IJIMM, Volume 2, Issue 4, 2024
ISSN: 2995-5319
http://medicaljournals.eu/index.php/IJIMM

INTERNATIONAL JOURNAL OF INTEGRATIVE AND MODERN MEDICINE

Comparing MRI Diagnostic Accuracy for ACL and PCL Knee Injuries: Evidence from Arthroscopy-Confirmed Cases

Dr.Entesar Abdul Ameer Haraj Alhusseini
Department of health of Al Diwaniyah ,Afak general hospital

Dr . Hanan Qassem samawy
Department of health of Dhi qar, Suq Alshuyukh general hospital.

Dr.Zahraa Qahtan Ali
Al muthanna health department, Alrumaitha general hospital

Abstract:

Background: Injuries of knee joints are commonly occurred for different causes. Knee joint is one of the most important. Anterior (ACL) and posterior (PCL) crucial ligaments are prone to tear or sparing. MRI represents a golden imaging modality for assessment both chronic and acute pain causing disorders in the knee.

Objective: To evaluate the accuracy of MRI in diagnosis of injuries in anterior and posterior crucial ligaments compared to arthroscopy.

Patients and Methods: This was a cross-sectional study conducted in Afak hospital in period from March 2022 to April 2023, included 40 patients who were visited the orthopedic clinic suffering from knee trauma and referred for knee MRI and then got arthroscopic examination.

Result: Patients' age ranged 25-55 years with a mean of 31.3±5.9 years. Overall ACL injury reported in 69.6% of patients and PCL injuries in 4% posterior cruciate ligaments. Compared to arthroscopy, MRI was 91.4% sensitive and 81.3% specific with accuracy of 89.2% in diagnosis of overall ACL injuries. For PCL injuries , MRI was 18% sensitive and 100% specific with 27.4% accuracy.

Conclusion: MRI had a good benefit in assessment of knee derangement. MRI had different efficacy according to types of knee problems

Keywords: arthroscopy-confirmed cases, mri diagnostic.

The knee joint is made up of the distal end of the femur and the proximal end of the tibia, with two menisci interposed between them, one external (meniscus fibularis) and the other internal (meniscus tibialis). It is vascularized by five branches of the popliteal artery. Knee mobility is controlled by two types of structures, some active periarticular (the muscle groups) and others passive (the capsuloligamentous formations). There are many ligaments that maintain the stability of the knee joint, and they include the anterior cruciate ligament (ACL) and the posterior cruciate ligament (PCL), both contribute to stabilizing the joint from the front and the back .

Ligament tear implies, in general terms, loss of stability, intense pain when it occurs, inflammation and a feeling of blockage [1-4].

The cruciate ligaments prevent shear movements of the joint and act as a guide in flexion and rotation of the joint. They are important structures in articular kinematics, ensuring anteroposterior stability, the countervalgus-varus and participating in the control of internal rotation by coiling each other [5,6].

Injuries to the knee ligaments are common, particularly in sports whose practice requires frequent changes of pace and direction. Also Knee injuries are more common in the elderly particularly with osteoarthritis disease [7-9].

Different risk factors and causes are associated with knee injuries such as obesity or being overweight that increases pressure on the knee joints. Some types of sports put great pressure on the knee, such as skiing and basketball. Having a previous knee injury increases the likelihood of a recurring knee injury. The main causes of knee injuries are bone fractures, Knee sprain; is an injury to the knee ligaments. ACL and PCL can occur during an automobile accident, in football tackle , collision or soccer , stopping quick running suddenly or wrong way of landing a jump [8,10,11]. Diagnosis of knee injuries based on clinical examination looking for swelling, accumulation of fluid, movement in different positions and other signs. Radiographic imaging and magnetic resonance imaging (MRI) study, an ultrasound, or sometimes an X-ray could help in diagnosis. However, some years ago arthrography and arthroscopy were more accepted for the evaluation of meniscal injuries[12- 15]. Magnetic resonance imaging (MRI) has been shown to have significant role in musculoskeletal diagnosis. Knee joint is commonly imaged with MRI for detection of injuries while plain imaging of less value, however, the the precise diagnosis is still

Patients and methods

This was a cross-sectional study conducted in Afak hospital in period from March 2022 to April 2023, included 40 patients who were visited the orthopedic clinic suffering from knee trauma and referred for knee MRI and then got arthroscopic examination.

Data collection:

After approval of the study protocol and consent of all participant patients, data were collected using a pre-constructed data collection sheet gathered the demographic data, clinical presentations, findings of MRI and arthroscopic findings. Data collected through full medical history taking and thorough clinical examination including the knee joints to specify the diagnosis ligamentous injuries. Diagnosis assured by expert orthopedic specialist surgeon. Full examination of knee joint was performed and each joint was palpated for detection of tenderness.

Study 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.

Data management and analysis:

Data were analyzed using the statistical package for social sciences (SPSS) version 20 and appropriate statistical tests were applied accordingly at twotailed level of significance (P. value≤0.05). Validity parameters (sensitivity, specificity, accuracy, positive predictive value (PPV) and negative predictive value (NPV) for MRI and arthroscopy were calculated and compared using standard equations؛

Result

This study included 60 patients with mean age 34.2±6.8 years and range from 20-59 years. There were 49 males and 11 females. There were 32.5% of patients had empty notch in MRI, 65.1% of them had increase intensity in MRI and 34.8% had anterior tibial dislocation, (**Table 1**). Out of sixty patients, there were 43 (71.7%) had ACL ligaments injury and 3 patients (5%) with posterior ligaments injury. Out of the 43 ACL injuries, 31 (72.1%) were partial and 12 (27.9%) were complete injuries, (**Table 2**). The MRI signs of partial and complete ACL injuries revealed that most of patient with complete ACL tear had both empty notch sign , total discontinuity and anterior tibilal translation in their MRI study , while those with partial ACL tear had focus area of increase intensity and anterior tibial translation(**Table 3**).

Table 1. Signs of MRI of the studied group.

Signs of MRI in ACL	**No.**	**%**
Empty notch	14	32.5
Total discontinuity	13	30.2
Abnormal increase in SI	28	65.1
Anterior tibial dislocation	15	34.8
Bone contusion	7	16.2

Table 2. Distribution of injuries according to MRI.

Type of injury by MRI		No.	%
ACL injury	Overall ACL injury (out of 60)	43	71.7
	Partial (out 43)	31	72.1
	Complete (out 43)	12	27.9
PCL injury (out of 60 patients)		3	5.0
Normal		14	23.4

Table 3. Distribution of MRI signs in complete and partial ACL injury

MRI signs	ACL injury		Total
	Complete	Partial	
Empty notch	12	2	14
Total discontinuity	12	1	13

Abnormal increase in SI	5	23	28
Anterior tibial translation	6	9	15
Bone contusion	3	4	7
Total	12	31	43

Discussion

Our study presented the mean age 34.2±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 consistent 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

[19]. and relatively similar to Rahman et al. study [20].

Higher proportion of males showed more effect in cruciate ligament, this could be attributed to the fact that males were more prone to trauma in their daily activities while females were more likely to have meniscal degenerative disorders, due to obesity and its weight bearing effect [21]. In our study the MRI diagnosed about 71.6% of patients to have overall anterior ligaments injury and 5% posterior ligaments. Out of 43 of overall anterior injury, 31 partial and 12 complete injury. These result close to that reported by Khandelwal et al. who reported ACL in 76% of 210 patients

(22).

Other study conducted by Mir et al. enrolled patient with knee problems show 18% of them with ACL and 2% with PCL [23].

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 [24].

Our study documented that for partial ACL, MRI showed a sensitivity, specificity and accuracy of 90.3%, 78.5% and 86.6% respectively. In complete ACL the sensitivity was 78.5%, specificity 91.6%, PPV 91.6%, NPV 78.5% and accuracy 84.6%. these results lower than reported by Khandelwal et al. study that found MRI sensitivity, specificity and accuracy of 97.5%, 90.4% and 95.7%, respectively, in diagnosis of ACL tears [22].

In addition, the positive and negative predictive values in the anterior cruciate ligament tears were 96.9% and 92.2%, respectively. Khandelwal et al. concluded that PPV and NPV were ranged between 70% to 76% and 70% to 100%, respectively [22]. A study conducted by Amin et al. found that in cases of reconstruction of the ACL after double bundle, the sensitivity of the MRI was 82.3% and the specificity was

100% for complete tears and MRI was accurately detected ACL tear in 93% to 97%(25)

Reference

1. Abulhasan JF, Grey MJ. Anatomy and physiology of knee stability. Journal of Functional Morphology and kinesiology. 2017 Sep 24;2(4):34-9

2. Hirtler L, Lübbers A, Rath C. Vascular coverage of the anterior knee region– an anatomical study. Journal of Anatomy. 2019 Aug;235(2):289-98.
3. Flaxman TE, Speirs AD, Benoit DL. Joint stabilisers or moment actuators: the role of knee joint muscles while weight-bearing. Journal of Biomechanics. 2012 Oct 11;45(15):2570-6.
4. Juneja P, Hubbard JB. Anatomy, bony pelvis and lower limb, knee medial collateral ligament.
5. Rong GW, Wang YC. The role of cruciate ligaments in maintaining knee joint stability. Clin Orthop Relat Res. 1987 Feb;(215):65-71.
6. Veltri DM, Deng XH, Torzilli PA, Warren RF, Maynard MJ. The role of the cruciate and posterolateral ligaments in stability of the knee. A biomechanical study. Am J Sports Med. 1995 JulAug;23(4):436-43.
7. Smillie IS. Injuries of the knee joint. Annexe Thesis Digitisation Project 2019 Block 22. 1946.
8. Majewski M, Susanne H, Klaus S. Epidemiology of athletic knee injuries: A 10-year study. The knee. 2006 Jun 1;13(3):184-8.
9. Rohman EM, Macalena JA . "Anterior cruciate ligament assessment using arthrometry and stress imaging". Current Reviews in Musculoskeletal Medicine.2016: 9 (2): 130–8
10. Muthuri SG, McWilliams DF, Doherty M, Zhang W. History of knee injuries and knee osteoarthritis: a meta-analysis of observational studies. Osteoarthritis and cartilage. 2011 Nov 1;19(11):1286-93.
11. Messier SP, Legault C, Schoenlank CR, Newman JJ, Martin DF, DeVita P. Risk factors and mechanisms of knee injury in runners. Med Sci Sports Exerc. 2008 Nov 1;40(11):1873-9.
12. Rossi R, Dettoni F, Bruzzone M, Cottino U, D'Elicio DG, Bonasia DE. Clinical examination of the knee: know your tools for diagnosis of knee injuries. Sports Medicine, Arthroscopy, Rehabilitation, Therapy & Technology. 2011 Dec;3(1):1-0.
13. Dickens V, Ali F, Gent H, Rees A. Assessment and diagnosis of knee injuries: the value of an experienced physiotherapist. Physiotherapy. 2003 Jul 1;89(7):417-22.
14. Geraets SEW, Meuffels DE, van Meer BL, Breedveldt Boer HP, BiermaZeinstra SMA, Reijman M. Diagnostic value of medical history and physical examination of anterior cruciate ligament injury: comparison between primary care physician and orthopaedic surgeon. Knee Surgery, Sport Traumatol Arthrosc 2015;23(4):968-
74.
15. van Eck CF, van den Bekerom MPJ, Fu FH, Poolman RW, Kerkhoff GMMJ. Methods to diagnose acute anterior cruciate ligament rupture: a meta-analysis of physical examinations with and without anaesthesai. Knee Surg Sports Traumatol Arthrosc. 2013;21:1895–1903
16. Siddiqui MA, Ahmad I, Bin Sabir A, Ullah E, Rizvi SAA, Rizvi SWA. Clinical examination vs MRI: evaluation of diagnostic accuracy in detecting ACL and meniscal injuries in comparison to arthroscopy. Pol Orthop Traumatol. 2013; 78:59–63.

17. Navali AM, Bazavar M, Mohseni MA, Safari B, Tabrizi A. Arthroscopic evaluation of the accuracy of clinical examination versus MRI in diagnosing meniscus tears and cruciate ligament ruptures. Arch Iran Med. 2013;16(4):229–232.
18. Kostov H, Arsovski O, Kostova E, Nikilov V. Diagnostic assessment in anterior cruciate ligament (ACL) tears. Prilozi. 2014;35(1):209–218.
19. Nasir A. the role of magnetic resonance image in knee joint injury. Int Res J Med Science: 2013: 1(5). 1-7.
20. Rahman A, Nafees M, Akram MH, Andrabi AH, Zahid M. Diagnostic accuracy of magnetic resonance imaging in meniscal injuries of knee joint and its role in selection of patients for arthroscopy. Journal of Ayub Medical College Abbottabad. 2010 Dec 1;22(4):10-4.
21. Ayman F. Ahmed, Ahmed Abdel Azeem, Amr Eladawy. Mohamed Abdeen. MRI as an accurate tool for the diagnosis and characterization of different knee joint meniscal injuries. the Egyptian Journal of Radiology and Nuclear Medicine 48 (2017) 953–960.
22. Khandelwal K, Chaturvedi VC, Mishra V, Khandelwal G. Diagnostic accuracy of MRI knee in reference to arthroscopy in meniscal and anterior cruciate ligament injuries. The Egyptian Journal of Radiology and Nuclear Medicine. 2018 Mar 1;49(1):138-45.
23. Mir BA, Sultan A, Bashir A. Internal derangement of the knee-sensitivity and specificity of an MRI in correlation with a diagnostic arthroscopy. Journal of Evolution of Medical and Dental Sciences. 2015 Dec 17;4(101):16635-8.
24. Gimhavanekar S, Suryavanshi K, Kaginalkar J, Rote-Kaginalkar V. Magnetic resonance imaging of knee joint: diagnosis and pitfalls using arthroscopy as gold standard. Int J Sci Stud. 2016 Apr 1;4(1):110-6.
25. Amin MF, Abd El Kareem H, Sadek AF, Saleh AN. MRI evaluation of the knee post double bundle ACL reconstruction: Association of graft findings and comparison with arthroscopy. The egyptian journal of radiology and nuclear medicine. 2016 Jun 1;47(2):521-9.