuries. Joint injuries can result in painful, swollen joints, and stiffness. Sometimes, the muscles, tendons, and ligaments surrounding the joint are torn or injured.

Meniscus injury: Injuries to the crescent-shaped cartilage pads between the two joints formed by the femur (the thigh bone) and the tibia (the shin bone). The meniscus acts as a smooth surface for the joint to move on.

A ligament is a structure that connects two bones. The junction of two bones is called a joint. Surrounding the joint are ligaments that hold the bones together, but provide enough flexibility to allow the joint to move.

An anterior cruciate ligament injury is the over-stretching or tearing of the anterior cruciate ligament (ACL) in the knee. A tear may be partial or complete.

Osteoarthritis. OA is the "wear-and-tear" arthritis that usually occurs with aging or after injury. Also can be defined as a pathological process, development of radiographic changes and last, but not least, as a sequence of clinical symptoms.

Knee effusion or swelling of the knee (colloquially known as water on the knee) occurs when excess fluid accumulates in or around the knee joint.

2.2. Research Design:

This retrospective study was performed in the period from Sep 2013 to Oct 2014 in the study setting. In addition cross section study was done through interview of nurses during patients (complained of knee injuries) preparation for MRI.

2.3.Setting and sample

Department of Diagnostic Radiology at Hospital King Abdul Aziz Specialist (KAASH), Taif city. One hundred and fifty patient' medical records, who presented with various knee joint problems, and were referred from orthopedic and Rheumatology Departments after physical examination, were examined. Moreover, fifteen out of twenty (75 %) nurses working at the same above setting were included in the study.

2.4.Tools of study An observation checklist, for data collection from medical records which was included Socio-demographic data, clinical history and complains, MRI examination findings were recorded from the entire study sample. In addition ,well designed questioner for nurses' participated which included Socio-demographic data, 7 questions related to nurses' role in patient preparation for MRI before, one question during MRI procedure, and 3 question after MRI procedure.

Magnetic Resonance Imaging (MRI) Instrument

Knee joints were imaged by using transmit receive four-channel knee coil and 1.5 Tesla Philips Gyro scan ACS-NT super conductive magnet with a useful aperture of 61 cm in diameter and dedicated extremity coils (surface coils) as both transmitter and receiver of radio-frequency waves was applied. The imaging system is enclosed in a radio frequency room .In the evaluation of internal Disturbance of the knee routine protocols included T1-weighted images in the axial, sagittal and coronal planes and T2*-weighted two- dimensional (2D) or (3D) Fourier transform gradient echo sagittal images were used.

The meniscal injuries appeared on MRI as an increased signal intensity in all pulse sequences applied (T1-weighted, T2- weighted, T2*-weighted, T2-weighted fast spin-echo, proton density and fat suppression techniques).

In Ligamentous injury ,Those injuries appeared as an increased signal intensity on T2- weighted and T2*-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 tout parallel margin, especially in the complete tears. Acute trauma, arthritis, infection, and neoplastic required T2- or fast spin-echo T2-weighted images.

Joint effusion demonstrated low signal intensity on T1 weighted images and bright signal intensity on corresponding T2-weighted images'

MRI evidence of OA includes: Subchondral sclerosis and cysts, Osteophyte formation, narrowing of joint space, Deformity and misalignment.

Nursing role

Before MRI, the nurse should assess for conditions that may require special consideration during the study or that may be contraindications to the study (eg, pregnancy; claustrophobia; inability to tolerate required positioning due to age, debility, or disability; metal implants). It is essential that the patient remove all jewelry, hair clips, hearing aids, and other metal before having an MRI. Explain that fasting or drinking only clear liquids may be necessary for some MRI scans; also, no alcohol, nicotine, caffeine, or iron supplements may be taken before testing. Make sure that the purpose, procedure, benefits, and risks of the MRI have been explained to the patient. Sedation may be required if patient is claustrophobic or otherwise unable to lie still during the procedure. Assure the patient that a two-way communication system between him and the operator will allow for continual monitoring and vocal feedback.

During MRI, Reassure the patient during testing.

Post-MRI: Evaluate patient outcome, and counsel appropriately. Monitor for sensitivity reactions and adverse reactions of gadolinium 50-DTPA contrast. Assess contrast injection site for signs of inflammation, bruising, irritation, infection, or extravasations of contrast agent. (Nurses Quick refer to common laboratory and diagnostic test, 2006, Suzanne and Smeltzer et al.2010 and The American College of Radiology, 2014).

2.5.Method of data collection:

A formal approval was obtained from Ethics and Scientific Committee of KAASH. Data was collected from patient medical records during period from Sep 2013 to Oct 2014. Verbal approval was taken from for every nurse for participation in the study , after explanation of purpose as well as the questioner of the study .after data collection all data had been coded and entered into computer for data analysis by utilizing SPSS program.

2.6.Statistical Study:

The statistical Package for (SPSS) version (20) was used to analyze data. Descriptive statistics was used included: Frequencies, and percentages. Cross tabulation between MRI with age and sex. The level of significance for this study was set at (p = 0.05) to detect any indication of differences found in the data available.

III. Results

Table 1: Distribution of the study sample according to age and sex N=150

Variable	SEX		Total N%
	MALE N %	FEMALE N%	
	109 (72.7%)	41 (27.3%)	
Age			
10<years	59(54.1%)	18(44%)	77(51.3%)
30<years	33(30.3%)	12(29.2%)	45(30%)
50- 60 y	17(15.6%)	11(26.8%)	28(18.7%)
TOTAL	109 (100%)	41(100%)	150(100%)

Figure 1: Number and percentage of the study sample according to age and Sex N=150

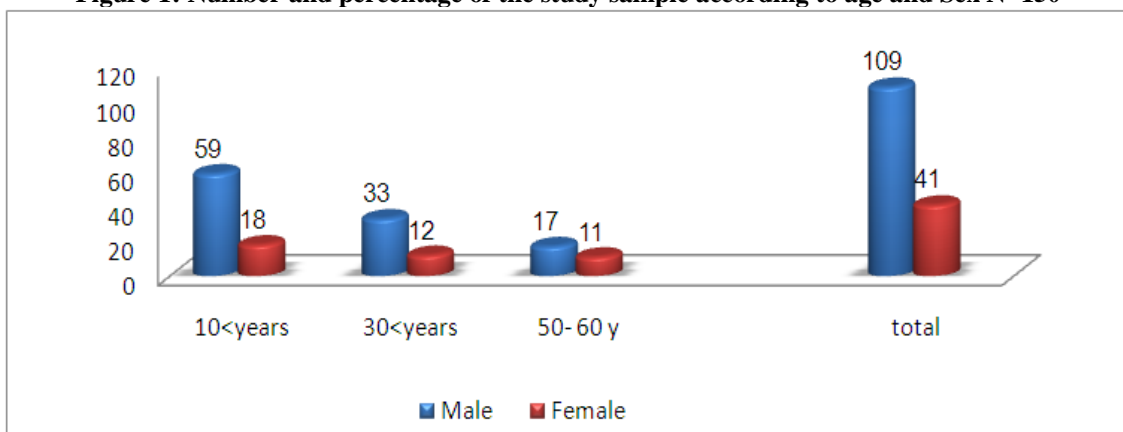


Table 1 and figure 1: Distribution of the study sample according to age and sex: This table shows that the most common age and sex affected was the age group of 10-29 y.(54.1%) for males ,(44%)for females, follow 30-49years(30.3% males ,29.3% females) and 50 or more.(15.6% males,26.8% for females).Majority of participant are male 72.7%.

Table 2: The Distribution of patients according to causes of referral or clinical diagnosis N=150

Cause of Referral	Clinic diagnosis	Frequency	Percentage
Swelling ,pain		53	35.3%
Joint effusion		37	24.7%
Injury (tear and degeneration)		27	18.0 %
Trauma		22	14.7%
Road traffic accident		11	7.3 %

Table 2: This table, represent: Swelling and pain (35.3%) more common causes of referral, follow by Joint effusion (24.7) , injury , trauma and road traffic accident represent (18%,14.7%,and 7.3%, respectively) .

Table 3: The Distribution of patients according to MRI finding N=150

MRI finding	Frequency	Percentage
Osteoarthritis	37	24.7%
Ligamentous Injury collateral sprains and tears;	35	23.3%
Meniscal disorder (tear)	29	19.3%
Normal	27	18.0%
Joint effusion	22	14.7%

Table 3: This table show that the most common MRI finding are osteoarthritis, Ligamentous injury and meniscal disorder (24.7%,23.3%,and 19.3%,respectively),followed by normal and joint effusion(18%,14.7%,respectively)

Table 4: Association between Clinical diagnosis and MRI Finding N=150

Clinic referral (clinical diagnosis)	MRI finding					x. squire	p. value
	Meniscal disorder (tear)	Ligamentous Injury (collateral sprains and tears)	Normal	Joint effusion	Osteoarthritis		
Swelling ,pain N=53	5(9.5%)	11(20.7%)	21(39.6 %)	5(9.5%)	11(20.7%)	61.7	0.000 HS**
Joint effusion N=37	15(40.5%)	3(8.1%)	1(2.7%)	12(32.5%)	6(16.2%)		
Injury N=27	5(18.5%)	10(37%)	2(7.4%)	3(11.1)	7(26%)		
Trauma N=22	4(18.1%)	9(41%)	1(4.5%)	1(4.5)	7(31.9%)		
Road traffic accident N=11	0	2(18.2%)	2(18.2%)	1(9.0%)	6(54.6%)		
total	29(19.3%)	35(23.3%)	27(18%)	22(14.7%)	37(24.7%)		

Table 4: This table show high statistical significance difference between clinical diagnosis and MRI finding P=0.00

Table 5: Association between MRI finding and age N=150

MRI finding	Age				x. squire	p. value
	10-29y N=77	30-49y N=45	50 and more N=28	Total 150		
Meniscal disorder (tear)	13(16.9%)	6(13.3%)	10 (35.7%)	29(19.3%)	15.04	0.05 S
Ligamentous Injury(collateral sprains and tears)	20(26.0%)	12(26.7%)	3(10.7%)	35(23.3%)		
Normal	17(22.0%)	8(17.8%)	2(7.2%)	27(18%)		
Joint effusion	14(18.2%)	4(8.9%)	4(14.3%)	22(14.7%)		
Osteoarthritis	13(16.9%)	15(33.3%)	9 (32.1%)	37(24.7%)		

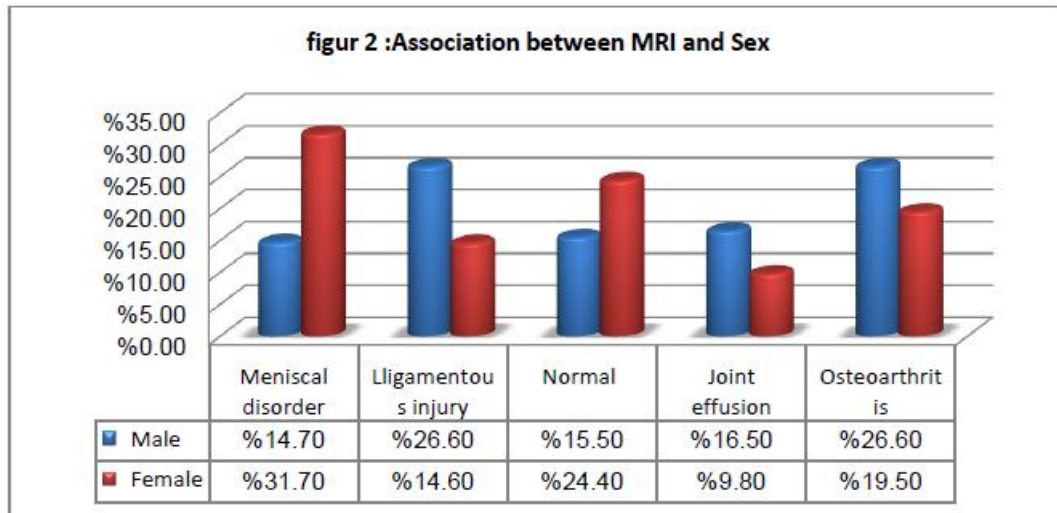
Table 5: Association between MRI finding and age ,this table showed that, most common finding by MRI between age 10-29 years include Ligamentous Injury, normal, joint effusion, Osteoarthritis and Meniscal disorder (26% ,22%,18.2%,16.9%, respectively),follow by age 30-49y,represent in Osteoarthritis ,Ligamentous Injury, Normal, Meniscal disorder and joint effusion (33.3 % ,26.7% 17.8%,13.3% and 8.9%,respectively),regard age

more than 50 years most finding , Meniscal disorder, Osteoarthritis ,(35.7%,32.1% respectively)and there are statistical significance difference between age and MRI finding $P \leq 0,05$.

Table 6: Association between MRI finding and Sex N=150

MRI finding	Sex			x. squire	p.value
	Male N=109	Female N=41	Total 150		
Meniscal disorder (tear)	16(14.7%)	13(31.7%)	29 (19.3%)	9.1	0.05 S
Ligamentous Injury(collateral sprains and tears)	29(26.6%)	6(14.6%)	35(23.3%)		
Normal	17(15.5%)	10(24.4%)	27(18%)		
Joint effusion	18(16.5%)	4(9.8%)	22(14.7%)		
Osteoarthritis	29(26.6%)	8(19.5%)	37(24.7%)		

Table 6 and figure 2: Association between MRI finding and Sex, this table represent most common finding by MRI in male compared with female, Ligamentous injury (collateral sprain and tears),Osteoarthritis, Joint effusion , Normal and Meniscal disorder (tear) (26.6%,16.5%,15.5%,&14.7%, respectively)but in female, Meniscal disorder (tear),Normal, Osteoarthritis, Ligamentous injury and joint effusion(31.7%,24.4%,19.5%,14.6% and 9.7%,respectively) and there are statistical significance difference between sex and MRI finding $P \leq 0,05$.



Table(7). Demographic characteristic of nurses participant N=15

Variable	N	%
Age (years)		
20-39	14	93.3%
40-60 years	1	6.7%
Qualification		
Diploma Degree of Nursing	1	6.7%
Bachelor Degree in Nursing	14	93.3%
Occupation		
Staff nurse	14	93.3%
Head nurse	1	6.7%
Years of Experience		
1 - 5 years	2	13.3%
6-10years	7	46.7%
11 and more	6	40%

Table 7:This table represent characteristic of participant nurses ,majority of nurses' age below 40 years ,bachelor and staff nurse (93.3%).Regarding years of experience ,most of nurses years of experience 6-10 years ,follow by 11 or more (46.7%,40%,respectively).

Table (8):Nursing role regarding patient preparation for MRI N=15

Nursing role	Perform	Not perform
Before procedure		
The nurse should assess for conditions that may be contraindicated to MRI (eg, pregnancy);	15(100%)	0
It is essential that the patient remove all jewelry, hair clips, hearing aids, and other metal before having an MRI	10(66.7%)	5(33.3%)
Explain that fasting or drinking only clear liquids may be necessary for some MRI scans; also, no alcohol, nicotine, caffeine, or iron supplements may be taken before testing.	7(46.7%)	8(53.3%)
Make sure that the purpose, procedure, benefits, and risks of the MRI have been explained to the patient	15(100%)	0
Sedation may be required if patient is claustrophobic or otherwise unable to lie still during the procedure	11(73.3)	4(26.7)
Assure the patient that a two-way communication system between him and the operator will allow for continual monitoring and vocal feedback.	11(73.3)	4(26.7)
Assess environment condition of MRI to prevent accident.	11(73.3)	4(26.7)
During procedure		
Reassure the patient during procedure	7(46.7)	8(53.3)
After procedure		
Evaluate patient outcome	7(46.7)	8(53.3)
Monitor for sensitivity reactions DTPA contrast	7(46.7)	8(53.3)
Assess contrast injection site for signs of inflammation, bruising, irritation, infection.	7(46.7)	8(53.3)

* DTPA (Diethylene Triamine Pentacetic Acid)

Table 8: This table shows that most of nurses perform patient preparation before MRI, but more than half of the nurses have poor performance regard patient preparation during procedure and after procedure (53.3% for each).

IV. Discussion

The purpose of this study was to demonstrate the diagnostic value of MRI in diagnosing the presence or absence of the most common injuries of the knee; the meniscus tears, the cruciate ligament ruptures and the Chondral defects and their relation with the age and sex of the patients in Taif -hospital Saudi Arabia, and investigate role of the nurse in preparing patient for MRI.

In the current study MRI examination medical record was performed on (150) patients with various knee complaints. Regarding the most common age group affected was the age group of 10-29y (51.3%) and majority of participants were male, 109 (72.7%) (Table 1 and figure 1). This indicated that knee injuries prevail mostly in young males and this is explained by the fact of this age group being the most active group and more susceptible to road traffic accidents and injury in the sport field. This finding agreement with Avcu et al. (2010), Rahman et al. (2010) and Nasir, (2013), who reported that most common age group affected was the age group of (21-40) and were mostly males.

One hundred and fifty medical records of patients with different complains and various age groups were referred from Orthopedic, Rheumatology department and outpatient clinic for MRI examination to confirm the diagnosis. The most common clinical diagnosis was swelling and pain (35.3%), joint effusion (24.7%), injury (18%), trauma (14.7) and road traffic accidents (7.3%), shown in **table 2**. This study agree with Mahmoud et al. (2013), reported that commonest clinical complaints were found to be a knee joint pain, swelling, and joint effusion.

Accurate diagnosis by using MRI regard, swelling and pain are (39.6% represent normal cases, 20.7% represent ligament injury, osteoarthritis, 9.5% represent meniscal disorders and joint effusion).

Regard joint effusion represent 37(24.7%) by MRI included (40.5% meniscal disorder, 32.5% joint effusion, 16.2% osteoarthritis, 8.1% ligament injury and 2.7% normal).

Regard Injury [tear and degeneration] 27(18%) by using MRI accurate diagnosis represent (Ligamentous Injury 37%, osteoarthritis 26%, Meniscal disorder 18.5%, joint effusion 11.1% and normal 7.4%).

Regard trauma 22(14.7%), by using MRI accurate diagnosis represent (Ligamentous Injury 41%, osteoarthritis 31.9%, Meniscal disorder 18.1%, 4.1% for joint effusion and normal)

Road traffic accident 11(7.3%), accurate diagnosis by MRI (54.6% Osteoarthritis, 18.2% normal, also Ligamentous injury and 9.1% joint effusion). There were statistical significant different between clinical diagnosis and MRI finding with higher accurate results in MRI diagnosis than clinical examination $P \leq 0.000$: Shown in **table 3** and **4**. This study supported by The American Academy of Orthopedic Surgeons supports MRI as an effective tool for evaluating knee injury and offers recommendations and guidelines for treating Ligamentous knee injury based on the findings of clinical examination and MRI. The Academy states that MRI is invaluable in preventing unnecessary surgery, and recommends it whenever Ligamentous injury is suspected (American Academy of orthopedic surgeons, 2009). 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 (Major et al.2003 and Zhang et al.2010).

Association between MRI finding, Sex and age, there were significance association between MRI findings, sex and age, $P \leq 0.05$, Shown in **table 4 and 5**. From (150) medical records of patients examined in this study, 123(82%) patients showed abnormal signs on MRI. Regard Ligamentous injury, there are 35 patients that showed anterior cruciate Ligamentous (ACL) injury on MRI .20(26.0%) patients in age 10-29y, 12(26.7%) in age 30- 49y, 3(10.7%) in age 50 and more .29(26.6%) were male and the other 6(14.6%) were females. This result explain ACL is the most often in knee ligaments, a complete tear of the ACL can lead to significance knee instability and limit physical activity. Also agreement with Nasir, (2013), who reported that: 16 patients (32%) that showed anterior cruciate Ligamentous injuries on MRI, 11 were male (22%) and the other 5 were females (15%). Also, Robertson et al.(1994), reported that the diagnosis accuracy of MRI in assessment of Ligamentous and cartilaginous injuries in the knee has been well documented and provides a basic standard on which to base any statistical observation.

Osteoarthritis (OA) was detected in 13(16.9%) in age 10-29y, follow 15(33.3%) in age 30-49y and 9(32.1%) in age 50 and more, and 29(26.6%) related male while female 8(19.5%). This result may be due to, previous trauma, smoking and obesity among male more than female. Also number of male in this study more than female. This study agreement with Silman et al.(1993), Zhang et al. (2010), 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, Ismail et al.2006 and Azam et al.2013.)

Regard meniscal disorder there were 29 patients that showed meniscal disorder on MRI. 10(35.7%) in age 50 or more, 13(16.9) patients in age 10-29y and 6(13.3%) in age 30-49y. 13(31.7%) were females and 16(14.7%) were males. The results of the present study demonstrate that meniscal injuries can be accurately diagnosed by MRI and support the findings of other studies and agreement with results obtained by Uppal et al.(1998), who highlighted that MRI of the knee has been shown to be accurate in the assessment of menisci in addition to Ligamentous and Articular. Also Cheung et al. (1997), Khanda et al.(2008) and Rahman et al.(2010), reported that patients having meniscal injuries of knee joint were mostly males (91%) with 70 % patients ranging between ages of 21–40. This indicated that meniscal injuries prevail mostly in young males. This is in accordance with international studies which favour young male predilection for meniscal injuries (Ahmad et al. 2005 ,Khanda et al. 2008 and Nikolaou et al .2008).

Regard Joint effusion there were 22 patients that showed Joint effusion on MRI. Joint effusion represent 14(18.2%) in age 10-29y, 4(8.9%) in age 30-49 and 4(14.3%) more 50 y, more common among male 18(16.5%) and 4(9.8%) in female. This result supported by Nasir,(2013), who reported that Joint effusion was detected in 10 patients (20%), (7) knee were related to male patients (14%) and other 3 knees were related to female patients (6%).

Regarding normal cases, approximately one fifth of clinical diagnoses cases were approved by MRI as normal. Which denote the need for more training on skills of orthopedic clinical examination for physician?

To the best of our knowledge no research articles were found regarding role of the nurse for patient preparation of MRI for knee injuries. However majority of researches were related to clinical, pathological, and radiological aspect of knee injuries. Accordingly we consider this study as first study regarding this issue. Our study highlighted the reasonable performance of nurses regarding MRI patient preparation before procedure. However, there was severe shortage of nurses' performance regarding MRI patient preparation, during or after procedure, which denotes the need for in-service training program for nurses working in KAASH.

V. 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 osteoarthritis, Ligamentous Injury collateral sprains and tears, Meniscal disorder (tear) and there are statistical significance difference between sex, age and MRI finding $P \leq 0.05$. Approximately one fifth of clinical diagnoses cases were approved by MRI as normal. Which denote the need for more training on skills of orthopedic clinical examination for physician. Most of nurses perform patient preparation before MRI reasonably, but more than half of the nurses have poor performance regarding patient preparation during and after procedure.

VI. Recommendation

1. The study recommended that, MRI should be used as a routine examination method
2. Implementation of similar study with larger sample size of nurses at different sittings in KSA should be done.
3. In-service training program should be planned and implemented for nurses working at KAASH about MRI patient preparation, either before or during, or after procedure.
4. Researches should be done, in the future, at high altitude areas to study its effect on the knee joints.

Acknowledgement

The authors thank deanship of scientific research, King Abdul-Aziz Specialist Hospital (KAASH). Taif City-Saudi Arabia for allowing collection of data to complete this study and grateful thanks for our Colleague, Prof.Dr. laila Dorgham for her valuable and meticulous review.

References

- [1]. 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.
- [2]. American Academy of Orthopedic Surgeons (2009): Common knee injuries. Available at: <http://orthoinfo.aaos.org/topic.cfm?topic=A00325>.
- [3]. American College of Radiology (2009): Manual on Contrast Media .<http://www.acr.org/> Secondary Main September 11, 75.
- [4]. American College of Radiology(2014):Acr–ssr practice parameter for the performance and interpretation of magnetic resonance imaging (mri) of the knee.
- [5]. Avcu S., Altun E., Akpınar I., Bulut D., Eresov K and Biren T.(2010):Knee joint examinations by magnetic resonance imaging: The correlation of pathology, age, and Sex,North American Journal of Medical Sciences. April, Volume 2.No. 4.
- [6]. Azam Md Q , Al-Othman A A., Sadat-Ali M and Tantawy A A. (2013):Topical herbal analgesic and anti arthritic (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.
- [7]. Brenner, Barry C., David C., Sunday C. and Carlos A.(2011): Positive association between attitude and suicide in 2584 U.S. counties. *High Altitude Medicine & Biology* 12 (1): 31–35.
- [8]. Cheurg L.P., LI KCP and Hollett M.D.(1997): Meniscal tears of the knee: Accuracy of detection with fast spin-echo MR imaging and arthroscopic correlation in 293 patients, *Radiology*, 203, 508-512 .
- [9]. 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.
- [10]. Duc SR, Pfirrmann CW, Koch PP, Zanetti M, Hodler J.(2008): Internal knee derangement assessed with 3-minute three-dimensional isovoxel true FISP MR sequence: preliminary study. *Radiology*; 246:526-535.
- [11]. Guermazi A, Roemer FW, Burstein D, Hayashi D. (2011): Why radiography should no longer be considered a surrogate outcome measure for longitudinal assessment of cartilage in knee osteoarthritis. *Arthritis Res Ther* 13: 247.
- [12]. Ha TP, Li KC, Beaulieu CF. (1998): Anterior cruciate ligament injury: fast spin echo MR imaging with arthroscopic correlation in 247 examinations. *AJR Am J Roentgenol*; 170: 1215-1219.
- [13]. Hoyy, Stanley AJ, Hui JH, Wang SC.(2007):Postoperative evaluation of the knee after autologous chondrocyte implantation: what radiologists need to know? *Radiographics*; 27:207-220; discussion 221-202.
- [14]. Hollingworth W., Dixon A. K., & Jenner J. R. (2011): Imaging for Knee and Shoulder Problems. In L. S. Medina, C. C. Blackmore & K. E. Applegate (Eds.), *Evidence-Based Imaging: Improving the Quality of Imaging in Patient Care* (1st ed., pp. 309–326). New York: Springer.
- [15]. Hughes LC; Archer CW; and Gwynn I . (2005): The ultra structure of mouse Articular cartilage: collagen orientation and implications for tissue functionality. A Polarised light and scanning electron microscope study and Review, *European cells and materials*, (9) 68-84.
- [16]. 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.
- [17]. Khanda GE., Akhtar W., Ahsan H., Ahmad N.(2008). Assessment of menisci and ligamentous injuries of the knee on magnetic resonance imaging: correlation with arthroscopy. *J Pak Med Assoc*; 58:537–40.
- [18]. Knee Pain Health Center (2012): Magnetic Resonance Imaging (MRI) of the Knee, WebMD Medical Reference from Healthwise, www.healthcenter.vt.edu.
- [19]. Koster IM, Oei EH, Hensen JH, Boks SS, Koes BW, et al. (2011):Predictive factors for new onset or progression of knee osteoarthritis one year after trauma: MRI follow-up in general practice. *Eur Radiol* 21: 1509-1516.
- [20]. Major MM, Beard LN, Helms CA.(2003): Accuracy of MRI of knee in adolescent. *AJR. Am J Roentgenol*; 180:17–9.
- [21]. McCraig LF. National Hospital Ambulatory Medical Care Survey(1994): emergency department summary. 245: 1-12.
- [22]. Mahmoud Z.M.,Fagiri A.M., Al-Motrfi F.A.,Suliman 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
- [23]. 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.
- [24]. Nikolaou VS, Chronopoulos E, Savvidou C, et al..(2008): MRI efficacy in diagnosing internal lesions of the knee: a retrospective analysis. *J Trauma Manag Outcomes* 2008; 2: 4.
- [25]. *Nurses' Quick Reference to Common Laboratory & Diagnostic Tests* (2006): 4th ed., Fischbach and MB Dunning, Lippincott Williams & Wilkins.
- [26]. Tomasz P.(2014):Osteoarthritis of the Knee: Assessing the Disease *Paradowski, Health Care* ,Volume 2 , Issue 2 , 1000e103 P2:4 <http://dx.doi.org/10.4172/hccr.1000e103>
- [27]. Rahman A., Nafees M., Akram H.M., Andrabi H.A and Zahid M.(2010):Diagnostic accuracy of magnetic resonance imaging in meniscal injuries of knee joint and its role in selection of patients for arthroscopy. *J Ayub Med Coll Abbottabad*;22(4)
- [28]. Ramnath RR, Magee T, Wasudev N, Murrath R. (2006):Accuracy of 3-T MRI using fast spin-echo technique to detect meniscal tears of the knee. *AJR Am J Roentgenol*; 187:221-225.

- [29]. Robertson PL, Schweitzer ME, Bartolozzi AR. et al.(1994): Anterior cruciate ligament tears: evaluation of multiple signs with MR imaging. *Radiology*; 193: 829-834.
- [30]. Rubin DA.(1997):MR imaging of the knee menisci.*RadiolClin North Am*; 35: 21-44
- [31]. Ryan PJ, Reddy K, Fleeteroft J.(1999): A prospective comparison of clinical examination, MRI, bone SPECT, and arthroscopy to detect meniscal tears. *ClinNucl Med*;23:803-6.
- [32]. Saraswathi KP.(2009): Analysis of the problems of the aged above 60 years in a selected urbancommunity in Hyderabad. *Nursing Journal of India*; 91(4): 86-88.
- [33]. Schiffert Health Center(2010): Knee Injury, www.healthcenter.vt.edu.
- [34]. Silman AJ, Hochberg MC. (1993): *Epidemiology of the rheumatic diseases*. Oxford: Oxford University Press.
- [35]. Shellock FG.(2009): *Reference Manual for Magnetic Resonance Safety, Implants, and Devices*. 2009 ed. Los Angeles, Calif.: Biomedical Research Publishing Company.
- [36]. Shetty DS, Lakhkar BN, Krishna GK.(2002): Magnetic Resonance Imaging in Pathological Conditions of Knee.*Ind J RadiolImag*;12:375-87.
- [37]. Sobhy H .A. (2014): Effect of High Altitude Hypoxia on the Knee Menisci of Rat, *International Journal of Advanced Research*, Volume 2, Issue 2, 958-972.
- [38]. Suzanne C. Smeltzer RNC, Brenda G. Bare , Janice L. Hinkle , Kerry H. Cheever (2010): *Brunner and Suddarth's Textbook of Medical Surgical Nursing*,12th edition, Lippincott company.
- [39]. SymmonsD.,Mathers C. and PfliegerB.(2000): Global burden of osteoarthritis in the year 2000.
- [40]. Thornton DD, Rubin DA.(2000): Magnetic resonance imaging of the knee menisci.*SeminRoentgenol*; 35:217-30.
- [41]. Uppal A., Disler D.G. and Short W.B. et al.(1998): Internal derangements of the knee: Rates in patients referred by physicians who are not orthopedic surgeon, *Radiology*, 207, 633-636.
- [42]. Vignon E, Valat J, Rostignol Met al.(2006): Osteoarthritis of the knee and hip and activity: a systematic international review and synthesis (OASIS). *Joint Bone Spine*. 73:442-55.
- [43]. Vincken, P. W., terBraak, B. P., van Erckel, A. R., de Rooy, T. P., Mallens, W. M., Post, W., & Bloem, J. L. (2002): Effectiveness of MR imaging in selection of patients for arthroscopy of the knee. *Radiology*,223(3), 739-746.
- [44]. Zhang Y, Jordan JM, (2010): Epidemiology of Osteoarthritis. *ClinGeriatr Med* 26: 355-369.
- [45]. Zubieta-Calleja, G. R.; Paulev, P-E., Zubieta-Calleja, L. Zubieta-Castillo, G. (2007). Altitude adaptation through hematocrit change. *Journal of Physiology and Pharmacology: an Official Journal of the Polish Physiological Society* 58 (Suppl 5(Pt 2)): 811-818.