The necessity of MRI in acute and mild knee trauma

Ali Birjandinejad[1], Mohammad Taghi Peivandi[1], Amir Reza Kachooei[2], Amin Razi[3], Sara Amelfarzad[4], Farzad Omidi Kashani[1]

[1.] Associate professor of Orthopedic surgery, Orthopedic and trauma Research Center, Mashhad University of Medical Sciences, Mashhad, Iran
[2.] Assistant Professor of Orthopedic Surgery, Orthopedic and trauma Research Center, Mashhad University of Medical Sciences, Mashhad, Iran
[3.] Orthopedic Resident, Orthopedic and Trauma Research Center, Mashhad University of Medical Sciences, Mashhad, Iran
[4.] Pharmacologist, Mashhad University of Medical Sciences, Mashhad, Iran
drpeivandy@yahoo.com

Abstract: In patients with mild knee injury, there is usually a lack of thorough examination concerning evaluation of the type and severity of articular damage; future knee complaints are referred to a previous mild trauma. The purpose of this study was to determine the relationship among knee examination under general anesthesia, patients' signs and MRI findings shortly after mild and acute knee traumas. Thirty four patients with mild knee trauma which were admitted to Emdadi Hospital's orthopedic unit during the year 2006 were included in this study. Forty one knees of 39 patients were admitted during the author's shifts, some of which were excluded and the remaining completed follow-up and treatment and the related data were accessible. In all the patients, the following measures were taken: plain x-ray, under general anesthesia examination, demographic and historical data gathering, knee MRI. Then, questionnaires were completed. The gathered data were analyzed using SPSS software, descriptive statistics and frequency distribution tables. The mean age of the patients was 29.5 ranging from 14 to 46. There were 5 female and 29 male patients. 5 patients showed positive clinical finding (14.7%) of which 4 patients had pathologic findings in MRI (80%) and one patient was normal. 29 patients had stable knee exams, of which 16 patients had pathologic MRI (55%) and the remaining 13 patients (45%) were normal. ACL tear was the most common pathologic finding in MRI (12 patients). There was a meaningful relationship between clinical exam and joint effusion and the possibility of pathologic MRI after mild and acute knee trauma. That is, in cases with positive clinical signs the possibility of pathologic MRI is quite high (80%). On the other side, in patients with normal knee exam and without joint effusion, in 48 % MRI is pathologic. In case of any suspicion in clinical examination, basic MRI is advised.

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1. Introduction

Patients with mild knee injury following the accidents will often refer with pain and sometimes with effusion and other symptoms. Primary proceedings for the patients will be examination of the knee and performance simple x-ray. In cases with suspected knee ligament tear for more accurate diagnosis and evaluation of soft tissue should be used other measures such as stress film, arthroscopy and MRI.MRI can show soft tissue damage which may be caused by tears in internal complex of knee, and also it is useful for preoperative planning. In mild knee injury especially in cases without effusion, performance a simple graphy and examination of knee and conservative treatment are enough usually [1].

But this patient that are multiple trauma ,later refer to pain of knee or meniscal tears that in the patients there is no evidence of a relationship between the initial trauma and subsequent symptoms of knee instability. In mild trauma usually do not MRI because this procedure is very expensive and also rarely has been found relationship between the results of MRI and the results of physical examination under anesthesia. Therefore we cannot check the possibility of the mild traumatic pathologies which may be caused by primary mild trauma. The aim of this study is to investigate relationship between examination under anesthesia and symptoms of patient and result of MRI, shortly after mild and acute trauma of knee [2].

2. Material and Methods

This is a descriptive study that was performed on 39 patients [41 knees] in 1386 year for one year. This study was performed on the patients who were admitted to Mashhad Emdadi hospital after motor vehicle accidents, and these patients complained of knee pain. In most of the cases were performed examinations of knee under anesthesia. Both in terms

of decision making and the subsequent legal issues to be included in patient records. The samples had a knee injury minor or negligible that after history and physical examination we did for them examination of knee under anesthesia. This examination had 4 tests [ADT, PDT, varus stress test and valgus stress test]. In the case of simple fracture, the patient was not enrolled. Additionally, the clinical study of the rate of effusion and superficial wounds or abrasion done and logged. The examination of knee carried out within a maximum of 24 hours after trauma and then done MRI of injured knee of patient.MIR was interpreted by radiologist.MIR was performed within three days after trauma usually. Important points in MIR were the internal and external lateral ligaments, the anterior and posterior cruciate ligaments, the internal and external meniscus, effusion and contusion of bone. In patient with mild and acute injury of knee, after performance of physical examination and x-rays were did MRI. Mild injury in this study is defined as:

1. Patients that complains of slight pain in the anterior knee
2. Having complete ROM
3. No severe effusion
4. No fractures around the knee

The rate of effusion in physical examination was defined as follows:

a. Mild: positive balotman

b. Moderate: filling the grooves of medial and lateral patellar

c. Severe: leading the pack of suprapatellar

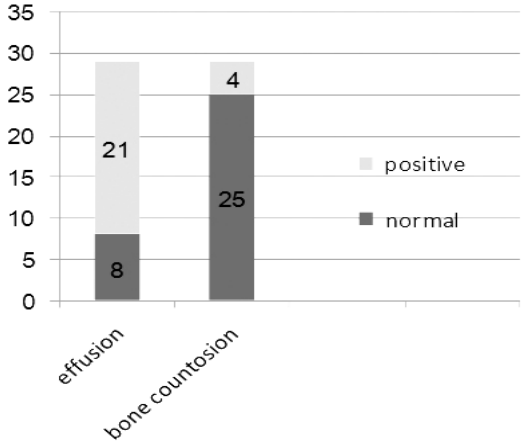
Table 1. Gradining of ligament injury of the knee

Degree of ligament injury	Examination
Grade 0	Stable
Grade 1	Less than 5 mm displacement in comparison with the opposite side.
Grade 2	More than 5 mm displacement with firm end point
Grade 3	More than 5 mm displacement without firm end point

For grading of knee ligament injury was used following method: The data collected with using of SPSS and this data was processed with descriptive statistics and frequency tables (Table 1).

3. Results

In this study 39 patients [41 knees] were examined and they did MIR. Two knees of 41 knees were excluded from this study because they had fracture in femoral shaft and tibial plateau. Five knees also were excluded because they were older than 50 years. Totally, 34 patients with 34 knees were evaluated with age rang 14 to 46 years and with the mean age 5/28. Of the 34 patients, five cases were women [%14] and 22 cases were men [%86]. Three cases with superficial wound were required to healing and 16 cases had superficial graze of knee [%47]. From examination of 34 patients were found 9 cases with mild effusion [%26] and two cases with moderate effusion [%5] and other patients were without effusion.



Diageram 1. Incidense of efusion and bone contusion in MRI of patients with stable knee

There was a ligaments positive result in five patients after examination of knee under Anesthesia [table 2]. The report of MIR was normal in ligaments and meniscus in 15 cases of 34 patients ,that 14 cases were men and 1 case were woman .Among these patients, only 2 patients had pathological clinical examination, [1 patient had positive ADT and another patient had ADT and positive valgus stress test.] Patients were divided into two groups of stable and unstable based on clinical observation. Stable group had 29 patients and unstable group had 5 patients. [Table 3, 4]. MIR was pathologic in 16 patients of first group [%55] .In second group, MIR was pathologic in 4 patients [%80] [diagram 1].

4. Discussions

There is a significant relationship between physical examination and effusion after mild and acute trauma with view of pathology in MRI [p=0/0004].It means that in cases with positive symptoms, joint injury was observed in MRI with a greater percentage [%80]. On the other hand, in patients with normal physical examination and without effusion, MIR is pathologic in %48 of cases. Accordance with obtained tables, there are cases that they have negative physical examination with positive MRI and conversely, in these cases there is no possibility of performing arthroscopic and the gold standard is not defined. Accordingly, we cannot get enough of each of them individually to decide in each case. All information must be supplied to comment and this information includes the history, physical examination and radiological proceeding. Positive

finding in MRI are much more than positive physical examination. In many cases that there is a sustained examination, in MRI is found the pathological findings that in examination, these findings are not tractable. For this reason, the examination alone is unreliable in cases that are negative. But in positive cases specially 2+ and 3+ physical examination and MRI are in agreement.

Table 2. MRI findings observed in patients with clinically positive signs

The clinical findings	Effusion on examination	Gender	Findings observed in MRI							
			Bone contusion	Joint Effusion	Lateral meniscus	Medial meniscus	LCL	MCL	PCL	ACL
ADT 1+ Valgus 1+S.T.	+	Male	+	-	-	-	-	-	-	-
AD 1+	+	Male	-	+	-	Tear grade 2	-	-	-	-
PDT 1+	+	Female	-	+	Tear grade 2	Tear grade 2	Elongation	-	-	Partial rupture
PDT 2+	+	Male	-	+	-	-	-	-	Avulsion	-
PDT 3+	-	Male	+	+	-	-	-	-	Complete rupture	-

ADT=anterior drawer test, PDT=Posterior drawer test, ACL=anterior cruciate lig. PCL=Posterior cruciate lig. MCL, LCL=medial and lateral collateral lig

Table 3. The type and severity of ligament damage observed in MRI examinations of patients with stable knee

	Normal	Ligament strain	Partial rupture	Complete rupture
ACL	17 Case (50%)	5 Case (7/14%)	4 Case (7/11%)	3 Case (8/8%)
PCL	22 Case (64%)	2 Case (8/5%)	-	-
MCL	27 Case (79%)	-	1 Case (9/2%)	1 Case (9/2%)
LCL	27 Case (79%)	1 Case (9/2%)	1 Case (9/2%)	-

Table4. The severity and type of meniscal tear in MRI examinations of patients with stable knee

	Normal	Tear Grade 2,1 dorsal horn	Rupture of the posterior horn of grade 3 and 4
Medical meniscus	16 (%47)	9 (%26.4)	4 (%11.7)
Lateral meniscus	26 (%76.4)	3 (%8.8)	

It should be considered false positive and negative results in MRI, but we were not unaware from treatment of mild traumatic, because treatment failure can cause severe injury and can convert nonsurgical treatment to surgical treatment. It is recommended that tests be performed more accurately and in case of any doubt, use radiological measures that MIR is the best of them. In cases that we did nonsurgical treatment and immobility, it is recommended use of MRI for follow-up of patients. it is recommended even in cases that need to do arthroscopic measures. Mr. Kalytun in 2008 said that most common knee ligament injury is meniscus tearing and then anterior cruciate ligament [1/8 case at 100 thousand in per year in public of UK]. In this study also it was necessary to be done more accurately analysis and more conservative treatment and more follow s-up.

In the study that performed in 2012 in UK, 36 patients in two groups were evaluated to demonstrate the utility of MRI in initial trauma and follow-up. The results showed that there was no difference between groups in overall cost that was spent for each patient, Because the patients who had done MRI had less need for physical therapy [because of having relative confidence that they have not injury]. these patients also had less pain and return to daily activities faster, So doing the MRI and early diagnosis can cause the action to be performed better in the future [3].

In a study that conducted in Canada in 2000 on 23 patients also it was recommended to do MRI in patients with mild to moderate trauma [4]. In another study that performed in America in 2012, MRI recommended in all cases of acute traumatic knee that they had traumatic effusion [5]. If we have pathologic MRI in patient with stable examination; it is a false positive MRI. In a systematic study in 2007 in UK, specificity of MRI was more than sensitivity of this and also the negative predictive value was more than the positive predictive value of MRI. If the MRI was taken as only screening before the operation, you may not need to perform arthroscopic procedure. MRI has

false positive results more than false negative results. Although the MRI is on the rise but cannot take the place of clinical diagnosis. MRI is helpful in the diagnosis of knee injuries. Most studies that have compared the MRI and arthroscopy said that MRI is good for the diagnosis of meniscus and cruciate lesions. But in any case, arthroscopy is standard for diagnosis of lesions in the knee and should be compared with other diagnosis moudalites. In most patients MRI is preferable to diagnosis arthroscopy [7].

In a prospective study, that has comparison between doing MIR and arthroscopy, %16 patients without symptoms had evidence of meniscal tear in MRI that this percent with rising of age to over 45 years reaches %36 [8]. MRI is a noninvasive imaging technique of choice for assessing pain of knee [9]. High specificity and negative predictive value approve the use of MRI as a screening tool for avoidance of doing unnecessary arthroscopy. Current techniques of MRI cannot take the place of arthroscopy in diagnosis of knee cartilage lesions [11]. When MRI is combined with the clinical examination will be provide the most accurate non-invasive data sources for meniscal and ACL pathologic findings [12]. Finally for exact expression is necessary that perform another studies with more volume and longer follow-up periods. This studies aims to investigate the sustainable and residual lesions after conservative treatment. The use of MRI is growing and the use of diagnosis arthroscopy is declining but use of arthroscopic treatment has increased [13]. The limitations of this study were the inability to perform the gold standard method [arthroscopy] and limited number of patients. Existence patients who are referred for a while after mild knee injury with several and longstanding problems, indicates the need for further evaluation of knee injuries.

Few studies performed on the association of MRI in acute and mild knee injuries. Therefore, it is recommended to perform more studies .It is useful to exam the patients who had normal examination and abnormal MRL for long-term to determine relationship between reported injuries in MRI and problems in the future.

Corresponding Author:
Dr. Mohammad Taghi Peivandi,
Orthopedic and trauma Research Center,
Mashhad University of Medical Sciences,
Mashhad, Iran
E-mail: drpeivandy@yahoo.com

References

1. Rehman,A. Alqahtani, S. Altameem, A. Saba, T. Virtual Machine Security Challenges: Case Studies, International Journal of Machine Learning and Cybernatics, 2013, DOI 10.1007/s13042-013-0166-4.
2. Clayton RA, Court-Brown CM. The epidemiology of musculoskeletal tendinous and ligamentous injuries. Injury. 2008; 39(12):1338-44.
3. Patel NK, Bucknill A, Ahearne D, Denning J, Desai K, Watson M. Early magnetic resonance imaging in acute knee injury: a cost analysis.Knee Surg Sports Traumatol Arthrosc. 2012 Jun; 20 (6):1152-8.
4. Munshi M, Davidson M, MacDonald PB, Froese W, Sutherland K. The efficacy of magnetic resonance imaging in acute knee injuries. Clin J Sport Med. 2000 Jan;10(1):34-9.
5. Abbasi D, May MM, Wall EJ, Chan G, Parikh SN. MRI findings in adolescent patients with acute traumatic knee hemarthrosis. J Pediatr Orthop. 2012 Dec;32(8):760-4.
6. Heron CW, Calvert PT. 3D gradient echo MRI of the knee: comparison with arthroscopy in 100 patients. Radiology (1992) 183:839–844.
7. Crawford R, Walley G, Bridgman S, Maffulli N. Magnetic resonance imaging versus arthroscopy in the diagnosis of knee pathology, concentrating on meniscal lesions and ACL tears: a systematic review. British Medical Bulletin. Online on September 3, 2007.
8. Saba, T. and Rehman, A. Effects of Artificially Intelligent Tools on Pattern Recognition, International Journal of Machine Learning and Cybernetics, 2012, 4(2), 155-162.
9. Crues JV, Mink J, Levy TL, Lotysch M, Stoller DW. Meniscal tears of the knee: accuracy of MRI imaging. Radiology (1987) 164:445–448.
10. Elvenes J, Jerome CP, Reikeras O, Johnsen O. MRI as a screening procedure to avoid arthroscopy for meniscal tears. Arch Orthop Trauma Surg (2000) 120:14–16.
11. Friemert B, Oblerlander Y, Schwarz W, et al. Diagnosis of chondral lesions of the knee joint: can MRI replace arthroscopy? Knee Surg Sports Traumatol Arthrosc (2004) 12:58–64.
12. Saba, T. Alzorani, S. Rehman, A. (2012) Expert system for offline clinical guidelines and treatment, Life Science Journal, 2012;9(4), pp. 2639 -2658.
13. MSM Rahim, T. Saba, F. Nayer. A.Z. Syed. 3D Texture Features Mining for MRI Brain Tumor Identification, 3D Res, 2014, 5(1), DOI 10.1007/s13319-013-0003-2.