



***Accuracy of MRI in diagnosis of anterior and posterior cruciate ligamentous knee injuries among arthroscopically proven cases.***

*A thesis Submitted to the council of college of medicine*

*University of Babylon in a partial fulfillment of the Degree of High Diploma in radiology*

by

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

وَمَا أُوتِيتُمْ مِنَ الْعِلْمِ إِلَّا قَلِيلًا

صَدَقَ اللَّهُ الْعَظِيمَ

الإسراء (85)

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# ***Dedication***

***MY FAMILY FOR LOVE, ENCOURAGEMENT AND BEING SO  
PATIENT THROUGHOUT MY STUDY PERIOD***

***To My Supervisor***

***To My Mentor***

***With Respect***

## ***ACKNOWLEDGEMENT***

**FOR ALLAH The Almighty WHO Granted me everything.....**

**- To my supervisor and teacher Dr. Professor Osamah Ayad for his encouragement, continuous guidance and support throughout the study period.**

**- To all Doctors and medical staff in the council of college of medicine University of Babylon in a partial fulfillment of the Degree of High Diploma in radiology.**

### **List of Abbreviations**

<b>ACL</b>	<b>Anterior cruciate ligament</b>
<b>PCL</b>	<b>Posterior cruciate ligament</b>
<b>MRI</b>	<b>Magnetic resonance image</b>
<b>ROC</b>	<b>Receiver Operating Characteristic</b>
<b>WHO</b>	<b>World Health Organization</b>

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## **Abstract**

The knee joint is one of the most commonly injured joints, the anterior and posterior cruciate ligaments are prone to spraining or tearing. These are primarily due to sports-related injuries, falls, and motor vehicle accidents. The wide range of treatment options for these knee pathologies has also seen recent advancements with arthroscopic management of most of the knee pathologies. MRI of the knee joint has effectively replaced arthrography as the imaging modality of choice in the evaluation of both acute and chronic disorders causing pain in the knee.

### **Aim**

to determine the accuracy of MRI in diagnosis of ACL and PCL injuries among patients with what had been proved by arthroscope.

### **Method**

A cross sectional study was done in Al-Hilla teaching hospital in period from 1<sup>st</sup> October 2019 to 1<sup>st</sup> July 2020. The study enrolled 60 patients which are visited the orthopedic clinic suffering from knee trauma and they referred for knee MRI after that all patients had undergone arthroscopic examination.

### **Result**

The mean age of patients was  $34.2 \pm 6.8$  years and range from 20-59 years. There were 71.6% of patients had overall ACL injury and 5% posterior cruciate ligaments. Out of 43 of overall anterior injury, 31 partial and 12 complete injury. the MRI diagnosis in consistence for 41 patients true positive while 11 patients true negative in overall anterior cruciate ligament injury. In partial anterior ligament injury, the MRI positively diagnosis 28 out of 31 and 3 out 14 reveal negative result, the sensitivity, specificity and accuracy 90.3%, 78.5% and 86.6% respectively. For complete ACL the MRI had the sensitivity 78.5%, specificity 91.6%, PPV 91.6%, NPV 78.5% and accuracy 84.6%. Regarding the posterior cruciate injury PCL, the MRI had the following parameters, the sensitivity 20%, specificity 100%, PPV 100%, NPV 14.2% and accuracy 29.4%.

## **Conclusion**

MRI had different efficacy in assessment of ligamentous knee injury .  
MRI highly sensitive and specific in ACL injury , highly specific but not very sensitive in PCL injury.

## Introduction

Anatomy of Knee Ligaments: -

The knee is one of the complex joints in the human body. It connects the femur to the tibia in the lower leg & fibula lying along its lateral side. It is connected together with four ligaments. The medial and lateral collateral ligaments prevent side-to-side motion of the femur across the tibia <sup>(1)</sup>.

The anterior and posterior cruciate ligaments are complex. The anterior cruciate ligament starts in the anterior aspect of the tibia in the joint space and goes up to the back of the joint space on the femur. It crisscrosses the posterior cruciate ligament that starts in the posterior aspect of the tibial joint space and ends in the anterior aspect of the femur <sup>(2)</sup>.

The anterior cruciate ligament (ACL) prevents the tibia from sliding forward along the femur, while the posterior cruciate ligament (PCL) prevents the tibia and femur from sliding towards each other<sup>(3)</sup>.

Injuries on the Anterior and Posterior Cruciate Ligaments of the Knee Joint :

the anterior and posterior cruciate ligaments are prone to spraining or tearing. These are primarily due to sports-related injuries, falls, and motor vehicle accidents <sup>(1)</sup>.

About half of all damaging injuries to the ACL happen at the same time as damage to the articular cartilage, other ligaments, or the menisci of the knee <sup>(2)</sup>. Injuries to the ligaments in the knee are graded according to their severity:

- Grade 1 Sprain: This involves a ligament that has become slightly stretched, but the knee is technically stable
- Grade 2 Sprains: The ligament has become loose or has become partially torn
- Grade 3 Sprains: This is when the ligament has completely torn, leaving the joint completely unstable. <sup>(4)</sup>

It is rare to have a partial tear of the ACL. Most injuries of the ACL involve complete tears.

Posterior cruciate ligament tears happen when the knee is in a bent position. This can happen in a sports-related injury, or in situations where a seated person strikes the dashboard with the bent knee <sup>(5)</sup>.

Posterior cruciate ligament tears involve the exact grades noted above with ACL ligamentous injuries. One big difference between a PCL and ACL tear is that a PCL tear is usually only a partial tear whereas an ACL tear is usually complete <sup>(6)</sup>.

### Cruciate Ligament Tear Symptoms: ACL and PCL

When you get an injury to the anterior cruciate ligament or the posterior cruciate ligament, there are slightly different symptoms <sup>(7)</sup>:

#### Anterior Cruciate Ligament Injury Symptoms

- Pain in the knee
- Swelling, which builds up over twenty-four hours
- Loss of complete range of motion of the knee
- Tenderness .
- Unstable knee

#### Posterior Cruciate Ligament Injury Symptoms

- Pain in the knee
- Immediate swelling of the knee
- Difficulty or impossibility of walking on the affected leg
- The knee feels like it is going to “give out” <sup>(8)</sup>

The causes of an ACL injury and a PCL sprain are slightly different. Here are some examples of possible causes of an ACL or PCL tear <sup>(6)</sup>:

- Automobile accident
- Changing direction quickly, as in football or soccer
- Stopping running quickly or suddenly
- Running and slowing down rapidly
- Landing a jump in the wrong way
- A football tackle with a direct collision

PCL Injury usually takes a great amount of force to injure the posterior cruciate ligament like direct blow to the bent knee in an automobile injury <sup>(9)</sup>.

According to research, female athletes have a higher risk of ACL sprain than male athletes (depending on the sport). It is said to be due to differences in muscular strength, neuromuscular control, and physical conditioning. Some people feel the difference is due to changes in the shape of the pelvis and in the lower extremity alignment that makes women have looser ACLs in the first place. Estrogen also has an effect on the properties of the ligaments <sup>(10)</sup>.

### Diagnosis of ACL and PCL Injury

The doctor will evaluate the ACL/PCL tear injury by checking for knee instability while comparing the findings to the uninjured knee. In PCL injuries, the knee will sag backward when bent. In addition, it can slide further back when the knee bends at greater than a 90-degree angle <sup>(11)</sup>.

X-rays cannot show the actual ligament but can reveal if the ligament has torn off a piece of the bone at the time of the injury. Such an event is called having an “avulsion fracture” of bone <sup>(11)</sup>.

The Radiographic sign of ACL injury include avulsion of tibial attachment, signs are:

-Deep lateral sulcus sign: depression of lateral femoral condyle representing impaction fracture.

-anterior tibial translocation sign.

-Segond fracture: avulsion fracture involves lateral tibial plateau.

-Arcuate sign: avulsion fracture of head of fibula at the insertion site of arcuate ligament complex.

-Joint effusion. <sup>(11)</sup>

MRI is the best way to assess ligamentous injury in the knee joint. It uses radio waves and a strong magnet to visualize bones and soft tissues. If the injury is at least 3 months old, however, it may not show up on MRI scanning <sup>(10)</sup>.

MRI imaging finding of ACL injury divided into primary sign (those related to the ligament itself), and secondary sign which are closely related to ACL injury.

#### Primary sign:

the most important primary sign of ACL tear are:

1- total discontinuity.

2- abnormal SI.



Another sign includes:

-Abnormal ACL orientation relative to intercondylar Blumensaat's line (which is the tangent drawn along the roof of intercondylar notch on lateral sagittal view).

-Empty notch sign: a fluid signal at the site of femoral attachment at the intercondylar notch, denote an avulsion at the femoral attachment.

### Secondary sign:

1-bone contusion in the lateral femoral condyle and posterolateral tibial plateau (kissing sign).

2- more than 5 mm of anterior tibial translation, also known as anterior tibial translocation. Sign or anterior drawer sign.

3-uncovered posterior horn of lateral meniscus.

4-Second fracture and lesser degree arcuate sign.

5-Avulsion fracture of the tibial insertion

6-Reduced PCL angle due to buckling of PCL & Positive PCL line sign.

7-Medial or lateral collateral ligament injury<sup>(14)</sup>.

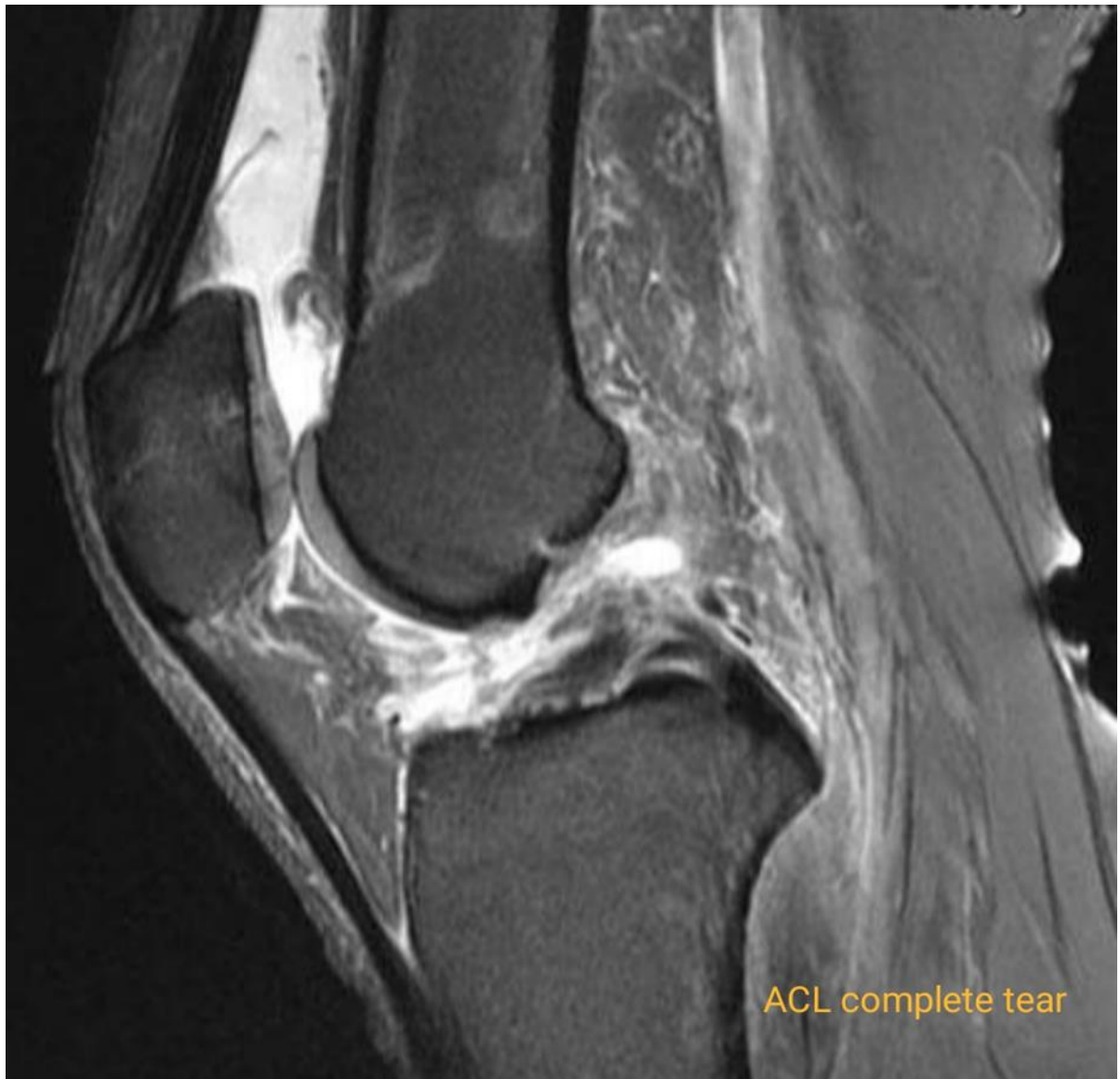
ACL tears typically occur at the middle portion of the ligament (mid substance tear) and appear as discontinuity of the ligament or abnormal contour, the signal of ACL can be more hyperintense on T2<sup>(15)</sup>.

So according to these criteria the types of ACL injuries are categorised into four types

1-partial tear: if we see discrete area or focus of increased signal intensity within the substance of ACL, focal angulation, wavy contour or single bundle sign.



2-complete tear: complete absence of ACL or poor definition of its ligamentous fibre.



3-Chronic tear: when we have fragmented ACL, absence of bone oedema and contusion, empty notch sign and anterior tibial drawer sign are present in chronic tear.

4- mucoid degeneration: when ACL thickened, abnormal SI caused by infiltration of mucoid like substance interspersed within the substance of ACL give it the celery stalk appearance.



PCL injury was diagnosed if we have as altered SI, or if we have avulsion from its tibial attachment. <sup>(16)</sup>





## **Magnetic resonance imaging (MRI)**

Has an enormous impact on musculoskeletal imaging and the knee is the most frequently visualized. MRI of the knee is most commonly indicated in patients with suspected injuries of the menisci and cruciate ligaments. Plain radiographs have little value unless injury is due to direct impact <sup>(17)</sup>. Orthopedic surgeons commonly examine patients with knee pain; however, precisely diagnosing an intra-articular cause of pain is difficult <sup>(17)</sup>.

MRI of the knee is used to diagnose disorders of the knee because the high soft tissue resolution allows precise imaging of intra-articular structures. MRI of the menisci has proven useful for more than 10 years, with current sensitivity and specificity for meniscal tears ranging from 90 to 95% in most reports <sup>(18)</sup>.

MRI has become a practical tool for the evaluation of anterior cruciate ligament (ACL) injuries, with its high levels of accuracy and sensitivity reported in the literature. Previous imaging provided an accuracy of 90% for the medial meniscus, 82% for the lateral meniscus, 94% for the ACL and 96% for the posterior cruciate ligament. The sensitivity was 87% for the medial meniscus, 46% for the lateral meniscus, 92% for the ACL and 80% for the posterior cruciate ligament. The specificity was relatively high at 92, 91, 94 and 97%, respectively <sup>(19)</sup>.

Intra-articular knee lesions are associated with significant morbidity and frequently need surgical treatment and rest. Although common, their correct diagnosis still is a challenge <sup>(18)</sup>. Clinical tests may be confusing, and delay in diagnosis can result in socioeconomic problems and sometimes a worse prognosis. Therefore, complementary diagnostic tools are often necessary, mainly when suspecting multiple lesions <sup>(20)</sup>.

**The aim of study:**

to determine the accuracy of MRI in diagnosis of ACL and PCL injuries among arthroscopically proven cases.

## Patients and methods

### Study design

A cross sectional study was done in Al-Hilla teaching hospital in period from 1<sup>st</sup> October 2019 to 1<sup>st</sup> July 2020.

The study enrolled 60 patients who had visit the orthopedic clinic suffering from knee trauma and they referred for knee MRI after these all patients had undergone arthroscopic examination.

### Data collection

After verbal consent, data collection followed the written questionnaire that contain demographic data of patients, sign and symptoms of diseased knee, MRI finding and last part about arthroscopic result. A detail medical history of trauma was taken from patients and physical examination was done by the orthopedic surgeon to knee joints to specified the diagnosis of ligamentous injury. The clinical diagnosis was made by orthopedic surgeon. Every joint was palpated in order to detect tenderness. After a general evaluation, a detailed knee examination was performed.

### Exclusion criteria

- 1- Patients had previous joint surgery
- 2- Significant knee trauma in the past.
- 3- Intraarticular drug administration.
- 4- Rheumatoid arthritis
- 5- Patients with neoplasm
- 6- Contraindication to MRI.

### Instruments:

The patient was examined in the radiological unit by MRI machine of close type Philips Achieva 1.5 tesla, with special knee coil, in addition, the patient had undergone arthroscope by Stryker (USA) model 2009, equipped with multiple type of diagnostic and operative hardware.



## **MRI protocol**

As with most MRI joint imaging, PD weighted sequence with or without fat saturation is the mainstay.

- 1- Axial T1
- 2- Sagittal T1, PD, T2
- 3- Coronal gradient echo, STIR

We started with explanations the procedure of MRI test and review contraindication conditions. Advice the patients to keep quiet during test.

MRI examination done under routine work and precaution for patients such as removing any metal things. Patient given head phone for decrease noises.

The sequences used in the examination were selected by a supervising radiologist at the site of examination. That included anterior-posterior and lateral views in addition to sunrise and tunnel views for assessing the knee alignment, fracture, determine skeletal maturity and evaluated the degenerative changes.

MRI images were available to the orthopedic surgeon only after having performed a standardized physical examination, in order not to bias the diagnosis. The evaluation of articular cartilage, menisci and ACL were made by the radiologist at the time of the MRI examination.

MRI images were obtained on 1.5T Philips Achieva with patient supine and knee in extension and 5° of external rotation. Pulse sequences used were spin echo (SE), fast SE, gradient recalled echo, short tau inversion recovery (STIR), and proton density in three standard imaging planes, namely, coronal, sagittal, and axial. Slice thickness of 4 mm, FOV of 15 × 15 cm, and 480 × 480 matrix were used. No movement was allowed during examination by supporting the ankle using pads.

MRI images of these patients were evaluated independently by a radiologist with experience in musculoskeletal radiology.

MRI findings were correlated with arthroscopic findings. We depended up on gold standard of arthroscopic result. When the same finding of ligaments injuries by two procedure called true positive, on other hand when no injuries can be noted in MRI and arthroscope, called true negative, while if the MRI show a tear and the arthroscope fail to find the same tear these called false positive, false negative when MRI cannot diagnose any lesion in the ligaments while arthroscope show tear.

### **Statistical analysis**

Data was collected and included in a data-based system and analyzed by statistical package of social sciences ((SPSS, Inc., Chicago, IL, USA)) version 20.

Discrete variables presented as number and percentage, were analyzed using chi square in comparison between these variables.

Continuous quantitative variable was calculated and presented by mean and standard deviation such as age, weight, height. The difference between continuous variable were measured by independent t-test.

With various parameters were calculated which include Sensitivity, Specificity, Positive predictive value and Negative predictive value were used for comparison between MRI and arthroscopy.

Significance was set at the  $P \leq 0.05$  level in all analyses.

## Result

This study included 60 patients with mean age  $34.2 \pm 6.8$  years and range from 20-59 years. There were 49 males and 11 females. According to MRI signs there were 65.1% of patients showed abnormal increase intensity, empty notch sign reported in 32.5% of them and anterior tibial translation presented in 34.8% as shown in table 1.

Table 1: Show MRI signs in ACL tear \*.

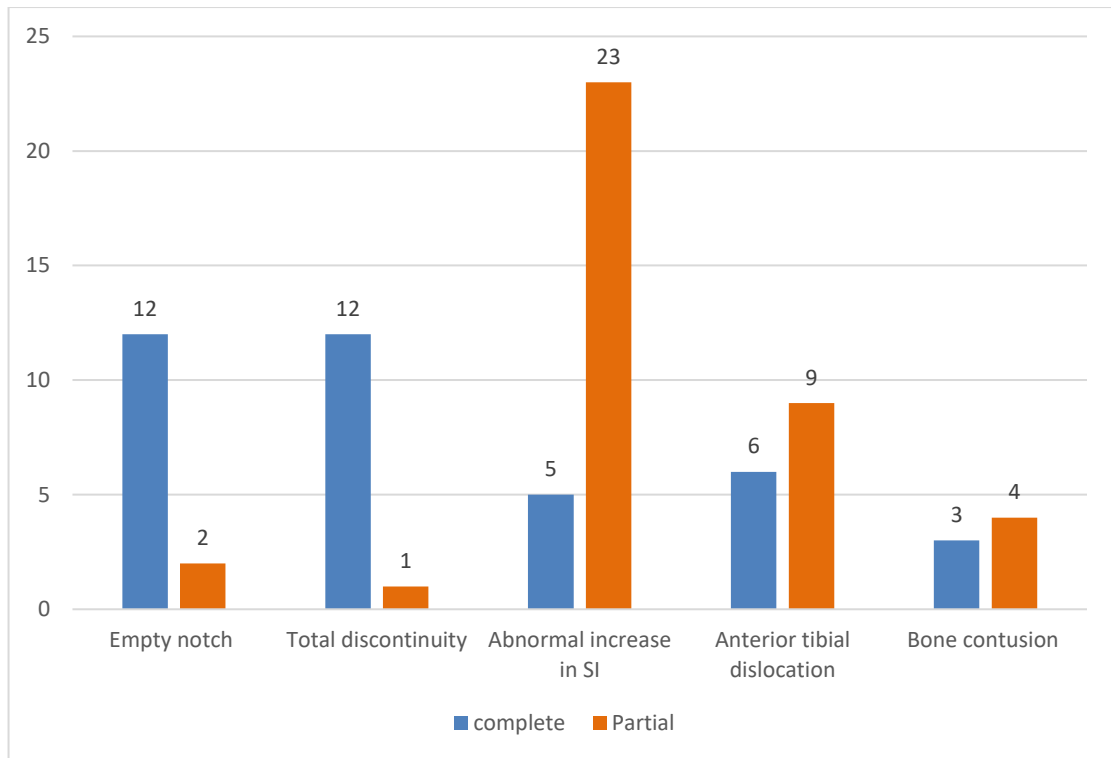
MRI sign in ACL tear	No.	Percent
Empty notch	14	32.5%
Total discontinuity	13	30.2%
Abnormal increase in SI	28	65.1%
Anterior tibial translation	15	34.8%
Bone contusion	7	16.2%

\*Note: many patients manifested one or more than one of MRI signs at same times.

Most of patient with complete ACL tear had both empty notch sign , total discontinuity and anterior tibial translation in their MRI study , while those with partial ACL tear had focus area of increase intensity and anterior tibial translation as showed in table 2.

Table 2: show the differences in signs between complete and partial ACL.

		ACL	
		complete	Partial
<b>MRI signs</b>	Empty notch	12	2
	Total discontinuity	12	1
	Abnormal increase in SI	5	23
	Anterior tibial translation	6	9
	Bone contusion	3	4

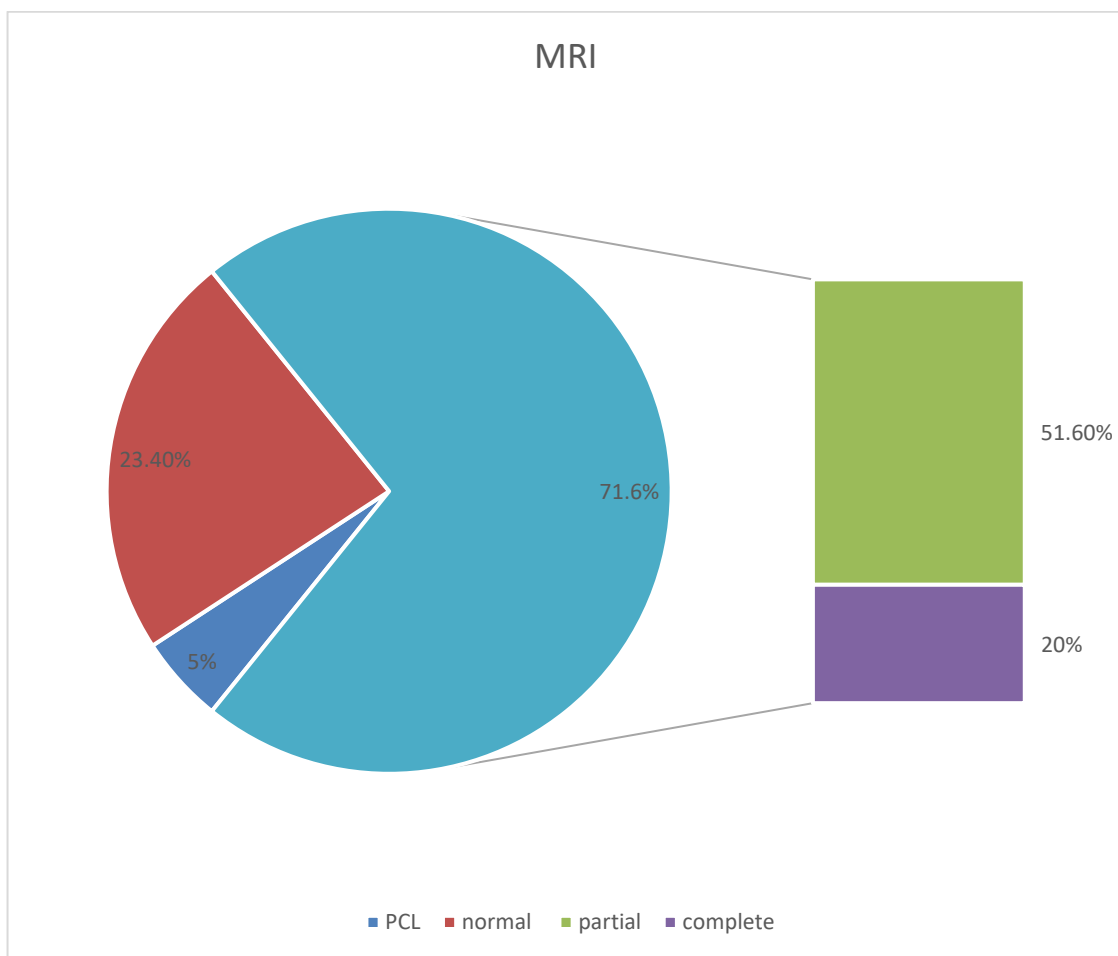


**Figure 1:** MRI signs in types of ACL.

Out of sixty patients, there were 71.6% of patients had overall anterior cruciate ligament injury and 5% posterior ligaments. Out of 43 of overall anterior injury, 31 partial and 12 complete injury. As in table 2.

**Table 3:** distribution of injury by MRI.

	Type of injury by MRI	No.	Percentage
<b>ACL (out of 60 patients)</b>	Overall ACL injury (out of 60)	43	71.6%
	ACL Partial (out 43)	31	51.6%
	ACL Complete (out 43)	12	20%
<b>PCL (out of 60 patients)</b>		3	5%
<b>Normal</b>		14	23.4%

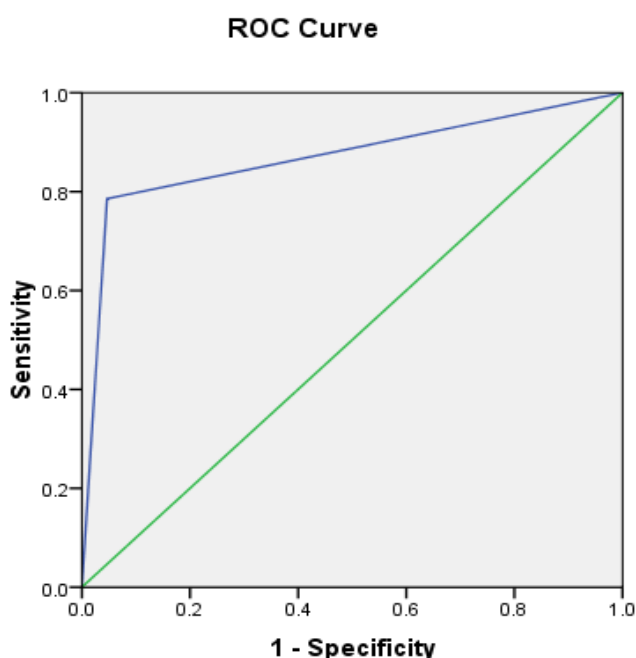


**Figure 2:** Distribution types of injury.

In table 4 show the MRI diagnosis in consistence for 41 patients true positive while 11 patients true negative in overall anterior cruciate ligament injury. In partial anterior ligament injury, the MRI positively diagnosis 28 out of 31 and 3 out 14 reveal negative result, the sensitivity, specificity and accuracy 90.3%, 78.5% and 86.6% respectively. As in table 4 and 5.

**Table 4:** accuracy between MRI and arthroscopy in regarding to overall injury.

Overall ACL injury		Arthroscopy		Total
		Positive	Negative	
MRI	Positive	41	2	43
	Negative	3	11	14
	Total	44	13	57



**Figure 3:** show the accuracy of MRI regarding to arthroscopy in overall injuries

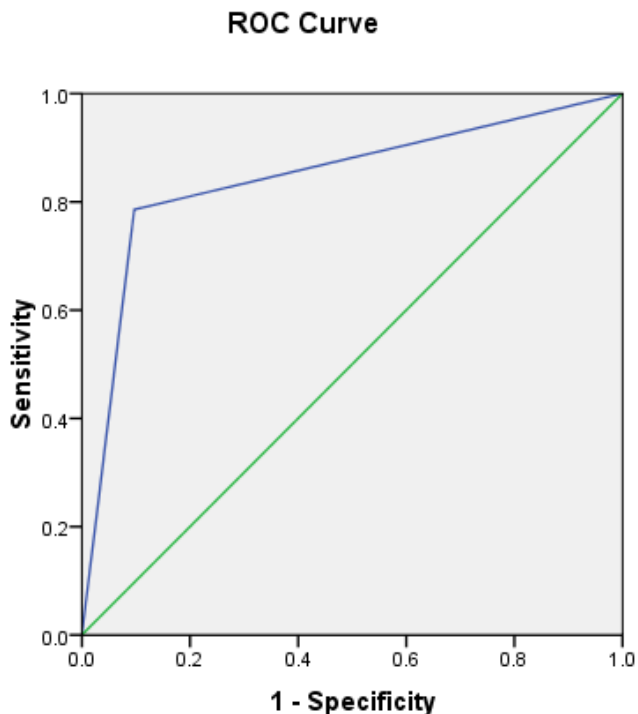
**Table 5:** the relation between MRI and arthroscopy in according to partial ACL.

<b>ACL partial</b>		<b>Arthroscopy</b>		
		Positive	Negative	
<b>MRI</b>	Positive	28	3	31
	Negative	3	11	14
		31	14	45



**Table 6:** MRI test parameters in regarding to partial ACL

<b>Statistic</b>	<b>Value</b>	<b>95% CI</b>
Sensitivity	90.32%	74.25% to 97.96%
Specificity	78.57%	49.20% to 95.34%
Positive Predictive Value	90.32%	77.28% to 96.24%
Negative Predictive Value	78.57%	54.73% to 91.75%
Accuracy	86.67%	73.21% to 94.95%



**Figure 4:** show the accuracy of MRI regarding to arthroscopy in partial ACL

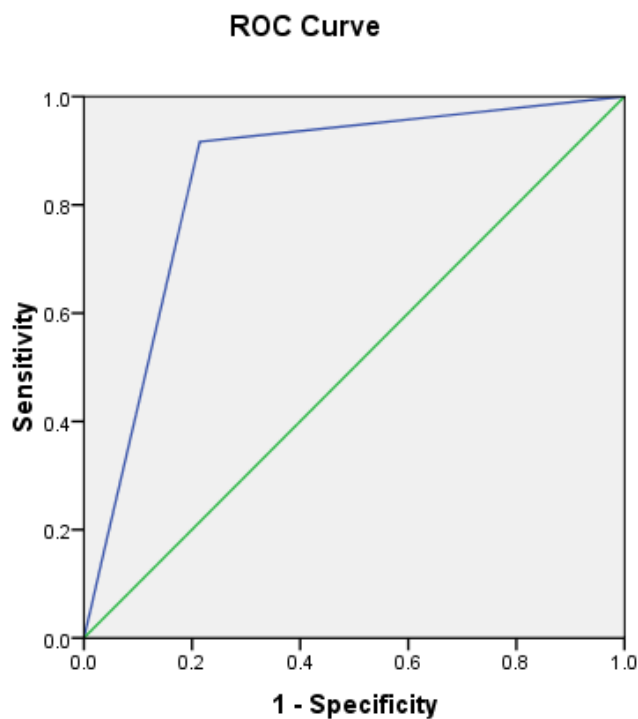
On other hand in complete ACL there were patients 11 true positive and only from MRI positive the arthroscopy diagnosed to be negative. Out of 14 negatives by MRI the arthroscopy diagnosed 3 with ACL complete injury. The sensitivity 78.5%, specificity 91.6%, PPV 91.6%, NPV 78.5% and accuracy 84.6% as in table 6 and 7.

**Table 7:** accuracy between MRI and arthroscopy in regarding to complete ACL.

<b>ACL complete</b>		<b>Arthroscopy</b>		
		Positive	Negative	
<b>MRI</b>	Positive	11	1	12
	Negative	3	11	14
		14	12	26

**Table 8:** MRI test parameters in regarding to complete ACL.

<b>Statistic</b>	<b>Value</b>	<b>95% CI</b>
Sensitivity	78.57%	49.20% to 95.34%
Specificity	91.67%	61.52% to 99.79%
Positive Predictive Value	91.67%	62.28% to 98.65%
Negative Predictive Value	78.57%	57.00% to 91.03%
Accuracy	84.62%	65.13% to 95.64%



**Figure 5:** show the accuracy of MRI regarding to arthroscopy in complete ACL

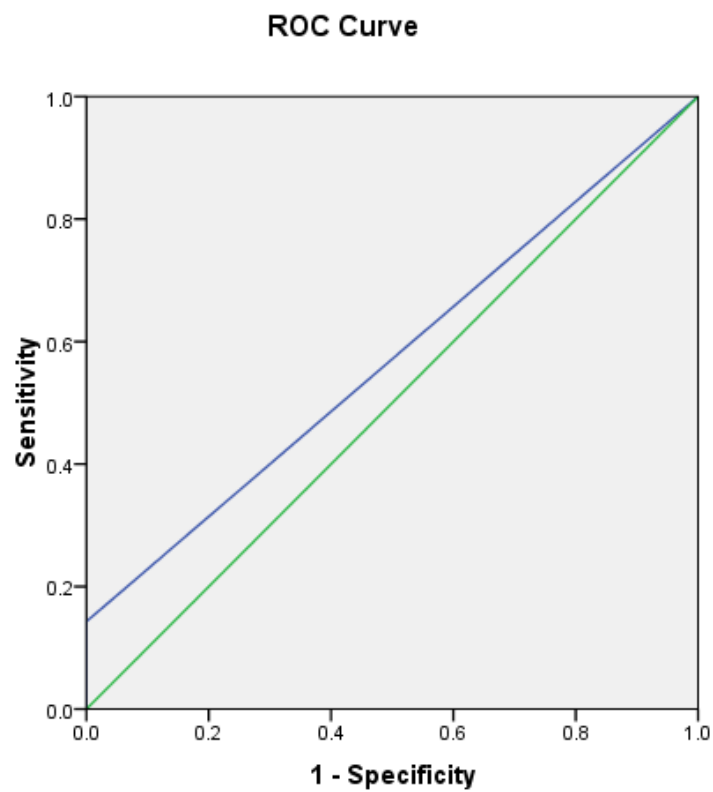
Regarding the posterior cruciate injury PCL, the MRI diagnosed only 3 patients while by arthroscopy were diagnosed 15 patients. The sensitivity 20%, specificity 100%, PPV 100%, NPV 14.2% and accuracy 29.4% as in table 8 and 9

**Table 9:** the relation between MRI and arthroscopy in regarding to PCL.

<b>PCL</b>		<b>Arthroscopy</b>		
		Positive	Negative	
<b>MRI</b>	Positive	3	0	3
	Negative	12	2	14
		15	2	17

**Table 10:** MRI test parameters in regarding to PCL

<b>Statistic</b>	<b>Value</b>	<b>95% CI</b>
Sensitivity	20.00%	4.33% to 48.09%
Specificity	100.00%	15.81% to 100.00%
Positive Predictive Value	100.00%	
Negative Predictive Value	14.29%	11.46% to 17.67%
Accuracy	29.41%	10.31% to 55.96%



**Figure 6:** show the accuracy of MRI regarding to arthroscopy in PCL

## Discussion

Overall, ACL injury is a common clinical form of knee damage. Quick and accurate diagnosis and treatment could prevent the emergence of cartilage degeneration, the progression of bone contusion, the aggravation of traumatic arthritis or the occurrence of knee joint dysfunction <sup>(21)</sup>.

MRI is an accurate and non-invasive diagnostic method of the knee injuries that could provide satisfactory guide for conservative treatment and guarding the patients from uncritical arthroscopic procedure, as well as, it has a great degree of specificity and sensitivity <sup>(22)</sup>.

It has the advantages of good soft tissue contrast, high spatial resolution and allows multi-parameter evaluation of morphological changes in an injured ACL <sup>(23)</sup>.

Additionally, different studies have attributed different values for sensitivity and specificity, ranging from 63.6%<sup>14</sup> to 100%<sup>9, 19, 29</sup> and from 68.4%<sup>26</sup> to 100%<sup>16, 19, 28</sup> respectively, owing to the slightly oblique angle of the ACL crossing the knee joint and to the difficulty of displaying the full ACL in the true sagittal plane via a single MRI scan <sup>(10)</sup>.

Meanwhile, the accuracy of MRI diagnosis depends on the scanning technique and the experience of the musculoskeletal radiologist<sup>30</sup>. Thus, the precise diagnostic accuracy of MRI for ACL injury is unknown <sup>(21)</sup>.

Our study presented the mean age  $34.2 \pm 6.8$  years and range from 20-59 years, there were 46.1% of them belonged to the age group 20-30 years. The male constituent 78.4% and female were constituted 21.6% of sample. These result in consistence with Nasir A study who had reported high male to female ratio the male was 78% and female was 22% in group of 39 patients <sup>(23)</sup>. and relatively similar to Rahman study <sup>(24)</sup>.

The study by Ayman F. Ahmed, show mean age  $39 \pm 9.3$  in range 25-61 years and male was 56% and female was 43.3% <sup>(25)</sup>.

Krati Khandelwal study was show great patient belong the age group of 20-30 years old which was constituting 47.14% of patients, and male about 76% and female 23% <sup>(26)</sup>.

Bashir Ahmed Mir study, A total of 50 patients were included in the study in the age group of 18 to 50 years with a mean age of 38.5 years. Out of 50 patients in our study, 35(70%) were males and 15(30%) were female <sup>(27)</sup>.

Shweta Gimhavanekar study reported different prevalence of injury with increase percent of female trauma. In that female about 36% and male 64%. the age ranges from 18-70 years. With similar in study the more effected age group which is the second decade of life <sup>(28)</sup>.

The male had showed more effect in cruciate ligament due to the fact that males are more vulnerable to traumatic knee injury during daily activity and sports injury, while females are more vulnerable to meniscal degeneration resulting from weight bearing due to obesity <sup>(25)</sup>.

According to MRI signs there were 65.1% of patients showed abnormal increase intensity, empty notch sign reported in 32.5% of them and anterior tibial translation presented in 34.8%. In addition, the most signs of empty notch and total discontinuity presented in complete ACL while increase intensity and anterior tibial translation showed in partial ACL. It agree with study that reported empty notch mostly reported with complete ACL injuries while increase intensity showed with partial injuries <sup>(29)</sup>. in our study the MRI diagnosed about 71.6% of patients had overall anterior ligaments injury and 5% posterior ligaments. Out of 43 of overall anterior injury, 31 partial and 12 complete injury. These result in near to result in India which reported ACL in 76% of sample of 210 patients <sup>(26)</sup>.

Gimhavanekar in his study reported 26 patients out of 50 patients with overall ACL, complete injury seen in 24 patients and partial ACL in 2 patients, and two patients with posterior cruciate injury <sup>(28)</sup>.

Other study by Bashir Ahmed Mir enrolled patient with knee problems show 18% of them with ACL and 2% with PCL <sup>(27)</sup>.

In regarding to sensitivity and specificity of MRI in our study, for partial ACL the result reveals the MRI positively diagnosis 28 out of 31 and 3 out 14 reveal negative result, the sensitivity, specificity and accuracy 90.3%, 78.5% and 86.6% respectively. On other hand in complete ACL there were patients 11 true positive and only from MRI positive the

arthroscopy diagnosed to be negative. Out of 14 negatives by MRI the arthroscopy diagnosed 3 with ACL complete injury. The sensitivity 78.5%, specificity 91.6%, PPV 91.6%, NPV 78.5% and accuracy 84.6%. these results lower than reported by Krati Khandelwal study that found in ACL tears, Sensitivity, specificity and accuracy of MRI with respect to Arthroscopy is 97.46%, 90.38%, and 95.71%, respectively <sup>(1)</sup>. In addition, the positive predictive value and negative predictive value in ACL tears was 96.85% and 92.16% respectively. He concluded The PPV and NPV range from 70% to 76% and 70% to 100% respectively <sup>(26)</sup>.

Amin et al. study in post double bundle ACL reconstruction cases, MRI had sensitivity of 82.3% and specificity of 100% for complete tears. MRI is accurate in identification of ACL tears, ranging from 93% to 97% <sup>(30)</sup>.

The sensitivity and specificity of MRI in other study in diagnosing complete ACL tear were 100% and 89.6% and for partial tear was 100% and 100%, respectively. In three patients, complete tear of ACL was given on MRI, on arthroscopy two were intact and one had a partial tear <sup>(28)</sup>.

Bashir Ahmed Mir reported 85%, 93%, 66% and 97% sensitivity, specificity, PPV and NPV respectively for ACL injury <sup>(27)</sup>.

However, some worker documented that a positive MRI for an ACL tear combined with a normal arthroscopy did not necessarily represent a false positive MRI and intrasubstance tear may be present which is difficult to detect with arthroscopy <sup>(30)</sup>.

Regarding the posterior cruciate injury PCL in our study, the MRI diagnosed only 3 patients while by arthroscopy were diagnosed 15 patients. The sensitivity 20%, specificity 100%, PPV 100%, NPV 14.2% and accuracy 29.4%. which is much lower than reported by Laoruengthana in study that show sensitivity, specificity, PPV, NPV and accuracy about 100%, 97%, 97%, 100% and 96% respectively <sup>(31)</sup>.

the accuracy in their study is more than ours. This could be explained by more radiologists reviewing their cases and more advanced MRI machine, in addition small sample size in our study <sup>(32)</sup>.



## **Conclusion**

1-MRI had a good benefit in assessment of knee derangement.

2- MRI had different efficacy in assessment of ligamentous knee injury . MRI highly sensitive and specific in ACL injury , highly specific but not very sensitive in PCL injury.

3-MRI should be done in every patient of suspected ligamentous injury, to be posted for arthroscopy, thus preventing unwanted arthroscopies.

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## الخلاصة

### نبذة:

يعد مفصل الركبة من أكثر المفاصل شيوعاً من حيث إصابات الأربطة الصليبية الأمامية والخلفية لمفصل الركبة. والأربطة الصليبية الأمامية والخلفية عرضة للالتواء أو التمزق. ويرجع ذلك في المقام الأول إلى الإصابات المرتبطة بالرياضة والسقوط وحوادث السيارات. وشهدت خيارات العلاج لأمراض الركبة هذه أيضاً تطوراً واسعاً وتطور حديث في العلاج التنظيرية لمعظم أمراض الركبة. حل التصوير بالرنين المغناطيسي لمفصل الركبة محل تصوير المفاصل بشكل فعال وكطريقة تصوير مفضلة في تقييم كل من الاضطرابات الحادة والمزمنة التي تسبب الألم في الركبة

### الهدف:

لتحديد دقة التصوير بالرنين المغناطيسي في تشخيص إصابات الرباط الصليبي الأمامي (ACL) والخلفي PCL بين المرضى الذين تم إثبات ذلك بواسطة منظار المفصل.

### طريقة الدراسة:

تم إجراء دراسة مقطعية في مستشفى الحلة التعليمي في الفترة من 1 تشرين الأول 2019 إلى 1 تموز 2020. شملت الدراسة 60 مريضاً زاروا عيادة العظام الذين يعانون من إصابات في الركبة وتم تحويلهم إلى التصوير بالرنين المغناطيسي على الركبة بعد أن خضع هؤلاء المرضى للفحص بالمنظار.

### النتائج:

كان متوسط عمر المرضى  $34.2 \pm 6.8$  سنة ويتراوح بين 20-59 سنة. كان هناك 71.6% من المرضى يعانون من إصابة عامة في أربطة الرباط الصليبي الأمامي و5% في الأربطة الخلفية. من أصل 43 إصابة أمامية عامة، 31 إصابة جزئية و12 إصابة كاملة. تشخيص التصوير بالرنين المغناطيسي متناسق لـ 41 مريضاً إيجابياً حقيقياً بينما 11 مريضاً سلبياً حقيقياً في إصابة الرباط الصليبي الأمامي بشكل عام. في إصابة الرباط الأمامي الجزئي، أظهر التشخيص الإيجابي للرنين المغناطيسي 28 من 31 و3 من 14 نتيجة سلبية، والحساسية والنوعية والدقة 90.3%، و78.5% و86.6% على التوالي. للحصول على ACL الكامل، كان لدى التصوير بالرنين المغناطيسي حساسية 78.5%، وخصوصية 91.6%، و PPV 91.6%، و NPV 78.5% ودقة 84.6%. فيما يتعلق بإصابة الصليبي الخلفي PCL، كان للتصوير بالرنين المغناطيسي المعلمات التالية، الحساسية 20%، النوعية 100%، PPV 100%، و NPV 14.2% والدقة 29.4%.

## الاستنتاج:

كان للتصوير بالرنين المغناطيسي فائدة جيدة في تقييم تشوه الركبة. كان للتصوير بالرنين المغناطيسي فعالية مختلفة حسب أنواع مشاكل الركبة.



وزارة التعليم العالي والبحث العلمي

كلية الطب/ جامعة بابل

فرع الجراحة/ شعبة الاشعة

**دقة فحص الرنين المغناطيسي في تشخيص إصابات  
الرباط الصليبي الامامي والخلفي في الحالات الخاضعة  
لتنظير الركبة الجراحي**

أطروحة مقدمة الى كلية الطب وهيئة الدراسات في جامعة بابل كجزء من متطلبات  
نيل شهادة الدبلوم العالي في الاشعة التشخيصية

**انتصار عبد الأمير حرج**

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