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Frequency of Knee Joint Pathologies on Magnetic Resonance Imaging (MRI) In Lahore, Pakistan

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Abstract **Original Research Article**

Background: The knee is the body's largest joint, and it can be affected by a variety of conditions including meniscal tears, ligament and bone damage, ulcerations, ruptures, and dislocations. Magnetic resonance imaging (MRI) is defined as a screening tool for identifying Knee Pathologies without the need for arthroscopy. ***Objective:*** To determine the frequency of knee joint pathologies on Magnetic Resonance Imaging (MRI) in Lahore, Pakistan**.** ***Material and Methods:*** Data was collected following inclusion criteria using convenient sampling technique. A total of 140 Patients undergone Knee MRI scans on MRI Machine 1.5T Phillips. Data was collected from Radiology Department of Sharif Medical city and analyzed on SPSS version 22. Frequencies of Knee pathologies were mentioned. For Categorical Data like Age Groups and Gender Mean, Median and Standard Deviation was applied. ***Results:*** Results were based on 140 Participants who had Knee Scan. In which the Male Patients were 57.1% and 42.9% Females. The highest frequency was in 36-45 among four Age groups having 54.3%. In Knee Pathologies the common Meniscal Injuries in Medial & Lateral have Longitudinal Tear as 18.6% & Horizontal tear as 12.9%. In Collateral Ligaments MCL have 7% Mesniscofemoral and LCL has 5.7% Mesniscofemoral Ligament Injuries. In ACL injuries 21.4% have complete rupture and 10% Partial Rupture in PCL. Patella has 27.1% chondromalacia while popliteal tendon has complete rupture of 8.6%. 15.7 Patients have Irregular Cartilage and 12.9% Ulceration. General and Local Synovitis in Synovia was 8.6%. ***Conclusion:*** In conclusion MRI diagnosis will enable patients to avoid arthroscopic interventional contrast procedures. The finding of this research supports the use of magnetic resonance imaging (MRI) in the diagnosis of internal knee diseases.

Keywords: MRI, Knee Pathologies, Menisci, Ligament, Knee Injuries.

INTRODUCTION

The knee is major and most delicate joint of the body. It is a joint with synovial hinge taking three joints such as 2 patellas femoral and 2 condyle tibial [1, 2]. The articular borders of the femur's condyles and trochlea surface, the tibia's condyles, the patella, and numerous bursa structures [3], are all surrounded by several exterior and interior ligaments and joined by articular cartilage [4]. The menisci and cruciate ligaments and are the main interior parts of the knee. The knee joint is susceptible to stress and deteriorating variations, and it is one of the joints with the highest risk of illness, especially among athletes and the elderly [5].

It is widely acknowledged that magnetic resonance imaging (MRI) is used to assess soft tissue pathology without exposing patients to radiation exposure [6]. Several organs' anatomy and pathophysiology are well visualized in advanced applications. Initial tests of the meniscus in the knee show excellent anatomy and pathological resolution [7]. Magnetic Resonance Imaging scan is a noninvasive, highly accurate method of documenting meniscal disease and cruciate ligament injuries in the knee [8]. In the early diagnosis of suspected interior disorders of the knee, the inability to produce comprehensive and accurate radiographs of internal anatomy and pathology has been a significant hindrance.[9]Magnetic Resonance Imaging (MRI) is Radiographic imaging modality that orthopedic surgeons can rely on because it is possibly safe and long-lasting. To maintain a healthy BMI, it maximizes patient satisfaction with diagnosis and treatment outcomes. We can avoid invasive treatments like arthroscopy by using an MRI of the knee for first diagnosis instead of arthroscopy, which has limited

diagnostic value and is useless in diagnosing some lesions and injuries.

KNEE STRUCTURES AND PATHOLOGIES ON MRI

MENISCI

The Menisci are the condylar discs that are typically observed in condylar junctions. The lateral and medial menisci in each knee predominantly follow the movement of the femoral condyles. These menisci are all C-shaped, with the biggest diameters in the axial plane. The best views of the menisci in MRI are in the sagittal and coronal planes. On all sequences, the normal menisci appear as a homogeneous low signal structure with a triangular structure and an outward convex boundary in the sagittal plane [10].

Discoid menisci

Meniscal abnormalities are in a wide range of different forms. Menisci can be discoid whole or partly. These are most typically observed in children and teenagers on the lateral side, but they can also be found on the medial side. Tears are more common in this group. Sagittal scans can be used to diagnose discoid meniscus [11].

Meniscal Tears

Meniscal abnormalities are classified using a grading system. Histological degeneration is represented by grade l, which appears as a spherical form with aberrant signal intensity that is not abutting. Grade 2 denotes collagen degradation that is more severe histologically. It appears as a linear pattern of aberrant signal intensity that does not about a surface. A Grade 3 straight or Grade 3b irregularly shaped aberrant, histologically correlating to an unaffected tear. A highly fractured meniscus is sometimes referred to as a grade 4 [12].

The bucket-handle tear

It is a full vertical rip with one or two meniscal fragments displaced in the axial plane.

Radial tears

They are tough to spot because they are on the inner margin. On sagittal pictures, a faint high-signal tensity line can be visible, and on coronal photos, an uneven inner boundary may be noticed.

Meniscal cysts

They are commonly understood to its relevance with horizontal meniscal tears on the lateral or either side of Knee. Accumulation of fluid is continuous with the dissecting meniscal tear.

COLLATERAL LIGAMENTS

They are present on each side of the joint and help to support it. From the medial condylar area, the medial collateral ligament has four attachments attaches' tibial plateau inferior and posterior to insertion. The lateral collateral ligament (LCL) is a posterior ligament that reinforces the capsule laterally. The medial ligament is far more commonly injured than the lateral ligament [13].

CRUCIATE LIGAMENTS

They are extrasynovial but intracapsular. The anterior cruciate ligament (ACL) attaches the anterior tibial intercondylar region to the posterior medial side of the femoral condyle part laterally. The posterior cruciate ligament (PCL) runs medial to the ACL which connects to the lateral portion of the medial femoral condyle to the posterior intercondylar fossa of the tibia. Two more ligaments may pass anteriorly (Humphrey ligament) or posteriorly (usually) in connection to the PC (ligament of Wrisberg) [14].

CARTILAGE

Cartilage is the main area of interest in cases of trauma or osteoarthritis. Although subchondral osseous damage, traumatic chondral flaws are defined often and (near) entire thickness, making diagnosis easier. When the underlying cartilage is disrupted, patients with intact cartilage are treated conservatively, however when the overlying cartilage is disrupted, surgery is used [15].

BONE

Bone bruising became a novel radiologic diagnostic. Bone bruises can occur on their own, although they're more commonly seen in conjunction with cartilage fractures. Bone bruising or occult fractures are significant on MRI findings if not detected can lead to career-ending injuries particularly in sports practice professionally [16].

PATELLA

Dislocation of the patella that may be accompanied with patella chondral abnormalities can be diagnosed with MRI. Patella dislocation generally resolves own self, and other half of patella dislocation patients are attentive of it. A patellar dislocation is easily diagnosed based on MR findings [17].

PATELLA TENDON

Patella tendinitis is typically detected in MRI as thickening of the proximal patella tendon with strong signal in and surrounding shows on T2-W imaging, can cause pain in the inferior patellae region in athletes [18].

MATERIAL AND METHODS

In order to receive desired objective, data was collected in Radiology Department of Sharif Medical city, Lahore. A Convenient Sampling technique was used to collect data of Knee Pathologies following MRI Examination. Data was collected and Recorded in SPSS Data entry Sheet. A sample was done on random basis patient undergoing knee scans. A total of 140 Patients undergone Knee MRI scans on MRI Machine 1.5T Phillips. Data was collected from Radiology

Department of Sharif Medical city and analyzed on SPSS version 22. Frequencies of Knee pathologies were mentioned. For Categorical Data like Age Groups and Gender Mean, Median and Standard Deviation was applied.

RESULTS

The Results are based on total of 140 Patients who came to Radiology Department for Knee MRI scans. The data was collected and included following inclusion criteria. The Socio demographic features like Age groups and Gender was considered as a variable in Knee Pathologies. In Table 1 Majority of the Patients having Knee MRI scans was Male having 57.1% and 42.9 % females. A total of 4 Age groups were made Male the highest frequency was in 36-45 having 54.3% following 22.9 % in 26-35, 18.6% in 46-55 and with most lowest falling in first age group of 15-25 with 4.3% mentioned in Table 2.

Table 1: A total of 57.1% Male Patients went for Knee MRI scans following 42.9% Females

Gender					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Female	60	42.9	42.9	42.9
	Male	80	57.1	57.1	100.0
	Total	140	100.0	100.0	

Table 2: A total of 4 Age groups were made in which the highest frequency was in 36-45 having 54.3%

Age Groups					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	15-25	6	4.3	4.3	4.3
	26-35	32	22.9	22.9	27.1
	36-45	76	54.3	54.3	81.4
	46-55	26	18.6	18.6	100.0
	Total	140	100.0	100.0	

Table 3: Showing the Knee Pathologies in Medial Meniscus of Knee in which 42.9 % is normal and have tears such as Longitudinal 18.6%, Degenerative 15.7%, and most low as Flap tear 2.9%

MRI Findings of Medial Meniscus					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Normal	60	42.9	42.9	42.9
	Radial Tear	8	5.7	5.7	48.6
	Horizontal Tear	12	8.6	8.6	57.1
	Longitudional Tear	26	18.6	18.6	75.7
	Bucket Handle Tear	8	5.7	5.7	81.4
	Flap Tear	4	2.9	2.9	84.3
	Degenerative Tear	22	15.7	15.7	100.0
	Total	140	100.0	100.0	

Table 4: Showing the Knee Pathologies in Lateral Meniscus of Knee in which 48.6% have normal findings and Majority have Horizontal Tear 12.9%, following 11.4 Longitudinal and with least 2.9 Flap Tear

MRI Findings of Lateral Meniscus					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid					
	Normal	68	48.6	49.7	51.4
	Radial Tear	8	5.7	5.7	55.7
	Horizontal Tear	18	12.9	12.9	68.6
	Longitudional Tear	16	11.4	11.4	80.0
	Bucket Handle Tear	10	7.1	7.1	87.1
	Flap Tear	4	2.9	2.9	90.0
	Degenrative Tear	14	10.0	10.0	100.0
	Total	140	100.0	100.0	

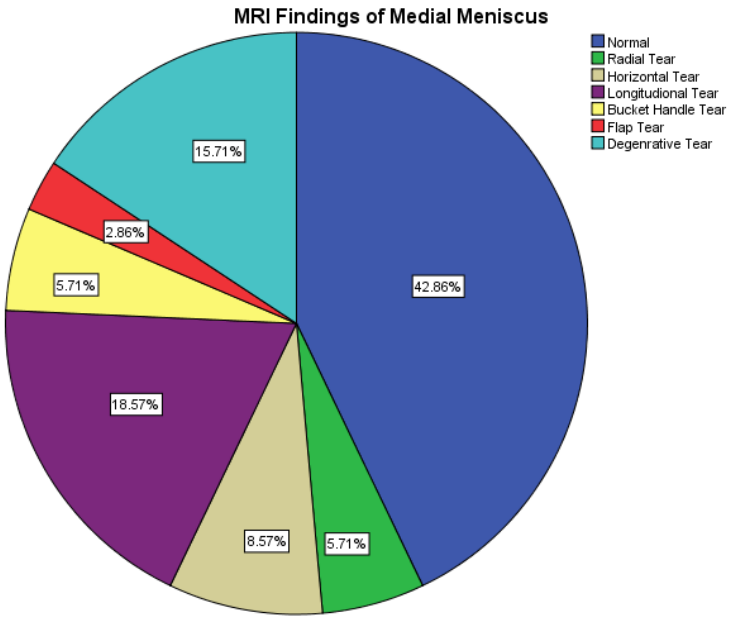

Figure 1: Pie ChartShowing the Knee Pathologies in Medial Meniscus of Knee

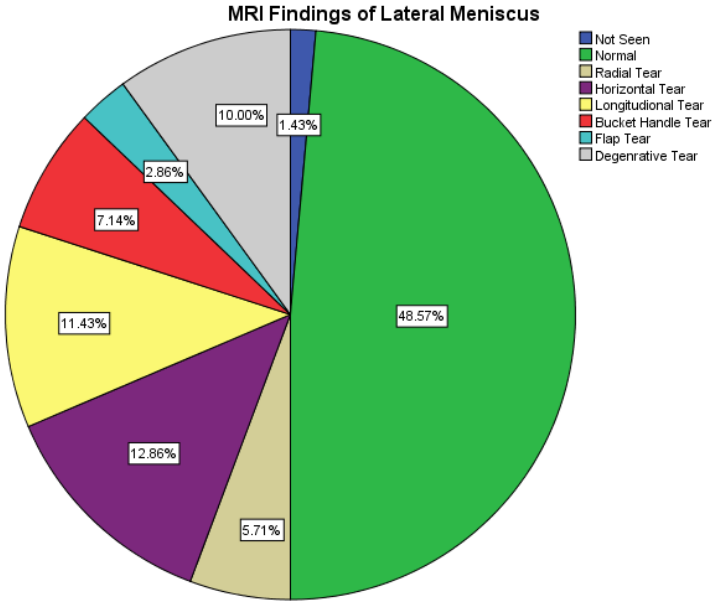

Figure 2: Pie Chart Showing the Knee Pathologies in Lateral Meniscus of Knee

Table 5: Showing the Knee Pathologies in Medial Collateral Ligament of Knee in which 87 5 have normal findings while 7% and 5% have Meniscofemoral and Meniscotibial ligament damaged

MRI Findings of Medial Collateral Ligament					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Normal	122	87.1	87.1	87.1
	Meniscofemoral Ligament Damaged	10	7.1	7.1	94.3
	Meniscotibial Ligament Damaged	8	5.7	5.7	100.0
	Total	140	100.0	100.0	

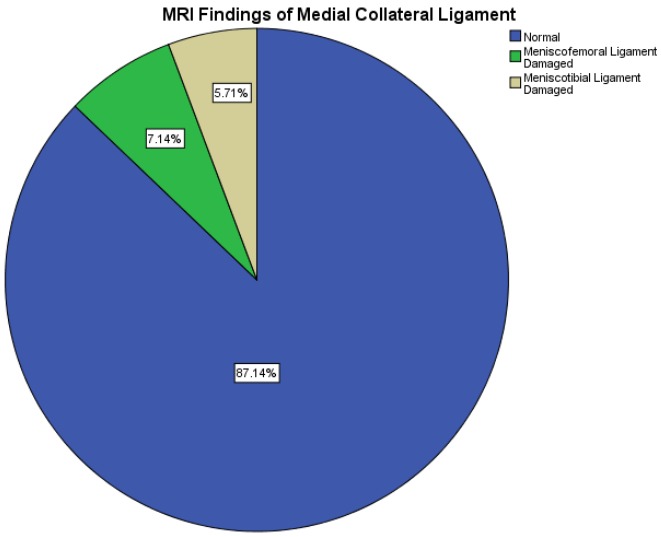

Figure 3: Pie ChartShowing the Knee Pathologies in Medial Collateral Ligament of Knee

Table 6: Showing the Knee Pathologies in Medial Collateral Ligament of Knee in which 87 5 have normal findings while 7% and 5% have Meniscofemoral and Meniscotibial ligament damaged

MRI Findings of Lateral Collateral Ligament					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Not Seen	2	1.4	1.4	1.4
	Normal	122	87.1	87.1	88.6
	Meniscofemoral Ligament Damaged	8	5.7	5.7	94.3
	Meniscotibial Ligament Damaged	8	5.7	5.7	100.0
	Total	140	100.0	100.0	

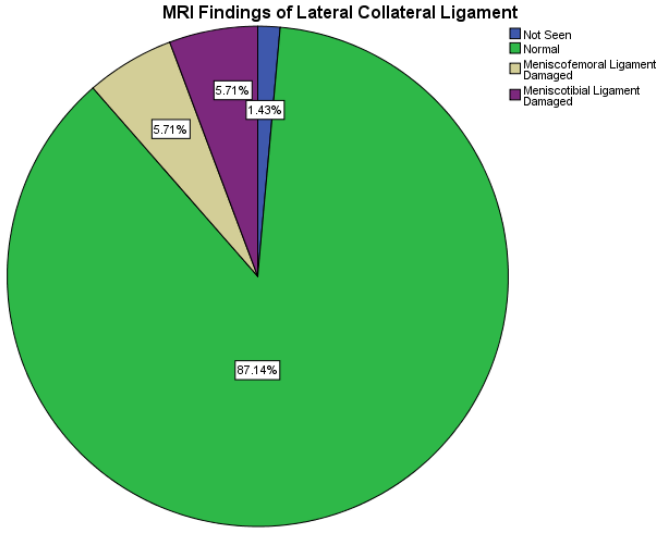

Figure 4: Pie ChartShowing the Knee Pathologies in Lateral Collateral Ligament of Knee

Table 7: Showing the Knee Pathologies in Anterior Cruciate Ligament of Knee in which 67% have normal findings while 21% have Complete Rupture and 11.4% have Partial Rupture

MRI Findings of Anterior Cruciate Ligament					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Normal	94	67.1	67.1	67.1
	Partial Rupture	16	11.4	11.4	78.6
	Complete Rupture	30	21.4	21.4	100.0
	Total	140	100.0	100.0	

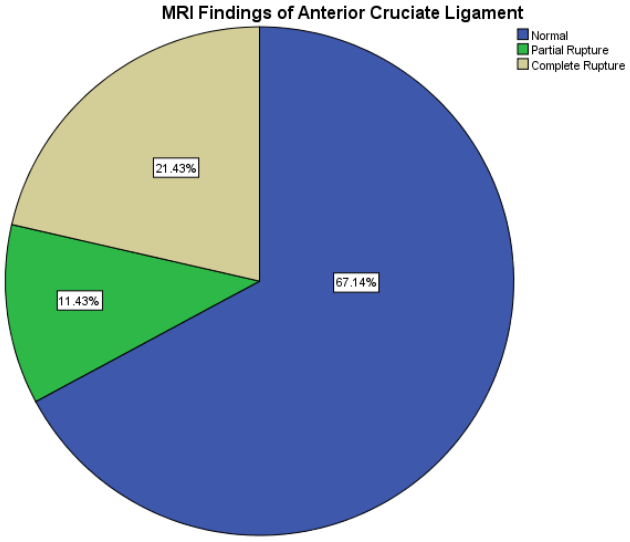

Figure 5: Pie ChartShowing the Knee Pathologies in Anterior Cruciate Ligament of Knee

Table 8: Showing the Knee Pathologies in Posterior Cruciate Ligament of Knee in which 80 % have normal findings while 5.7% have Complete Rupture and 10% have Partial Rupture

MRI Findings of Posterior Cruciate Ligament					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Normal	112	80.0	80.0	80.0
	Partial Rupture	14	10.0	10.0	90.0
	Complete Rupture	8	5.7	5.7	95.7
	Slightly rupture	6	4.3	4.3	100.0
	Total	140	100.0	100.0	

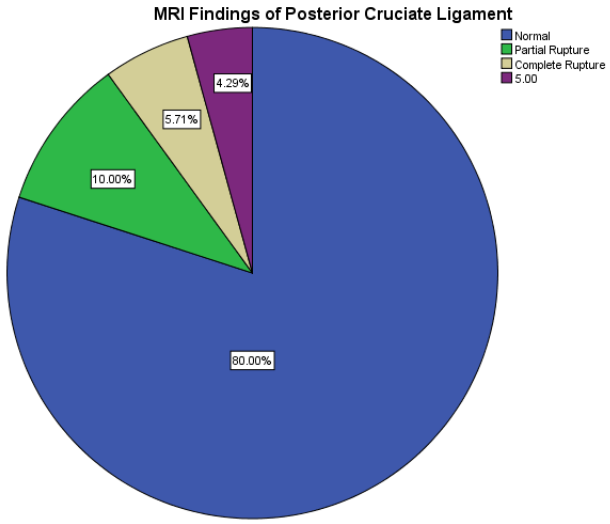

Figure 6: Pie ChartShowing the Knee Pathologies in Posterior Cruciate Ligament of Knee

Table 9: Showing the Knee Pathologies in Patella of Knee in which 70% was normal while 27.1% and 2.9 have Chondromalacia and Subluxation

MRI Findings of Patella					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Normal	98	70.0	70.0	70.0
	Chondromalacia	38	27.1	27.1	97.1
	Subluxation	4	2.9	2.9	100.0
	Total	140	100.0	100.0	

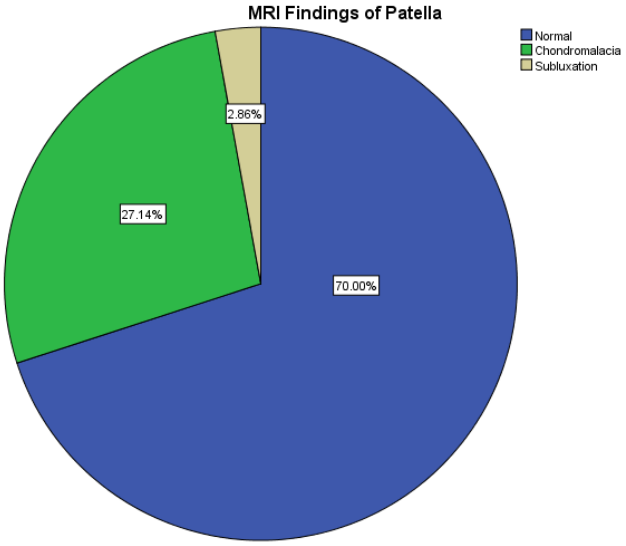

Figure 7: Pie ChartShowing the Knee Pathologies in Patella of Knee

Table 10: Showing the Knee Pathologies in Popliteal Tendon of Knee have normal 84.3 findings while 7.1% have Partial Rupture and 8.6 have Complete Rupture

MRI Findings of Popliteal Tendon					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Normal	118	84.3	84.3	84.3
	Partial Fracture	10	7.1	7.1	91.4
	Complete Rupture	12	8.6	8.6	100.0
	Total	140	100.0	100.0	

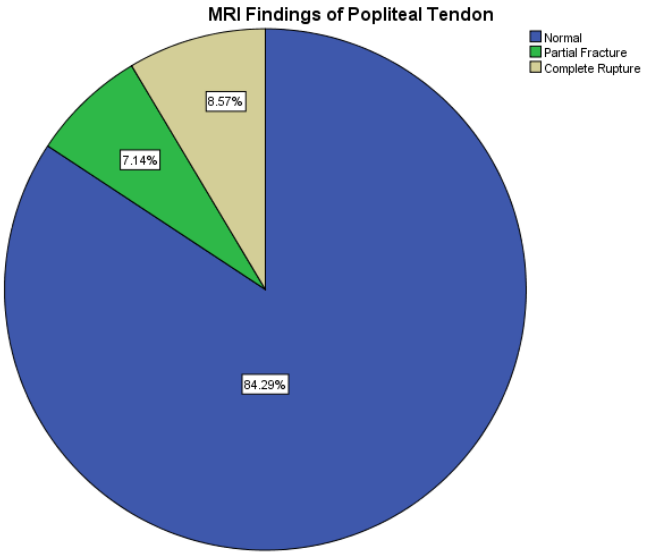

Figure 8: Pie ChartShowing the Knee Pathologies in Popliteal Tendon of Knee

Table 11: Showing the Knee Pathologies in Cartilage of Knee in which 71.4% have normal findings while 15.7 have Irregular Surface and 12.9 Have Bone ulcerations

MRI Findings of Cartilage					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Normal	100	71.4	71.4	71.4
	Irregular Surface	22	15.7	15.7	87.1
	Ulcer to Bone	18	12.9	12.9	100.0
	Total	140	100.0	100.0	

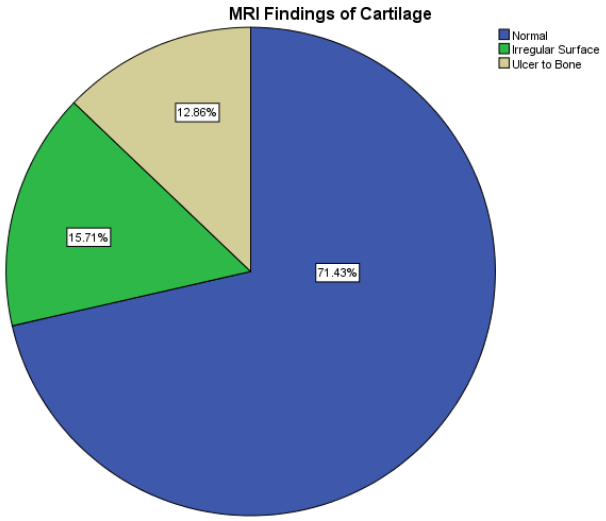

Figure 9: Pie ChartShowing the Knee Pathologies in Cartilage of Knee

Table 12: Showing the Knee Pathologies in Synovia of Knee in which 8.6 % each have general and Local Synovitis following 82.9% Normal Scans

MRI Findings of Synovia					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Normal	116	82.9	82.9	82.9
	Local Synovitis	12	8.6	8.6	91.4
	General Synovitis	12	8.6	8.6	100.0
	Total	140	100.0	100.0	

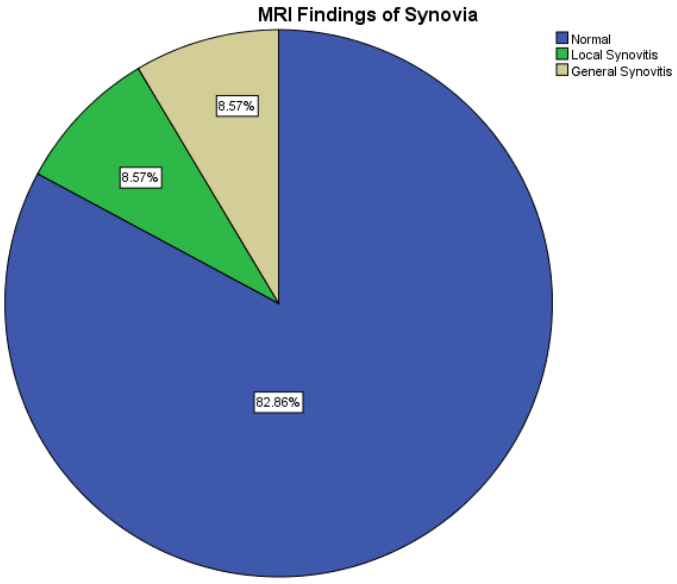

Figure 10: Pie ChartShowing the Knee Pathologies in Synovia of Knee

DISCUSSION

It is well acknowledged that magnetic resonance imaging (MRI) can be used to assess soft tissue illness without exposing patients to ionizing radiation. 6 Many organs' anatomy and pathology are well visualized in modern applications. Preliminary tests of the meniscus in the knee show excellent anatomy and pathological resolution. In current study the Results of Knee MRI was summarized in a Detail according to the structure of Knee Joint classifying as Menisci & Types Medial Menisci (MM) and Lateral Menisci (LM) and Collateral Ligaments in which Medial Collateral Ligament (MCL) & Lateral Collateral Ligament (LCL), Cruciate Ligaments include Anterior Cruciate Ligament (ACL) and Posterior Cruciate Ligament (PCL). The Joint Structure such as Patella and Popliteal Tendon was studied on MRI following Bone & Cartilage and Synovia.

In MRI Examination of Menisci of Knee Medial Menisci and Lateral Menisci was seen. In Medial Menisci 42% were normal, 18.8% have Longitudinal tear, 15.7 Degenerative Tear and most least with 2.9 Flap tear While in Lateral Menisci 48.6 are normal, 12.9% Horizontal tear, 11.4% and 10% Degenerative with least 2.9 Flap tear. In 2016, Nighen felon published a meta-analysis of 14 researches that demonstrated the accuracy of MRI detecting medial and lateral meniscal injuries. MRI shows the sensitivity and specificity assessed to be 87 percent and 93 percent for medial meniscal tears, and 78 and 95 percent for lateral meniscal tears, respectively. It also indicates the frequency of Tears, which is similar to my findings in that Horizontal and Degenerative Tears were common, and it demonstrates the usefulness of MRI in identifying Meniscal Tears [19].

In MRI Examination of Collateral Ligaments Medial and Lateral Collateral Ligaments have been examined. In Medial Collateral Ligament 87.1% have normal finding, 7.1% have Mesniscofemoral ligament and 5.7% have Meniscotibial. While in Lateral 87% have normal findings 5.7% have Mesniscofemoral and Meniscotibial. According to a 2015 study by Atul K., the medial and lateral collateral ligaments were found in 51 percent of knees, with the anterolateral ligament being entirely evident in 11 percent and partially noticeable in 40 percent. The current study's MRI findings were substantial, and the frequency of identifying Femoral and Tibial fractures was similar, with a percentage of 9% [20].

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%. Patients with acute ACL and PCL damage had MRI scans of right and left knees, according to a 2019 study by Andrea Ferrati. Three observers rated the images. The inter- and intra-observer reliabilities of MRI parameters of the anterolateral and poster lateral ligaments were determined. In addition, they discovered 20% Complete Rupture in the Anterior Cruciate Ligament. His research also found that MRI assessment revealed abnormalities in the common of acutely ACL injuries of knee, similar to the current study [21].

In MRI Examination of Patella 70% have normal scans and 27.1% have Chondromalacia and 2.9% have subluxation. Murv Jersey conducted a study in 2018. Also demonstrates whether there was a significant variation in the distribution of five patellar malt racking measures between patients with chondromalacia patellae and people with normal cartilage. He conducted a case-control research, but the results were quite similar to those of the current study, indicating the occurrence of chondromalacia in a small fraction of the population with minor modifications [22].

In MRI Examination of Popliteal tendon Normal findings were 84.3 %, Partial Rupture has 7.1% and Complete Rupture have 8.6%. In MRI Examination of Cartilages of Knee 71.4% have normal findings, 15.7 have Irregular Surface and 12.9 have bone ulceration and Synovial normal findings are 82.9% while General and Local Synovitis have 8.6% respectively. Camila Patezani published a study in 2019 that demonstrates the Popliteal Tendon Normal and Abnormal findings in close proximity to the study with substantial worries about the ACL. It also has to do with recent findings of Knee Pathologies such as Bone Ulceration and Synovitis. The current study suggests the use of magnetic resonance imaging (MRI) in the proper and accurate identification of knee pathologies and injuries.

CONCLUSION

MRI is most accurate and precise Imaging modality to detect most internal derangements of the knee efficiently. In current study it was accurate in detecting all the pathologies in Menisci, Ligament and Bones. MRI is suitable screening tool prior to performing a therapeutic arthroscopy interventional. MRI diagnosis can be considered significant an accurate to avoid any arthroscopic Interventional Contrast studies. The results of this study support the reliable use of MRI in the diagnosis of knee derangements and pathologies of the knee.

Conflict of Interest: Nil

Funding Resources: Nil

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