Sudan University of Science and Technology
College of Graduate Studies

A Study of Meniscus Tear In Knee Joint Using MRI

دراسة تمزق الغضروف الهلالي بالركبة باستخدام التصوير بالرنين المغناطيسي

A Thesis Submitted in Partial Fulfillment of the Requirement of MSc Degree in Diagnostic Medical Imaging

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الاية

قآل الله تعآلى:

{ اقْرَأْ بِاسْمِ رَبِّكَ الَّذِي خَلَقَ (1) خَلَقَ الْإِنْسَانَ مِنْ عَلَقٍ (2) اقْرَأْ وَرَبُّكَ الْأَكْرَمُ (3) الَّذِي عَلَّمَ بِالْقَلَمِ (4) عَلَّمَ الْإِنْسَانَ

مَا لَمْ يَعْلَمْ (5) كَلَّا إِنَّ الْإِنْسَانَ لَيَطْغَى (6) أَنْ رَآهُ اسْتَغْنَى (7) إِنَّ إِلَى رَبِّكَ الرُّجْعَى (8) أَرَأَيْتَ الَّذِي يَنْهَى

(9) عَبْدًا إِذَا صَلَّى (10) أَرَأَيْتَ إِنْ كَانَ عَلَى الْهُدَى (11) أَوْ أَمَرَ بِالتَّقْوَى (12) أَرَأَيْتَ إِنْ كَذَّبَ وَتَوَلَّى (13) أَلَمْ

يَعْلَمْ بِأَنَّ اللَّهَ يَرَى (14) كَلَّا لَئِنْ لَمْ يَنْتَهِ لَنَسْفَعًا بِالنَّاصِيَةِ (15) نَاصِيَةٍ كَاذِبَةٍ خَاطِئَةٍ (16) فَلْيَدْعُ نَادِيَهُ (17)

سَنَدْعُ الزَّبَانِيَةَ (18) كَلَّا لَا تُطِعْهُ وَاسْجُدْ وَاقْتَرِبْ (19) }

سورة العلق

Dedication

To my father, mother, sister

brothers, friends,

colleagues, and my teachers

Acknowledgment

First of all thank to Almighty Allah for giving me the knowledge and strength to complete this dissertation. I would like to express my deep gratitude to my supervisor **Dr.Hussein Ahmed Hussein** for his keen supervision, encouragement and support through this work.

I'm sincerely thanking all those who helped me specially my lovely Extended family.

Finally, thanks are extended to the staff of Modern Medical Center, my colleagues and friends for their effort.

List of Abbreviations

MRI	Magnetic Resonance Image
ACL	Anterior Cruciate Ligament
PCL	Posterior Cruciate Ligament
ECM	Extra Cellular Matrix
NMR	Nuclear Magnetic Resonance
B_0	Magnetic Field
D	Dimensional
CT	Computer Tomography
FOV	Field of View
TSE	Time Spin Echo
PD	Proton Density
TE	Time Echo
T	Tesla
MMC	Modern Medical Center
MM	Mile Meter
DNA	Deoxyribonucleic Acid
MFFE	Multislise Fast Filed Echo
CM	Cent Meter
MSEC	Mile Second
T_1	Relaxation Time
T_2	Decay Time
Fat Sat	Fat Saturation
SPAIR	Spectral Attenuated Inversion Recovery
SAG	Sagittal
COR	Coronal

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Abstract

The main objective of this study was to study meniscus tear using MRI, and described the correlation of meniscus tear to age, sex, the identification most of the side affected, the data was collected and conducted in the modern medical center during the period from March 2018 to In May 2018, General Electron Electron Microscope 1.5 Tesla was used. The study included a sample of 50 patients, 36 males and 14 females. The study found that the prevalence of meniscus tear in males was 72% and in females 28% aged 19 to 75. in the age group from 19 to 39 and its proportion 44%, followed by 40% to 59%, followed by 60% to 79%. The study found that the affected side was the left knee 78% and the left knee 22%. The most common type of intermediate meniscus tear was 76%, 20% and finally 4%, and most of the meniscus tear was caused by shock. This study concluded MRI that helps to identify and classify the degree of meniscus tear.

الخلاصة

الهدف الرئيسي من هذا البحث هو دراسة تمزق الغضروف ، ووصفت ارتباط تمزق الغضروف الي العمر و الجنس و تحديد جانب الغضروف الاكثر ضراراً بإستخدام التصوير بالرنين المغناطيسي، تم جمع البيانات واجريت الدراسة في المركز الطبي الحديث خلال الفترة من شهر مارس 2018 الي شهر مايو 2018، تم إستخدام جهاز الرنين المغنطيسي جنرال الكترون 1.5 تيسلا، تشمل الدراسة عينة من 50 مريض وهم 36 ذكر و 14 انثى من نتائج الدراسة ان انتشار تمزق الغضروف في الذكور 72% وعند الاناث 28% تتراوح اعمارهم بين 19 الي 75 وان انتشار التمزق في الفئة العمرية من 19 الي 39 ونسبتها 44% تليها الفئة من 40 الي 59 نسبتها 36% تليها 60 الي 79 نسبتها 20%، و ان الغضروف المتضرر من التمزق هو غضروف الركبة اليسري ونسبتها 78% وغضروف الركبة اليمني 22%، اظهرت الدراسة ان درجة تمزق الغضروف الاكثر شيوعاً هي الدرجة 3 نسبتها 60% تليها الدرجة 2 نسبها 36% تليها الدرجة 1 نسبتها 4%، كما ان الاكثر شيوعا في تمزق الغضروف الوسيط 76% كان اكثر من التمزق المشترك وهي 20% و الاقل حدوثاً هو الجانبي 4%، و معظم تمزق الغضروف ناتج عن الصدمة، خلصت هذة الدراسة ان التصوير بالرنين المغناطيسي يساعد في التعرف و تصنيف درجات تمزق الغضروف .

Chapter one

Introduction

Chapter one

1.1 Introduction

The knee joint is a common site of injury due to trauma, repetitive activities, and sports activities. Clinical tests used in the diagnosis of meniscal and ligament injuries have limitations and it may be difficult to elicit objective signs repeatedly, mainly due to pain in an acute or subacute presentation. History taking regarding the mechanism of knee injury gives a vital clue to the structures injured in the knee joint. Hyperextension with an audible pop would suggest an anterior cruciate ligament (ACL) tear. A direct blow to the knee from the side would point toward collateral ligament injury, and from the front, would indicate a cruciate ligament injury. Although clinical examination is most important for the diagnosis of a ligament injury, painful stress examinations are not always accurate in the acute phase of the injury. Clinical tests may be confusing and may cause a delay in diagnosis. Therefore, complementary diagnostic tools are often necessary, mainly when suspicion of multiple lesions exists (Sheung-et al,2017).

Magnetic resonance imaging (MRI) has a better soft tissue contrast and multiplanar slice capability which has revolutionized and has become the ideal modality for imaging the complex anatomy of the knee joint.(Kaplan,et al,1992)

MRI is a completely noninvasive diagnostic modality and there is no ionizing radiation. Moreover, the ligaments of the knee are divided into intraarticular and extraarticular. MRI plays a most important role in their evaluation. This division is important, as the extraarticular ligaments are not visible on routine arthroscopic procedures. However, identification of meniscal tears can be difficult to interpret and can be observer dependent as well as dependent upon the sensitivity of the scanner. (Straeten,2014)

1.2 The Problem of Study:

meniscus tear common in old and young special sports and trauma, the accurate diagnosis of meniscus tear will help in cure without complication MRI is image mobility's choice to diagnosis.

1.3 objectives of the study:

1.3.1 General objective:

To study meniscus tear in MRI.

1.3.2 Specific Objectives:

- To correlation meniscus tear to age.
- To correlation meniscus tear to gender.
- To identify the most comes side.

1.4 Significance of Research:

This research aims to verify that MRI is has revolutionized imaging of the knee and become the “gold standard” for meniscus diagnosis.

1.5 Research overview:

The research will fall in five chapters: chapter one deal with the introduction, objectives, problem, where chapter two deal with literature review and previous studies, chapter three deal with materials and methods where chapter four presents the results and five deal with discussion conclusion and recommendations.

Chapter Two

Background and literature review

Chapter two

Background and literature review

2.1 anatomy of meniscus

The word meniscus comes from the Greek word me-niskos, meaning "crescent," diminutive of me-ne-, meaning "moon." The menisci are semilunar discs of fibrocartilaginous tissue which are vital for the normal biomechanics and long-term health of the knee joint.

The characteristic shape of the lateral and medial menisci is attained between the 8th and 10th week of gestation. They arise from a condensation of the intermediate layer of mesenchymal tissue to form attachments to the surrounding joint capsule (Gardner, el al,1968) (Gray, el al,1950).

The knee menisci are fibrocartilaginous structures that sit within the knee joint, deepening the tibiofemoral articulation. They function to improve stability, shock absorption and load transmission of the knee. (Yuranga,2008) (Henry,2012)

2.2 Gross anatomy

There are two knee menisci in each joint: medial and lateral. The menisci are described as having a central body with anterior and posterior horns. In cross-section, they have a triangular (bow-tie) shape, being thicker peripherally and thinning to a free-edge centrally. Each meniscus has a differing shape, size and attachments. (Yuranga,2008) (Henry Knipe,2012)

2.3 medial meniscus

C-shape or semilunar and Larger and more open and wider semi-circular in shape. (Yuranga,2008) (Henry Knipe,2012)

2.3.1 Medial Meniscus Attachments

The anterior horn of the medial meniscus attaches immediately anterior to the tibial attachment of the anterior cruciate ligament (ACL) in the intercondylar area. (Yuranga,2008) (Henry,2012)
lateral aspect attached to the deep (third) layer of the medial collateral ligament posterior horn is attached to the posterior intercondylar area of the tibial plateau, between PCL insertion posteriorly and posterior root attachment of lateral meniscus, anteriorly. (Yuranga , 2008) (Henry,2012)

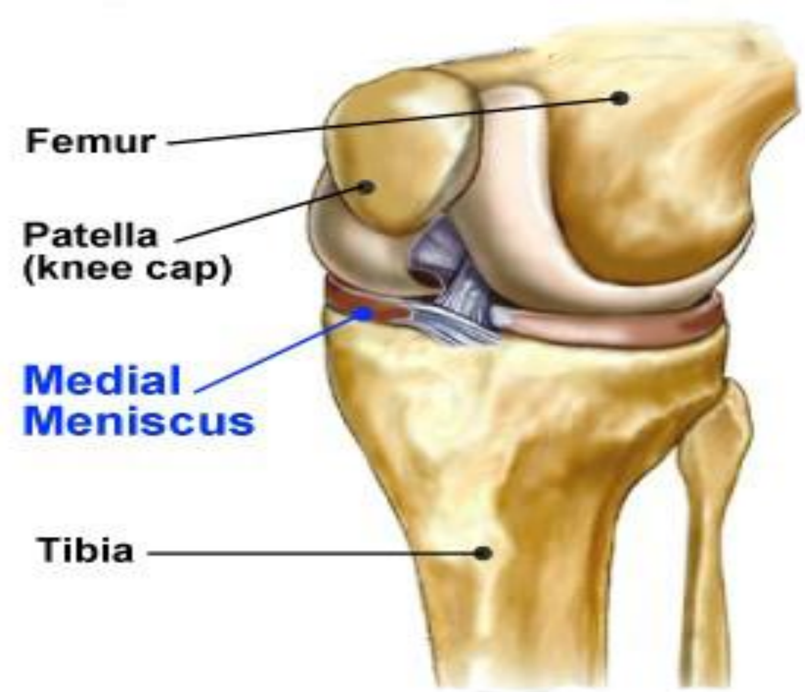

figure (2-1) medial meniscus anatomy

2.4 lateral meniscus

Semicircular-like an incomplete circle, anterior and posterior and tibial roots are very close to each other and Smaller. (Yuranga , 2008) (Henry,2012)

2.4.1 lateral meniscus attachments

The anterior horn of the lateral meniscus attaches immediately lateral to the tibial attachment of the ACL on the intercondylar area. (Yuranga,2008) (Henry,2012)

no attachment to the lateral collateral ligament except anterior horn and posterior most portion of posterior horn; this is due to the passage of the intra-articular portion of the popliteus tendon. (Yuranga,2008) (Henry,2012)

posterior horn of the lateral meniscus attaches to the posterior intercondylar area of the tibial plateau anterior to the medial meniscus and posterior to ACL. (Yuranga,2008) (Henry,2012)

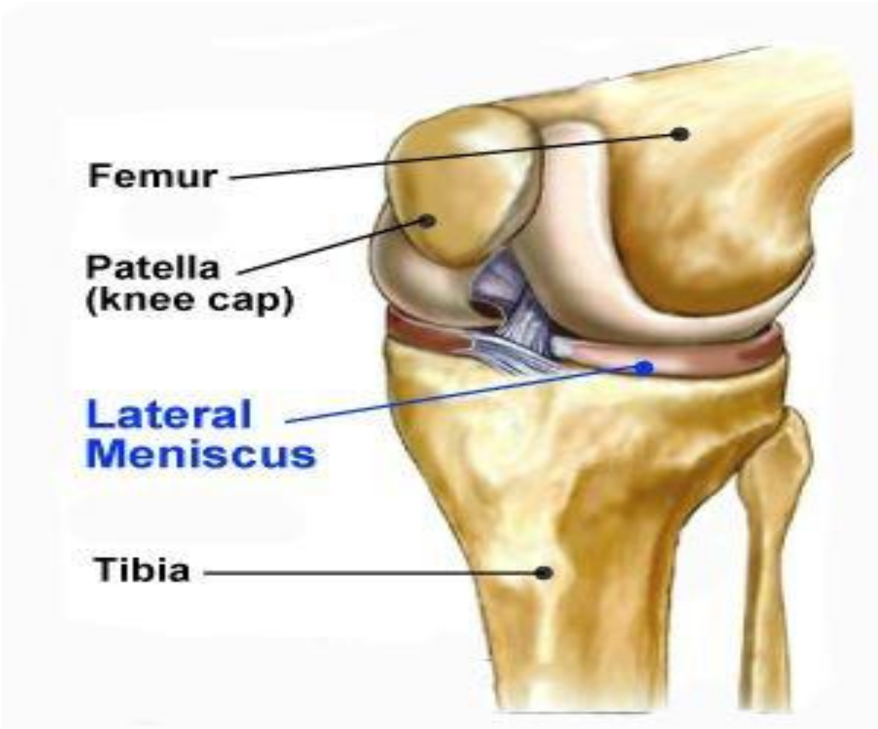

figure (2-2) lateral meniscus anatomy

2.5 Extracellular matrix and cellularity

Considering composition by wet weight, the meniscus has high water content (72 %), The remaining 28 % consists of an organic component, mostly ECM and cells, collagens comprise the majority (75 %) of the organic matter, followed by DNA (2 %), adhesion glycoproteins (<1 %), and elastin (<1%). (Makris, et al,2011) (Herwig, et al,1984)

These proportions vary according to age, injury, or pathological conditions. (Herwig, et al,2001)

Collagen is the main fibrillar component of the meniscus. Different collagen types exist in various quantities in each region of meniscus, In the red–red zone, type I collagen is predominant (80 % composition in dry weight). In the white–white zone, 60 % is type II collagen and 40 % is type I collagen. (Herwig, et al,2001)

The major orientation of collagen fibers in the meniscus is circumferential; radial fibers and perforating fibers also are present. (Cheung,1987)

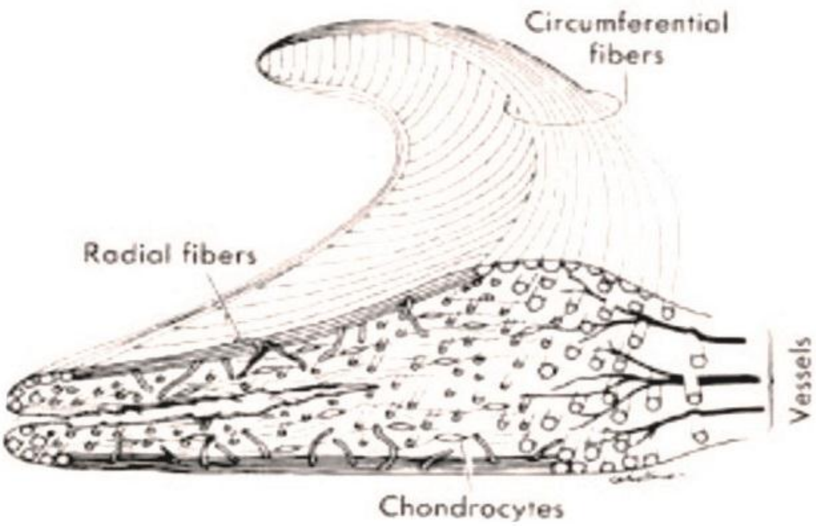

figure (2-3) fibers in the meniscus with interspersed cells

2.6 Blood supply

outer one-third: supply from the peripheral meniscal plexus, in turn formed from the medial, lateral and middle genicular arteries. (Stuart, et al,2005) (Brindle, et al,2010)

inner two-thirds: no vascular supply, diffusion dependent. (Stuart, et al,2005)

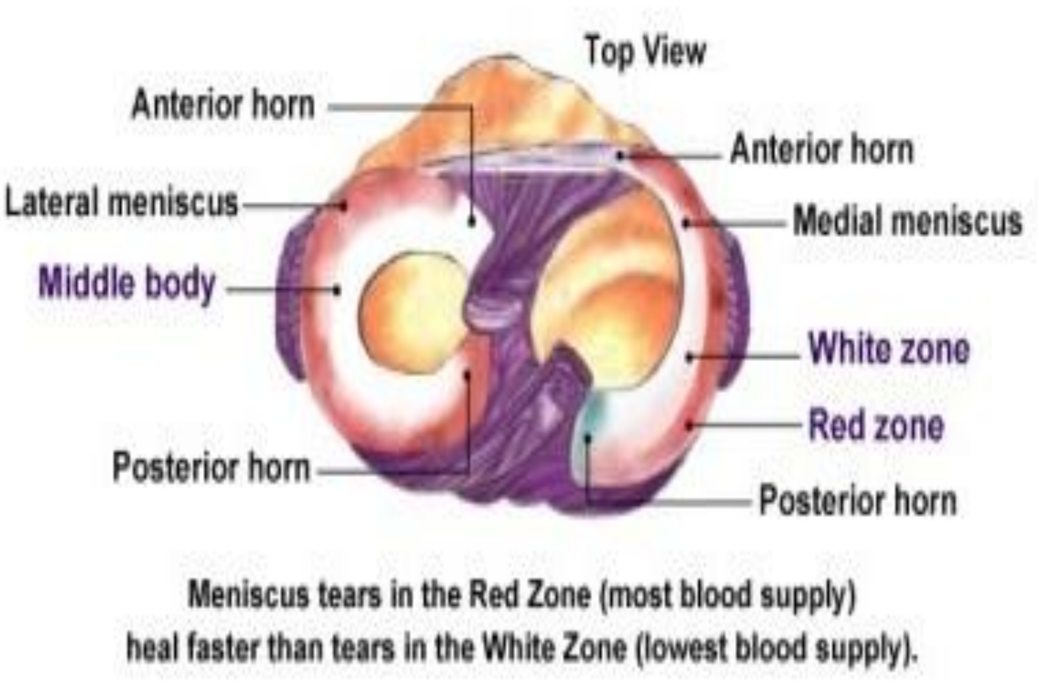

figure (2-4) menisci blood supply

2.7 Innervation

posterior articular branch of the tibial nerve and terminal obturator and femoral nerve branches. (Brindle, et al,2010)

2.8 Biomechanical Function

The biomechanical function of the meniscus is a reflection of the gross and ultrastructural anatomy and of its relationship to the surrounding intra-articular and extra-articular structures. The meniscus withstands many different forces such as shear, tension, and compression. It also plays a crucial role in load-bearing, load transmission, shock absorption, stability, propioception as well as lubrication and nutrition of articular cartilage. (Cameron, et al,1972) (Tissakht, et al,1996).

They also serve to decrease contact stresses and increase contact area and congruity of the knee. (Kettelkamp, et al,1972) (Walker, et al,1975).

2.8.1 Load transmission

Axial load transferred through the joint is converted into meniscal hoop stresses. (Baratz, et al,1986)

The meniscus

conforms to the femoral condyles and increases its circumference and translates outwards and spreads the load over a large contact area and hence reduces the stresses on the underlying cartilage end. (Baratz, et al,1986)

2.8.2 Shock absorption

The menisci play a vital role in attenuating the intermittent shock waves generated by impulse loading of the knee with normal gait. (Kurosawa, et al,1980) (Seedhom, et al,1979)

Voloshin and Wosk showed that the normal knee has a shock-absorbing capacity about 20% higher than knees that have undergone meniscectomy, As the inability of a joint system to absorb shock has been implicated in the development of osteoarthritis, the meniscus would appear to play an important role in maintaining the health of the knee joint. (Radin, et al,1986)

2.8.3 joint stability

The geometric structure of the menisci provides an important role in maintaining joint congruity and stability. The superior surface of each meniscus is concave, enabling effective articulation between the convex femoral condyles and flat tibial plateau. When the meniscus is intact, axial loading of the knee has a multidirectional stabilizing function, limiting excess motion in all directions. (Arnoczky, et al,1992)

2.8.4 Joint Nutrition and Lubrication

The menisci may also play a role in the nutrition and lubrication of the knee joint. The mechanics of this lubrication remains unknown; the menisci may compress synovial fluid into the articular cartilage, which reduces frictional forces during weightbearing. (Arnoczky, et al ,1988)

There is a system of microcanals within the meniscus located close to the blood vessels, which communicates with the synovial cavity; these may provide fluid transport for nutrition and joint lubrication. (Arnoczky, et al,1988) (Bird, et al,1987)

2.9 Loss of a meniscus

Results in Cartilage to cartilage contact and Less conformity and Decreased contact area and Increased contact stresses (up to 200%). (Arnoczky, et al,1988) (Bird, et al,1987)

2.10 Pathology

Meniscal tears are the failure of the fibrocartilaginous menisci of the knee, There are several types and can occur in an acute or chronic setting. Meniscal tears are best evaluated with MRI. Acute meniscal tears occur after the rotatory trauma of the knee, whereas chronic degenerative meniscal tears often occur in the elderly after minimal rotatory trauma or stress on the knee. (Rand, 1986)

In older adults, attritional changes in the meniscus lead to fragmentation of the meniscus and a variety of tears (there usually occur at the posterior horn of the medial meniscus). (Rand, 1986)

2.10.1 Types of Pathology

There are different types of meniscal tears, describing the morphology of the injury. Identifying and accurately describing the type of meniscal tear can help the surgeon in patient education and planning of the surgical procedure. Meniscal tear types include. (Nguyen, et al,2014) (Smet, 2012) (Perdikakis,et al,2013)

2.10.2 basic tears:

A horizontal meniscal tear (or cleavage tear) is a type of meniscal tear where the tear is oriented is horizontally parallel to the tibial plateau. These tears may be difficult to visualise on arthroscopy. (Henry,2012) (Robbert,2014) longitudinal tear (vertical tear):

Longitudinal meniscal tears (sometimes called a vertical tear) are a morphological subtype of meniscal tear where a component of the tear is seen extending in a vertical orientation parallel to the circumference of the meniscus. (Yuranga,2008) (Henry,2012)

radial tear:

perpendicular to both the tibial plateau and the long axis of the meniscus. (Henry,2012) (Yuranga,2008)

root tear:

typically radial-type tear located at the meniscal. (Yuranga,2008)

2.10.3 complex tear:

Combination of all or some of horizontal, longitudinal and radial-type tears. (Dan,2008) (Yuranga,2008)

2.10.4 displaced tear:

tear involving a component that is displaced, either still attached to the parent meniscus or detached:

flap tear: displaced horizontal or longitudinal tears.

bucket-handle tear: displaced longitudinal tear. (Yuranga,2008)

parrot beak tear:displaced radial tear. (Henry,2012) (Yuranga,2008)

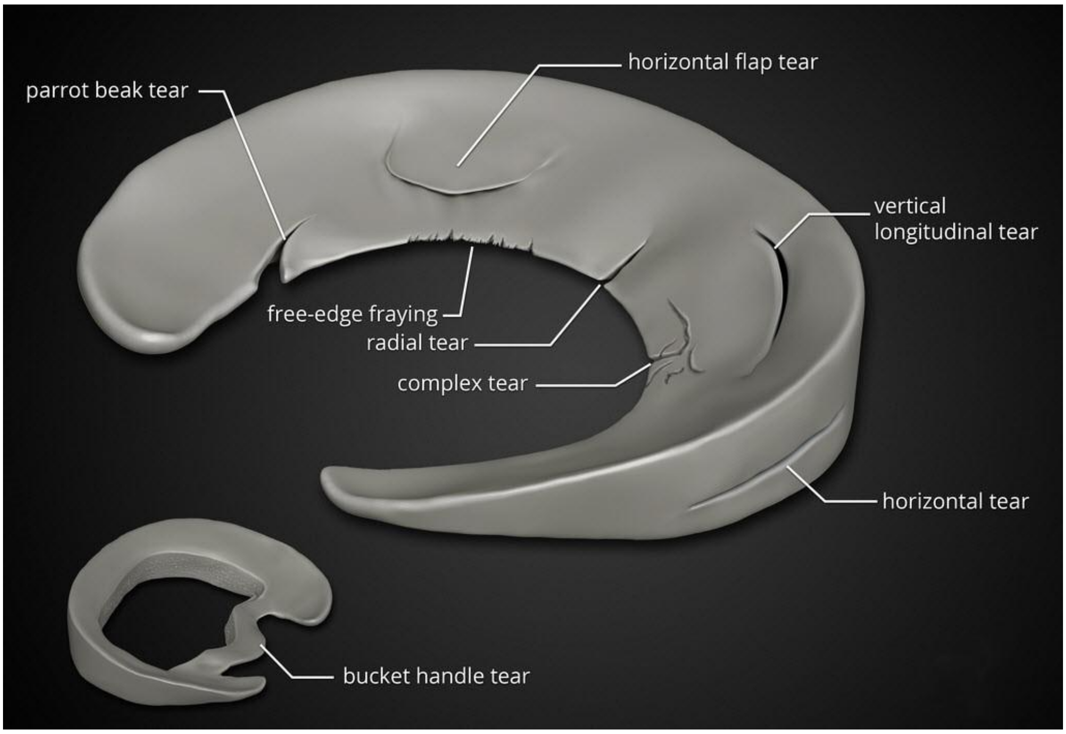

figure (2-5) types of meniscal tears

2.11 MRI principles

The property of Nuclear Magnetic Resonance (NMR) was first described by Purcell and Bloch in 1946, work for which they received the Nobel prize in 1952. Since then NMR has become a powerful tool in the analysis of chemical composition and structure. In 1973 Lauterbur and Mansfield used the principles of NMR to describe a technique for determining physical structure. Since then Magnetic Resonance Imaging (MRI) has been used in many biomedical, chemical and engineering applications. (Mansfield, et al, 1973)

2.12 Physics principles

The physics of magnetic resonance imaging (MRI) involves the interaction of biological tissue with electromagnetic fields. MRI is a medical imaging technique used in radiology to investigate the anatomy and physiology of the body. The human body is largely composed of water molecules, each containing two hydrogen nuclei, or protons. When inside the magnetic field (B0) of the scanner, the magnetic moments of these protons align with the direction of the field. (Poustchi, et al,2000)

A radio frequency pulse is then applied, causing the protons to alter their magnetization alignment relative to the field. In response to the force bringing them back to their equilibrium orientation, the protons undergo a rotating motion (precession), much like a spin wheel under the effect of gravity ,These changes in magnetization alignment cause a changing magnetic flux, which yields a changing voltage in receiver coils to give the signal. (Poustchi, et al,2000)

The frequency at which a proton or group of protons in a voxel resonates depends on the strength of the local magnetic field around the proton or group of protons. By applying additional magnetic fields (gradients) that vary linearly over space, specific slices to be imaged can be selected, and an image is obtained by taking the 2-D Fourier transform of the spatial frequencies of the signal (a.k.a., k-space).

Due to the magnetic Lorentz force from B0 on the current flowing in the gradient coils, the gradient coils will try to move. The knocking sounds heard during an MRI scan are the result of the gradient coils trying to move against the constraint of the concrete or epoxy in which they are secured. These sounds can be very unnerving to the patient, particularly given the tight space in which the patient lays. (Poustchi, et al,2000)

This behavior of MRI scanners can be described in terms of a fully coupled acousto-magneto-mechanical system Solutions to such systems can provide useful insight for design engineers. (Poustchi, et al,2000)

Diseased tissue, such as tumors, can be detected because the protons in different tissues return to their equilibrium state at different rates (i.e., they have different relaxation times). By changing the parameters on the scanner this effect is used to create contrast between different types of body tissue. (Poustchi, et al,2000)

Contrast agents may be injected intravenously to enhance the appearance of blood vessels, tumors or inflammation. Contrast agents may also be directly injected into a joint in the case of arthrograms, MRI images of joints. Unlike CT, MRI uses no ionizing radiation and is generally a very safe procedure. Patients with some metal implants, cochlear implants, and cardiac pacemakers are prevented from having an MRI scan due to effects of the strong magnetic field and powerful radio frequency pulses unless the device they carry is labeled MR-Conditional. (Poustchi, et al,2000)

MRI is used to image every part of the body, and is particularly useful for neurological conditions, for disorders of the muscles and joints, for evaluating tumors, and for showing abnormalities in the heart and blood vessels. (Poustchi, et al,2000)

2.13 Knee Protocol

MRI Image:

	Localizer (REF scan)	Mode	Slice	Gap	FAT SAT	FOV	Scan Range
AXIAL	Mid TE (40-45) T2 Fat Sat	TSE	2.5-3 mm	0.5mm	SPAIR	15cm	3cm above and below knee joint
AXIAL	PD (TE=20msec)	TSE	2.5-3 mm	0.5mm	None	15cm	3cm above and below knee joint
COR	PD (TE=20msec)	TSE	2.5-3 mm	0.5mm	None	15cm	Angle to femoral condyles to patella
COR	Mid TE (40-45) T2 Fat Sat	TSE	2.5-3 mm	0.5mm	SPAIR	15cm	Angle to femoral condyles to patella
SAG	PD (TE= 20msec)	TSE	2.5-3 mm	0.5mm	None	15cm	Angle to lateral condyle
SAG	Mid TE (40-45) T2 Fat Sat	TSE	2.5-3 mm	0.5mm	SPAIR	15cm	Angle to lateral condyle
SAG	3D mFFE WATS Sense	3D mFFE	2.5-3 mm	0mm	Proset	15cm	Angle to lateral condyle

(Dr.Fergus Coakley,2017)

2.14 Radiographic features

Plain radiograph:

On plain radiographs, meniscal tears are not visible. In rare cases secondary signs can be seen, such as a soft tissue swelling next to the meniscus when a meniscal cyst is present. (Guolong,2013)

2.15 MRI sensitivity and a specificity

With a sensitivity of ~95% and a specificity of 81% for medial meniscal tears and a sensitivity of ~85% and a specificity of 93% for lateral meniscal tears. (Crawford, et al,2007)

MRI is the modality of choice when a meniscal tear is suspected, with sagittal images being the most sensitive. (Smet,2012)

2.16 MRI grading system for abnormal high meniscal signal intensity was reported

by Lotysch et al. MR grades 1, 2 and 3 have been used:

- grade 1: small focal area of hyperintensity, no extension to the articular surface
- grade 2: linear areas of hyperintensity, no extension to the articular surface
- grade 3: abnormal hyperintensity extends to at least one articular surface (superior or inferior), and is referred as a definite meniscal tear. (Amir,2012) (Mohammad,2015).

2.17 Previous Study

The Study by Thorlund JB, et al 2017 Patient reported outcomes in patients undergoing arthroscopic partial meniscectomy for traumatic or degenerative meniscal tears: comparative prospective cohort study, the Objectives to compare patient reported outcomes from before surgery to 52 weeks after surgery between individuals undergoing arthroscopic partial meniscectomy for traumatic meniscal tears and those for degenerative meniscal tears, Results 397 eligible adults (42% women) with a traumatic or degenerative meniscal tear (n=141, mean age 38.7 years (standard deviation 10.9); n=256, 46.6 years (6.4); respectively) were included in the main analysis. At 52 weeks after arthroscopic partial meniscectomy, 55 (14%) patients were lost to follow-up. Statistically, participants with degenerative meniscal tears had a significantly larger improvement in scores than those with traumatic tears (adjusted between-group difference −5.1 (95% confidence interval −8.9 to −1.3); P=0.008). In the analysis include in score at all-time points, a significant time-by-group interaction was observed in both the unadjusted (P=0.025) and adjusted analysis (P=0.024), indicating better self-reported outcomes in participants with degenerative tears. However, the difference between groups was at no time point considered clinically meaningful. Other study by Yan R, et al 2011 Predicted probability of meniscus tears: comparing history and physical examination with MRI, the Objective: The aims of this study were to identify sensitive and specific clinical tests and elements of patients' history with a high predictive value, and to assess the combined diagnostic accuracy of sensitive and specific clinical tests and elements of patients' history with MRI.

Result showed The overall diagnostic value of MRI for meniscal tears was: accuracy, 88.8%, sensitivity, 95.7%; specificity, 75.8%, positive predictive value (PPV), 88.2%, and negative predictive value (NPV), 90.4%. Giving way, locking and McMurray's test were independent diagnostic factors with a predicted correct percentage of 80.0% ($p < 0.05$) for the diagnosis of meniscal tears found during arthroscopy. Locking, McMurray's test and MRI increased the predicted correct percentage of meniscal tears found during arthroscopy to 91.6% ($p < 0.05$). For the diagnosis of meniscal tears found during arthroscopy, giving way, locking and McMurray's test had the following values for accuracy (49.2, 60.9, 76), sensitivity (43.5, 55.2, 75.8), specificity (84, 96, 76.9), PPV (94.4, 98.8, 95.1) and NPV (19.4, 25.8, 35.1). Combining MRI, the diagnostic values of giving way, locking, and McMurray's test were: accuracy, 88.3,89.9,89.4, sensitivity, 95.7,97.4,97.4, specificity, 74.2,75.8,74.2, PPV, 87.5,88.4,87.7, and NPV,90.2,94,93.9.

Chapter Three

Materials and Methods

Chapter Three

Materials and Methods

3.1 Materials

3.1.1 Machine used

MRI general electric machine 1.5T Knee coil at MMC installed 2003.

3.1.2 Populations

The study sample consist of 50 patients, 36 males and 14 females with different age and meniscal lesions complain of pain and patient with confirmation of unstable meniscal injuries, all of patients underwent knee MRI study of the following sequence.

3.2 Methods

3.2.1 Techniques used

The patient was supine with feet first on MRI table with both legs extended the foot medially rotated to centralize the patella between the femoral condyles, the knee coil should be in close contact with joint. Centre 2.5 cm below the apex of patella through the joint apace, image sequence sagittal T1(TR:620, TE:7.8), T2(TR:2500, TE:94.6), PD (TR:1760, TE:39.5) and coronal PD (TR:400, TE:42) and FOV 15MM slice thickness 2.5-3MM and GAP 0.5MM.

3.2.2 data acquisition and image interpretation:

The patient's demographic data and clinical finding, where collection the image diagnosis by radiologist meniscal tear identified and classified the grades from the radiologist report.

Chapter Four

Results

Chapter Four

Results

The result of the study is presented the flowing table and graph:

Table (4-1): Frequency distribution of patient's gender

Gender	Frequency	Percentage
Male	36	72%
Female	14	28%

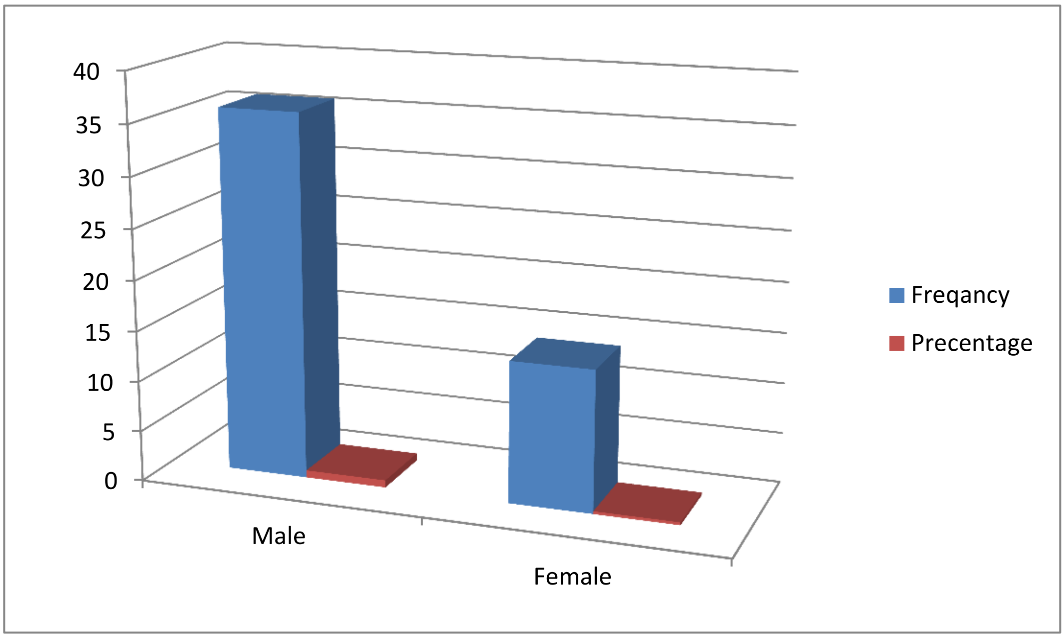

figure (4-1): study graph gender distribution

Table (4 -2): Frequency distribution of patients age

Range of patients age (in years)	**Frequency**	**Percentage**
19 – 39	22	44%
40 – 59	18	36%
60 – 79	10	20%

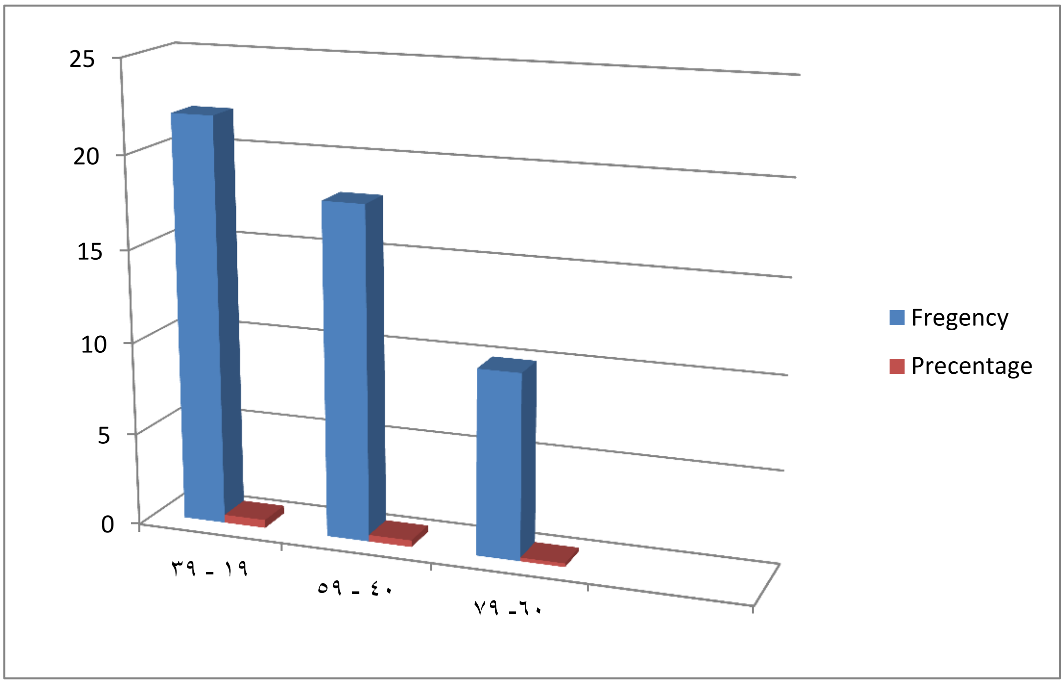

figure (4-2): study graph age distribution

Table (4 -3): Frequency distribution of side of effect

side of effect	Frequency	Percentage
Left	39	78%
Right	11	22%

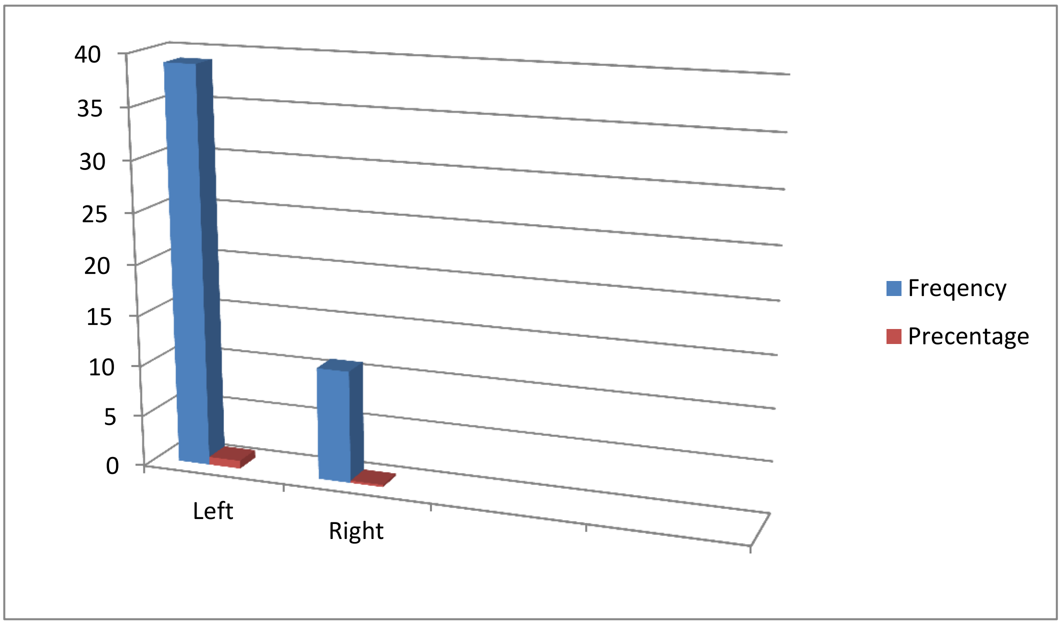

figure (4-3): study graph side of effect distribution

Table (4 -4): Frequency distribution of MRI grading

MRI grading	**Frequency**	**Percentage**
I	2	4%
II	18	36%
III	30	60%

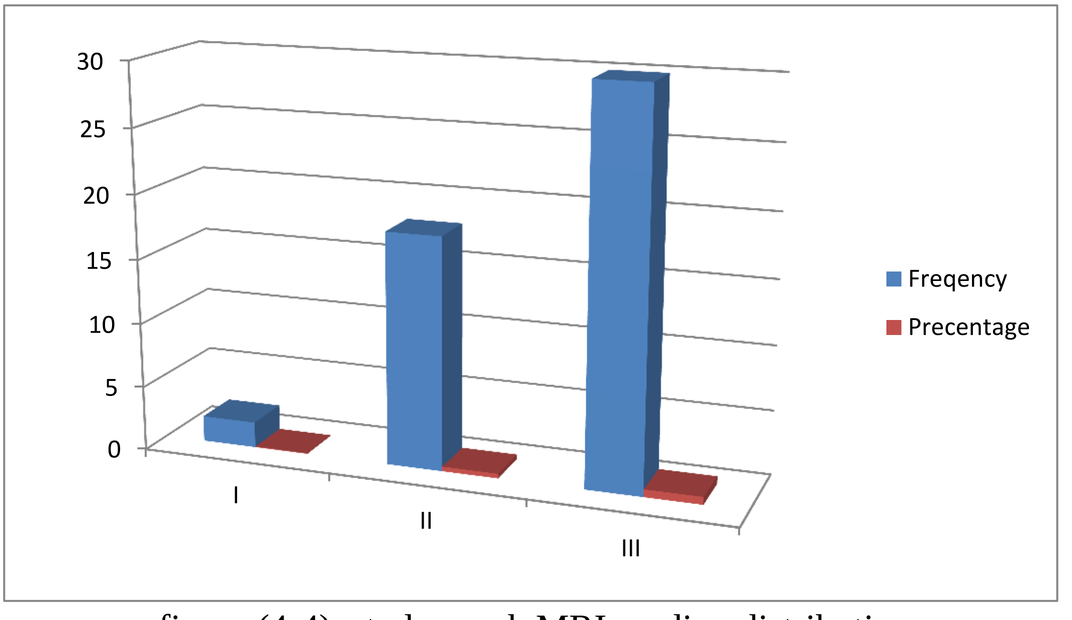

figure (4-4): study graph MRI grading distribution

Table (4 -5): Frequency distribution MRI finding

MRI finding	Frequency	Percentage
Medial	38	76%
lateral	2	4%
Bilateral(medial and lateral)	10	20%

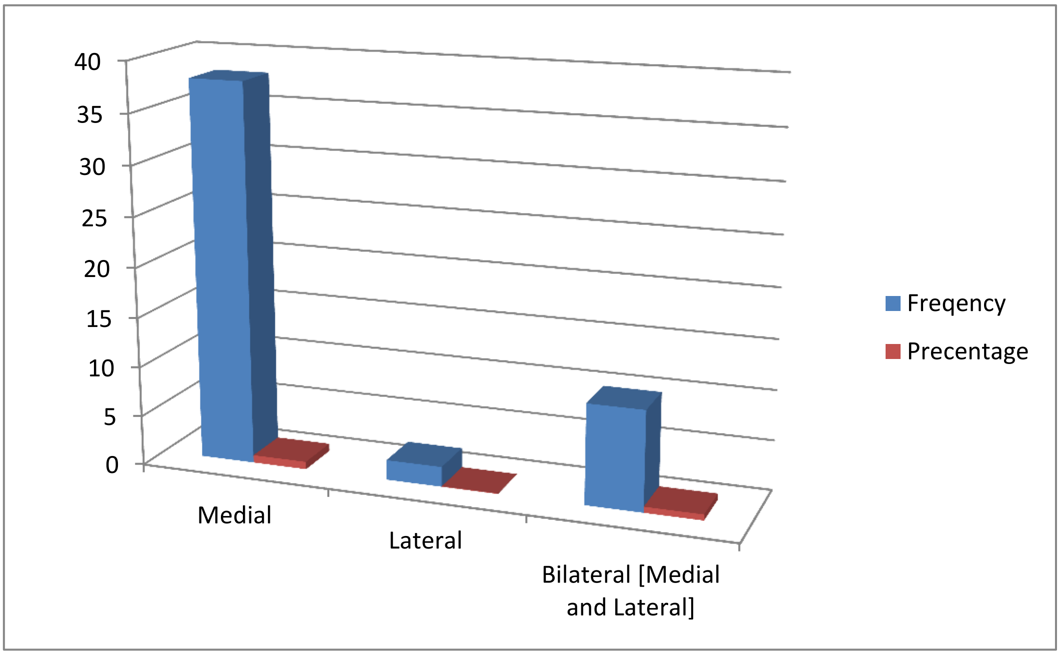

figure (4-5): study graph MRI finding distribution

Chapter Five

Discussion, Conclusion and Recommendation

Chapter five

Discussion, Conclusion and Recommendation

5.1 Discussion:

The study showed that frequency of meniscus tears high in males (72%)than frequency of females (28%), This is due to history of patients relatively traumatic associated with what we found in (figuer4-1) that show frequency distribution of gender. The study showed the most effected age group (19-39) years old frequency distribution (44%)than (40-59) years old (36%) the last group (60-79) frequency distribution (28%), the same result was what we found in previous study (figure 4-2) show the frequency distribution of patients age. The study showed the most side of effect left knee meniscus tear 39(78%)and 11(22%) right knee in meniscus tear, the different result was what we found in previse study the most side effected right knee female than males (figure 4-3) show the frequency distribution of side effected. The study showed the most common meniscus tear frequency grade3(60%) than grade2(36%) the last grade1(4%), the different result was what we found in previous study the most common grade1 than grade2 than grade3(figure 4-3) show the frequency distribution of MRI grading. The study showed that high frequency MRI finding of meniscus tear the medial (76%)than bilateral (20%) than lateral (4%), he same result was what we found in previous study the medial the first but the different for other found the second lateral than bilateral (figure 4-5) show the frequency distribution of MRI finding.

5.2Conclusion:

The study concluded that:

- the meniscus tears high in males than females.
- the most effected age group (19-39) years old.
- the most side effect the left knee in meniscus tear.
- the most common meniscus tear in grade3.
- the high MRI finding meniscus tear the medial.
- the most meniscus tears traumatic patient.

5.3 Recommendations:

The study Recommend:

- we need to have more long-term prospective studies done to determine the true natural of these finding.
- The study should be in the future with large group.
- The study should be more analyze.
- The study should be in the future include the patient the body mass index.
- The study should be in the future include the meniscus tear treatment.

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Appendices

Appendix A

Sudan University of Science and Technology

College of Graduate Studies

Thesis submitted in partial fulfillment of the requirement of the degree of MSc in diagnostic medical Imaging

Data Collection Sheet

Study OF Meniscus Tear IN Knee Using MRI

1- Gender: male ☐ female ☐

2- Age: ☐

3- Side Effected: RT ☐ ☐ LT

4- MRI Grading: I ☐ II ☐ III ☐

5- MRI Finding: Medial ☐ Lateral ☐ Bilateral ☐

6- Clinical Finding: ……………………………………………

7- Best Sequence showed meniscus tear

Appendix B

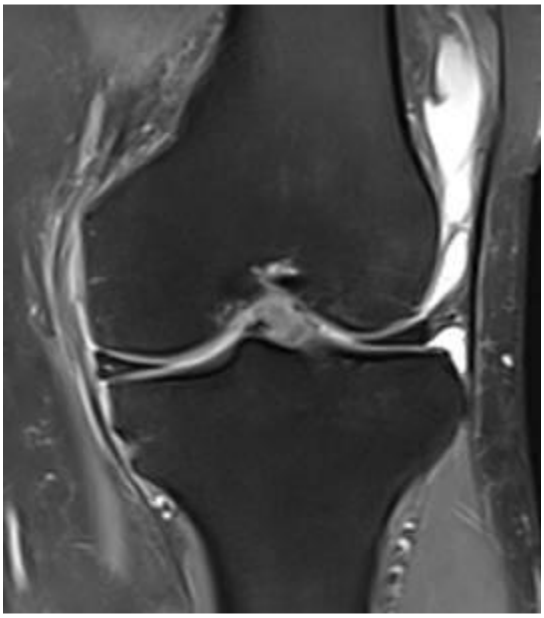

Image B-1 MRI coronal PD image for Left knee of male 37 years old showed medial meniscus tear grade I

Image B-2 MRI Sagittal PD image for Right knee of male 31 years old showed lateral meniscus tear grade II

Image B-3 MRI T2 weighted coronal image for Right knee of female

54 years old showed lateral meniscus tear grade III