Diagnostic Accuracy of Anterior Drawer Test in Detection of Anterior Cruciate Ligament Tear Using Magnetic Resonance Imaging as Gold Standard

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ABSTRACT

Objective   *To determine the diagnostic accuracy of anterior Drawer test in detection of anterior cruciate ligament (ACL) tear, using MRI as gold standard.*

Study design   *Cross sectional study.*

Place & Duration of study   *Department of Orthopaedics and Trauma, Khyber Teaching Hospital Peshawar, from March 2013 to September 2013.*

Methodology   *Patients presenting with post-traumatic knee pain and instability, were subjected to anterior Drawer test and then MRI of the involved knee was performed to match the findings of the two. The data was analyzed with SPSS version 10. Sensitivity, specificity, positive predictive value and negative predictive value were determined by taking MRI as gold standard.*

Results   *A total of 115 patients were enrolled. There were 96 (83.48%) males and 19 (16.52%) females. On anterior Drawer test, true positive and true negative patients for ACL tear were 64 (55.65%) and 42 (36.52%) respectively while false positive and false negative patients for ACL tear were 3 (2.61%) and 6 (5.22%) respectively. The sensitivity and specificity of anterior Drawer test were 91.43% and 93.33% respectively while positive and negative predictive values were 95.52% and 87.50% respectively. The diagnostic accuracy was 92.20%.*

Conclusions   *Anterior Drawer test has better specificity than sensitivity and high positive predictive value. It is more accurate in ruling out an anterior cruciate ligament injury.*

Key words   *Anterior cruciate ligament injury, Anterior Drawer test, Traumatic knee pain.*

INTRODUCTION:

The anterior cruciate ligament is an extrasynovial band of dense connective tissue that courses from the femur to the tibia. It is a major ligament to stabilize the knee joint movements against anterior tibial translational and rotational loads. The anteromedial part is the primary stabilizer during knee flexion and the posterolateral part stabilizes knee during extension.[1] Most of the ACL injuries (approximately 70%) take place in sports situations.[2] The overall estimated incidence of ACL injury is up to 36.9 injuries per 100,000 persons per year.[2] Treatment consists of either conservative management or surgical intervention, with the later being the better option for patients who want to return to a high level of activity.[3] The reported prevalence of knee osteoarthritis, resulting from isolated anterior cruciate ligament tear has been reported up to be 13% and with additional meniscal injury, it ranges between 21% to 48%.[4]

Typically, the diagnosis of ACL tear can be made

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on the basis of detailed history and thorough physical examination, and confirmed on MRI with reported sensitivity from 90-95% and specificity from 95-100%.[5] The anterior Drawer test, Lachman test and Pivot shift test are commonly performed clinical tests to diagnose ACL tears.[6] The Lachman test is considered the most sensitive test for anterior tibial displacement in acute cases but anterior Drawer test is the most commonly performed test for all grades (1-3) of ACL injuries especially in chronic cases.[3] Most of the studies show the specificity of anterior Drawer test in both acute and chronic ACL injuries to be about 95% but the sensitivity varies in acute and chronic cases from 9% to 93% with mean 62%.[3] Knee stability assessment contribute to the management model for ACL injury. The functional assessment indicate, if the athlete is fully recovered in terms of stability to pre-injury activity level.[7]

Anterior Drawer test has a high accuracy for diagnosing ACL injury. The anterior translation of 1 mm to 5 mm is defined as grade I laxity, 6 mm to 10 mm as grade II, and greater than 10 mm or without a displacement limit (end point) as grade III. End point is further graded as firm, marginal or soft.[8] The aim of this study was to find the diagnostic accuracy of anterior Drawer test in the detection of ACL tear of knee joint as sensitivity and specificity of anterior Drawer test has been reported differently by various authors.

METHODOLOGY:

This cross sectional study was carried out at Orthopedics Unit, Khyber Teaching Hospital Peshawar, from March 2013 to September 2013. Sample size of this study was 115, using 93% sensitivity, 91% specificity, 70% proportion of ACL injuries in sports,[1] and 6% margin of error according to WHO software for sample size. The sampling technique was consecutive (non-probability). All patient presenting with post-traumatic knee pain and instability (knee giving way / hyper extention / popped out and reduced back), age group between 18 year to 60 year, either gender and injury older than two weeks, were included in the study. All patients with any fracture in or around knee joint as evident on plain digital radiographs, those with heart pacemaker or implants where MRI was contraindicated, patients with any signs of knee infection, with open injuries to knee joint, were excluded. Approval was taken from research and ethical committee.

The demographic information was recorded. Thorough history was taken and physical examination

performed, including anterior Drawer test. MRI of the involved knee was done to confirm the findings obtained from anterior Drawer test. The collected data was entered in SPSS version 10 and analyzed. Mean + standard deviation were calculated for continuous variables like age of the patient. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) were determined by taking MRI as gold standard from 2x2 table.

RESULTS:

The total number of patients presenting with post-traumatic knee pain and instability were 115 comprising of 96 (83.47%) males and 19 (16.53%) females. The most commonly involved site was right knee joint in 78 (67.8%) patients. The age range was from 18 year to 60 year. The mean age of male and female patients was 31.78+9.90 year and 31.10+11.36 year respectively with an overall mean age of 31.70+11.71 year. Maximum number of patients were from 18 year to 30 year (n=66 - 57.39%).

On anterior Drawer test, 67 (58.26%) patients had ACL torn while torn ACL was found in 70 (60.87%) patients on MRI. Normal ACL examination on anterior Drawer test was noted in 42 (41.74%) patients while MRI reported normal ACL in 45 (39.13%) patients. On anterior Drawer test, true positive and true negative patients for ACL tear were 64 (55.65%) and 42 (36.52%) respectively. Details are given in table I. The diagnostic accuracy was 92.20%.

Table I: Diagnostic Accuracy of Anterior Drawer Test In Detection of Anterior Cruciate Ligament Tear	
	Anterior Drawer Test
True Positive	64 (55.65%)
False Positive	3 (2.61%)
True Negative	42 (36.52%)
False Negative	6 (5.20%)
Sensitivity	91.43%
Specificity	93.33%
PPV	95.43%
NPV	87.50%
Diagnostic accuracy	92.20%

DISCUSSION:

Complete ACL injury usually cause considerable knee joint instability on clinical examination. On the other hand, a partial ACL tear can be difficult to diagnose. Since reconstructive surgery involves

significant remodeling, confirmation of the diagnosis is desirable before undertaking unnecessary surgery on patients with incomplete ACL tears. A number of previous studies have examined the accuracy of clinical diagnosis in ligamentous injuries of the knee. In our study, on anterior Drawer test, 58.26% patients had ACL torn but 60.85% were confirmed on MRI. According to Tsai K et al, the statistical conception of test accuracy is a summation of its true-positive and true-negative rates.[9] Thus a test with high true-negative and fair true-positive rates will still be very accurate. However, a high true-positive rate is critical for tests upon which a decision to surgically intervene is made. In our study a high true negative rate 36.52% was found. These results compared favorably with those from the published literature, suggesting a high level of accuracy with a commonly performed anterior Drawer test.

Sensitivity and specificity values may be more useful than predictive values. The true positive results indicate the degree to which a positive clinical test truly represents the presence of the condition. Expressed as a percentage, the higher the sensitivity, the better the chance that a positive test will confirm the presence of the condition. Fritz and Wainner noted that a negative test finding for a test with high sensitivity provides a strong indication that the condition is indeed absent.[10] Specificity represents the number of patients without the condition who had a negative test result. Higher the specificity, the better the chance that a negative test result reflects the absence of the condition.[11,12] Applying this criterion to the pooled results gathered from the Scholten et al review, suggests that the anterior Drawer test was a better overall test for assessing the ACL tear.[13]

Katz JW et al retrospectively studied 85 patients with knee injuries and compared the relative accuracy of the Lachman test, the anterior drawer sign and the pivot shift test.[14] All examinations were performed under anesthesia and then confirmed by arthroscopy. A total of 22 injuries were confirmed. They noted that the pivot shift test was the most sensitive (88.8%), followed by the Lachman test with 77.7% sensitivity. The anterior drawer sign was the least sensitive at 22.2%. Specificities of the three tests were more than 95%. For all injuries of more than 2 weeks duration (n=13), the Lachman and pivot shift tests were 84.6% sensitive, while the anterior Drawer sign increased to a sensitivity of 53.8%. Again, all were specific to more than 95%. For all ACL injuries, irrespective of age, the Lachman test was 81.8% sensitive and 96.8% specific, the anterior Drawer sign was 40.9% sensitive and 95.2% specific;

while the pivot shift was 81.8% sensitive and 98.4% specific.

Kocabey Y et al evaluated 50 consecutive patients with 65 pathologies of medial meniscal tears, lateral meniscal tears, and/or ACL rupture.[12] After initial clinical examination MRI was performed followed by arthroscopic procedure. They found that there was no statistical difference between MRI or clinical examination in diagnosing medial or lateral meniscal tears or ACL tears (p >.05). The accuracy of the clinical examination and MRI evaluation was equal.

CONCLUSION:

High specificity and negative predictive values indicate that anterior Drawer test is more accurate in ruling out an ACL tear.

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