

Statistical Relationship between Clinical and Functional Findings Based on the Lysholm Standard Score on the Success Rate of ACL Arthroscopic Reconstruction Surgery

Abstract

Introduction: This study aimed to find a statistical relationship between clinical and functional findings based on the Lysholm scoring scale in the success rate of surgery and patient satisfaction with the arthroscopic reconstruction of the anterior cruciate ligament (ACL).

Method: This prospective and cross-sectional study was performed on 38 patients (42 knees) aged 17 to 45 years who underwent anterior cruciate ligament (ACL) reconstruction during 2018-2019 due to ACL rupture at Imam Khomeini Hospital in Ahvaz. 6 and 12 months after surgery, clinical trials of "anterior drawer" and "Lachman test" were performed, and the standard Lysholm questionnaire for patients was completed. Then, the compatibility of the test results with the results of the Lysholm questionnaire and MRI was assessed.

Results: In the diagnosis of ACL rupture, 6 months after surgery, the highest sensitivity was related to the anterior drawer and Lysholm scale tests, and the highest specificity was related to the Lachman test. Also, the highest positive predictive value was related to the Lachman test and the highest negative predictive value was related to the anterior drawer and Lysholm scale tests. 12 months after surgery, the highest sensitivity was related to the Lysholm scale and the highest specificity was related to the Lachman test. The highest positive predictive value was for the Lachman test and the highest negative predictive value was for the Lysholm scale. In the first 6 months, graft failure was observed in 13.6% of patients, but the percentage of patients with "Fair" and "Poor" Lysholm scale was 28.95%. In the second 6 months, graft failure was observed in 7.14% of patients, but the percentage of patients with "Fair" and "Poor" Lysholm scale was 19.05%.

Conclusion: Since in some cases, such as excessive knee diameter due to obesity or swelling, the examination may be limited and citation of clinical test results may be erroneous, it is recommended that in addition to mechanical tests such as the Lachman test and the anterior drawer test, standard questionnaires such as Lysholm be used to more accurately assess the success of surgery and treatment, as well as to help identify more accurate lesions.

Keywords: ACL, Anterior Drawer, Lachman, Lysholm

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Introduction

Distal the anterior cruciate ligament is one of the most important ligaments that stabilize the knee. Rupture of this ligament increases the risk of damage to the meniscus and articular cartilage^(1, 2). Anterior cruciate ligament reconstruction is usually performed arthroscopically and, like other surgeries, may be associated with possible complications^(3, 4). To diagnose ACL rupture, physical examination and specific tests are performed after taking a detailed history. For ligament and knee meniscus injuries, there are several clinical tests with different diagnostic values, such as pivot-shift, anterior drawer, and Lachman⁽⁵⁻¹⁰⁾. In chronic ACL ruptures, it has been reported that the Lachman test is the most sensitive test for diagnosing ACL lesions, and its sensitivity for detecting ACL ruptures in the range of 84 to 98% has been reported. The specificity of this test has been reported to be very extensive (about 35% in conscious patients to 98% in anesthetic patients)^(8, 11). The Ant. Drawer and Lachman tests are similarly sensitive, but the Ant. Drawer test is less specific⁽¹²⁾.

Although clinical trials of knee examinations and related joint stability tests have been described in medical textbooks, there are limitations in mechanical examinations, clinical diagnosis of knee ligament lesions, and menisci, and even if performed by skilled physicians, the results of these examinations are not very accurate. Therefore, this study aimed to find a statistical relationship between clinical findings and functional findings based on the Lysholm score through which to help find the most appropriate and reliable method of evaluation in the success of the surgery and patient satisfaction with ALC arthroscopic reconstruction according to their functional results.

Methods

After obtaining permission from the ethics committee of Ahvaz Jundishapur University of Medical Sciences (Code of Ethics: IR.AJUMS.REC.1398.422), this prospective and cross-sectional study was performed on 38 patients (42 knees) aged 17 to 45 years who underwent anterior cruciate ligament (ACL) reconstruction during 2018-2019 due to ACL rupture using two-stranded and four-stranded hamstring autografts at Imam Khomeini Hospital in Ahvaz.

Patients with an open growth plate and patients over 45 years of age, patients with osteoarthritis, rheumatoid arthritis, acute and chronic infections, tumor at the lesion site, and patients with reinjury were excluded from the study.

Grading the Tegner Lysholm Knee Scoring Scale was considered according to the standard classification of the questionnaire as follows:

65 > (Poor), 65-83 (Fair), 84-90 (Good), and 90 < (Excellent)⁽²¹⁾.

Lachman test is graded in three classes: normal, +1 (increased forward movement with endpoint), and +2 (increased forward movement without endpoint).

Ant. Drawer test results were recorded positive (if the tibia moved forward 6 to 8 mm relative to the opposite side) and negative.

All patients underwent orthopedic surgery by the same orthopedic surgeon using a trans-tibial and extraction technique. The rehabilitation program was carried out according to the instructions of knee physiotherapy and the treatment steps of all patients with the same conditions and the same protocol.

The information of eligible patients for whom at least 6 months were passed since their surgery was extracted, and they were contacted to attend the clinic and perform the first stage clinical evaluations and examinations. In the second stage, 12 months after surgery, both tests were performed on patients again.

The sensitivity, specificity, and accuracy of the two tests, Lachman and Ant. Drawer, and the Lysholm questionnaire were calculated based on MRI images to determine the degree of success or failure of ACL reconstruction, 6 and 12 months after surgery. To determine the true negatives and positives and false positives and negatives, in the case of Lachman and anterior drawer tests, the negative result was considered as no complication recurrence (ACL rupture) and the positive result was considered as re-rupture. In the case of the Lysholm scoring scale, "Excellent" and "Good" cases were considered as diagnoses of healthy individuals, and cases with functional levels of "Fair" and "Poor" were considered as a diagnosis of rupture.

To describe the data, frequency and percentage were used for qualitative

variables, and the mean and standard deviation were used for quantitative variables. Statistical data were analyzed using SPSS software version 20.

Results

38 patients (42 knees) including 29 males (76.22%) and 9 females (23.68%) were included in the study. The mean age of patients was 32.26 ± 9.19 years, their mean height was 168.14 ± 8.10 , and their mean weight was 71.36 ± 10.99 kg.

6 months after surgery, Lachman and Ant. Drawer tests were performed and the Lysholm questionnaire was completed for patients. MRI images for 2 knees with

negative results of Lachman and anterior drawer tests and "Fair" functional level reported no recurrence of the complication. Also for 4 knees with a negative Lachman test result and a positive anterior drawer test result and Fair functional level, MRI images reported no recurrence of the complication in 3 knees. However, in one knee, a PCL rupture was confirmed. According to the patient, slipping on the stairs 4 months after ACL reconstruction surgery had caused this complication. MRI images reported the presence of graft failure in all 3 patients with a positive Lachman test and anterior drawer test (Table 1).

Table 1. Distribution of patients based on the results of clinical trials and Lysholm Grading, 6 months after surgery

Clinical Test	Lysholm Grading (N = 42)			
	Excellent	Good	Fair	Poor
Lachman (-), Anterior Drawer (-)	18 (42.86%)	15 (35.71%)	2 (4.76%)	-
Lachman (-), Anterior Drawer(+)	-	-	4 (9.52%)	-
Lachman (+), Anterior Drawer(+)	-	-	1 (2.38%)	2 (4.76%)

Table 2. Distribution of patients based on the results of clinical trials and Lysholm Grading, 12 months after surgery

Clinical Test	Lysholm Grading (N = 38)			
	Excellent	Good	Fair	Poor
Lachman (-), Anterior Drawer (-)	15 (39.47%)	12 (31.58%)	3 (7.89%)	1 (2.63%)
Lachman (-), Anterior Drawer (+)	-	-	3 (7.89%)	-
Lachman (+), Anterior Drawer (+)	-	-	2 (5.26%)	2 (5.26%)

Table 3. Sensitivity, specificity, positive and negative predictive value related to each test in two evaluation stages

Assessment methods		Sensitivity	Specificity	Accuracy	Positive predictive value	Negative predictive value
6 months	Lachman test	75%	100%	97.62%	100%	97.44%
	Anterior Drawer test	100%	92.11%	92.86%	57.14%	100%
	Lysholm	100%	86.84%	88.09%	44.44%	100%
12 months	Lachman test	80%	100%	97.37%	100%	97.06%
	Anterior Drawer test	80%	90.91%	89.47%	57.14%	96.77%
	Lysholm	100%	81.82%	84.21%	45.45%	100%

3 patients (3 knees), whose both Lachman and Ant. Drawer results were positive, and one patient (1 knee) with PCL rupture were excluded from the study, and 34 patients (38 knees) were re-examined after 6 months (12 months after surgery).

MRI images for 3 knees with negative results of Lachman and anterior drawer tests and Fair functional level reported no recurrence of the complication. Only 1 knee showed evidence of partial rupture. However, in 1 knee with negative results for both tests and the "Poor" functional level, in which obesity and high knee diameter did not allow for standard examination, MRI confirmed the presence of graft failure. MRI images for 3 knees were also reported with a negative response to the Lachman test and a positive anterior drawer test, and "Fair" functional level reported no recurrence of the complication in the 3 knees. MRI evaluation confirmed the presence of graft failure in 4 knees in which both Lachman and anterior drawer tests were positive (Table 2). Also, for 3 knees with a negative Lachman test result and a positive anterior drawer test result and "Fair" functional level, MRI images reported no recurrence of the complication in 3 knees. MRI evaluation confirmed the presence of graft failure in 4 knees in which both Lachman and anterior drawer tests were positive (Table 2).

At both stages of evaluation, sensitivity, specificity, positive and negative predictive values of all three tests were calculated based on the results of MRI images.

Six months after surgery, the highest sensitivity was related to the Ant. Drawer test and the Lysholm criterion, the highest specificity was related to the Lachman test, the highest positive predictive value was related to the Lachman test, and the highest negative predictive value was related to the Ant. Drawer test and Lysholm scale. Also, 12 months after surgery, the highest sensitivity was related to the Lysholm scale, the highest specificity was related to the Lachman test, the highest positive predictive value was related to

the Lachman test, and the highest negative predictive value was related to the Lysholm scale.

Discussion

In both studies, the Lysholm scale had the lowest positive predictive value in both assessments. The reason for this is that this scale measures knee performance in several separate sections. This feature makes this scale more valuable in identifying other accompanying complications such as weakness in the muscles around the knee, primary osteoarthritis or diagnose graft failure in patients with swelling in the knee joint or excess adipose tissue around the knee joint that does not allow for a standard examination; a feature that is not present in the other two tests. Therefore, in postoperative follow-up treatment, Lysholm scale can be used to increase the sensitivity and specificity of the two mechanical tests, Lachman and Ant. Drawer, and to ensure the correct diagnosis of knee stability or surgical failure, as well as the diagnosis of other associated complications and the most appropriate treatment strategy.

In the first six months of the evaluation, 13.16% of patients had graft failure, but the frequency of patients with "fair" and "poor" scores of the Lysholm scale was 28.95%. Also, in the second 6 months of the evaluation (6 to 12 months after surgery), graft failure was observed in 7.14% of patients, but the frequency of patients with "fair" and "poor" scores of the Lysholm scale was 19.05%.

On this basis, it can be concluded that the Lysholm scale, in addition to its high sensitivity in diagnosing graft failure, can help diagnose other associated complications in patients. Relevant strategies to address these complications will lead to improved patient satisfaction with treatment and the overall outcome of the surgery.

In a prospective study, Rayan et al. compared the results of clinical trials with arthroscopic

and MRI findings in the diagnosis of anterior cruciate ligament injuries in 1131 patients. The results of their study showed that clinical examinations if performed carefully could lead to better or equal diagnosis of arthroscopy or MRI in meniscus and ACL injuries ⁽¹³⁾, which was consistent with the results of the present study. In the present study, all three tests reported high sensitivity, specificity, and accuracy, which with complementary tests such as the Lysholm scale could be of diagnostic value equal to arthroscopy or MRI ⁽¹⁴⁾.

The results of a meta-analysis study by Prins et al. showed that although the Lachman and Drawer test physical tests were sensitive and acceptable in detecting ACL ruptures, they could be erroneous in some cases ⁽¹⁵⁾. In confirmation of the conclusion of their study, in the present study, these two tests were also erroneous in some cases, so the Lysholm scale was proposed to increase the diagnostic value of the tests.

In a prospective study, Sadoni et al. (2018) compared the results of the Ant. Drawer test and the Lachman test on the Lysholm scale in 101 patients undergoing ACL reconstruction. Patients were evaluated 3 to 9 months after surgery with the Lachman test, Ant. Drawer test, and the Lysholm scale. Lachman and Ant. Drawer test reported improvement in the third and ninth months, but the Lysholm scale did not change significantly. Besides, patients' satisfaction with treatment and return to previous activities did not change significantly. The Ant. Drawer test showed more changes than the Lachman test in patients. They concluded that the Ant. Drawer and Lachman test responses did not report a definite success rate in surgery and patient satisfaction with treatment and that the use of the Lysholm scale was more appropriate for this purpose ⁽¹⁶⁾.

In a meta-analysis study, Van Eck et al. Examined the susceptibility of various diagnostic tests before and after anesthesia in the diagnosis of ACL rupture. The results

showed that the sensitivity of the Lachman test before anesthesia was 81% and its specificity was 81%. After anesthesia, the sensitivity of this test was 91% and its specificity was 78%. The sensitivity of the Ant. Drawer test before anesthesia was 38% and its specificity was 81%. After anesthesia, the sensitivity of this test was 63% and its specificity was 91%. From the results obtained, it was concluded that before and after anesthesia, the Lachman test had the highest sensitivity in detecting ACL rupture, while both tests had close values in terms of specificity ⁽¹⁷⁾. The difference between the results of the study by Van Eck et al. and the present study could be due to differences in the timing of the tests.

In a study, Rosenberg et al. examined the sensitivity and specificity of ACL rupture diagnostic tests such as Lachman and Ant. Drawer on 20 knees. After reviewing the results, the Lachman test showed the highest sensitivity in diagnosing ACL rupture. However, Ant. Drawer did not recognize acceptable tension in the various parts of the ligament ⁽¹⁸⁾. The difference between the results of the study by Rosenberg et al. and the present study may be due to the small number of patients studying them compared to the present study, which may affect the value of the final results.

In the present study, the frequency of patients with "fair" and "poor" scores of the Lysholm scale was higher than that of patients with the final diagnosis of graft failure. Based on the results of the present study and citing other studies, since performing mechanical tests for patients requires proficiency in these tests, the percentage of error in the results can vary depending on the extent of the examiner's proficiency. Also, in knees that have multiple ligamentous and meniscal injuries, the MRI feature decreases, and the sensitivity to diagnose medial meniscus injury is reduced ⁽¹⁹⁾. Therefore, in postoperative follow-up and when patients refer to the office or clinic, it seems that in addition to clinical tests, it is better to use standard knee questionnaires that evaluate its functional level in different sections.

Conclusion

Because in some cases, such as swelling or excessive adipose tissue around the joint, the examination may be limited and the results of clinical trials may be erroneous, it is recommended that during clinical postoperative examinations, in addition to mechanical tests such as the Lachman and Ant. Drawer tests, standard knee assessment questionnaires such as Lysholm be used to more accurately assess functional levels and the success rate of surgery and treatment, as well as to help identify more accurate lesions. Also, completing the questionnaire can save time when examining the symptoms and functional level of the treated knee, and in the case of patients with low treatment satisfaction, they will help the practitioner to decide on the next steps.

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