

Validation of the Thessaly test for detecting meniscal tears in anterior cruciate deficient knees

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ABSTRACT

Meniscal injuries are frequently associated with anterior cruciate ligament (ACL) tears. Clinical tests that are useful for detecting meniscal tears may not be valid in this setting. The Thessaly test, a newly described dynamic clinical examination, has been shown to have a very high diagnostic accuracy for detecting meniscal tears. This study evaluates the accuracy of the Thessaly test in patients with combined ACL and meniscus injuries. We examined eighty patients with ACL deficiency for meniscal injuries using the Thessaly test (at 20° of knee flexion), the lateral and medial joint line tenderness tests, and the McMurray test. Examiners were blinded to the MRI report on the conditions of the menisci. All patients underwent arthroscopic ACL reconstruction during which the menisci were evaluated by direct vision and probing. During the Thessaly test, six patients developed severe pain and could not complete the test. Sensitivity, specificity, likelihood ratios and predictive values were calculated for all tests. The Thessaly test had a sensitivity of 79%, specificity of 40%, positive predictive value of 56%, negative predictive value of 66%, positive likelihood ratio of 1.33, negative likelihood ratio of 0.51, and overall accuracy of 60%. We concluded that the Thessaly test has a low specificity in patients with combined ACL and meniscal injuries and can not be recommended as a diagnostic test in this setting.

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1. Introduction

Meniscus injury is a frequently encountered clinical orthopedic issue and is epidemiologically correlated with osteoarthritis [1]. Diagnosis of meniscal injury is based on clinical history, physical examination and imaging studies. The classic history of knee twisting with subsequent knee catching and pain is not specific for meniscal injury and may be seen in other ligamentous injuries of the knee [2–5]. Palpation along the joint line elicits tenderness in both meniscal and collateral ligament injuries. A torn anterior cruciate ligament (ACL) remnant may act as a mechanical block, mimicking a displaced bucket handle meniscal tear [6]. Several specialized tests with different accuracies have been described for evaluating meniscal pathology. Recently, a new clinical test, the “Thessaly test,” has been described and reported to have a very high diagnostic accuracy rate of 94% for medial meniscus tears and 96% for lateral meniscus tears [7,8]. In this test the examiner supports the patient by holding his or her outstretched hands. The patient then rotates his or her knee and body, internally and externally, three times, keeping the knee flexed at 20°. Patients with suspected meniscal tears experience medial or lateral joint line pain. To our knowledge, based on a literature review, no other provocative maneuver or clinical test has this level of accuracy.

The incidence of meniscal injury with a concomitant acute ligamentous injury, specifically, the ACL, has been variously reported as having an incidence from 34 to 92% [9–11]. Detection and treatment of meniscal injuries plays an influential role in the achievement of satisfactory results in patients with ACL reconstructions. Although the validity of the Thessaly test has been described, its accuracy in the presence of an ACL tear, which constitutes a large number of patients with meniscal injuries, has not yet been studied. The purpose of this study was to assess the validity of the Thessaly test in detecting meniscal injuries in patients with concomitant ACL tears. Our hypothesis was that the Thessaly test would have a low specificity in ACL deficient knees.

2. Materials and methods

Between June 2007 and October 2008, we visited all the patients with knee problems coming to the knee surgery clinic at our hospital. From this pool of patients, 85 cases with a primary provisional diagnosis of ACL injury were detected. A senior attending physician with more than 10 years experience in knee surgery examined all patients. During the physical examination no attempt was made to detect meniscal injuries. The diagnosis of ACL injury was based on the history and physical examination. MRI was performed for all patients using a 1.5-T Achieva Philips (Netherlands) scanner. Sagittal fat-suppression intermediate-weighted and coronal T2-weighted spin-echo sequences with 4 mm section thickness were acquired. A

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musculoskeletal radiologist evaluated the MRI and confirmed the presence of the ACL tear but the surgeon and other examiners remained blind to the status of the menisci. MRI-confirmed ACL injury and referral for surgical treatment were the inclusion criteria. The exclusion criteria included age over 40 years old, multiligamentous injuries (detected by physical examination), a history of previous knee surgery, and any rheumatologic disease. Patients with a history of previous anterior knee pain and those with radiological evidence of any degenerative changes were also excluded. MRI showed that five patients had concomitant partial PCL or MCL injuries which were missed on physical examination because there was little instability or few clinical manifestations. They were excluded from the study, leaving 76 men and four women with a mean age of 26.62 years old (range 17 to 40).

Patients were admitted to the orthopedic ward if they had met the criteria for ACL reconstruction. Using specific meniscal tests, two orthopedic residents evaluated the patients clinically for meniscal tears. The tests include palpation for local joint line tenderness, the McMurray test and the Thessaly test. Meticulous attention was paid to the performance and interpretation of the Thessaly test and if there was disagreement between examiners, re-examination was done to reach a consensus. All test results were recorded in a sheet separate to the patients chart. The Thessaly test was done in 20° of the knee flexion using the technique described by Karachalios et al. [7]. Patients then underwent arthroscopic ACL reconstruction surgery using a transfix system (Arthrex). During arthroscopy both menisci were carefully inspected and probed to identify and classify tears. Meniscal repairs and meniscectomies were performed if indicated and the location and type of tears were recorded. According to the arthroscopic and clinical examination findings, patients were categorized in two main groups (positive or negative Thessaly test), each subdivided into two subgroups (normal or damaged menisci at arthroscopy) (Table 1). The MRI report was also compared with the arthroscopic findings for menisci status.

Analysis focused on comparing the results of the preoperative meniscal tests (which had been done by the orthopedic residents) and the arthroscopic findings (as the definitive diagnostic data point of the study). True positive, false positive, true negative and false negative results were used to calculate the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and likelihood ratios of the Thessaly test.

3. Results

A total of 80 patients with ACL injury diagnosed by physical examination and confirmed by MRI were available for study. The most common mechanism of trauma was sports injuries. Fifty-five patients (68%) out of 80 with an isolated ACL tear had a positive Thessaly test at 20° of knee flexion. Ninety-five percent interobserver agreement was present between the two examiners. During the Thessaly test, the

Table 1
Arthroscopic findings following a positive or negative Thessaly test.

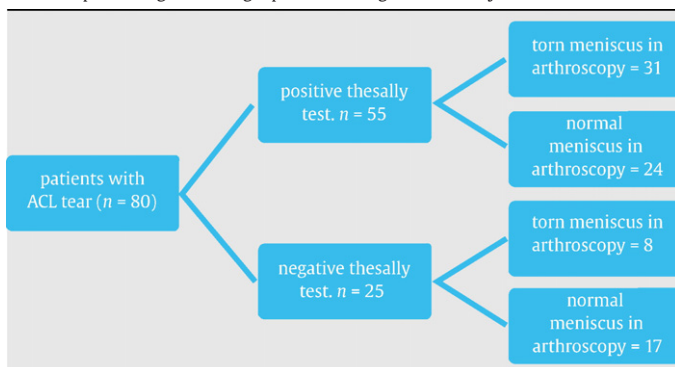


Table 2

Comparison of the Thessaly test with the McMurray and joint line tenderness tests for meniscal tears in ACL deficient knees.

	TP	FP	FN	TN	Sensitivity	Specificity
Thessaly test	31	24	8	17	79%	40%
McMurray test	16	4	15	45	51%	91%
Joint line tenderness test	36	15	3	26	92%	63%

TP, true positive.

FP, false positive.

FN, false negative.

TN, true negative.

knee gave way in six patients and they could not perform the test completely. They experienced severe pain and two of them developed subsequent swelling of the knee. We considered those patients who could not complete the Thessaly test as having negative results because their signs and symptoms were not the positive results of the original test described by Karachalios et al. [7].

Of the 55 positive results from the Thessaly test, 44 were on the medial side and 11 on the lateral side. The findings at arthroscopy included medial meniscus tear in 22 patients and lateral meniscus tear in 17 patients (Table 1). With regard to the MRI and arthroscopic findings, there was agreement in 76 patients (95%). In the remaining four patients, MRI suggested a tear but no tear could be found at arthroscopy. Table 2 records the sensitivity and specificity of the Thessaly, McMurray tests and joint line tenderness tests for meniscal tears in these ACL deficient knees. Forty-three percent of patients had false positive findings for the Thessaly test and this produced a low specificity rate (40%). The sensitivity of the test was 79%. The probability of a torn meniscus when a positive result was obtained was approximately 56% (i.e., 56% positive predictive value). Overall, the accuracy rate of the Thessaly test was 60%. Table 3 compares the results of the Thessaly test in our patients with those of previous studies.

4. Discussion

To the best of our knowledge, this is the first report investigating the Thessaly test in patients with combined ACL and meniscus injuries. The accuracy of the Thessaly test in identifying meniscal injuries in these patients was 60%. This figure is much less than the reported accuracy for isolated meniscal injuries, for which the sensitivity and specificity have been reported to be 89 and 97%, respectively [7,8].

Two specifically studied methods to detect meniscal injuries are the joint line tenderness test and the McMurray maneuver. Joint line tenderness is sensitive (67% to 76%) but not very specific (13% to 49%), while the McMurray test is specific (58% to 100%) but not very sensitive (29% to 63%) [12–15]. The Thessaly test produces pain by reproducing load transmission in the knee joint. We believe that in order to get a valid result from provocative maneuvers for meniscal tears, the normal biomechanics of the knee joint are of great importance. The ACL plays a substantial role in the rotary stability of the knee joint [16,17]. Absence of the ACL produces pain and fear of movement, especially cutting movements. The Thessaly test in 20° of knee flexion is a simulation of what happens during a cutting movement of the lower extremity. As these types of movements

Table 3

Diagnostic parameters of the Thessaly test and their values in ACL deficient knees compared with findings from previous studies.

	Sensitivity	Specificity	+ PV	–PV	+LR	–LR	Accuracy
Thessaly test in ACL deficient knees, present study	79%	40%	56%	66%	1.33	0.51	60%
Karachalios et al. study [7]	80%	91%	–	–	–	–	90%
Bradley study	90.3%	97.7%	98.5%	86%	39.3	0.09	88.8%

–LR, negative likelihood ratio.

+LR, positive likelihood ratio.

–PV, negative predictive value.

+ PV, positive predictive value [edit okay?].

produce pain and fear, patients prefer to avoid these positions and may be reluctant to adopt them. Performing the Thessaly test in an ACL deficient knee may be impractical because the abnormal kinematic and biomechanics present in the knee joint interfere with the patient's ability to perform the test. In our study, six patients developed giving way when they were asked to perform the rotational maneuvers. Further investigations showed that three of them had a medial meniscus tear and three had normal menisci.

The low accuracy rate of the Thessaly test in our study may result from patient inability to perform the test correctly. The specificity and sensitivity of the McMurray and joint line tenderness tests in our patients were similar to those of other studies. Although the mechanism by which McMurray test elicits pain involves a rotational maneuver, the maneuver is passive and is out of the control of the patient. We found that the positive diagnostic likelihood ratio of the Thessaly test was small enough (1.33) to make it a useless method in patients with ACL deficient knees and we have stopped using it. We believe that joint line tenderness has the highest accuracy in this setting.

We did not perform the Thessaly test in 5° of flexion for two reasons. First, it was difficult to train the patients to perform the test in this position as they usually flexed their knees more than this. Second, most of the meniscal tears in the ACL deficient knees are usually in the posterior horns [11] and more flexion is needed to squeeze and detect the lesions.

Arthroscopy is the gold standard diagnostic tool for meniscal tears. It directly visualizes the injury site and precisely determines the shape and type of the tear. Most studies rely on MRI findings to delineate the power of meniscus-specific tests. However, the accuracy rate of MRI for meniscus tears is 92–94% and this figure may be lower if clinical findings are not considered in MRI reports; additionally, the experience of the radiologist and surgeon affects the rate of accuracy [19,20]. Relying blindly on MRI to determine surgical intervention would have resulted in inappropriate treatment in 35% of the cases [18]. In our study, the true and false positivity or negativity of the Thessaly test was measured using arthroscopic findings. This is the strength of the study.

Our study has its drawbacks. The sample size was smaller than in other studies but the study was done in a more restricted population. Although the examiners were carefully trained to perform this test, they were limited in number. It is also possible that the performance of the examiners may have been affected by the two patients who developed knee swelling after the test; this may have led them to perform the test with a suboptimal technique.

5. Conclusion

We have shown that in the presence of a ACL tear, the specificity of the Thessaly test for meniscal injury is low. This test should be used with caution in cases of combined meniscus and ACL tears.

6. Conflict of interest

We confirm that there is no any type of conflict of interest in preparing of this manuscript.

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