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ASSESSMENT OF KNEE JOINT PATHOLOGIES ON MRI AMONG DIFFERENT AGE GROUPS

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Abstract

Background: Among body joints, the most complex and most intricate is knee joint essential for enabling movement and sustaining body weight. Magnetic Resonance Imaging (MRI) is a modality that is non- intrusive approach for the diagnosis of knee abnormalities.

Objective: To assess and evaluate the prevalence of the knee joint pathologies on MRI among different age groups.

Material and Methods: Convenient sampling was used to gather data of 87 patients with a history of chronic knee pain. Data was collected prospectively from multicenters in Lahore and analyzed using SPSS version 23. Knee pathologies frequencies were assessed across three age groups, from 19 to 80 years old comprising 55 (63.2%) patients in 19-40, 26 (29.9%) in 41-60 and only 6 (6.9%) in 61-80 age group.

Results: Among total of 87 patients undergoing knee MRI, Gender distribution showed 67 males (77.01%) with highest frequency in 19-40 age group (87.3%) and 20 females (22.99%) with highest frequency 38.5% in 41-60 age group. 39 patients had an ACL tear with highest frequency of 49.1% in 19–40 age group. 3 patients suffered from MCL tear with highest frequency of 3.6% in 19-40 age group, 5 patients had PCL tear with highest frequency 5.5% in 19-40, 4 patients had LCL tears with highest frequency 7.7% in 41-60 age group. Joint effusion highest frequency was 61.9% in 19-40 age group.

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Conclusion: MRI can be brought into play as a screening tool for affected individuals with persistent knee pain symptoms who are anxious to resume their usual lifestyle, therefore prompt diagnosis of their condition based on their age will shorten the recovery period. They can also choose therapeutic techniques through MRI screening.

Introduction

The most prevalent bone or joint-related ailments that affects people of all ages equally is knee pain. Indispositions and traumas that impair articular structures like meniscus, cartilage, ligaments, and other factors that produce knee discomfort, disablement and ultimately prevalence of morbidity increases. According to the Pakistan national joint registry data source, every 9.5 out of 100 individuals underwent TKR (Total Knee Replacement) between 2014 and 2021 (Bukhari, Allana, Najjad, & Noor, 2023).

In a survey conducted in Gujranwala, 2023; 17.7% of the individuals tested positive for anterior knee pain (Abbas, Asghar, Islam, & Raza, 2023). Plain radiography, Computed tomography (CT) and Arthroscopy are used as the initial diagnostic tool but most accurate diagnostic tool is Magnetic Resonance Imaging (MRI). MRI being non-ionizing pertains well explained images of the body's organs and tissues by the use of radio waves and a strong magnetic field. It is capable of having great soft tissue contrast and can differentiate between fat, water, muscle, and other soft tissues by reconstructed anatomy in multiplanar images or slices.

Knee injuries and pathologies are a prevalent concern in the field of orthopedics and sports medicine. Magnetic resonance imaging (MRI) has become an indispensable tool for the accurate determination and evaluation of various knee conditions (Ahmad et al., 2019). Arthroscopy is considered to be the gold standard for knee joint assessment (Nikolaou et al., 2008), however due its invasive nature and anesthesia induction, many patients reconsider their choice of diagnosis where radiology comes in.

The diagnostic accuracy of MRI in both traumatic history in athletes and degenerative disorders in older patients has increased over years. For better prognosis and treatment plan, fine detailed images are needed which only MRI can provide. Meniscal injuries result from intra articular bruise which further leads to joint impairment if left undiagnosed. Patients present in clinics with chronic knee pain and get a physical examination as a first protocol of diagnosis when MRI has clearly proved that meniscal injury or tear could not be diagnosed through physically examining the patient (Krakowski et al., 2021), instead sending them off to MRI could help the physician to clearly rule out the actual cause of pain.

Aims & Objectives of the study

To find the frequency of most prevalent disease or injury in patients with the age limit of 19-80 years.

To study the benefits of MRI in early diagnosing a disease associated with only painful symptoms history and the highest frequency of pathologies in different age groups.

To assess the knee joint pathologies on MRI among different age groups.

MATERIAL AND METHODS

Research Design

The aim of this research project was to evaluate the efficacy of MRI in diagnosis of knee joint pathologies, to achieve the targeted objective a prospective study was performed. The research design was cross sectional observational and quantitative in order to quantify the findings of knee pathologies on MRI.

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Ethical consideration
Board of Advance Studies and Research (BASAR) of our university approved the research project. Hospital authorities were given a brief introduction to the research purpose and its significant role in diagnosis plan. Patients were explained individually and consent was taken through informed procedure. Willingness of patients to participate was acquired through questionnaire Performa which included history and findings. This whole project is written following the American Psychology Association (APA, 2013) guidelines.

Setting
Data collection took place in multi centers including only private hospitals and diagnostic labs in Lahore, Pakistan. Selection of research setting was based on the allowance from Radiology department and availability of MRI scanners.

Methods
Data collected was based on convenience sampling. Sample size of patients was 87 calculated by using finite population formula. Patients were selected randomly with a history of knee joint pain, stiffness, joint immobility, tenderness and walking difficulty. Patient Performa containing demographic profile, history of knee pain and MRI findings was filled according to the patients given information and examination. MRI Scanner was of 1.5 Tesla strength. All patients went through the same procedure using MRI knee coils. The study span was three and a half months (from April 1st, 2024 to July 15th, 2024). Data Analysis was performed using SPSS V23 for frequency distribution.

Inclusion Criteria:
Age 19 to 80 years old patients.
Both genders (Male & Female).
Chronic knee pain (up to 6 weeks).
Patients with history of joint immobility.

Exclusion Criteria:
Below 19 and above 80 years old patients.
Trauma history.
Acute knee pain.
Patients with history of surgery or arthroscopy on the same knee.
Patients not willing to give written consent for the study.

RESULTS
Results were analyzed using SPSS V23 for frequency distribution. Patients were divided into three age groups in which most patients were in 19-40 age group comprising total 55 (63.2%), 41-60 had 26 (29.9%) and 61-80 had only 6 (6.9%) patients. (Table 1, Fig 1). Gender distribution showed highest frequency in 19-40 age group (87.3%), then 41-60 (61%). altogether 67 males (77.01%) and females highest frequency was 38.5% in 41-60 age group; altogether 20 females (22.99%). (Table 2, Fig 2). Based on MRI examination findings of patients, pathologies frequency was analyzed. Among 19-40 age group 27 (49.1%), 11 patients 42%) in 41-60 age group and only 1 patient in 61-80 age group had ACL tear (Table 3). Only 2 patients in 19-40

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age group and one patient in 41-60 age group had MCL tear (Table 4). LCL tear was findings in 2 patients each from 19-40 and 41-60 age groups (Table 5). PCL tear was findings in 3 patients of 19-40 age group and 2 patients in 41-60 age group (Table 6).

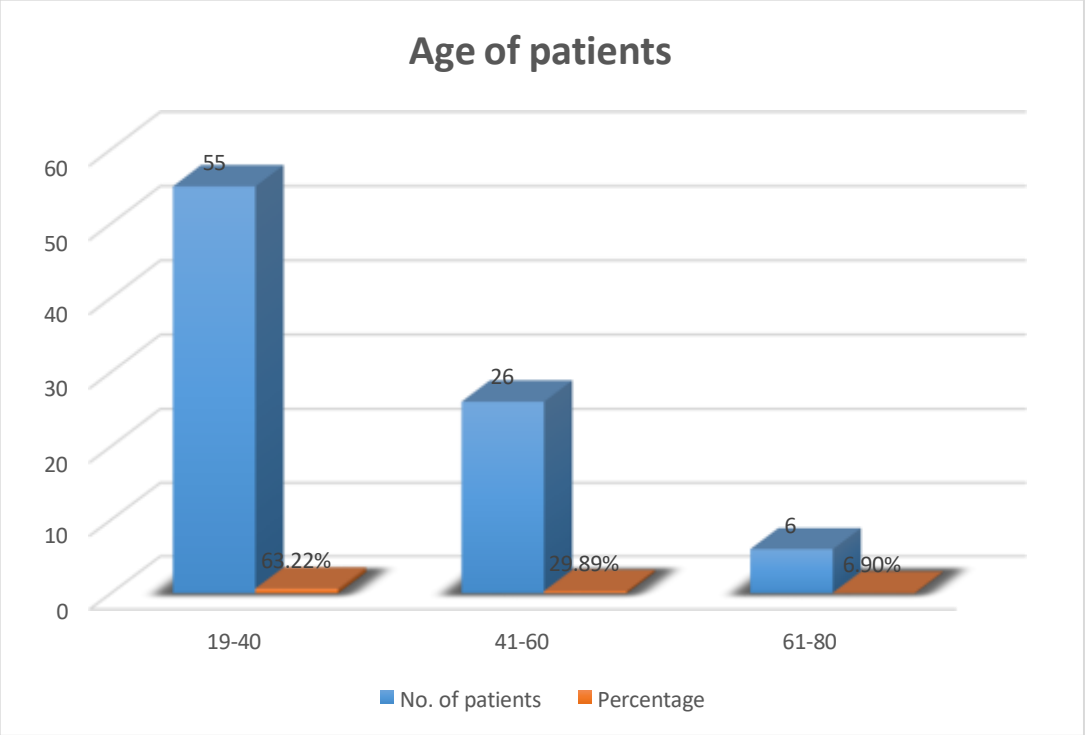

Fig 1: Bar chart showing Number of patients based on Age groups

	Number of patients according to Age Groups				
		Frequency	**Percentage**	**Valid percentage**	**Cumulative percentage**
Valid	19-40	55	63.2	63.2	63.2
	41-60	26	29.9	29.9	93.1
	61-80	6	6.9	6.9	100
	Total	87	100	100	

Table 1: 3 Age groups of patients showing highest frequency percentage 63% in 19-40 age group and 29.9% in 41-60 age group.

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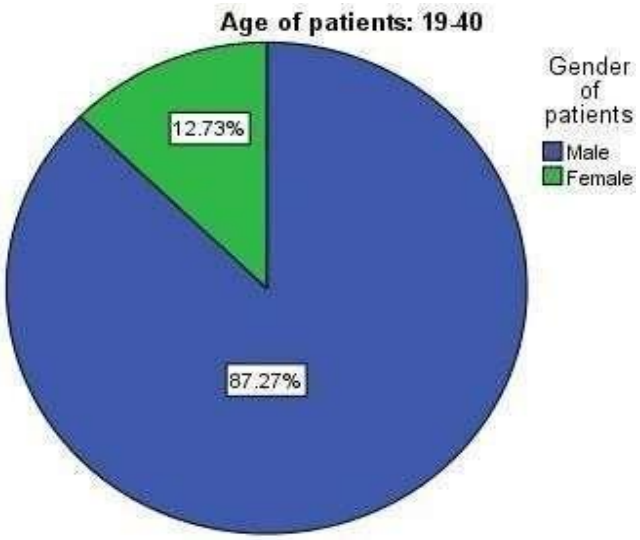

Figure 2: Gender distribution in 19-40 age group showing highest frequency of males (87.27%)

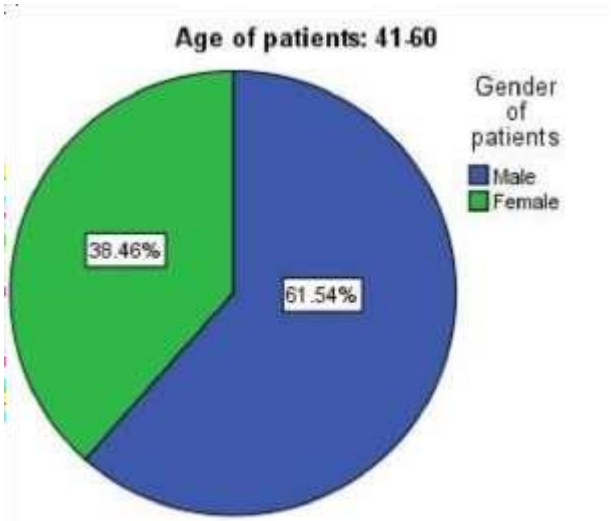

Figure 3: Gender distribution in 41-60 age group showing 61.54% of males & 38.46% females

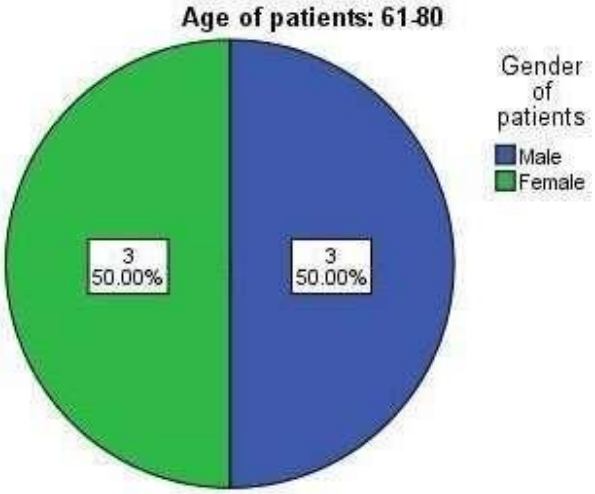

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Figure 4: Gender distribution in 61-80 age group showing equal distribution of both genders

Gender Distribution						
			Frequency	**Percentage**	**Valid percentage**	**Cumulative percentage**
Valid	19-40	Male	48	87.3	87.3	87.3
		Female	7	12.7	12.7	100
		Total	55	100	100	
	41-60	Male	16	61.5	61.5	61.5
		Female	10	38.5	38.5	100
		Total	26	100	100	
	61-80	Male	3	50	50	50
		Female	3	50	50	100
		Total	6	100	100	

Table 2: Gender distribution according to Age groups

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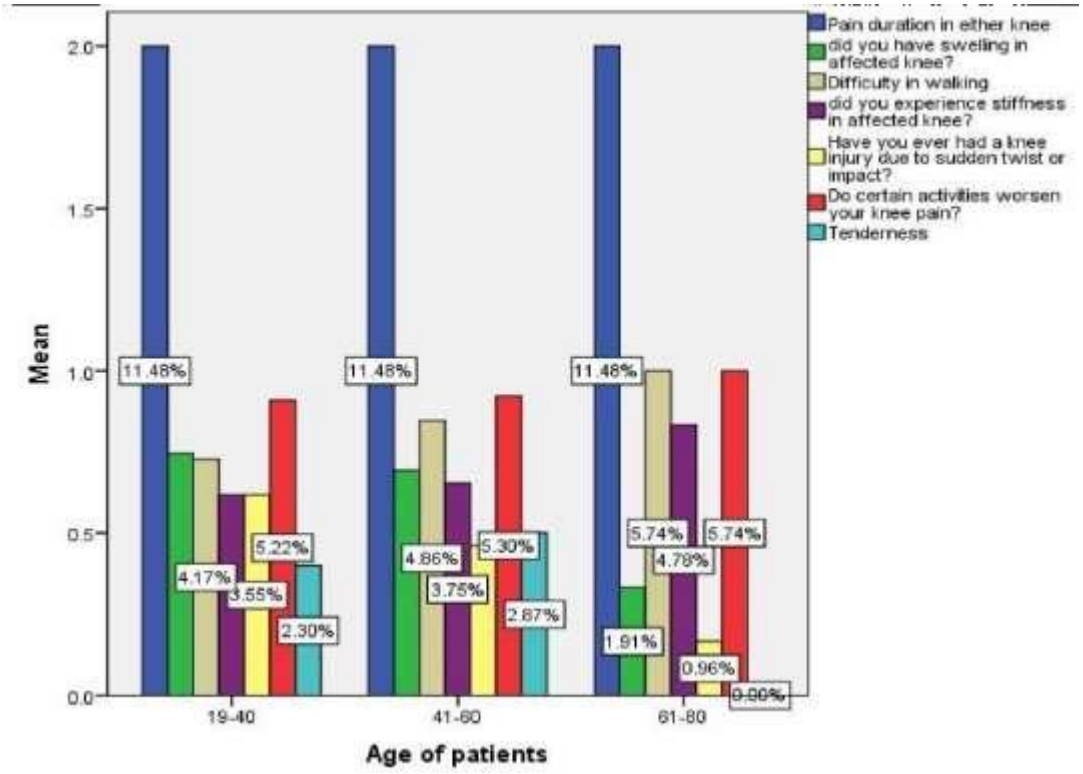

Figure 5: Chronic knee pain in all age groups with highest frequency of 5.22%

MRI Findings: ACL Tear						
			Frequency	**Percentage**	**Valid %**	**Accumulative percent**
Valid	19-40	No	28	50.9	50.9	50.9
		Yes	27	49.1	49.1	100
		Total	55	100	100	
	41-60	No	15	57.7	57.7	57.7
		Yes	11	42.3	42.3	100
		Total	26	100	100	
	61-80	No	5	83.3	83.3	83.3
		Yes	1	16.7	16.7	100
		Total	6	100	100	

worsening knee pain on activity in all age groups with tenderness being the lowest.

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Table 3: ACL tear in 19-40 age group is highest showing 49.1% and 42.3% in 41-60 age group. 61-80 shows only 16.7%.

MRI Findings: MCL Tear						
			Frequency	**Percentage**	**Valid %**	**Accumulative percentage**
Valid	19-40	No	53	96.4	96.4	96.4
		Yes	2	3.6	3.6	100
		Total	55	100	100	
	41-60	No	25	96.2	96.2	96.2
		Yes	1	3.8	3.8	100
		Total	26	100	100	
	61-80	No	6	100	100	100

Table 4: MCL tear shows 3.8% knee pathologies among the 41-60 age group and 3.6% in 19-40 age group.

MRI Findings: LCL Tear						
			Frequency	**Percentage**	**Valid %**	**Accumulative percentage**
Valid	19-40	No	53	96.4	96.4	96.4
		Yes	2	3.6	3.6	100
		Total	55	100	100	
	41-60	No	24	92.3	92.3	92.3
		Yes	2	7.7	7.7	100
		Total	26	100	100	
	61-80	No	6	100	100	100

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Table 5: LCL tear showing highest frequency in both 19-40 & 41-60 age groups.

MRI Findings: PCL Tear						
			Frequency	Percent	Valid percent	Cumulative percent
Valid	19-40	No	52	94.5	94.5	94.5
		Yes	3	5.5	5.5	100
		Total	55	100	100	
	41-60	No	24	92.3	92.3	92.3
		Yes	2	7.7	7.7	100
		Total	26	100	100	
	61-80	No	6	100	100	100

Table 6: PCL tear in 41-60 age group shows higher frequency of 7.7% than 19-40 age group with only 5.5%. (Fig 6)

MRI Findings: Medial Meniscal Tear						
			Frequency	**Percentage**	**Valid %**	**Accumulative percentage**
Valid	19-40	No	40	72.7	72.7	72.7
		Yes	15	27.3	27.3	100
		Total	55	100	100	
	41-60	No	20	76.9	76.9	76.9
		Yes	6	23.1	23.1	100
		Total	26	100	100	
	61-80	No	5	83.3	83.3	83.3
		Yes	1	16.7	16.7	100
		Total	6	100	100	

Table 7: Medial meniscal tear in 19-40 age group shows 27% affected patients and 23% patient in 41-60 age group. (Fig 7)**.**

MRI Findings: Lateral Meniscal Tear						
			Frequency	**Percent**	**Valid percent**	**Cumulative percent**
Valid	19-40	No	48	87.3	87.3	87.3
		Yes	7	12.7	12.7	100
		Total	55	100	100	
	41-60	No	23	88.5	88.5	88.5

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		Yes	3	11.5	11.5	100
		Total	26	100	100	
	61-80	No	6	100	100	100

Table 8: Lateral meniscal tear was present in 7 patients with highest frequency in 19-40 age group. (Fig 7)

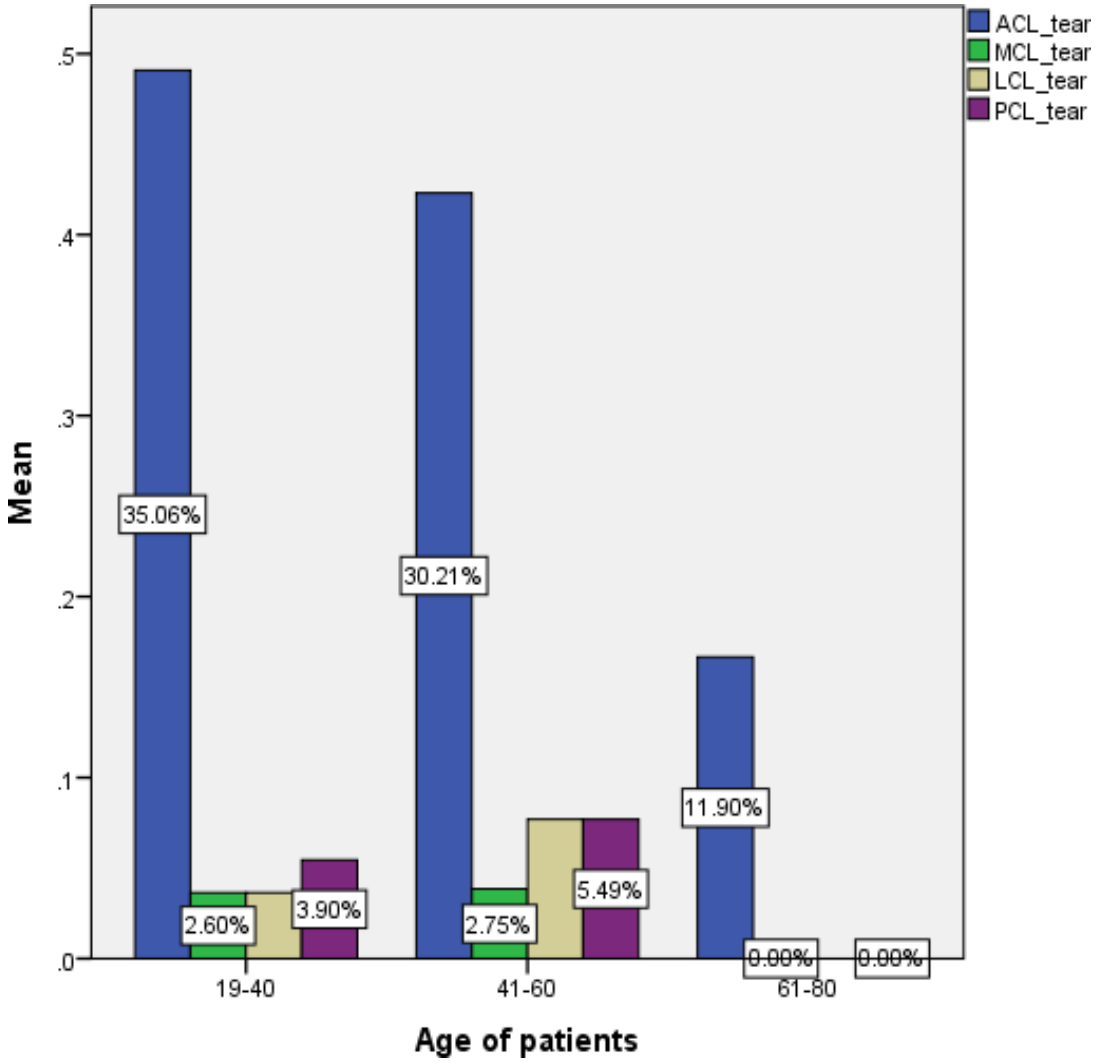

Fig 6: ACL tear has the highest frequency of 35.06% in age group 19-40, 30.21% in 41-60 and 11% in 61-80 age group.

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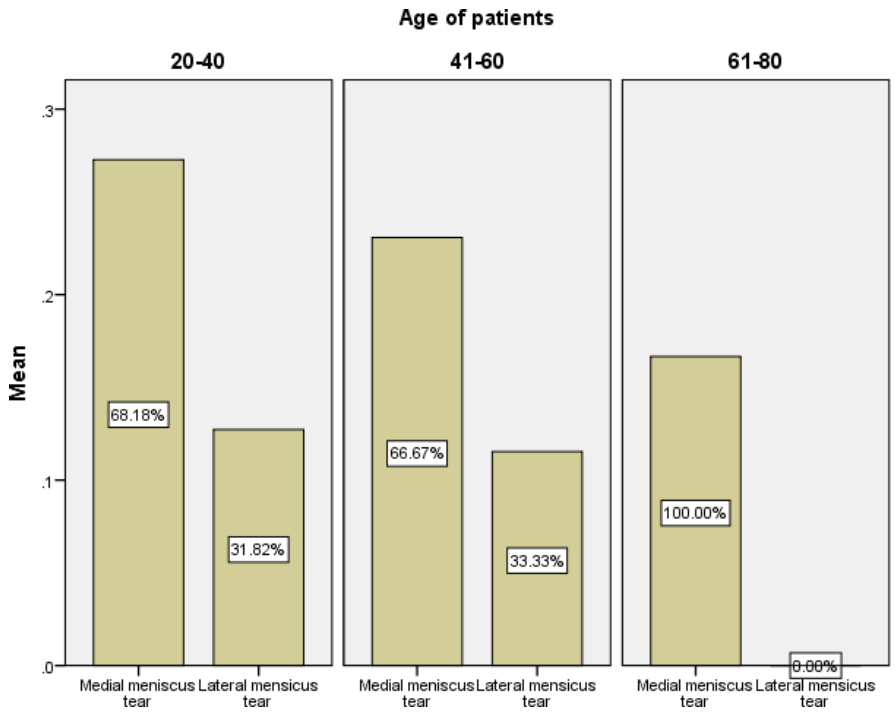

Fig 7: Medial meniscal tear had highest frequency 68.18% in 20-40 years age group and 31.82% patients had lateral meniscal tear.

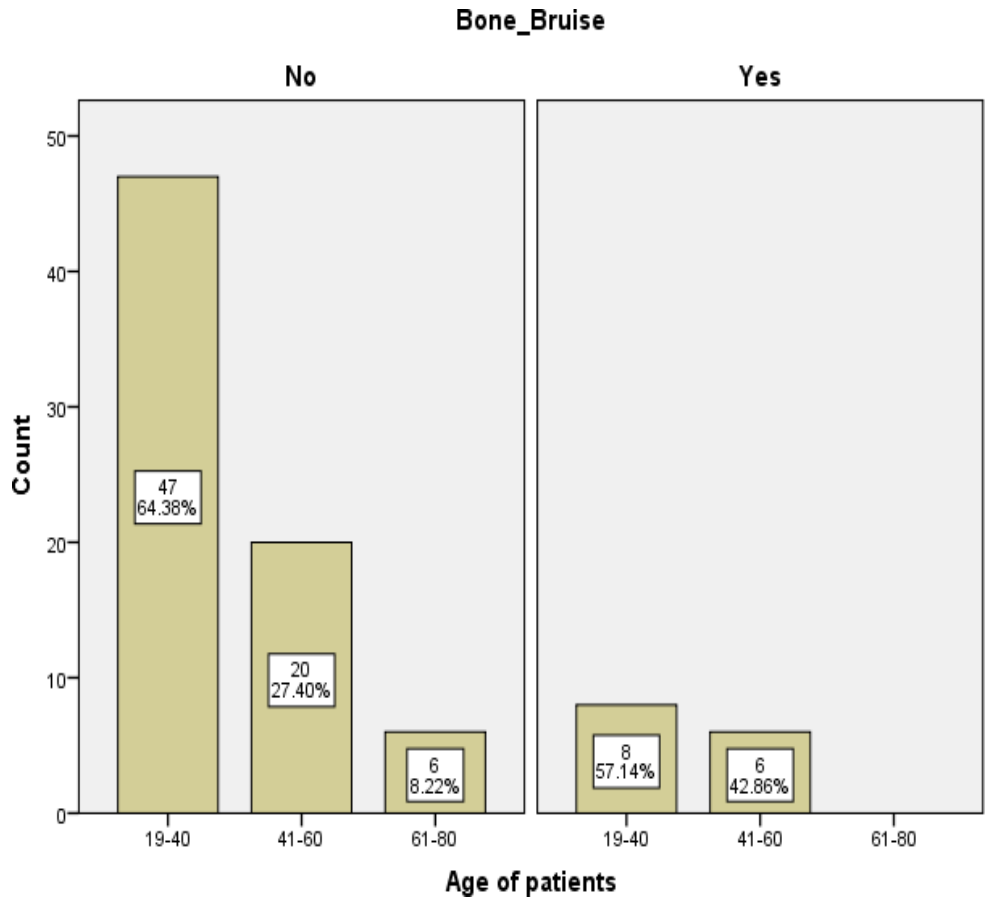

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Fig 8: knee pathologies showing bone bruising in 19-40 age group with highest frequency of 57.14% and 42% in 41-60 age group.

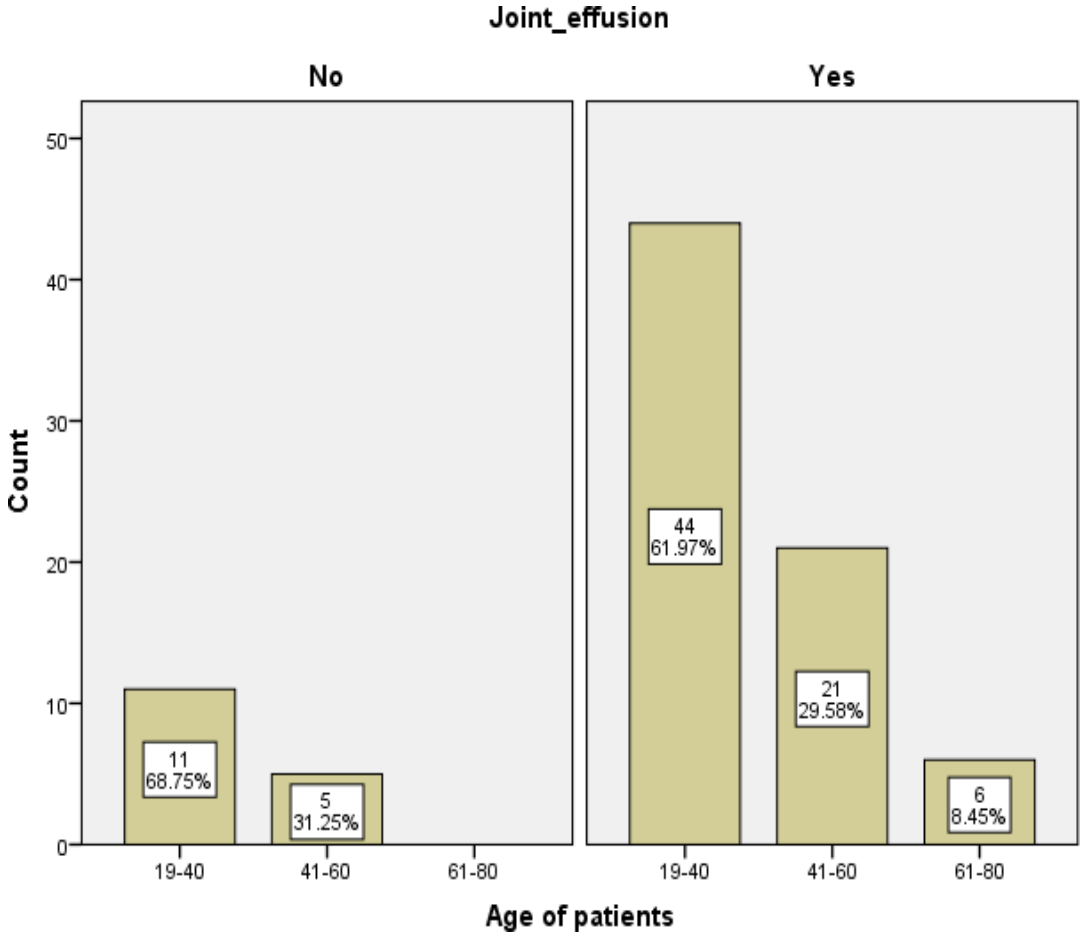

Fig 9: Joint effusion was present in 19-40 age group with highest frequency of 62% and 29.58% in 41-60age group.

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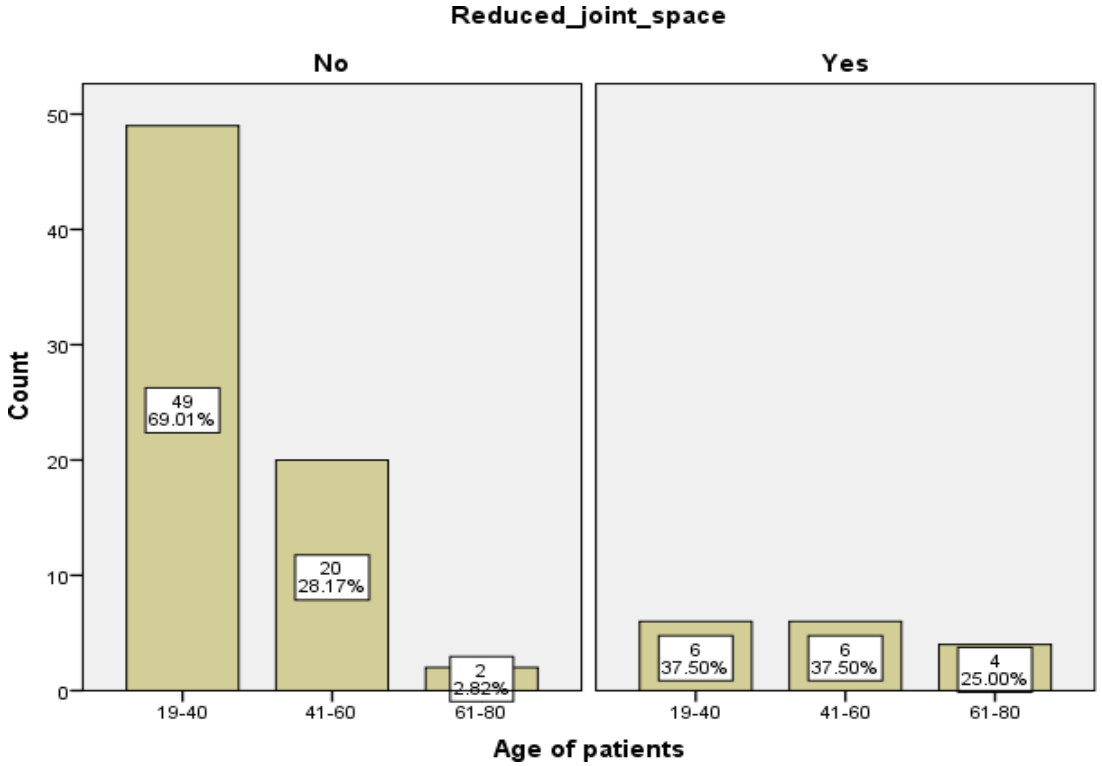

Fig 10: Knee pathologies showing reduced joint space in 19-40 age group as well as 41-60 age group about 37.50%

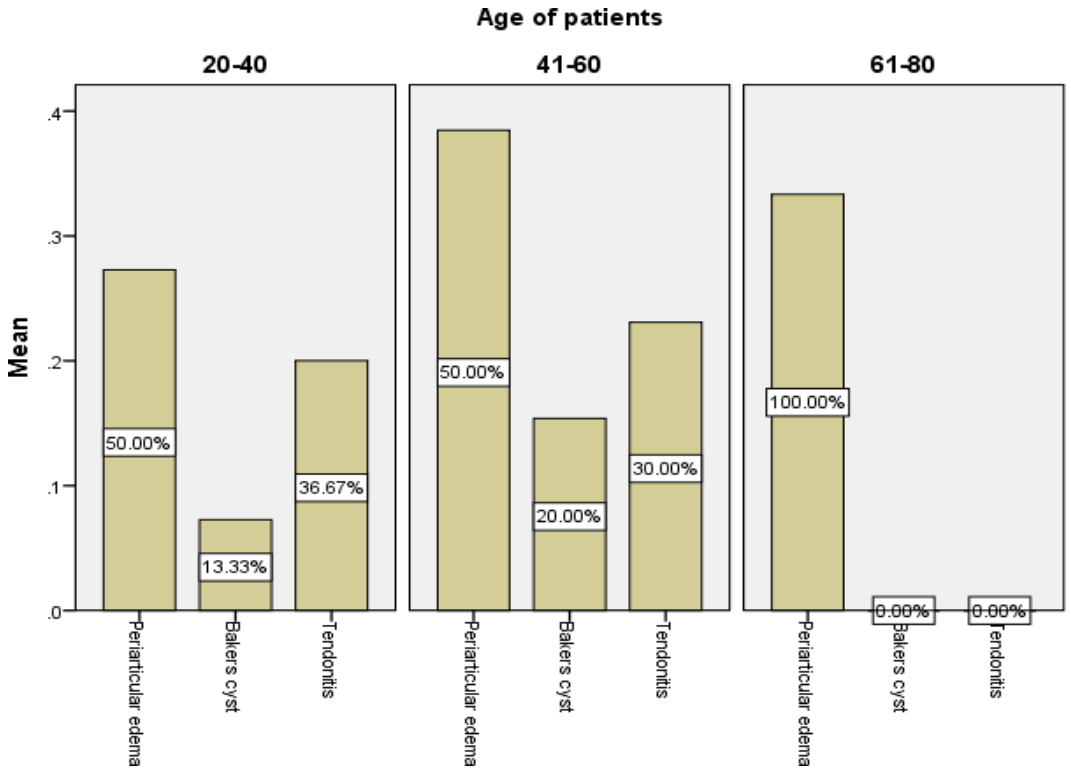

Fig 11: Other Knee pathologies showing bakers cyst highest frequency 50% in 41-60 age group, periarticular edema 50% frequency in first 2 age groups and

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tendonitis highest frequency of 36.67% in 20-40 age group frequency of 36.67% in 20-40 age group.

DISCUSSION

The principal joint of the human lower limbs is the knee joint. One of its major use is weight-bearing and a large amount of exercise, as it is the center of lower limb activities. Its anatomy and physiology are the most complex one. In sports population especially, the slip trip mode often causes knee joint trauma, for instance, the anterior cruciate ligament, the meniscus, and other associated structures are affected. Amidst them, anterior cruciate ligament injury is a kind of common potential injury, and it often presents as a kind of noncontact injury in sports, such as landing, changing direction, twisting, and other movements (Kaeding et al., 2017). Most commonly injured joint is knee joint because of its phenomenal nature, its susceptibility to external forces, and the functional demands imposed on it. In days before the technology advancements there were restricted supplies to diagnose and manage cases associated with a knee injury and mostly it was done based on the clinical examination and x rays.

Recurrently, we find patient with complaints of knee injury from all age groups, from a pedestrian crossing street to elderly falling on the ground, almost all athletes' experiences knee injury during their lifetimes. Knee joint is more prone to multiple types of traumas like fracture, dislocation, and ligamentous, tendinous, and cartilaginous tears because of its composite structure (Naraghi & White, 2016). MRI has made it possible to explore the injured knee non-invasively, therefore avoiding invasive procedures and further ailment. The knee joint is a complex type of synovial joint and due to the lack of bony support, stability of the joint is highly reliant on its supporting ligamentous structures, therefore ligamentous and menisci injuries are extremely frequent.

Singh JP et al, 2004 study findings showed ACL tears in 78 out of 173 patients and stated that among ligamentous injuries ACL tear is the most common than other ligaments. However, in our study, the most common knee pathology on MRI examination was ACL tear in about 39 patients' total with highest frequency of 49% in Age group 19-40 years old, which also makes it the most common in ligamentous and meniscal injury. PCL tears are relatively not common in patients with knee injuries. Dhande et al. (2022) study examined PCL tears through MRI in 8 patients in a study span of 2 years Although in our study, PCL tear was diagnosed in only 5 patients with highest frequency 5.5% in 19-40 age group. ACL tears predominated in PCL tears.

Among the menisci tear findings on MRI in our study, 22 patients had medial meniscal tear with highest frequency of 27.3% in age group 19-40 years old and lateral meniscal tear was examined in 10 patients with highest frequency of 12% in 19-40 age group which is correspondent with findings of Phelan et al. (2015) that found the MRI has 87% sensitivity & 93% specificity for diagnosing Medial menisci lesions and for lateral menisci lesions, MRI has 78% sensitivity and 95% specificity. Kumar et el, 2020 findings were based on the grading of medial meniscal tear, 33 patients had grade 1 tear, 4 patients suffered from grade 2 tear and 29 from grade 3 tear resulting in patients with medial meniscal tears more than lateral meniscal tears examined in 20 patients only.

It was observed in a study conducted by Kumar S., 2021 that frequent knee pathologies were medial meniscal tears in 6, lateral meniscal tears in 7, chondromalacia patellae in 5, rheumatoid arthritis in 8, anterior cruciate ligament (ACL) tear in 14, posterior cruciate ligament (PCL) tear in 10, medial collateral ligament (MCL) tears in 5 lateral

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collateral ligament (LCL) tears in 7. The difference was remarkable (P< 0.05). Although, our study only included the tear and lesions frequency of knee joint in patients of 19-80 years old. MRI examination showed normal findings in 40 patients with highest frequency of 72% in 19-40 age group. Joint effusion affected 71 patients with highest frequency of 62% in 19-40 age group.

In MRI Examination of Anterior and Posterior Cruciate Ligament, anterior have 67.1% have normal, 11.4% have Partial and 21.4% have Complete Rupture. While in Posterior Cruciate have 80% normal findings, Partial Rupture 10% and Complete Rupture 5.7% (Khan et al., 2021). Findings in our study was among 19-40 age group 27 (49.1%), 11 patients 42%) in 41-60 age group and only 1 patient in 61-80 age group had ACL tear. Only 2 patients in 19-40 age group and one patient in 41-60 age group had MCL tear. No grading was utilized as the scale of severity as it was frequency distributed study according to age.

According to Cristiani et al., 2024, the most common related injuries were PCL about 0.4 percent, MCL 41.3 percent (superficial MCL) and deep MCL 16.5 percent, bone bruising (92.9 percent. However, In our study, the highest frequency of knee pathology was ACL (49%) tear in 19-40 age group, MCL (3.6%) tear in 19-40 age group, LCL (3.6%) tear, Medial meniscus (27%), lateral meniscus (12.7%), bone bruising (57%) with no fracture of associated bone. Joint effusion was evident in 62% of cases in 19-40 age group. The highest frequency of knee pathologies was in the age group from 19 years old to 40 years old. Age factor had an impact on the MRI examination significantly.

Conclusion

It is well known that Magnetic Resonance Imaging (MRI) hold the initial diagnostic tool platform for being non-invasive, non-ionizing, highly accurate and disease specific examination. Young individuals are more prone to sports injuries and middle aged individuals suffer from wear & tear of knee joint which results in chronic pain constantly. Many among these individuals with no clear etiology of any disease and trauma history deny the diagnosis of chronic pain which leads to permanent injury of either ligaments (Cruciate or Collateral) or menisci. Hence, besides being the most accurate tool for diagnosis it could also be used as a screening tool. Timely diagnosed problem according to their age can reduce the time of recovery and as patients with chronic knee pain are eager to return back to their normal lifestyle, through MRI screening they can opt for therapeutic procedures.

Limitations of this study

Duration of study was short for 3 and a half month only
Not enough time for follow up study to observe therapeutic management
Only Lahore Hospitals were included
Limited sample size

Recommendations

The current study was conducted to assess the efficacy of MRI in knee joint pathologies. If a retrospective analysis of these cases is to be done, multiple cities of Pakistan has to be included for the prevalence of knee pathologies on a national scale because that might improve the therapeutic decision making on a broader scale. More research on Knee MRI Sequences for better differentiation of soft tissue and intra-articular knee

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can aid in MRI sensitivity and specificity as there is a close proximity of soft tissues lesions with diseases of articular surface of knee.

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