Original article

Accuracy of Lelli Test For Anterior Cruciate Ligament Tear

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Abstract

Introduction: The anterior cruciate ligament (ACL) is an important stabilizer of the knee. Rupture of the ACL, unfortunately, is a common sports injury. Three most accurate test routinely applied in clinical practice to determine ACL injuries are the Anterior drawer, Lachman, and pivot shift tests test .In this study we evaluate the accuracy of Lelli test for detecting ACL tear and compare it with those tests.

Methods: This study included 80 patients attending sports clinic at Department of orthopedics, Tribhuvan University, Teaching Hospital from December 2013 to November 2014, aged between 20-45 years with knee symptoms of giving way/locking/pain following sports or non sports injury .Clinical history and detail clinical assessment of knee for instability including Anterior drawer test, Lachman test, Pivot shift test ,Lelli test were performed by standard technique and recorded in the Performa. All patient underwent knee arthroscopic evaluation and needful procedure by an experienced arthroscopic surgeon. Arthroscopy findings of ACL tear was recorded and used to assess the reliability of clinical test.

Results : In this study sensitivity of Anterior drawer test, Lachman test , Pivot shift test , Lelli test was 80.00%(CI 62.53-90.93),91.42%(CI 75.81-97.75) ,51.42%(CI 34.27-68.27), 85.71%(CI 68.95-94.61) respectively and Specificity was 93.33%(CI 80.68-98.28), 95.55%(CI 83.36-99.22), 100%(CI 90.20-100.00) , 91.11%(CI 77.87-97.11) respectively.

Conclusion: Lelli test being simple test can be routinely used in evaluation of ACL function in both acute and chronic knee injury.

Keywords: Anterior drawer test, Lachman test, Pivot shift test, Lelli test

Introduction

The anterior cruciate ligament (ACL) is an important stabiliser of the knee, functioning as the primary constraint preventing anterior translation of the tibia on the femur, and also stabilising the knee against rotational and valgus stresses [1]. Rupture of the ACL, unfortunately, is a common sports injury, with a reported incidence of 0.38 per 100,000 individuals [2]. Functional problems in the ACL deficient knee arise from instability, particularly in activities requiring pivoting and side stepping. Recurrent knee injuries secondary to instability can result in intraarticular damage, in particular meniscal tears and subsequent osteoarthritis (OA). After ACL rupture, most patients have detectable signs and symptoms of excess knee laxity and instability. Three most accurate test routinely applied in clinical practice to determine ACL injuries are the anterior drawer, the Lachman, and the pivot shift tests test [3- 4]. There is no published paper so far to the best of our knowledge regarding validity (specificity and sensitivity) of lelli test. So here we evaluate the accuracy of Lelli test as described by Dr. Alessandro Lelli of Bologna, Italy, for detecting ACL tear and compare it with those tests.

Methods

This Prospective analytical study included 80 patients attending sports clinic at Department of orthopedics, TUTH from December 2013 to November 2014,aged between 20-45 years with knee symptoms of giving way/locking/pain following sports or non sports injury. Clinical history and detail clinical assessment of knee for instability including Anterior drawer test, Lachman test, Pivot shift test ,Lelli test were performed by standard technique and recorded in the Performa.

Lelli test was carried out with patient in supine position, knee in full extension and heel touching the bed, clenched fist is placed beneath the proximal calf just distal to tibial tuberosity then a gentle posterior directed thrust is applied over quadriceps tendon and we look for heel liftoff from the bed. The test is positive if there is no heel liftoff from the bed in springy manner compared to normal side.

ACL tears were clinically diagnosed by a positive Anterior Drawer Test, Pivot shift test, Lachman test and Lelli test. All patients underwent knee arthroscopic evaluation and needful procedure by an experienced arthroscopic surgeon, under regional or general anaesthesia with a tourniquet, using standard anteromedial and anterolateral portals. Additional portals were used when required. Arthroscopy findings of ACL tear and Meniscus tear were recorded and used to assess the reliability of clinical test.

Statistical analysis

Statistical analysis using SPPS 20 was used to calculate the sensitivity, specificity and 95% confidence interval [CI] of those tests. Categorical variables were summarized using frequency and were compared using the chi-square .p-value of less than 0.05 was considered to be statistically significant

Results

In the study total of 80 cases undergoing knee arthroscopy for knee symptoms of pain/giving way/locking were included. Of them 50 were male and 30 were female, with mean age of 32.12 yrs (range 21-42 years). Out of them 35 had ACL tear, isolated in13 (37.1%) and with associated meniscus tear in 22(62.8%). The most common cause of ACL injury was sports activities 22(62.8%) and patients chief complaints were giving way 29(82.8%), pain 23(65.7%), locking 18(51.4%).The right knee was involved in 20 cases (57.1%) and the left knee in 15 cases(42.8%).

Clinical diagnosis of ACL injury

Comparison of the arthroscopic findings of ACL Tear and clinical tests Anterior Drawer test, Lachman test, Pivot shift test and Lelli test findings yielded the following results shown in table 1-5

Table 1 Anterior drawer test and ACL Tear

ADT	ACLtear		Total	Sensitivity (CI)	Specificity (CI)
	Present	Absent			
Positive	28	3	31	80.00	93.33
Negative	7	42	49	(62.53-90.93)	(80.68-98.28)
Total	35	45	80		

Anterior drawer test had sensitivity 80.00 % (CI 62.53-90.93) and Specificity 93.33% (CI 80.68-98.28)

Table 2 Lachman test and ACL Tear

Lachman Test	ACLtear		Total	Sensitivity (CI)	Specificity (CI)
	Present	Absent			
Positive	32	2	34	91.42	95.55
Negative	3	43	46	(75.81-97.75)	(83.36-99.22)
Total	35	45	80		

Lachman test had sensitivity 91.42 %(CI 75.81-97.75) and Specificity 95.55 %(CI 83.36-99.22)

Table 3 Pivot shift test and ACLtear

Pivot shift Test	ACLtear		Total	Sensitivity (CI)	Specificity (CI)
	Present	Absent			
Positive	18	0	18	51.42	100.00
Negative	17	45	62	(34.27-68.27)	(90.20-100.00)
Total	35	45	80		

Pivot shift test had sensitivity 51.42 % (CI 34.27-68.27) and Specificity 100%(CI 90.20-100.00)

Table 4 Lelli test and ACLtear

Lelli test	ACLtear		Total	Sensitivity (CI)	Specificity (CI)
	Present	Absent			
Positive	30	5	35	85.71	91.11
Negative	5	40	45	(68.95-94.61)	(77.87-97.11)
Total	35	45	80		

Lelli test had sensitivity 85.71 %(CI 68.95-94.61) and Specificity 91.11 %(CI 77.87-97.11)

Table 5 Comparison of sensitivity and specificity of Lelli Test* with Pivot shift test, Lachman test and Anterior drawer test

Test	Sensitivity	p-value	Specificity	p-value
Pivot shift Test	51.42	0.000	100.00	0.0625
Lachman Test	91.42	0.727	95.55	0.453
Anterior drawer test	80.00	0.774	93.33	0.727

* Sensitivity = 85.71 & Specificity = 91.11

Lelli test has sensitivity statistically significant (p=0.000) than pivot shift test, rest are statistically insignificant.

Discussion

After ACL rupture, most patients have detectable signs and symptoms of excess knee laxity and the joint becomes unstable[5]. Three commonly applied tests in clinical practice to determine ACL injuries are the anterior drawer, the Lachman, and the pivot shift tests test[8]. Lelli test is based on ACL function as primary constraints for anterior translation of tibia, with intact ACL the anterior translation of tibia is restricted so the heel lifts off from the bed when a posterior directed force is applied to quadriceps tendon with patellar tendon trying to translate tibia anterior. This test can be done in both acute and chronic ACL injury, associated MCL injury and patellar tendon rupture also does not affect this test. There is no published study so far to the best of our knowledge regarding validity of lelli test. So here we evaluate the accuracy of Lelli test for detecting ACL tear and compare it with those tests.

In this study sensitivity of Anterior drawer test, Lachman test , Pivot shift test was 80.00%(CI 62.53-90.93),91.42%(CI 75.81-97.75) ,51.42%(CI 34.27-68.27) respectively and Specificity 93.33%(CI 80.68-98.28), 95.55%(CI 83.36-99.22), 100%(CI 90.20-100.00) respectively .This result is similar to meta-analysis of Twenty-eight studies that assessed the accuracy of clinical tests for diagnosing ACL ruptures by Benjaminse et al[6] with pooled sensitivity of Anterior drawer test, Lachman test, Pivot shift test 92% (CI 88-95) , 85% (CI 83-87), 24% (CI 21-27) respectively and pooled specificity 91% (CI 87-94) ,94% (95% CI, 92-95), 98% (CI 96-99) respectively. Kostov Hristijan, et al.[7] on similar study found Sensitivity of Anterior drawer test, Lachman test, Pivot shift test 94.5 %,91.7%, 62.1% respectively and Specificity 100% , 100% ,98.2% respectively. In study by Makhmalbaf, Hadi, et al.[8] the Sensitivity of anterior drawer test and Lachman test was 94.4% ,93.5% respectively. Katez et al [9]concluded that in all ACL injuries, irrespective of age, the anterior drawer sign was 40.9% sensitive and 95.2% specific ,the Lachman test was 81.8% sensitive and 96.8% specific and the pivot shift was 81.8% sensitive and 98.4% specific.

In this study we found Lelli test had sensitivity 85.71%(CI 68.95-94.61) and Specificity 91.11%(CI 77.87-97.11),which is comparable to three commonly applied tests in clinical practice to determine ACL injuries the anterior drawer, the Lachman, and the pivot shift tests. There are no available literature sources to compare our findings on lelli test.

There are limitations to the commonly applied test like for Lachman test, examiners who have small hands may face difficulties on patients with a large thigh girth[6]. For pivot shift test patient with a chronic ACL-deficient knee is familiar with unpleasant phenomenon of pivoting and will show protective muscle action. Additionally, to perform this test, the MCL must be intact to build up enough contact pressure in the lateral compartment. Moreover, the pivot shift sign is also intimately dependent upon the normal function of the iliotibial tract, which tightens and therefore causes reduction of the displaced tibial plateau at approximately 30° of flexion[10]. The accuracy of a complex test maneuver such as the pivot shift test may increase with experience thus the pivot shift test has very high specificity and low sensitivity,which correlates with our study finding of statistically significant(p=0.000) difference between lelli and lachman test sensitivity. For Anterior drawer test the hemarthrosis and reactive synovitis may preclude knee flexion to 90°, hindering the proper performance of the test, protective muscle action of the hamstrings secondary to joint pain provides a vector force opposite to the anterior translation of the tibia and the posterior horn of the medial meniscus becomes buttressed against the posterior most margin of the medial femoral condyle and may preclude anterior translation of the tibia[11].

We found lelli test to be least affected by those phenomenon, relatively easy to carryout in both acute and chronic knee injury situation with comparable sensitivity and specificity to those routinely applied clinical test for ACL tear.

Conclusion

Because data concerning the validity of clinical diagnostic tests for ACL ruptures are heterogeneous, it is difficult to conclude which test, or which combination of tests, is most appropriate for the diagnosis of suspected ACL rupture. Lelli test being simple , with comparable sensitivity and specificity to those routinely applied clinical test for ACL tear ,can be routinely used in evaluation of ACL function in both acute and chronic knee injury.

Conflict of interests: None declared.

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