RESEARCH ARTICLE

Accuracy of Lachman and Anterior Drawer Tests for Anterior Cruciate Ligament Injuries

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Abstract

Background: The knee joint is prone to injury because of its complexity and weight-bearing function. Anterior cruciate ligament (ACL) ruptures happen in young and physically active population and can result in instability, meniscal tears, and articular cartilage damage. The aim of this study is to evaluate the accuracy of Lachman and anterior drawer tests in ACL injury in compare with arthroscopy.

Methods: In a descriptive, analytical study from 2009 to 2013, 653 patients who were suspected to have ACL rapture were entered the study. Statistical analysis was performed by the usage of SPSS 16. Multiple comparison procedures were performed for comparing data between clinical examination and arthroscopic findings and their relation with age and sex.

Results: Mean age of patients was 28.3±7.58 years (range from 16 to 68 years). From 428 patients, 41.2% (175 patients) were between 26 and 35, 38.8% (165 ones) between 15 and 25 and 20% (85 patients) out of 36 years. 414 patients were male (97.2%) and 12 were female (2.8%). Sensitivity of anterior drawer test was 94.4% and sensitivity of Lachman test was 93.5%.

Conclusion: The diagnosis of the ACL injury and the decision to reconstruct ACL could be reliably made with regards to the anterior drawer and Lachman tests result. The tests did not have privilege to each other. The test accuracy increased considerably under anesthesia especially in women.

Keywords: Accuracy, Anterior drawer test, Lachman test

Introduction

The knee joint is prone to injury because of its anatomic orientation and weight-bearing function. Anterior cruciate ligament (ACL) rupture occures in young and physically active population and could result in instability followed by, meniscusal tears, and articular cartilage damage if not well treated (1). It is estimated that 80,000 to 100,000 ACL reconstructions is performed in the United States annually. studies have shown a 1.4 to 9.5 times increased risk of ACL tear in women (2, 3). MRI is the most common imaging study for ACL injury in USA. MRI could show not only ACL tear but also shows any other soft tissue or bone injuries (4). Immediately after injury, if the condition allows (pain and swelling), the knee must be evaluated to diagnose any ACL tear or other injuries (5). A thorough physical examination is the first step in evaluating a patient with knee pain after injury. Different studies has confirmed that a proper and complete knee examination can be sensitive for ACL injury in more than 80 percentages of cases. Physical examination should be started from patient`s gait observation plus taking careful history (6). Ligament laxity measurement is clinically valuable to diagnosis injury and also to compare laxity before and after surgical procedure. However, the level of instability and laxity does not correlate with patients' signs and symptoms (7).

The Lachman (anterior displacement of tibial manually at 20° of flexion) is an accurate test for detecting ACL tear (mean sensitivity 84%) (2, 8, 9). Anterior drawer test and the pivot shift tests have a sensitivity of about 62 percent. Increasing pressure to reduce health care expenses, leads to investigate new methods to increase the precision of clinical tests which could be achieved through various reviews evaluating the diagnostic accuracy of these tests (10).

The aim of this study is to evaluate the accuracy of Lachman and anterior drawer tests in the knee with ACL injury in compare with arthroscopy findings.

Materials and Methods

Between 2009 and 2013, in a descriptive, analytical study, 653 patients who were suspected of having ACL

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rapture diagnosed by general orthopedic surgeons, sport medicine specialist or general practisoners admitted in our referral hospital for further evaluation. After history taking and physical examination and imaging studies evaluation, by the senior author of our study, 428 patients became candidates for knee arthroscopy. The ethical approval to conduct the study was obtained from Mashhad University of Medical Sciences. Exclusion criteria were previous knee surgery, deformity or contracture. All the subjects had non-acute ACL injuries with more than 3 weeks passed from the incident with the normal other side for comparative evaluation.

History

Data was collected by a junior orthopedic surgeon which included: demographic information (age and gender), ACL rupture etiology and history and patient chief complaint at the time of admission.

Physical examinations

All physical examinations were performed blindly by one orthopedic resident trained in knee examination. Physical examinations included: anterior drawer and Lachman tests. These two tests were performed twice for each patient, first in clinic and second time under general anesthesia before reconstruction of ACL on the operating table. The examiner checked the affected side with normal one in all cases. Knee arthroscopic surgeries were performed by our senior who specialized in knee surgery not aware of physical examination results.

Anterior drawer test

With the patient in supine position, the hip and knee were flexed to 45 and 90 degrees respectively. While the foot was stabilized on the examination table and the hamstrings were relax, frequent manual gentle antro-posterior forces were applied to the proximal tibia, and tibia antero-posterior displacement in flexed knee was measured. The degree of displacement was compared with normal side. Displacement of more than 6mm comparing the opposite side with a soft end point was proposed as torn ACL.

Lachman test

The Lachman test is carried out in relax supine position, the examiner bends the knee to about 15 degrees and slightly external rotation. Then, by stabilizing the femur with one hand and putting the other hand behind the proximal tibia at the level of joint line, and then the tibia is pulled forward. In normal response there should be a steady restraint to anterior movement. Anterior displacement of proximal tibia being felt by examiner thumb in a soft or mushy end point was associated with positive Lachman test. Grade of laxity was defined by the amount of anterior tibial movement.

Table1. Causes of ACL injury

Causes	Frequency
Sport	316 (75.7%)
Unknown Trauma	49 (11.4%)
Fall	27 (6.3%)
Car accidents	15 (3.5%)
Work accidents	8 (1.9%)
Other	2 (0.3%)

Statistical analyzes

Statistical analysis was performed by the usage of SPSS 16. Multiple comparison procedure was performed for comparing data between clinical examination and arthroscopic findings and their relation with age and sex. Sensitivity was considered as number of true positives to number of true positives and false negatives and specificity as number of false positives to number of false positives and true negatives (5).

Results

Mean age of patients was 28.3±7.58 years (range from 16 to 68 years). From 428 patients, 41.2% (175 patients) were between 26 and 35, 38.8% (165 patients) between 15 and 25 and 20% (85 patients) over 36 years. 414 patients were male (97.2%) and 12 were female (2.8%).

Etiology of ACL injury was shown in Table 1. The most common cause of ACL injury was sport activities (75.7%) such as football, volleyball, wrestling and etc.

Among 316 ACL ruptures due to sports activities, 233 (74%) happened during football, 50 (16%) during wrestling and other contact-sport, 19 (6%) during volleyball, 8 (3%) at basketball, 5 (2%) at handball and 1(0.3) during skiing.

Patients` chief compliant were; giving away 308 (72.4%), locking 82 (189.3%) and pain 35 (8.2%).

In Table 2, the initial (with clinical examination) and final (after arthroscopy) diagnoses was compared. In 75.6%, ACL injuries the clinical examination were compatible with arthroscopic diagnosis. ACL rupture in association with of lateral meniscus rupture was led to the most misdiagnosis of our cases.

Sensitivity of anterior drawer test was 94.4% and its sen-

Table 2. First (clinical examination in clinic) and final (arthroscopic) diagnoses

Site of injury	Physical examination	Arthroscopic diagnoses	Sensitivity	Specificity
ACL rupture and medial meniscus injury	244 (57.3%)	208 (48.8%)	95%	82%
ACL rupture	148 (34.7%)	112 (26.3%)	98%	90%
ACL rupture and lateral meniscus injury	15 (3.5%)	53 (12.4%)	52%	99%
ACL rupture and both meniscus injury	4 (0.9%)	42 (9.9%)	56%	100%
ACL and PCL rupture and meniscus injury	4 (0.9%)	2 (0.5%)	100%	99%
Medial meniscus injury	6 (1.4%)	3 (0.7%)	75%	98%
ACL rupture and meniscus injury and OA	5 (1.2%)	5 (1.2%)	83%	99%
Medial and lateral meniscus injury	0	1 (0.2%)	50%	100%

sitivity with general anesthesia was 96.4%. This sensitivity was not related to age (P>0.05). Sensitivity of anterior drawer test in clinic was significantly different in men and women (95%vs. 72.7%, P=0.018) but not under general anesthesia (96.6% vas 91.7%, P=0.19).

Sensitivity of Lachman test was 93.5% and its sensitivity under general anesthesia was 96.9%. This sensitivity was not related to age (P>0.05). Sensitivity of Lachman test in clinic was significantly different in men and women (66.7%vs. 94.6%, P=0.005) but not under general anesthesia (97.3% vas 91.7%, P=0.317).

Discussion

After ACL rupture, most patients have detectable signs and symptoms of excess knee laxity and the joint becomes unstable. Anterior tibial translation in normal knees has very little different in right and left knees and in 95% of normal population; this difference is less than 2 mm. It is crucial to use the contralateral normal knee as control to compare the difference in laxity between normal and injured knees (9).

In our study the sensitivity of anterior drawer test in clinic was 94.4% and its sensitivity with general anesthesia was 96.4%. This sensitivity was not related to age (P>0.05). Sensitivity of anterior drawer test in clinic was significantly different in men and women (95%vs. 72.7%, P=0.018). Lachman test sensitivity was respectively 93.5% and 96.9% in and after general anesthesia which was not associated with age (P>0.05). Sensitivity of Lachman test in clinic did not differ in male and female (66.7%vs. 94.6%, P=0.005). Anterior drawer and Lachman tests did not have privilege to each other. Physical examination in women were more sensitive under general anesthesia than in clinic. It did not apply in men.

Several studies confirmed that the sensitivity of diagnostic tests such as anterior drawer and Lachman would increase in chronic ACL injuries (9, 7, 11). On the other hand, it has been demonstrated that knee diagnostic test accuracy rose under anesthesia which is suggestive of the importance of patient factor in the sensitivity of these tests (12).

Oberlander evaluated the diagnostic accuracy of knee clinical examination and his study resulted in 63% sensitivity of the tests (13). In Benjaminse`s meta- analysis, the accuracy for Lachman test showed a pooled sensitivity of 85% (14). Jain revealed the sensitivity of the Lachman test under anesthesia to be 92.9 % (15).

Liu showed that the sensitivity of Lachman and anterior drawer test was 95 and 61%, respectively (16). Lachman test sensitivity rose to 100% under anesthesia. Lee *et al* showed that the sensitivity of MR imaging was 94% . compared with 78% for the anterior drawer test and 89% for the Lachman test. Katez *et al* concluded that in 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; and the pivot shift was 81.8% sensitive and 98.4% specific.

Regarding to high sensitivity of Lachman test a negative test result, provides a strong clinical suspicion for rulling out the ACL injury (17,18). Jonsson *et al* concluded in examining an acutely injured knee in a patient without anesthesia, the Lachman test was superior to the anterior drawer sign, but, in chronic injuries, both the tests had high diagnostic accuracy (19).

Lachman and anterior drawer tests are subjective and operator dependent tests; then, the results of this study should be considered with more caution. The experience and precision of examiner will influence the end result of the test. For as much as general practitioners who are at the first line of dealing with patients are less experienced in carrying out these tests, the tests inevitably would be less accurate in primary care and outpatient clinics (7, 12).

The anterior drawer and Lachman tests are valuable means to assess ACL injuries. The tests did not have privilege to each other. The accuracy of these test increased considerably under anesthesia especially in women.

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