Efficacy of lelli test for detecting anterior cruciate ligament tear

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ABSTRACT

INTRODUCTION: Anterior cruciate ligament is most commonly injured knee ligament which may be stretched, partially torn, or completely torn. Commonly applied tests in clinical practice to determine Anterior cruciate ligament injuries are the anterior drawer test, the Lachman, and the pivot shift test. This study is aimed to establish efficacy of Lelli test in diagnosing ACL tear in relation to MRI or arthroscopic finding.

METHODS: Prospective observational study performed in National Trauma Centre and Civil Hospital, Kathmandu. This study evaluated 90 consecutive patients seen at OPD for 1 year. All patients with a chief concern of acute knee pain following trauma, popping sound, swelling, instability, who underwent physical examination and MRI and necessary arthroscopic procedure.

RESULTS: Average subject age was 30 years among which 56 were males and 34 were females. Eighty (88.8%) had Anterior cruciate ligament tears diagnosed by magnetic resonance imaging and confirmed by arthroscopy. The sensitivity and specificity of Lelli test were 87.5%, 93.2%respectively as compared to that of Anterior drawer test (81.2%,90.5%), Lachman test (93.8%,90.5%), pivot shift test (87.5%,62.2%).

CONCLUSION: The Lelli test showed high sensitivity, specificity, in the detection of anterior cruciate ligament tear comparable to other Lachman, anterior drawer test, or pivot shift tests. It can be done in case where other test couldn't be done due to pain, also Lelli test eliminates drawback of other tests. It should be regularly performed along with other tests.

KEYWORDS: Anterior cruciate ligament; Lelli test

INTRODUCTION

Anterior cruciate ligament is important structure of knee which provides 85% stability to prevent anterior translation of tibia relative to the femur and also as secondary restraint to tibial rotation and varus/valgus rotation. ACL has anteromedial that is tight in flexion and posterolateral bundles that is tight in extension. ACL originates at posteromedial aspect of lateral femoral condyle, courses distally in anteromedial fashion to anteromedial aspect of tibia between condyles.

ACL is most commonly injured knee ligament. About 200,000 people are affected per year in the United States.[1] In some sports, females have a higher risk of ACL injury, while in others, both sexes are equally affected. Anterior cruciate ligament injury is when the anterior cruciate ligament is stretched, partially torn, or completely torn. The most common injury is a complete tear and are common in sporting

pursuits, RTA. Symptoms include pain, a popping sound during injury, instability of the knee, and joint swelling. Swelling generally appears within a couple of hours.

There are several tests to evaluate the damage to the knee like Pivot-shift test, Anterior drawer test, Lachman test. Lachman test is recognized by most authorities as the most reliable and sensitive of the three. Diagnosis is usually confirmed by magnetic resonance imaging. The most accurate method for diagnosis of an ACL tear is direct visualization through diagnostic arthroscopy.[2] MRI is valid and noninvasive diagnostic method with specificity and sensitivity (94-98%). If physical examination and MRI are inconclusive, laximetry testing is done.

The main objective is to determine efficacy of Lelli Test for detecting Anterior Cruciate Ligament Tear.

METHODS

Prospective observational study at Bir Hospital, National Trauma Center and Civil Hospital was conducted for 1 year from May 2018 to April 2019. Inclusion criteria of our study were Patients with suspected acute and chronic complete ACL tear. Exclusion criteria of our study were Co-morbidities such as cartilage defects, prior reconstructions of the affected ACL, Partial ACL tear and patient with no MRI reports.

Data will be collected using data collection form (Proforma) data was analyzed by means of SPSS 22. This study evaluated consecutive patients seen at OPD for 8 months. All patients with a chief concern of acute knee pain following trauma, popping sound, swelling, instability, are eligible to be enrolled. All patients underwent a thorough history, physical examination, and standard radiographs and MRI and arthroscopic examination and repair if needed. To assess the integrity of the ACL, 4 physical examination maneuvers—The anterior drawer, Lachman, pivot shift test, and lever sign tests—were performed on each symptomatic knee. The

definitive ACL status was determined by MRI and arthroscopy in patients.

The patient is placed supine with the knees fully extended on a hard surface such as the examining table. The examiner stands at the side of the patient and places a closed fist under the proximal third of the calf. This causes the knee to flex slightly. With his other hand, he applies moderate downward force to the distal third of the quadriceps. In an intact knee, the creation of a complete lever by the ACL allows the downward force on the quadriceps to more than offset the force of gravity, the knee joint rotates into full extension, and the heel rises up off of the examination table. With a partially or completely ruptured ACL, the ability to offset the force of gravity on the lower leg is compromised and then tibial plateau slides anteriorly with respect to the femoral condyles. In this case, the gravity pulls the heel down to the examination table.[3]

Figure 1. Lelli test

Sample size: $= Z^2 pq/ d^2$
$$= 1.96\ ^2 x 0.375\ (1-0.375)/0.1^2$$
$$= 0.9/0.01$$
$$= 90$$

Lelli test

True positive – both test and disease positive

False positive – test positive and disease negative True negative – both disease and test are negative

False negative – disease positive test negative

Sensitivity – ability of test to identify the presence of disease

Calculation = true positive/ (true positive +false negative)

Specificity: ability of test to identify absence of disease

Calculation= true negative / (true negative + false positive)

Statistical analyses were performed with SPSS statistical software (SPSS Inc). The chi-square test will be used to compare the sensitivity and specificity of the various maneuvers. P < .05 will be considered statistically significant.

Symptom/Characteristic/Case Definition

	+	-
+	**A** True Positives	**B** False Positives
-	**C** False Negatives	**D** True Negatives

Sensitivity = A/(A+C) Positive Predictive Value = A/(A+B)

Specificity = D/(D+B) Negative Predictive Value = D/(C+D)

RESULTS

Table 1: Lelli test ACL cross tabulation

		ACL		Total
		Negative	Positive	
Negative	Count	14	5	19
	% within ACL	87.5%	6.8%	21.1%
Positive	Count	2	69	71
	% within ACL	12.5%	93.2%	78.9%
Total	Count	16	74	90
	% within ACL	100.0%	100.0%	100.0%

87.5% sensitivity and 93.2% specificity

Table 2: Sensitivity and specificity of Pivot shift test

PST * ACL Cross tabulation					
			ACL		Total
			Negative	Positive	
PST	Negative	Count	14	28	42
		% within ACL	87.5%	37.8%	46.7%
	Positive	Count	2	46	48
		% within ACL	12.5%	62.2%	53.3%
Total		Count	16	74	90
		% within ACL	100.0%	100.0%	100.0%

87.5% sensitivity and 62.2% specificity

Table 3: Specificity and sensitivity of Lachmann test

LACHMANN_TEST * ACL Cross tabulation					
			ACL		Total
			Negative	Positive	
LACHMANN_TEST	Negative	Count	15	7	22
		% within ACL	93.8%	9.5%	24.4%
	Positive	Count	1	67	68
		% within ACL	6.2%	90.5%	75.6%
Total		Count	16	74	90
		% within ACL	100.0%	100.0%	100.0%

93.8 sensitivity and 90.5 % specificity

Table 4: Sensitivity and specificity of ADT

ADT * ACL Cross tabulation					
			ACL		Total
			Negative	Positive	
ADT	Negative	Count	13	7	20
		% within ACL	81.2%	9.5%	22.2%
	Positive	Count	3	67	70
		% within ACL	18.8%	90.5%	77.8%
Total		Count	16	74	90
		% within ACL	100.0%	100.0%	100.0%

81.2% sensitivity and 90.5% specificity

DISCUSSION

Knee injuries are common injuries encountered in daily OPD basis due to injury from sport and non-sport activities. Rupture of the ACL, unfortunately, is a common sports injury.[4] Diagnosis depends upon the experience of surgeon and clinical tests and MRI findings. so, these ligamentous injury including ACL are commonly missed in periphery especially in hands of inexperienced surgeons. These missed ligamentous injury and Recurrent knee injuries secondary to instability can result in intraarticular damage, in particular meniscal tears and subsequent osteoarthritis.[4] Therefore, ligamentous injury should be identified promptly and management should be started promptly. So this study aims to evaluate sensitivity of new Lelli test and other test and MRI/ arthroscopic findings to make diagnosis of ACL injury.

In our study, age group between 16-54 are included and the average age of presentation is 30.61. Younger age group was involved due to involvement in sport and other recreational activities and awareness about their knee symptoms. In a study conducted by Keith A Jarbo[5] for the period of 4 weeks mean age was 23 yrs. between age group (15-66 yrs.). Other study by Patrick A Mussey[6] average age was 28 yrs. and study by Alper Deveci et.al.[7] mean age was 25.8 between age (17-45 yrs.)

In our study out of 90 pts 34 female (37.8%) and 56 males (62.2%) were involved in the study and this high rate of male involvement may be due to greater involvement of male in sports and physical activities. In a study conducted by Edward C. Cheung et.al,[8] women may have increased tibial and meniscal slopes, narrower femoral notches, and smaller ACL, which may place the ACL at risk from injury. Study conducted by Mount castle et.al.on[9] Gender Differences in Anterior Cruciate Ligament Injury Vary with Activity. anterior cruciate ligament injury rate, excluding male-only sports, was significantly greater in women (incidence rate ratio, 1.51 [95% confidence interval, 1.032.21])

In this study the sensitivity and specificity of ADT, Lachman test, pivot shift test were found out to be 81.2% and 90.5%, 93.8 and 90.5%, 87.5% and 62.2%.the sensitivity and specificity of Lelli test 87.5% and 93.2%. sensitivity is comparable to pivot shift test and ADT but less than Lachman test. The specificity of Lelli test is greater than anterior draw test, pivot shift test and comparable with Lachman test.

In study conducted by Alexander Lelli[3] 400 patients were evaluated and divided into four, equal-sized groups based on time elapsed from injury and MRI findings: Group A (acute phase with positive MRI for complete ACL rupture), Group B (chronic phase with positive MRI for complete ACL rupture), Group C (acute phase with positive MRI for partial ACL rupture), and Group D (chronic phase with positive MRI for partial ACL rupture). All tests were nearly 100% sensitive for patients with chronic, complete tears of the ACL. However, for patients with acute, partial tears, the sensitivity was much lower for the Lachman test (0.42), Anterior Drawer test (0.29), and Pivot Shift test (0.11), but not the Lever Sign test (1.00).

Other study conducted in Nepal by Thapa SS et.al[4] sensitivity of Anterior drawer test, Lachman test, Pivot shift test, Lelli test was 80.00%(CI 62.53-90.93), 91.42%(CI 75.8197.75), 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 83.3699.22), 100%(CI 90.20-100.00), 91.11%(CI 77.87-97.11) respectively compared to our study on Nepalese population.

Other study by Alper Deveci et.al[7] pre anaesthesia positivity was found in lever sign at 94.2 %, Lachman at 80.5%, pivot shift at 62.3 % and anterior drawer at 60.1%. These rates were determined after anaesthesia as lever sign 98.4 %, Lachman 88.7 %, pivot shift 88.3 % and anterior drawer 84.2 % with suggestion of including Lelli test in regular clinical examination. Other study by Miranda C. Lichtenberg[10] lever sign test showed the highest

specificity (100%) and the lowest sensitivity (39%) when compared with the other 3 tests. Moreover, its positive and negative predictive values were 100% and 65%, respectively, while an accuracy of 71% was calculated. Clustering the lever sign test parallel with the other 3 tests resulted in the highest accuracy of 91%

Jarbo et al.[5] overall accuracy of the lever sign test was 77% (63% sensitivity, 90% specificity); the accuracy was similar between patients under anaesthesia and awake (77% vs 76%, respectively). There were no significant differences when comparing the sensitivity and specificity of the lever sign test with patients under anaesthesia and awake concluded that while the Lachman test was determined to be the most accurate test in the study, they found that the lever sign test was easy to learn and reproduce, and the ability to perform the test is not impacted by the size of the patient.

In Study conducted by Edward P. Mulligan[11], The sensitivity of the Lever Sign, prone, and supine Lachman tests were 38, 83, and 67 % respectively and the specificity was 72, 89, and 97%. Sample size was small and is no that conclusive and advised lever sign test to be adjunct to other clinical test of ACL.

In a study by Anne Benjaminse[12] ACL tears, showing a pooled sensitivity of 85% (95% confidence interval [CI], 83-87) and a pooled specificity of 94% (95% CI, 92-95). The pivot shift test is very specific, namely 98% (95% CI, 96-99), but has a poor sensitivity of 24% (95% CI, 21-27).

CONCLUSION

The results of this study suggest that Lachman has high sensitivity and Lelli test has high specificity and the sensitivity of Lelli test is comparable to Lachman test and better than ADT and pivot shift test. Also, Lelli test in isolation, does not accurately detect the status of the ACL so, during the clinical examination, the Lelli Sign should be used as an adjunct to Lachman tests, anterior draw test pivot shift test

and confirmed with MRI/ arthroscopy.

LIMITATION

It had smaller sample size. Test were done without anaesthesia. It didn't include the duration of injury. Those without MRI were not included in the study.

Conflict of Interest: None.

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