COMPARISON OF CLINICAL AND ARTHROSCOPIC FINDINGS IN MENISCAL TEARS

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Abstract: Introduction: This study was conducted to compare the clinical and arthroscopic findings in lateral and medial meniscal tear injuries in order to assess the diagnostic significance of the clinical examinations findings. **Patients and methods:** All patients attending our clinic with knee pain from 2009. to 2013. underwent systematic and thorough clinical assessment. From one hundred and three patients with knee problems in 40 were diagnosed LM (lateral meniscus) tears and in 45 MM (medial meniscus) tears arthroscopically. In this study meniscal tears were clinically diagnosed by positive McMurray and Apley test. All clinically diagnosed patients underwent diagnostic and therapeutic knee arthroscopy to assess the accuracy of clinical diagnosis. The accuracy, PPV, NPV, sensitivity and specificity were calculated based on clinical examinations and arthroscopic findings. **Results:** Identification of meniscal tears in our study was presented with 85% accuracy of “McMurray” clinical examination test for LM tears and 80% accuracy for the MM tears, and for “Apley” clinical examination test for LM tears was obtained with 73% accuracy and 63% accuracy for MM tears. **Conclusion:** According to our findings we can conclude that McMurray clinical examination test is more accurate for predicting i.e. diagnosing of meniscal tears. Contrary, Apley clinical examination test showed less accuracy for predicting i.e. diagnosing of meniscal tears.

Key words: arthroscopy, meniscus tear, knee, clinical diagnosis.

INTRODUCTION

The major meniscal functions are to distribute stress across the knee during weight bearing, provide shock absorption, provide articular cartilage nutrition and lubrication, facilitate joint gliding, prevent hyper-

extension, and protect the joint margins (1, 2). They may also function as secondary stabilizers (particularly in the absence of a functioning anterior cruciate ligament), have a proprioceptive role and aid in the lubrication and nutrition of the articular cartilage (3, 4).

Since the condyles of the femur and tibia meet at one point (which changes during flexion and extension), the menisci spread the load of the body's weight (5). Meniscal motion allows maximal congruency during knee flexion and helps to protect the menisci from injury (6, 7).

A commonly used surgical classification of meniscal tears includes the following types: horizontal, longitudinal, radial, bucket handle, displaced flap and complex (8).

In this study meniscal tears were clinically diagnosed by positive McMurray test and Apley test. Arthroscopy was used to assess the liability of clinical diagnosis.

Advanced modality in the management of meniscal tears is arthroscopy, which can be used in its dual mode, either as diagnostic and/or as therapeutic tool. Arthroscopy offers direct visualization of all intra-articular structures with high diagnostic accuracy, the possibility to examine the stability of the knee under anesthesia and the possibility to perform a therapeutic procedure in the same session (9).

The aim of this study was to compare findings from clinical examinations and arthroscopy in lateral and medial meniscal tears in order to assess the diagnostic significance of the clinical examinations findings.

PATIENTS AND METHODS

In our study we involved 103 patients with history of knee injuries who were admitted in the Clinic of Tra-

umatology, Clinical Center-Majka Tereza, Skopje. MRI of the knee joint was done before the admission and some of them before the clinical examination.

In this study meniscal tears were clinically diagnosed by:

McMurray's test. At various stages of knee flexion internal and external tibial rotation is performed. A palpable click and pain is considered as a positive test (10).

Apley grinding test. The patient is in prone position, the hip is extended and the knee flexed in 90°. The examiner applies axial pressure on to the foot and rotates the tibia. There sulking knee joint pain is regarded as a positive test (11).

The same surgeon has performed clinical as well as arthroscopic examination. Though this reduces the chance of inter observer variability, it creates possibility of observational bias.

In patients with positive clinical examination findings for meniscal and anterior cruciate ligament (ACL) tears of the knee, who admitted in the Clinic of Traumatology, Clinical Center-Majka Tereza, Skopje, during the period from September 2009 to May 2013, diagnostic and therapeutic knee arthroscopy was performed to assess the accuracy of clinical diagnosis.

All arthroscopic procedures were performed in a standard manner by experienced arthroscopic surgeon carried out under regional or general anaesthesia with tourniquet, using standard anteromedial and anterolateral portals. Additional portals were used when required. Operative findings were documented in the official patient's document, which included the survey of the entire joint and anatomical structure, lesions involved with the presence or absence of tear, its location, status of the articular cartilage and others. The composite data was tabulated and studied for correlation with clinical examinations findings and grouped into four categories:

1. True-positive — if the clinical examinations findings were confirmed by arthroscopic evaluation.
2. True-negative — when clinical examinations findings only for meniscal lesion, (McMurray and Apley) were negative and the same was confirmed by arthroscopy.
3. False-positive — when clinical examinations findings shows lesion but the arthroscopy was negative.
4. False-negative-result when arthroscopy was positive but the clinical examinations findings showed negative findings.

Statistical analysis

Statistical analysis was used to calculate the sensitivity, specificity, accuracy, positive predictive value (PPV) and the negative predictive value (NPV), in or-

der to assess the diagnostic significance of the clinical examinations findings.

Categorical variables were summarised using frequency and were compared using the chi-square or McNemar test as appropriate, p-value of less than 0.05 was considered to be statistically significant.

RESULTS

The study group of 103 patients consisted of 81 men (79%) and 22 women (21%). The average age of patients was 29.7 ± 10.77 years, range 16 to 58. We found statistical significant difference in distribution of frequencies, male patients were dominant ($\chi^2 = 33.79$, $DF = 1$, $p < 0.01$). The males average age was 30.26 ± 10.26 ranged 16–58, and females average age was 27.68 ± 12.52 ranged 16–53, Student's t-test for two large unrelated samples showed $t = 0.99$, $DF = 101$, $p > 0.05$, i.e. perceived difference is not statistically significant in average ages between males and females. All patients underwent arthroscopic knee surgery. Maximum number of patients ($n = 34$) who suffered knee injuries were in the age group of 21–30 years (Figure 1). The right knee was involved in 56 cases (54.4%) and the left knee in 47 (45.6%).

Figure 1. Number of patients according age distribution

Table 1 show the methods and formulas used to calculate there liability of clinical diagnosis. Clinical diagnostic test characteristics:

- Sensitivity: how good the clinical examination test is at detecting meniscal tears
- Specificity: how good the clinical examination test is at identifying normal knee
- Positive predictive value: how often a patient with a positive clinical examination test has the meniscal tears
- Negative predictive value: how often a patient with a negative clinical examination test does not have meniscal tears
- Accuracy: proportion of clinical examination test which correctly identifies meniscal tears

Comparison of the arthroscopic and clinical “McMurray test” findings yielded the following results.

Clinical “McMurray” test findings for the lateral meniscus (LM) yielded 24 true-positives (were confirmed on arthroscopy) and 63 true-negatives (without evidence of LM tears) with 0 false positive (were misinterpreted to have LM tears) and 16 false negative (were not diagnosed clinically) (Table 1), which resulted in 60% sensitivity, 100% specificity, 100% PPV, 84% NPV and 85% accuracy (Table 5).

Table 1. McNemar matching for arthroscopy and clinical McMurray test findings in LM

	Arthroscopy findings in LM		
	Positive findings	Negative findings	Total
Clinical “McMurray test” Positive findings	24 (TP)	0 (FP)	24
Clinical “McMurray test” Negative findings	16 (FN)	63 (TN)	79
	40	63	103

TP (true positive); TN (true negative); FP (false positive); FN (false negative)

Comparison of the arthroscopic and clinical “Apley” test findings yielded the following results.

Clinical “Apley” test findings for the LM yielded 29 true-positives (were confirmed on arthroscopy) and 11 true-negatives (without evidence of LM tears) with 17 false positive (were misinterpreted to have LM tears) and 11 false negative (were not diagnosed clinically) (Table 2), which resulted in 81% sensitivity, 77% specificity, 73% PPV, 84% NPV and 73% accuracy (Table 5).

Table 2. McNemar matching for arthroscopy and clinical Apley test findings in LM

	Arthroscopy findings in LM		
	Positive findings	Negative findings	Total
Clinical “Apley test” Positive findings	29 (TP)	17 (FP)	46
Clinical “Apley test” Negative findings	11 (FN)	11 (TN)	57
	40	63	103

TP (true positive); TN (true negative); FP (false positive); FN (false negative)

Clinical “McMurray” test findings for the medial meniscus (MM) tears yielded 37 true-positives (were confirmed on arthroscopy) and 45 true-negatives (without evidence of MM tears) with 13 false positive (were misinterpreted to have MM tears) and 8 false negative (were not diagnosed clinically) (Table 3), which re-

sulted in 86% sensitivity, 80% specificity, 79% PPV, 87% NPV and 80% accuracy (Table 5).

Table 3. McNemar matching for arthroscopy and clinical McMurray test findings in MM

	Arthroscopy findings in MM		
	Positive findings	Negative findings	Total
Clinical “McMurray test” Positive findings	37 (TP)	13 (FP)	50
Clinical “McMurray test” Negative findings	8 (FN)	45 (TN)	53
	45	58	103

TP (true positive); TN (true negative); FP (false positive); FN (false negative)

Clinical “Apley” test findings for the MM tears yielded 39 true-positives (were confirmed on arthroscopy) and 26 true-negatives (without evidence of MM tears) with 32 false positive (were misinterpreted to have MM tears) and 6 false negative (were not diagnosed clinically) (Table 4), which resulted in 92% sensitivity, 50% specificity, 69% PPV, 84% NPV and 63% accuracy (Table 5).

Table 4. McNemar matching for arthroscopy and clinical Apley test findings in MM

	Arthroscopy findings in MM		
	Positive findings	Negative findings	Total
Clinical “Apley test” Positive findings	39 (TP)	32 (FP)	71
Clinical “Apley test” Negative findings	6 (FN)	26 (TN)	32
	45	58	103

TP (true positive); TN (true negative); FP (false positive); FN (false negative)

Table 5. Reliability of clinical examinations tests for medial and lateral meniscal tears

	McMurray Test LM (%)	Apley Test LM (%)	McMurray Test MM (%)	Apley Test MM (%)
Sensitivity	60	81	86	92
Specificity	100	77	80	50
Positive predictive value (PPV)	100	73	79	69
Negative predictive value (NPV)	84	84	87	84
Accuracy	85	73	80	63

McNemar test showed that $\chi^2 = 16.56$, $DF = 1$, $p < 0.01$, i.e. there are statistical significant differences in distribution of frequencies in positive and negative findings of LM tears in clinical examination “McMurray” test and arthroscopy or perceived difference is statistically significant and **they do not match among themselves**. Contrary, we found nostatistical significant difference in distribution of frequencies in positive and negative findings of LM tears in clinical examination “Apley” test and arthroscopy ($\chi^2 = 3.4$, $DF = 1$, $p > 0.05$) (Figure 2) or perceived difference is statistical not significant and **they match among themselves**.

Figure 2. McMurray and Apley tests findings versus arthroscopic findings in LM tears

McNemar test showed that $\chi^2 = 3.5$, $DF = 1$, $p > 0.05$, i.e. there are no statistical significant differences in distribution of frequencies in positive and negative findings of MM tears in clinical examination “McMurray” test and arthroscopy or perceived difference is not statistically significant and **they match among themselves**. Contrary, we found statistical significant difference in distribution of frequencies in positive and negative findings of MM tears in clinical examination “Apley” test and arthroscopy ($\chi^2 = 26$, $DF = 1$, $p < 0.01$) (Figure 3) or perceived difference is statistical significant and **they do not match among themselves**.

Figure 3. McMurray and Apley tests findings versus arthroscopic findings in MM tears

DISCUSSION

The purpose of this study was to compare the findings from clinical examination and arthroscopy in order to evaluate the significance of these findings in diagnosis of medial and lateral meniscal tears. In the study we evaluated 103 patients with history of knee injuries (sports injury was the most common mode) who were admitted at our hospital.

The age group ranging from 16 to 58 years. Maximum number of patients ($n = 34$; $n = 28$) who suffered knee injuries were in the age group of 21–30 years and 31–40 years (Figure 1). Sports injury was the most common mode of injury. This showed that there was a tendency of males getting injured and operated at the earlier age since they are sports active. A study done by Avcu et al. showed males are most likely to suffer knee injuries since they are active in sports and the right knee was more frequently injured than left (12).

Our results were 60% sensitivity, 100% specificity, 100% PPV and 84% NPV of “McMurray” clinical examination test with respect to fair correlation with arthroscopy in LM tears.

Identification of meniscal tears in our study was presented with 85% accuracy of “McMurray” clinical examination test for LM tears and 80% accuracy for the MM tears correlated with arthroscopy and they belong together in range of very good (80–90%) accurate group according many studies of “McMurray” clinical examination test accuracy of predicting meniscal tears.

For the “Apley” clinical examination test we obtained 81% sensitivity, 77% specificity, 73% PPV and 84% NPV compared arthroscopy in diagnosing LM tears.

Identification of meniscal tears in our study presented with “Apley” clinical examination test for LM tears was obtained with 73% accuracy and 63% accuracy for MM tears correlated with arthroscopy were ranged together in good accurate group. According many studies of clinical examination tests compared (correlated) with arthroscopy, the accuracy of predicting meniscal tears depend from the level of skilled orthopaedic surgeon’s hands.

For the MM tears in our study we obtained 86% sensitivity, 80% specificity, PPV 79% and NPV 87% of “McMurray” clinical examination test in comparing with arthroscopic findings. Identification of MM tears in our study presented with “Apley” clinical examination test correlated with arthroscopy was obtained with 92% sensitivity, 50% specificity, PPV 69% and NPV 84%.

Miller found overall clinical diagnosis accuracy of meniscal tears of 80.7% and the corresponding accuracy for MRI was 73.7% (13).

Rose and Gold found the clinical examination to be correct more often than MRI diagnosis. They found no

significant difference in accuracy between clinical examination and MRI in both medial and lateral meniscal tears or anterior cruciate ligament (ACL) tears (14).

Akseki et al. suggested that the accuracy of clinical diagnosis of a meniscal tear is decreased by the presence of an ACL tear and the presence of both these injuries requires more frequent magnetic resonance imaging (15).

The results are close to the ones given in the professional literature which refers to the standardized approach in taking the anamnestic data and realization of the physical signs and test examination technique (16, 17, 18).

Kocabey et al. stated that clinical examination is as accurate as MRI in the skilled orthopaedic surgeon's hands and MRI should be reserved for more complicated and confusing cases (19). Bohnsack et al. also concluded that an experienced examiner can diagnose adequately by clinical examination alone (20).

At the same time, reliable statistical data of the diagnostic value of the MRI are also related to the independent base of reference. A meniscal tear was correctly diagnosed in 76% of cases with conventional MRI and in 88% of cases with high-resolution MRI (21).

Regarding knee MRI, in most of the studies and in our study as well, the base of reference is arthroscopy (22, 23). This presupposes that arthroscopy is 100% accurate allows for the diagnosis of every possible knee pathology. This is not always the case (24).

Arthroscopy should be considered a diagnostic aid used in conjunctions with a good history, complete physical examination and appropriate radiographs.

With increased proficiency in examination of extremities and more accurate adjuvant tests, including MRI, we rarely perform simple "diagnostic arthroscopy." Surgical alternatives are discussed thoroughly with the patient before the procedure, and the definitive surgical procedure is performed at the time of an arthroscopic examination.

CONCLUSION

The results of our study suggest that McMurray clinical examination test is more accurate for predicting i.e. diagnosing of meniscal tears. Contrary, Apley clinical examination test showed less accuracy for predicting i.e. diagnosing of meniscal tears. According many studies of clinical examination tests compared (correlated) with arthroscopy, the accuracy of predicting meniscal tears depend from the arthroscopic skill level of the surgeon hands.

Abbreviations

ACL — anterior cruciate ligament
MRI — magnetic resonance imaging
LM — lateral meniscus
MM — medial meniscus
PPV — positive predictive value
NPV — negative predictive value
TP — true positive
TN — true negative
FP — false positive
FN — false negative
DF — distribution of frequencies
 χ^2 — chi-square

Sažetak

POREĐENJE KLINIČKIH I ARTROSKOPSKIH NALAZA POVREDA MENISKUSA

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Uvod: Ova studija je sprovedena kako bi uporedila kliničke i artroskopske nalaze povreda u lateralnim i medijalnim meniskusa u cilju procene dijagnostičkog značaja kliničkih ispitivanja nalaza. **Pacijenti, metode i rezultati:** Svi pacijenti s bolom u kolenu, koji su posetili našu Kliniku, od 2009. do 2013. god. prošli su sistematsku i temeljnu kliničku procenu. Od stotinu i tri pacijenta s problemima kolena kod 40 su artroskopski dijagnostifikovane povrede kod LM (lateralnog meniskusa) a kod 45 povrede MM (medijalnog meniskusa).

U ovoj studiji meniskusne povrede klinički su dijagnostifikovane pozitivnim McMurray i Apley testom. Svi klinički dijagnostikovani pacijenti bili su podvrgnuti dijagnostičkoj i terapijskoj artroskopiji kolena kako bi se procenila tačnost kliničke dijagnoze. Tačnost, PPV, NPV, osetljivost i specifičnost su izračunate na temelju kliničkih ispitivanja i artroskopskih nalaza. Identifikacija meniskusnih povreda u našoj studiji je predstavljena sa 85% tačnosti „McMurray“ kliničko-preglednog testa za povrede LM i 80 % tačnosti za povrede MM, a

za „Apley“ test kliničkog ispitivanja za povrede LM dobili smo 73 % tačnosti i 63% za povrede MM. **Zaključak:** Prema našim saznanjima, možemo zaključiti da McMurray kliničko-pregledni test je tačniji za predviđanje odnosno dijagnozu povrede meniskusa. Su-

protno, Apley kliničko-pregledni test je pokazao manju tačnost u predviđanju odnosno u dijagnozi meniskusne povrede.

Ključne reči: artroskopija, povreda meniskusa, koleno, klinička dijagnoza.

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