

Akut Diz Yaralanması Tanısı-Klinik Muayene, MRI ve Artroskopi Sonuçlarının Karşılaştırılması-Klinik Testlerin Yok Olmasından Sakınmak!

Diagnosis of Acute Knee Injury-Comparison of The Results of Clinical Examination, MRI And Arthroscopy-Save Clinical Tests From Extinction!

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ÖZ

GİRİŞ ve AMAÇ: Bu çalışmanın amacı akut diz yaralanması olan hastalarda artroskopi sonuçları ile fizik muayene ve manyetik rezonans görüntüleme (MRG) sonuçlarını karşılaştırmaktır. İkinci amaç yaralanmadan 3 hafta, 3 ve 6 ay sonra artroskopik meniscectomi uygulanan hastaların klinik sonuçlarını karşılaştırmaktır.

YÖNTEM ve GEREÇLER: Ocak 2003'ten Kasım 2008'e kadar, dizde artroskopik cerrahi geçiren 159 hasta vardı. Akut yaralanma olan 121 hasta, 99 erkek ve 22 kadın, 13-62 yaş, 67 sağ diz / 54 sol diz. Ortopedik cerrah, menisküsün gözyaşı incelemesi için test yapmış, anterior cruciate ligament (ACL), posterior cruciate ligament (PCL), medial kollateral ligament (MCL) ve lateral kollateral ligament (LCL) stabilitesini test etmek için test yapmıştır. Ayrıca, hareket aralığı (ROM) hakkında bilgi toplandı ve hastalar Lysholm diz anketini yerine getirmek zorunda kaldı. Postoperatif aynı ölçümler yapıldı.

BULGULAR: Sonuçlar, klinik muayene ile MRG arasında başlangıç tanısının doğruluğu açısından istatistiksel bir farklılık göstermedi ($p = 0,640$). Sonuçlar menisküs rüptürü ($p = 0,948$) ve menisküs ve ACL ($p = 1,000$) için benzerdi.

TARTIŞMA ve SONUÇ: Klinik ve MRG testlerinin kesinliği, duyarlılığı, özgüllüğü, prediktif pozitif ve negatif değerlerinin karşılaştırılması ve bunların artroskopinin sonuçları ile karşılaştırılmasında istatistiksel olarak anlamlı bir fark bulunmadı. Lysholm ve ROM sonuçları, üç grup arasında istatistiksel olarak anlamlı bir fark göstermedi ve tüm gruplarda ameliyat öncesi sonuçlarla karşılaştırıldı- ğında postoperatif sonuçlarda istatistiksel olarak anlamlı iyileşme görülmedi.

Anahtar Kelimeler: Anterior cruciate ligament, menisküs, akut diz yaralanması, manyetik rezonans görüntüleme, artroskopi, meniscectomi

ABSTRACT

INTRODUCTION: The aim of this study was to compare the physical exam and magnetic resonance imaging (MRI) results, with results of arthroscopy, in patients with acute knee injury. The second aim was to compare the clinical results of patients who underwent arthroscopic meniscectomy after 3 weeks, 3 and 6 months from injury.

METHODS: From January 2003 to November 2008, there were 159 patients which underwent arthroscopic surgery on the knee. 121 patients with acute injury, 99 men and 22 women, age 13 to 62 years, 67 right knee/54 left knee. The orthopaedic surgeon performed test to examine the meniscus for tear, test to examine for stability of the anterior cruciate ligament (ACL), posterior cruciate ligament (PCL), medial collateral ligament (MCL) and lateral collateral ligament (LCL). Also were collected information of range of movement (ROM), and patients had to fulfil the Lysholm knee questionnaire. Postoperatively were done the same measurements.

RESULTS: The results showed no statistical difference for the accuracy of the initial diagnosis between clinical examination and MRI ($p = 0,640$). The results were similar for the rupture of the meniscus ($p = 0,948$) and meniscus and ACL ($p=1,000$).

DISCUSSION and CONCLUSION: Comparing the results of precision, sensibility, specificity, predictive positive and negative value of clinical and MRI tests and comparing them to the results of arthroscopy, there was no statistically significant difference. The results of Lysholm and ROM showed no statistical difference between three groups and statistically significant improvement of postoperative results when comparing them with preoperative results in all groups.

Keywords: Anterior cruciate ligament, meniscus, acute knee injury, magnetic resonance imaging, arthroscopy, meniscectomy

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INTRODUCTION

Acute knee injuries are very common in everyday orthopaedic practice. They are set of injuries of joint capsule, ligaments and meniscus caused by a force that tends to change the normal relationship of the joints¹. Numerous clinical tests are used in the diagnosis of knee injuries but the accuracy is still unclear². Cimino et al.³ concluded that clinical diagnosis of anterior cruciate ligament (ACL) injury is based upon history and physical examination findings. Further, they stated that suspected cases should be confirmed by magnetic resonance imaging (MRI) or arthroscopy. Rossi et al.³ stated in their review that knowing all clinical tests well, represents a powerful tool for diagnosis and followup of the pathologies involving patellofemoral compartment, meniscal and chondral lesions and instability of the knee. However, some findings highlight the lack of accuracy in the usage of history and physical examination to diagnose ACL injury². In this study we investigated severe injuries of the knee joint that are defined as a rupture of ligaments and meniscus. In patients with suspected ACL injury or meniscus is necessary to do a physical examination of the knee joint. Physical examination consist of McMurray, Apley, Steinmann I and II test for examination of the meniscus for tear, anterior drawer and Lachman test to examine the tension of the ACL, posterior drawer to examine the tension of the posterior cruciate ligament (PCL), valgus stress test for stability of the medial collateral ligament (MCL) and varus stress test for stability of the lateral collateral ligament (LCL). When the clinical tests are uncertain it is necessary to do an MRI as the gold standard procedure. However, if the clinical tests themselves are insufficient for precise diagnosis of serious soft tissue injuries of the knee they should always be complemented by MRI, which is very expensive diagnostic method on the one hand but on the other hand, according to the data of different studies it is not so highly precise and reliable method in detection of soft tissues injuries of the knee, as was originally thought. Aim of this study is that the result of clinical examination as a diagnostic tool is more reliable than the result of MRI in patients with acute knee injury. The second aim is that early arthroscopy in patients with rupture of the meniscus leads to good postoperative results including better mobility of the

knee joint, and higher patient satisfaction. The first objective is to compare the results of the clinical examination and the results of the MRI to the results of arthroscopy in patients with acute knee injury that were all done at the University Hospital Center Mostar.

MATERIALS and METHODS

The study was approved by the Ethics Committee of the University Hospital Center Mostar, in accordance with the Helsinki Declaration. In this prospective study at the University Hospital Center Mostar, Department for orthopaedic surgery in the period from January 2003 to November 2008, 159 patients were subjected to arthroscopic knee surgery, of whom 121 patient were diagnosed with acute knee injuries, 22 patients with knee osteoarthritis (OA), 14 patients with chronic knee injury, 2 patients with loose bodies, 1 patient with osteochondral lesion of the medial condyle of the femur. The study included only patients with acute knee injury. The study included 99 men and 22 women, the oldest patient was 62 years and the youngest 13 years. Arthroscopy was performed in all 121 patients with acute knee injury, in 67 patients on the right, and in 54 patients in the left knee. All patients were clinically evaluated preoperatively, a clinical examination included a McMurray test, Apley test, Steinmann I and II test, anterior drawer and Lachman test, posterior drawer, valgus and varus stress test. We collected the patient's data on the mobility of the knee joint (preoperatively we measured ROM of the knee joint by goniometer, this was done surveys Lysholm knee questionnaire and postoperatively we did Lysholm knee questionnaire and clinical examination at which we examined the ROM for all patients). The second objective was to compare the clinical outcomes between patients with arthroscopic intervention within 3 weeks, within 3 months, and within 6 months from the injury. Purpose of the study was to see whether there is any difference in diagnostic accuracy between clinical examination and MRI, as well as collecting necessary data and comparing preoperative and postoperative clinical results using Lysholm knee questionnaire, ROM and patient satisfaction so we could presume what would be the optimum time for performing the arthroscopic surgery after acute knee injury. MRI examinations

were done on MRI machine of 1 Tesla (T) power. All of the MRI were done by one radiologist MM, to whom were available demographic information about the patients and the preliminary diagnosis. MRI was done in 39 patients. Clinical examination, described earlier, was performed in 82 patients by an experienced orthopaedic surgeon GM. Arthroscopy as a "gold standard" method was performed in all 121 patients by an orthopaedist GM. The ACL was declared ruptured in the case of complete or partial rupture.

Statistical analysis

Data analysis was performed using the Statistical Package for the Social Sciences (v13.0, SPSS Inc., Chicago, IL, USA). Statistical analysis examined the sensitivity, specificity, predictive positive and negative value. Data were considered true positive if MRI was confirmed by arthroscopy, true negative if the clinical examination and MRI were negative and arthroscopy negative, false positive if the clinical examination and MRI weren't confirmed by arthroscopy, false negatives, if the clinical examination and MRI were negative for injury and arthroscopy positive. The chi square test was used to determine whether there is a difference between examinations. Statistical significance was set at $p < 0.05$.

RESULTS

The results showed no statistical difference in accuracy between clinical examination and MRI (Table 1).

Table 1. Analysis of the accuracy of the working diagnosis between clinical examination and MRI.			
Exam	Number (%)		Total
	diagnosis		
	Correct	Incorrect	
MRI	32 (82.1)	7 (17.9)	39
Clinical exam	70 (85.4)	12 (14.6)	82
	102	19	121
χ^2 test = 0.219; df = 1; P = 0.640			

Table 2 shows accuracy of clinical examination for meniscus. The results show no significant differences between clinical examination and MRI (χ^2 test = 0.004; $p = 0.948$).

Table 2. Analysis of the accuracy of clinical examination and MRI for rupture of the meniscus.		
Meniscus	Number (%) patients by type of exam	
	Clinical exam	MRI
Correct	60 (85.7)	24 (82.8)
Incorrect	10 (14.3)	5 (17.2)
(χ^2 test = 0.004; P = 0.948; Yates correction)		

Accuracy of clinical examination for both the meniscus and ACL stood at 80% versus MRI 80% for the diagnosis of acute injury to the meniscus and ligaments (Table 3), with no statistical differences between them ($p = 1.000$).

Table 3. Analysis of the accuracy of clinical examination and an MRI of ruptured ACL		
Meniscus+ACL ‡	Number (%) patients by type of exam	
	Clinical exam	MR
Correct	8 (80.0)	8 (80.0)
Incorrect	2 (20.0)	2 (20.0)
‡ ACL anterior cruciate ligament. (χ^2 test <0.001; P = 1.000; Yates correction)		

There is also no statistically significant differences in the sensitivity, specificity, positive and negative predictive values between clinical tests for a meniscus: sensitivity 98%, specificity 54%, positive predictive value 86%, negative predictive value 93%; MRI and 92%, 62%, 83%, 80%; and both meniscus and ACL, 50%, 97%, 80%, 89%, MRI 62%, 92%, 80%, 83% (Tables 4,5).

Table 4. Analysis of sensitivity, specificity, positive and negative predictive value of clinical examination in the working diagnosis.

Diagnosis	Value of clinical examination as diagnostic tool			
	sensitivity	Specificity	positive predictive value	negative predictive value
Meniscus	0.98	0.52	0.86	0.92
ACL*	0.40	1.00	1.00	0.96
Meniscus +ACL	0.50	0.97	0.80	0.89

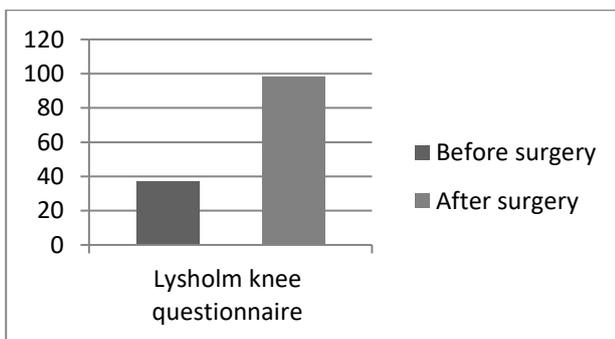
* ACL: anterior cruciate ligament

Table 5. Analysis of sensitivity, specificity, positive and negative predictive value of MRI techniques in working diagnoses

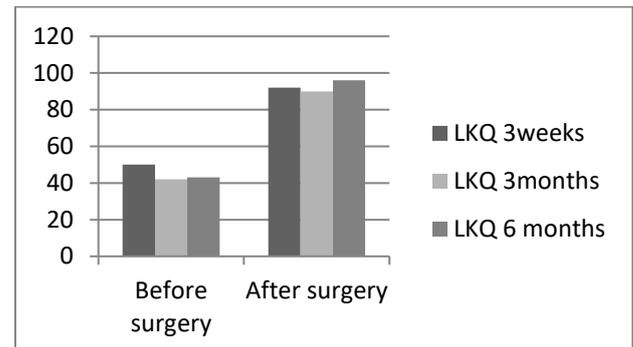
Diagnosis	Value of MRI as diagnostic tool			
	sensitivity	Specificity	positive predictive value	negative predictive value
Meniscus	0.92	0.62	0.83	0.80
Men+ACL*	0.62	0.92	0.80	0.83

* ACL: anterior cruciate ligament

Lysholm knee questionnaire for all three groups together (after 3 weeks, after 3 months and after 6 months), showed a significant difference in the values before and after surgery ($F(1,57) = 172.264$, $p < 0.001$) (Figure 1).

**Figure 1.** Lysholm knee questionnaire for all three groups together

The difference in the value of the Lysholm knee questionnaire at the three groups were divided according to the time of the operation (after 3 weeks, after 3 months and after 6 months) was not significant ($F(1,57) = 0.572$; $P = 0.568$) (Figure 2).

**Figure 2.** Difference in the value of the Lysholm knee questionnaire in the three groups

Comparing the values of the ROM of all participants together (after 3 weeks, after 3 months and after 6 months), showed a significant difference in the values before and after surgery ($F(1,57) = 79.258$; $P < 0.001$) (Figure 3).

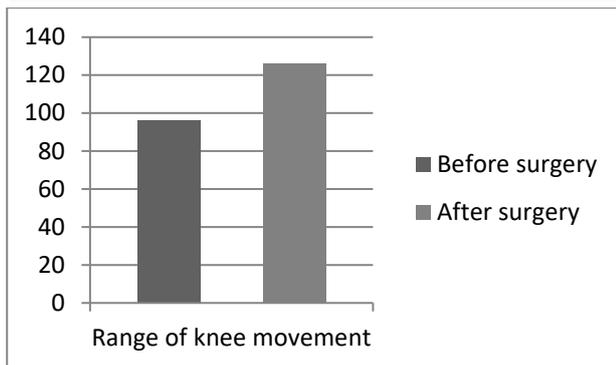


Figure 3. Difference in the range ROM of all participants together

The difference in the values of range of motion between the three groups were divided according to the time of the operation (after 3 weeks, after 3 months and after 6 months) was not significant ($F(1,57) = 0.686$; $P = 0.508$) (Figure 4).

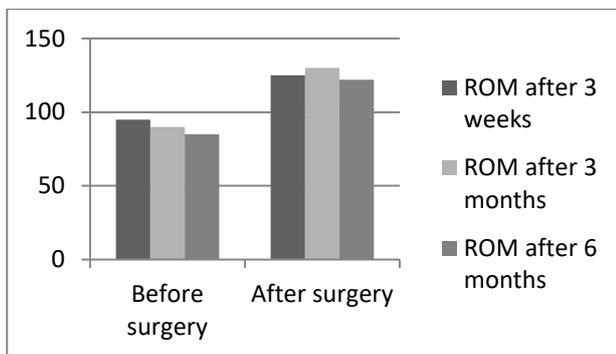


Figure 4. Difference in the ROM between the three groups

DISCUSSION

The advantages of MRI was the fact that the people were saved from unnecessary trauma, and its accuracy was very high, in particular for injuries of meniscus up to 90%⁴. But today after usage an MRI in medicine, in this case in orthopaedics for many years, some recent studies have shown that the accuracy of MRI ranges from 48%-94%, with a mean of 85%⁵⁻⁸. There is no advantage in accuracy for detecting acute injuries inside the knee when compared with clinical examination which accuracy ranges from 35%-87% with a mean of 70%⁵⁻⁸. On the other hand MRI is expensive diagnostic exam. Clinical examination and MRI have similar diagnostic accuracy of 85%-90% compared to 75%-80% in clinical trials, while the sensitivity of 72% for MRI and 73% in clinical trials, and the specificity 91% versus 83%^{9,10}, and some

studies have even shown that the clinical tests are more accurate with an accuracy of 82% for medial meniscus, 76% for the lateral meniscus, and 99% for ACL versus MRI accuracy of 75% for medial meniscus, 69% for the lateral meniscus and 98% for ACL^{11,12}.

Still we don't have too many studies on this subject, and their results are very contradictory and there is no consensus how to access patients with acute knee injury in terms of diagnosis. This study had the intention to examine whether the clinical examination is enough to make a correct diagnosis, and is it possible only on the basis of clinical examination to refer the patients with ruptured meniscus to arthroscopic surgery. This is truly important because it will reduce the costs of medical treatment. Further diagnostic tests for acute knee injury such as MRI are not necessary, and this will only encourage clinical thinking, and will help to save the clinical skills from "extinction".

What distinguishes this study from the other studies is that it did not consider the individual diagnosis (i.e. only ruptured meniscus or ruptured ACL) but also the combined injury (ruptured meniscus and ruptured ACL) that are not rare and greatly hinder the adoption of a diagnosis, what the results showed. This study confirmed the hypothesis and the results showed no statistically difference in accuracy between clinical examination and MRI (Table 1). Accuracy of clinical examination for both the meniscus and ACL stood at 80% versus MRI 80% for the diagnosis of acute injury to the meniscus and ligaments, versus arthroscopy as a "gold standard". There is also no statistically significant differences in the sensitivity, specificity, positive and negative predictive values between clinical tests for a meniscus: sensitivity 98%, specificity 54%, positive predictive value 86%, negative predictive value 93%, MRI at 92%, 62%, 83%, 80%; and both meniscus and ACL at 50%, 97%, 80%, 89% and MRI at 62%, 92%, 80%, 83%. This provides us the right to conclude that the clinical examination is sufficient to make an accurate diagnosis and that we can safely after detailed clinical examination indicate the arthroscopic surgery. In this study, it was noted that clinical examination has a slightly lower accuracy, sensitivity or specificity of

all three parameters together especially when there are concomitant injuries of both meniscus or injuries of the lateral meniscus and ACL or the medial meniscus and ACL. In both meniscus injuries clinical test sensitivity was at 50% and in the ACL injury sensitivity was 40%. In these cases for such a low value it should be advisable to run an additional diagnostics, especially in cases of simultaneous injury of the medial meniscus and ACL, because it can lead to unnecessary arthroscopy surgery in half of the cases. This data is similar with other studies, stating that with combined injuries accuracy of clinical tests for detecting the rupture of the meniscus falls to 30%, and with combined rupture of the ACL sensitivity for the diagnosis of rupture of the medial meniscus is 45%, and for lateral meniscus is 58%^{13,14}. It should be also noted that in these cases and especially in cases of ruptured ACL and the medial meniscus MRI showed a slightly lower sensitivity of 55% and specificity of 100%. While in the case of combined injury of ACL and lateral meniscus accuracy is only 33% and positive predictive value of only 33%. We think that in this study the reason for weaker performance of MRI is that some anatomical structures of the knee may resemble meniscus or ligament pathology, thus creating false positive results. In the end, it can be concluded that clinical examination is sufficient in most cases to set accurate diagnosis without harming patients and reducing the costs of the hospital treatment. Some studies in recent years tried to prove that the treatment results of acute knee injuries, especially in case of ruptured meniscus were better in patients who underwent surgery earlier. However, experience has shown that the optimum time for the arthroscopic surgery intervention after acute knee injury is 3 weeks. This period of time is taken because neither clinical nor MRI tests have a high percentage of accuracy, sensitivity and specificity in the first weeks after the injury. In few studies it was recognized that in some minor meniscus injuries that are clinically positive at baseline, symptomatology may be withdrawn throughout the week to two, while other studies cite 4 to 6 weeks for withdrawal of symptomatology^{15,16}. On the other hand, a long delay of arthroscopic surgery can lead to further damage inside the knee joint. The results of this study did not confirm the hypothesis, but showed

that there were no statistically significant differences in the results of arthroscopic meniscectomy in any of the three groups (3 weeks, 3 months and 6 months). Results of the study showed also a lot of improvement, especially at ROM, physical activity and loss of pain in the patients who underwent arthroscopic surgery, in all three groups. This allows us to conclude that it does not matter when arthroscopic surgery is performed after the injury. Patients with meniscal injuries must be reassured and advised that's wiser to wait for the operation, and encourage them to undergo physical therapy which can lead to withdrawal of symptoms and allow normal everyday life activities.

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