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MAGNETIC RESONANCE IMAGING FINDINGS IN PEOPLE WITH SYMPTOMATIC AND ASYMPTOMATIC MENISCAL ABNORMALITIES

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Meniscal lesions are damages that occur at the menisci insertions, which are considered the major orthopedic issue regarding knee joint biomechanics. The imaging modality of choice for meniscal lesions is magnetic resonance imaging (MRI), which has the highest sensitivity, specificity, and accuracy.

Purpose. To evaluate the percentage of MRI abnormalities of the knees in asymptomatic and symptomatic people with suspected meniscal and other lesions.

Methods. A comparative cross-sectional study was conducted; two MRI machines were used: one in the oncology Teaching Hospital 1.5 Tesla Siemens system (Magnetom Aera; Siemens Healthineers, Erlangen, Germany) and the other is 1.5 Tesla unit (Avanto, Siemens Healthineers, Germany) in X-ray Institute). A total of 100 participants, fifty symptomatic meniscal lesions (33 males and 17 females) and fifty asymptomatic meniscal lesions (24 males and 26 females) were enrolled in this study. The age of participants ranged from 46 years to 67 years.

Results. The mean age of symptomatic meniscal lesions (MLs) was 52.96±3.854 years (median 53 years), ranging from 46 years to 66 years, while the mean age of asymptomatic meniscal lesions was 56.96±5.284 years (median 56 years), ranged from 48 years to 67 years. Males symptomatic meniscal lesions were 33 (66%), whereas females were 17 (34%). Whereas in asymptomatic meniscal lesions, males were 24 (48%), whereas females were 26 (52%). Painful knee (96%), discomfort (100%) and reduce joint motions (100%) are the most common manifestations recorded. The asymptomatic meniscal lesions patients age is higher than the age of symptomatic meniscal lesions cases with a strong statistically significant difference (P<0.0001). On the other hand, the comorbidity has a high statistically significant difference (P=0.009), between the two groups. Furthermore, joints effusion, bone marrow and soft tissue edema, horizontal meniscal lesions, and complex meniscal lesions have a statistically significant difference (P=0.004), (P<0.0001), (P=0.04), (P=0.002), respectively, to be more in symptomatic knees. Medial meniscus tears are more prevalent than lateral in both horizontal and complex meniscal lesions and both symptomatic and asymptomatic knees. In symptomatic, the most common tears were reported in the posterior horn of the medial meniscus among horizontal meniscal lesions and complex meniscal lesions [(11, 25.6%), and (5, 55.6%)], respectively. In asymptomatic, the most common tears were reported in the anterior horn of the Medial meniscus of horizontal meniscal lesions (8, 18.6%).

Conclusions. The old-age and comorbid conditions have a positive correlation with meniscal lesions in symptomatic more than in asymptomatic knees. Gender, BMI, and trauma history have a negative association with the development of meniscal lesions in symptomatic and asymptomatic knees meniscal lesions. Joint effusion, bone marrow or soft tissue edema, meniscal tear (horizontal), meniscal tear (complex, vertical, radial), and ACL in symptomatic meniscal lesions represent the most common MRI findings seeing more than in asymptomatic meniscal lesions. Horizontal medial meniscal tears are frequently the most common meniscal lesions in symptomatic and asymptomatic knees. Complex lateral meniscal tears are the least common observation.

Keywords: meniscal tears, anterior cruciate ligament, fat suppression, knee joint.

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НАХОДКИ ПРИ МАГНИТНО-РЕЗОНАНСНОЙ ТОМОГРАФИИ У ЛЮДЕЙ С СИМПТОМНЫМИ И БЕССИМПТОМНЫМИ ПОВРЕЖДЕНИЯМИ МЕНИСКА КОЛЕННОГО СУСТАВА

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Повреждения менисков – это повреждения, возникающие в местах прикрепления менисков, считающиеся основной ортопедической проблемой в отношении биомеханики коленного сустава. Предпочтительным методом визуализации при повреждениях мениска является магнитно-резонансная томография, которая обладает самой высокой чувствительностью, специфичностью и точностью.

Цель. Исследование было направлено на выявление процента патологических изменений коленного сустава при магнитно-резонансной томографии у людей с клиническими проявлениями и без, с подозрением на повреждения мениска и другую патологию.

Материалы и методы. Было проведено сравнительное кросс-секционное исследование: использовались два аппарата МРТ – один в онкологическом клиническом госпитале, 1,5 Тесла с системой Siemens (Magnetom Aera; Siemens Healthineers, Эрланген, Германия), другой – 1,5 Тесла в Институте радиологии (Avanto, Siemens Healthineers, Германия).

В исследование было включено 100 участников, из них у 50 человек наблюдались поражения мениска с клиническими проявлениями (33 мужчины и 17 женщин) и 50 человек с бессимптомными поражениями мениска (24 мужчины и 26 женщин). Возраст участников составил от 46 до 67 лет.

Результаты. Средний возраст симптомных поражений мениска составлял 52,96 ± 3,854 года (медиана 53 года), в диапазоне от 46 до 66 лет, в то время как средний возраст бессимптомных поражений мениска составлял 56,96 ± 5,284 года (медиана 56 лет), в диапазоне от 48 лет до 67 лет. Поражения мениска с клиническими проявлениями у мужчин встречались в 33 случаях (66%), тогда как у женщин – в 17 (34%). Бессимптомные поражения мениска у мужчин встречались в 24 случаях (48%), у женщин – в 26 (52%). Боль в колене (96%), дискомфорт (100%) и снижение подвижности сустава (100%) являются наиболее частыми регистрируемыми клиническими проявлениями. Возраст пациентов с бессимптомным поражением мениска выше, чем возраст пациентов с симптомным поражением мениска с сильной статистически значимой разницей (P<0,0001). С другой стороны, коморбидность имеет высокую статистически значимую разницу (P = 0,009) между двумя группами. Кроме того, суставной выпот, отек костного мозга и мягких тканей, горизонтальные поражения и сложные поражения мениска имеют статистически значимую разницу (P = 0,004), (P <0,0001), (P = 0,04), (P = 0,002) соответственно, и представлены больше у людей с клиническими проявлениями. Разрывы медиального мениска более распространены, чем латерального, как при горизонтальном, так и при сложном поражении мениска у людей как с клиническими проявлениями, так и без. При случаях с наличием симптомов наиболее частые разрывы были зарегистрированы в заднем роге медиального мениска среди горизонтальных поражений и сложных поражений мениска [(11, 25,6%) и (5, 55,6%)] соответственно. При бессимптомном течении чаще всего выявлялись разрывы переднего рога медиального мениска при горизонтальных поражениях мениска (8, 18,6%).

Выводы. Пожилой возраст и коморбидные состояния имеют прямую корреляцию с симптомными поражениями менисков больше, чем в бессимптомных случаях. Пол, индекс массы тела и травмы в анамнезе имеют непрямую связь с развитием поражений менисков в симптом-

ных и бессимптомных случаях. Суставной выпот, отек костного мозга или мягких тканей, разрыв мениска (горизонтальный), разрыв мениска (сложный, вертикальный, радиальный) и передней крестообразной связки при симптомных поражениях мениска представляют собой наиболее распространенные результаты МРТ, выявляемые больше, чем при бессимптомных случаях. Горизонтальные разрывы медиального мениска являются наиболее распространенными повреждениями мениска в симптомных и бессимптомных случаях. Сложные разрывы латерального мениска встречаются реже всего.

Ключевые слова: разрывы мениска, передняя крестообразная связка, жироподавление, коленный сустав.

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Meniscal tears are lesions that occur at the menisci insertions, which are considered the major orthopedic issue regarding knee joint biomechanics. The proper load transmission to the joint need menisci integrity [1]. Knee menisci have several important roles as shock absorption and distributing load, increasing stability, providing nutrition to the cartilage, limitation of extreme movement, and movement control [2]. The menisci lesions lead to changes in knee joint weight-bearing load due to resistance failure of the meniscus against compression. These injuries are classified into two main categories include acute (lateral meniscus) and chronic mostly (medial meniscus) [1].

It is challenging to diagnose these lesions, which may require radiographic X-rays, MRI, and arthroscopy [3]. The x-ray is unable to demonstrate pathology of the meniscus, its ability limit to exclude bony pathologies and assess the narrowing joint space width, loose bodies, chondrocalcinosis, osteophytes, subchondral cysts, bone sclerosis, and other degenerative changes [4].

The imaging modality of choice for meniscal lesions is the MRI, which has the highest sensitivity and specificity [1, 3]. MRI represents the gold standard diagnostic method for any pathology of the knee joint, and it is widely used for assessing meniscal tears [3]. Several previous MR studies have reported the high accuracy of knee MRI [5]. It is a non-invasive approach. It performs by obtaining an exquisite image using a magnetic field in which electrons of the atoms are disturbed by an external radio frequency energy [6]. There are two different sequences can be used, T1-weight and T2-weight. De Smet and Mukherjee 2008, concluded that MRI has a 100% diagnostic rate for meniscal lesions, showing a 93% sensitivity, and 100% specificity and with a predictive value reach to 100% [7].

Recently, a meta-analysis based on twenty-two studies described an overall sensitivity and specificity of 88% and 94%, respectively, for the detection of meniscal lesions [8]. The T2-weighted sequences of axial, sagittal, and coronal images are the most common and preferable way to visualize and assess a tear [9]. Others, spin-echo or fast spin-echo proton density with or without fat saturation, T1, and gradient echo can be used [6]. Also, MRI plays a role as a guided diagnostic test to distinguish the exact area of the joint affected to perform the suitable treatment options [10]. Statistically speaking, the accuracy range of 82–95% of MRI for diagnosing meniscal tears, with sensitivity and specificity are 93% and 88%, respectively for medial tears, and 79% and 95%, respectively for lateral tears [11].

Many studies, reported that meniscal tear incidence may be as high as six per 1000 population with a 2.5 to 4 times male predominance. Age of traumatic meniscal tear peaks at 20–29 years [12]. The overall M:F ratio range from 2.5:1 to 4:1, with a peak incidence occurring in men between 21 and 30 years of age and in women between 11- and 20 years old [13]. Medial is more common than lateral meniscal tears at 81% and 19%, respectively [14]. Meniscal lesions can happen from an acute trauma, and an acute blowout hit to the knee or also can occur as consequence of a chronic and degenerative conditions like rheumatoid arthritis, spontaneous osteonecrosis, and osteoarthritis [1]. The most common risk factors for

degenerative meniscal ruptures are genetic predisposition, female gender, high BMI, older age, activity level, smoking status, and varus alignment condition [14]. Generally, the tears are caused by a combination of axial loading and rotational (twisting) forces that result in a shear load on the meniscus. Traumatic conditions occur in younger, and more active individuals, whereas the degenerative tears may reflect cumulative stress, chondral-malacia, and elderly people [15].

The main categories of meniscal tears according to the morphology include vertical longitudinal, radial (transverse), horizontal (cleavage), complex (degenerative), and bucket handle tears [16]. Recently, a classification by LaPrade et al. was made by a combination between clinical approach, outcome, and arthroscopic assessment. There are five types [17]:

• Type 1: partial and stable root tears (7%)

• Type 2: A complete radial tear within the root attachment (68%)

• Type 3: a "bucket-handle" tear with complete detachment (6%)

• Type 4: complex tear with complete detachment (10%)

• Type 5: a root bony avulsion (7%).

The study aims to study MRI findings of the knee in asymptomatic and symptomatic people with suspected meniscal lesions and associated abnormalities. The explanations for these purposes are most of Iraqi patients are neglected and don't care about their knee lesions. As a result, these groups are specially recruited or enrolled for comparison. Most patients obese, comorbid, low socioeconomic, low educated and unaware about their conditions. The study initially based on the experiences of orthopedics, rheumatologists and radiologists that suspected of the meniscus lesions who distinguished lesions from history, clinically or radiography.

Methods.

Study Design and setting.

A comparison cross-sectional study conducted in Baghdad city, Iraq in Baghdad Medical City Complex and X-Ray institute, from 1st March 2021 to 30th December 2021.

Participants.

A total of 100 participants, fifty-symptomatic meniscal lesions (33 males and 17 females) and fifty-asymptomatic meniscal lesions (24 males and 26 females) were enrolled in this study. The age of participants ranged from 46 years to 67 years. Those who were referred for possible meniscal lesions were cross-sectionally examined with an MRI of their knees. Most of the patients were referred by orthopedic (n=70), the rest by rheumatologists (n=21), and general practitioners (n=9).

Inclusion criteria.

• Patients with symptomatic and asymptomatic meniscal lesions.

• Patients were recruited regardless of their history of trauma.

• Patients accept to assign written informed consent.

Exclusion criteria.

• Contraindications for MRI examination (pacemaker, implants, claustrophobia, and pregnancy).

• Patients who refused to do the MRI examination.

• Malignancy.

• Patients with a history of knee surgery.

Variables.

History and investigation data were documented and recorded for each participant in his/her file, the variables studied included age (years), gender, BMI, history of knee trauma, and comorbid conditions. In symptomatic patients, ask about pain, swelling, locking, catching, and giving away the knee. On examination, look for mass, redness, tenderness, discomfort, effusion, scar, and decrease in motion.

MRI lesion data measurement.

All the studied patients underwent for MRI examination, which was done before any intervention. Joints effusion, bone marrow, soft tissue edema, meniscal tears [horizontal, complex, vertical, radial], medial and lateral MLs, and ligamentous tears (anterior cruciate ligament (ACL)) were evaluated and analyzed.

MRI protocols.

MRI examination was estimated utilizing the 1.5 Tesla Siemens system (Magnetom Aera; Siemens Healthineers, Erlangen, Germany) and (1.5 Tesla unit Avanto, Siemens Healthineers, Germany). The protocol applied in examined patients included:

• Sagittal proton density (PD).

TR 3200 ms, TE 30 ms, 3mm slice thickness.

• Sagittal proton density with fat suppression.

TR 3500 ms, TE 39ms, 3mm slice thickness.

• Coronal proton density.

• Coronal proton density with fat suppression.

• Axial T2 weighted images.

TR5800 ms, TE 68ms, 3mm slice thickness.

Signals of intra meniscal.

Four grades on MRI signals, which are first described by Stoller and Colleagues (Figure 1) [4, 18].

• Grade 0 is normal.

• Grade 1 is rounded or amorphous sig-

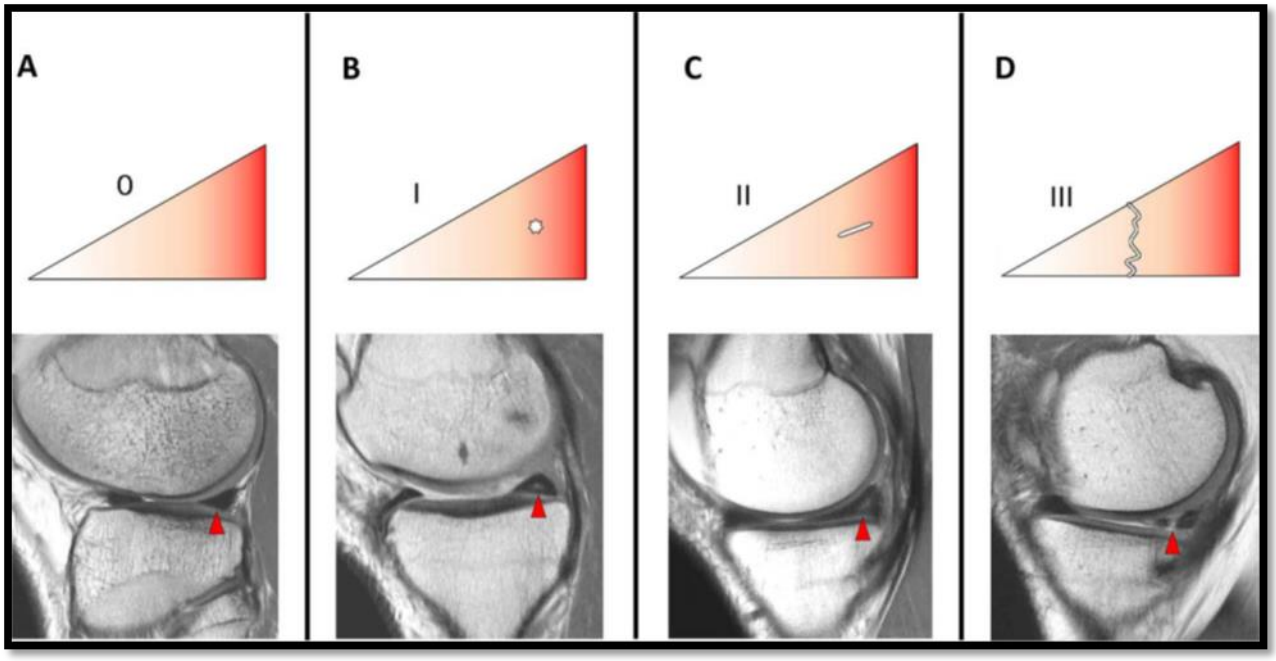

Fig. 1 (Рис. 1)

Fig. 1. Meniscal lesions grading.

A - Grade 0, normal intact meniscus;

B - Grade I, intra-substance globular-appearing signal not extending to the articular surface;

C - Grade II, linear increased signal patterns not extending to the articular surface;

D - Grade III, abnormal signal intersects the superior and/or inferior articular surface of the meniscus, an arthroscopically confirmable tear [4].

Рис. 1. Классификация повреждений мениска.

А - Степень 0, нормальный неповрежденный мениск;

Б - Степень I, очаговое изменение сигнала внутри мениска, не распространяющееся на суставную поверхность мениска;

В - Степень II, линейное усиление сигнала повышенной интенсивности, не распространяющееся на суставную поверхность мениска;

Г - Степень III, усиление сигнала повышенной интенсивности, пересекающее верхнюю и/или нижнюю суставную поверхность мениска; артроскопически подтвержденный разрыв [4].

nal intensity without disruption of the articular surface.

• Grade 2 is a liner signal correlated with disrupting the surface.

• Grade 3 is a signal that extended to the articular surface and represents a meniscal tear [6].

Assessment of meniscal tears.

Tears were grouped as follows:

• Horizontal, defined as a tear parallel to the tibial plateau (TP) separating the meniscus into two parts upper and lower.

• Oblique (parrot-beak), is defined as a tear oblique to the circumferentially oriented collagen fibers.

• Longitudinal, defined as a vertical tear perpendicular to the TP and parallel to the orientation of the circumferential fibers.

• Radial, defined as a vertical tear that began in the central free margin and was perpendicular both to the TP and the circumferential fiber orientation

• Complex, it is multiple tears in more than one configuration.

• A root is a tear in the posterior or anterior central meniscal attachment [19].

Ethical considerations.

Written informed consent was obtained from all participants, to involve in this study. The scientific Committee at Iraqi Board for Medical Specializations/Diagnostic Radiology approved this study.

Table №1. Age groups of symptomatic MLs patients (n=50).

Age group	No.	%
>45-55	33	66
>55-65	17	34
>65	0	0

Table №2. Age groups of asymptomatic MLs patients (n=50).

Age group	No.	%
>45-55	24	48
>55-65	22	44
>65	4	8

Table №3. Distribution of symptomatic patients according to the clinical features.

Symptoms	No.	%
Pain	48	96
Swelling	27	54
Locking	33	66
Catching	38	76
Giving away	18	36
Tenderness	40	80
Discomfort	50	100
Effusion	22	44
Decrease motion	50	100
Redness	32	64

Statistical analysis.

All analyses were conducted by using SPSS version 20.0 for Windows (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics consist of numbers and percentages measured. Mean and SD for categorical data were also calculated. Comparisons analysis performed between the two groups was made with the use of the chi-square test or the t-test as required. A two-sided P value of 0.05 or less was considered statistically significant.

Results.

The mean age of symptomatic cases with meniscal lesions (MLS) in this study was 52.96±3.854 years (median 53 years), ranging from 46 years to 66 years. Approximately, the mean age for symptomatic males was 53.18±3.087 years (median 53), ranging from 47–59 years, while the mean age for symptomatic females was 52.53±5.113 years (median 55), ranging from 46–60 years. In addition, 66% of patients aged >45-55 years, and the rest (17%) aged >55-60 years, showed in Table №1.

The mean age of asymptomatic cases with MLs was 56.96±5.284 years (median 56 years), ranging from 48 years to 67 years. Approximately, the mean age for asymptomatic males was 56.12±5.773 years (median 55), ranging from 48-67 years, while the mean age for symptomatic females was 57.73±4.771 years (median 56.5), ranged from 50-67 years. In addition, 66% of patients aged >45-55 years, and the rest (17%) aged >55-60 years, showed in Table №2.

Among symptomatic MLs, males were 33 (66%), whereas females were 17(34%) with M:F ratio (1.94:1). Whereas in asymptomatic MLs, males were 24 (48%), whereas females were 26 (52%) with M:F ratio (1:1.08).

The mean BMI of symptomatic patients with MLs was 28.303±4.9 Kg/m2 (median 27.6 Kg/m2), ranging from 17.4 Kg/m2 to 38.6 Kg/m2. Approximately, the mean BMI for symptomatic males was 27.653±5.23 Kg/m2 (median 27.24), ranged from 17.4–38.6Kg/m2, while the mean BMI for symptomatic females was 29.565±4.014Kg/m2 (median 29.4), ranged from 24.5–38.2Kg/m2.

In this study, the mean BMI of asymptomatic patients with MLs was 28.28±4.74 Kg/m2 (median 27.9 Kg/m2), ranging from 17.4 Kg/m2 to 38.4 Kg/m2. Approximately, the mean BMI for asymptomatic males was 28.093±4.58Kg/m2 (median 27.35), ranging from 20 – 38.4Kg/m2, while the mean BMI for asymptomatic females was 28.454±4.97Kg/m2 (median 29.25), ranged from 17.4 – 38.2Kg/m2.

Associated symptoms and signs of symptomatic MLs in the current study were listed in Table №3.

A comparison analysis between symptomatic and asymptomatic MLs according to demographic characters showed in Table 4. The mean age of asymptomatic MLs patients (56.96±5.284 years) was higher than the mean age of symptomatic MLs patients (52.96±3.854 years) with a strong statistically significant difference (P<0.0001). Concerning gender, there was no significant difference between males and females among symptomatic and asymptomatic MLs patients (P=0.069). There was no significant difference between the mean BMI of asymptomatic MLs patients (28.281±4.746) and the mean BMI of symptomatic MLs patients (28.303±4.9), (P=0.982). Among history of knee injury (trauma), there was no significant difference between both groups, (P=0.15). Regarding comorbidity, there was a high statistically significant difference (P=0.009) between the two groups.

The prevalence of joints effusion, bone marrow, and soft tissue edema, meniscal tear (horizontal), meniscal tear (complex, vertical, radial) (Figure 2, 3, 4 and 5(B)), and ACL in symptomatic MLs were 50(100%) (Figure 5(A)), 23(46%), 27(54%), 9(18%), and 11 (22%). Oth-

Table №4. Comparison analysis between symptomatic and asymptomatic MLs according to demographic characters.

Variables		Symptomatic MLs	Asymptomatic MLs	P value
		No. (%)		
Age (years)	Mean±SD	52.96±3.854	56.96±5.284	<0.0001*
Gender	Male	33 (33)	24 (24)	0.069**
	Female	17 (17)	26 (26)	
BMI(Kg/m^2)	Mean±SD	28.303±4.9	28.281±4.746	0.982**
History of knee injury (trauma)	Yes	23 (23)	16 (16)	0.15**
	No	27 (27)	34 (34)	
Comorbidity	Yes	44 (44)	33 (33)	0.009#
	No	6 (6)	17 (17)	

*t-test significant, #chi-square significant, **non-significant

Table №5. Comparison analysis between symptomatic and asymptomatic MLs according to MRI findings.

MRI findings		Symptomatic	Asymptomatic	P value
		No. (%)		
Joints effusion	Yes	50 (100)	42 (84)	0.004*
	No	0	8 (16)	
Bone marrow and soft tissue edema	Yes	23 (46)	2 (4)	0.0001*
	No	27 (54)	48 (96)	
Meniscal tear (horizontal)	Yes	27 (54)	16 (32)	0.04*
	No	23 (46)	32 (68)	
Meniscal tear (complex, vertical, radial)	Yes	9 (18)	0	0.002*
	No	41 (82)	50 (100)	
ACL	Yes	11 (22) partial tear	6 (12) mucoid degeneration	0.133**
	No	39 (78)	44 (88)	

*t-test significant, **non-significant

erwise, the prevalence of the same MRI findings in asymptomatic MLs were 42(84%), 2(4%), 16(32%), 0(0%), and 6 (12%).

The comparison analysis revealed that joint effusion has a strong statistically significant difference (P=0.004) between the two categories. There was a strong statistically significant difference between symptomatic and asymptomatic MLs (P<0.0001) concerning bone marrow and soft tissue edema. Regarding horizontal meniscal tears, there was a highly significant difference between symptomatic and asymptomatic MLs (P=0.04). Also, regarding meniscal tears (complex, vertical, radial), there was a highly significant difference between symptomatic and asymptomatic MLs (P=0.002). Furthermore, there was no significant difference between symptomatic and asymptomatic MLs (P=0.133) concerning ACL lesions (Table №5).

On the other hand, table №6 showed the comparison analysis between symptomatic and asymptomatic MLs according to meniscus types. Accordingly, 19(44.2%) of horizontal tears were in MM in symptomatic knees, while 12(27.9%) of lesions were in asymptomatic knees. Laterally, the horizontal tears presented in symptomatic and asymptomatic knees as 8(18.6%) and 4(9.3%), respectively, without significant relation (P=0.743). Furthermore, seven tears (77.8%) of complex MLs were seen in MM, whereas two lesions (22.2%) were reported in LM and no complicated asymptomatic MLs, with no significant difference (P=0.425).

Grading for meniscal injuries was shown in table №7. In symptomatic, GI reported in 3(6%), GII in 11(22%), and GIII in 36(72%). However, asymptomatic cases were normal in 5(10%), GI in 8(16%), GII in 21(42%), and GIII in 16(32%). There was a high statistically significant difference (P=0.0008).

Table №8 compared symptomatic and asymptomatic MLs according to morphology. In symptomatic, the most common tears were reported in the posterior horn of MM among horizontal MLs and complex MLs [(11, 25.6%), and

Table №6. Comparison analysis between symptomatic and asymptomatic MLs according to meniscus types.

MRI findings		Symptomatic	Asymptomatic	P value
		No. (%)		
Horizontal MLs (n=43)	MM	19 (44.2)	12 (27.9)	0.743*
	LM	8 (18.6)	4 (9.3)	
Complex MLs (n=9)	MM	7 (77.8)	0	0.425*
	LM	2 (22.2)	0	

*non-significant

Table №7. Grading of meniscal tears in this study.

Grades	Symptomatic	Asymptomatic	P value
	No. (%)		
0 (normal)	0	5 (10)	0.0008
I	3 (6)	8 (16)	
II	11 (22)	21 (42)	
III	36 (72)	16 (32)	

Chi-square is 16.535

Table №8. Comparison analysis between symptomatic and asymptomatic MLs according to morphology.

MRI findings		Symptomatic		Asymptomatic		P value
		Anterior horn	Posterior horn	Anterior horn	Posterior horn	
		No. (%)				
Horizontal MLs (n=43)	MM	8 (18.6)	11 (25.6)	8 (18.6)	4 (9.3)	0.899*
	LM	4 (9.3)	4 (9.3)	2 (4.6)	2 (4.6)	
Complex MLs (n=9)	MM	2 (22.2)	5 (55.6)	0	0	0.646*
	LM	2 (22.2)	0	0	0	

*non-significant chi-square is 1.66

(5, 55.6%)], respectively. In asymptomatic, the most common tears were reported in the anterior horn of MM of horizontal MLs (8, 18.6%), whereas no complex lesions were reported.

Discussion.

In this study, one hundred patients (57 men and 43 women) were sub-categorized into fifty– symptomatic MLs (33 males and 17 females), and fifty – asymptomatic MLs (24 males and 26 females).

Regarding age, the mean age of symptomatic MLs cases was 52.96 years (median 53 years), ranging from 46 years to 66 years and the mean age of asymptomatic MLs was 56.96 years (median 56 years), ranging from 48 years to 67 years. The overall age of patients in this study is much higher than that reported by Shukri and Musalah study in the Department of Surgery and MRI unit/ Azadi teaching hospital/ Duhok, Iraq [20]. They conducted a cross-sectional study of 58 males and 22 females to document MRI yield in knee injuries clinically suspected as possible meniscal lesions [26]. Also, disagreement was observed in a prospective study of Zanetti and colleagues. They studied one hundred patients (59 men and 41 women; the mean age was 42.7 years; age ranged between, 18–73 years) referred for suspected meniscal lesions were examined with MRI [21]. This could be explained by the availability of facilities to detect MLs and the long life expectancy of individuals in other countries.

Moreover, Englund et al., studied 2582 people, who were 50 years of age or older [22]. Of them, 991 were women, with a mean age was 62.3 years (range, 50.1 to 90.5), which is higher than we observed. The prevalence of meniscal tears increased with increasing age in both sexes and the occurrence of meniscal damage was more liable in the middle-aged group [23].

In the current study, both sexes complained of MLs in symptomatic, males were 33 (66%), whereas females were 17 (34%), and in asymptomatic MLs, males were 24 (48%), whereas females were 26 (52%), with no significant difference between both groups (P=0.069). These results disagree with Shukri and Musalah, who found that male predominance (72.5%) and disagree with Magee and Williams, who reported that males were common (73%)

Fig. 2 (Рис. 2)

Fig. 2. MRI, knee, sagittal view, proton density, 1.5 T.

46-years-old asymptomatic male, grade II degeneration of the posterior horn of the medial meniscus (yellow arrow).

Рис. 2. МРТ, коленный сустав, сагиттальная плоскость, изображение, взвешенное по протонной плотности, 1,5 Т.

Мужчина, 46 лет, без клинических проявлений, II степень дегенерации заднего рога медиального мениска (желтая стрелка).

Fig. 3 (Рис. 3)

Fig. 3. MRI, knee, sagittal view, proton density, fat suppression, 1.5 T.

A 48-year-old male presented with knee pain, send for a suspected meniscal lesion. Horizontal tear grade III of the anterior horn of the lateral meniscus (yellow arrow).

Рис. 3. МРТ, коленный сустав, сагиттальная плоскость, изображение, взвешенное по протонной плотности с подавлением сигнала от жировой ткани, 1,5 Т.

Мужчина, 48 лет, поступил с жалобами на боль в коленном суставе, с подозрением на повреждение мениска. Горизонтальный разрыв III степени переднего рога латерального мениска (желтая стрелка).

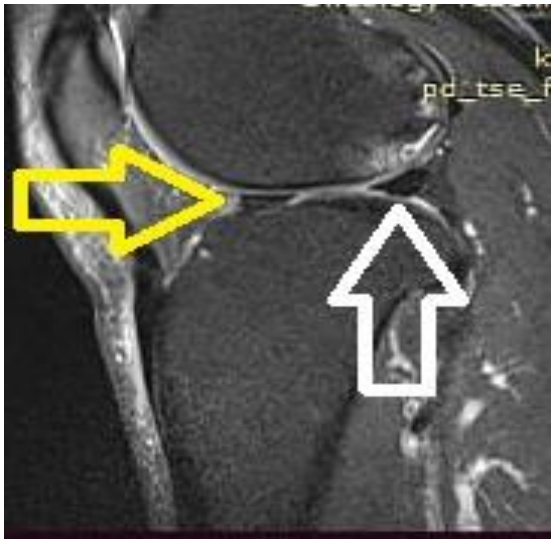

Fig. 4 (Рис. 4)

Fig. 4. MRI, knee, sagittal view, proton density, fat suppression, 1.5 T.

A 46-year-old male presented with knee pain and locking. Degeneration grade II of the posterior horn (white arrow) and horizontal tear grade III of the anterior horn of the lateral meniscus (yellow arrow).

Рис. 4. МРТ, коленный сустав, сагиттальная плоскость, изображение, взвешенное по протонной плотности с подавлением сигнала от жировой ткани, 1,5 Т.

Мужчина, 46 лет, жалобы на боль в коленном суставе и ограничение подвижности сустава. Дегенерация II степени заднего рога (белая стрелка) и горизонтальный разрыв III степени переднего рога латерального мениска (желтая стрелка).

[20, 24]. Furthermore, Englund et al., found that women were more exposed to MLs in 57%. This could be explained by the difference between the two genders functionally and physiologically [22].

Several studies revealed a positive association between the female gender and MLs as the strongest risk factor, which may be due to hormonal changes in females, pregnancy, sedentary lifestyle, obesity, and genetics [18, 23].

In fact, the functions of the knee meniscus are shock absorption and distributing the load of the weight of the body, stability, and movements control [3]. High BMI is a predisposing factor for the development MLs [14].

In this study, the overweight value of BMI is the most common in both groups of the study. The mean BMI of symptomatic patients with MLs was 28.303±4.9 Kg/m2 and the mean BMI of asymptomatic patients with MLs was 28.28±4.74 Kg/m2 with no significant difference (P=0.982) concerning MLs types (whether symptomatic or asymptomatic) and about sex (male or female). The results of this study were similar to data recorded by Englund et al., they found that the mean BMI was 28.5 (range, 16.6 to 55.6) [22]. In addition, they mention that women with MLs had a higher BMI than women without meniscal damage (29.9 vs. 27.9, P<0.001), but among men, there was no significant difference in the BMI between the group with damage and the group without damage (28.7 and 28.6, respectively; P = 0.83) [22].

In addition, Ding and others agree with this study, in multivariable analysis, the prevalence of meniscal tears was significantly associated with age (OR 1.06 to 1.12 years), BMI (OR 1.06 to 1.11 kg/m2), sex (women vs. men: OR 4.14 to 4.23), and family history of OA (OR 1.97 to 2.01) [23].

In the current study, among a history of knee injury (trauma), there was no significant difference between both groups, (P=0.15), but concerning comorbidity, there was a high statistically significant difference (P=0.009) between the two groups. The mechanism of MLs either traumatic or degenerative. The traumatic MLs is mostly occurring in the younger age group and their rate decreased with increasing age due to decrease activities. The degenerative

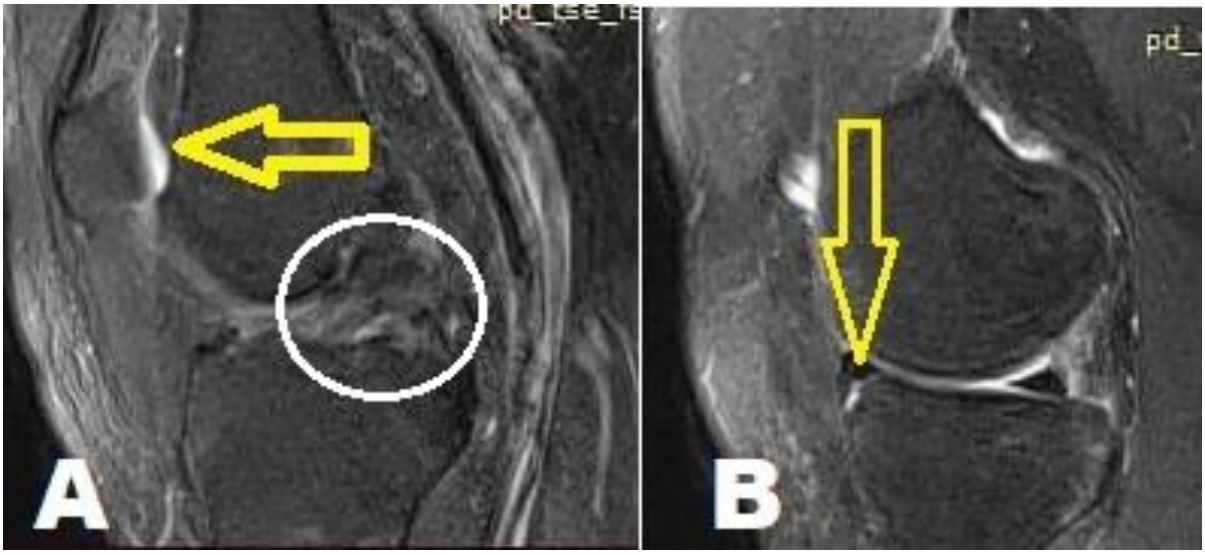

Fig. 5 (Рис. 5)

Fig. 5. MRI, 55-years-old asymptomatic male patient.

A – MRI, knee, sagittal view, proton density, fat suppression, 1.5 T. Mild joint effusion (white circle) and mucoid degeneration of anterior cruciate ligament (ACL) (yellow arrow).

B – MRI, knee, sagittal view, proton density, fat suppression, 1.5 T. Vertical tear grade III of the anterior horn of the medial meniscus (yellow arrow).

Рис. 5. МРТ, мужчина, 55 лет, без клинических проявлений.

А – МРТ, коленный сустав, сагиттальная плоскость, изображение, взвешенное по протонной плотности с подавлением сигнала от жировой ткани, 1,5 Т. Умеренный суставной выпот (белый кружок) и мукоидная дегенерация передней крестообразной связки (желтая стрелка).

Б – МРТ, коленный сустав, сагиттальная плоскость, изображение, взвешенное по протонной плотности с подавлением сигнала от жировой ткани, 1,5 Т. Вертикальный разрыв III степени переднего рога медиального мениска (желтая стрелка).

cause of damage occurred mainly in the middle-aged group [20]. These findings are not supported by data from a study done in Erbil city [25]. The authors concluded that traumatic MLs more commonly occurred in patients of lower BMI while degenerative tears were more common in obese patients [20, 26].

Painful knee (96%), discomfort (100%), and reduce joint motions (100%) are the most common manifestations in this study. We also recorded swelling, locking, catching, giving away knee, tenderness, mass, effusion, scar, and redness. Englund et al. documented the same results, the presence of MLs was more common in persons who had knee pain, tenderness, or stiffness on most days than in asymptomatic cases (45% vs. 26%, P<0.001) [22].

The present study results revealed the prevalence of MRI findings as joints effusion (100%), bone marrow and soft tissue edema (46%), meniscal tear (horizontal) (54%), meniscal tear (complex, vertical, radial) (18%), and ACL (22%) in symptomatic MLs. Otherwise, the prevalence of the same MRI findings in asymptomatic MLs were 42 (84%), 2 (4%), 16 (32%), 0 (0%), and 6 (12%). The study findings suggest that symptomatic patients have a higher prevalence of MRI radiological signs than asymptomatic. These results are like the results of Zanetti et al., meniscal tears were found in fifty-seven symptomatic knees and thirty-six asymptomatic knees (p < 0.001) [21].

According to the current study results, 44.2% of horizontal tears were in MM in symptomatic knees, while 18.6% of lesions were in asymptomatic knees. Whereas the lateral horizontal tears presented in symptomatic and asymptomatic knees as 12 (27.9%) and 4 (9.3%), respectively, without significant relation (P=0.744). Furthermore, seven tears (77.8%) of complex MLs were seen in MM, whereas two lesions (22.2%) were reported in LM and no complicated asymptomatic MLs were seen, with no significant difference (P=0.425). Shukri and Musalah showed different proportions for each lesion as followed: medial meniscus (MM) tear (80%), lateral meniscus (LM) tear (20%), isolated anterior horn tear of LM (12.5%), isolated anterior horn tear of MM (1.25%), isolated posterior horn tear of MM (66.25%), isolated posterior horn tear of LM (7.5%), horizontal tear (50%), vertical longitudinal tear (10%), Bucket handle tear (12.5%), and complex tears (27.5%) [20]. These differences could be explained by differences in the sample studied, different in locality, equipment, and facilities.

Englund et al., [22], mentioned that the prevalence of meniscal tears in the symptomatic knee was 35%. Damage to the MM was more common than damage to the LM. The tear involved the posterior horn of the meniscus (66%), the body segment (62%), and the anterior horn (11%). About other findings, they found that 40% presented as horizontal tears, 37% as complex tears, 12% as oblique tears, 15% as radial tears, 7% as longitudinal tears, and 1% as root tears.

Zanetti and colleagues recorded horizontal tears MM in 32 and 11 in LM in symptomatic knees, and 29 in MM and 8 in LM in asymptomatic cases with no significance. Complex tears were found medially in 18 and laterally in five symptomatic cases [21].

Joint effusion has a strong difference (P=0.004) between the two categories in the current study. There was a strong statistically significant difference between symptomatic and asymptomatic MLs (P<0.0001) concerning bone marrow and soft tissue edema. These results are consistent with Zanetti et al. [21], who found a significant difference between pericapsular edema in symptomatic and asymptomatic cases (P<0.001), additionally to, edema-like bone marrow (P<0.001).

The pericapsular edema is represent an indirect sign for meniscal lesions, but this statement is not confirmed [27-29]. De Smet et al. [30] believed it is because of hemorrhage from capsular stretching or damage that may be associated with knee OA (KOA).

Bone marrow edemas are called "bone bruises" they are associated with traumatic injury. It is a rare entity, since; there are few reports about these findings [21]. In terms of histopathology, it appears as necrosis, fibrosis, trabecular bone abnormalities, and fragments of cartilage, rather than edema [27, 29, 30].

Horizontal meniscal tears are more frequently recorded in symptomatic than asymptomatic MLs (P=0.04). The same for complex meniscal tears (vertical, radial), they are more predominant in symptomatic than asymptomatic MLs (P=0.002). These results are disliked with that concluded by Zanetti et al. [21], who concluded horizontal MLs are mostly encountered in both asymptomatic and symptomatic cases and may not always be related to symptoms.

On the other hand, other kinds of literature agree with the findings of this study, which mentioned that radial, vertical, and complex are found almost and exclusively on the symptomatic knees and practically appear to be clinical benefits [24, 28].

Lastly, there was no significant difference between symptomatic and asymptomatic MLs (P=0.133) concerning ACL lesions. Guimaraes et al., disagree with this study's results, they concluded that intra-meniscal signal-intensity

alterations are a common finding in subjects with an ACL tear [18]. Primary ruptures of ACL are increasingly symptomatic than asymptomatic knees, and radiologists should be familiar with such tears. Which required an overview of the normal and abnormal appearances after these ruptures at MRI follow-up [31]. ACL injury incidence was fairly consistent and more frequent in players [6]. This discrepancy could be explained by the there are no sportsmen or women in this study sample, therefor we suggest further future studies in such a situation.

Limitations of this study include, firstly, this study has limited cooperation among asymptomatic people (as they do not have any complaints) and did not want to find new issues in unexpected (painless) organs. Lastly, the COVID-19 pandemic also affected the number of people (especially the asymptomatic) in this study.

Conclusion.

The old-age and comorbid conditions correlate with MLs in symptomatic more than in asymptomatic knees. Gender, BMI, and history of trauma are not statistically associated with the development of MLs in symptomatic and asymptomatic MLs knees. Joints effusion (100% in symptomatic and 84% in asymptomatic), bone marrow or soft tissue edema (46% in symptomatic and 4% in asymptomatic), meniscal tear (horizontal) (54% in symptomatic and 32% in asymptomatic), meniscal tear (complex, vertical, and radial) (18% in symptomatic), and ACL (22% in symptomatic and 12% in asymptomatic) are represented as most common MRI findings seeing more than in symptomatic over asymptomatic MLs. Horizontal medial meniscal tears are frequently the most common MLs in symptomatic (44.2%) and asymptomatic (27.9%) knees. Complex lateral meniscal tears (2 cases only) are the least common observation. Grade III injury is common in symptomatic cases (72%) while Grade II injury is common in asymptomatic cases (42%). We recommend not overestimating the degenerative changes related to aging as an MLs, to prevent unnecessary surgery. Applying a systematic program for early detection of MLs.

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