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Research Article

Investigating the short-term effectiveness of anterior cruciate ligament (ACL) reconstruction surgery in patients with ACL rupture

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Abstract

***Background*:** Current studies do not consider surgery to be sufficient, considering the expectations of the treatment of people with cruciate ligament tears. There is also evidence that these patients should first undergo non-surgical procedures and then undergo surgery. This study aims to investigate the short-term effectiveness of anterior cruciate ligament reconstruction surgery in patients with ACL.

***Methods*:** This cross-sectional study was conducted on patients admitted to Valiasr Hospital in Qaemshahr, who underwent anterior cruciate ligament reconstruction surgery using hamstring tendon. 135 patients were included in the study with the available sampling method, and after applying the exclusion criteria, 100 patients were examined. Data analysis was performed in SPSS 21(α=0.05).

***Results*:** 100 patients were examined, 94(94%) were men. Knee activity level, pain level, swelling, occurrence of knee stiffness, knee locking and number of pain episodes before and after ACL reconstruction were compared. Before surgery, the average International Knee Documentation Committee (IKDC) score was 33.91(6.66), while after surgery, this number increased to 50.18(1.98), which indicates a significant improvement; surgery was significantly effective (P< 0.001).

Conclusion: ACL ligament reconstruction surgery using a tendon of the thigh muscle significantly improved all criteria of the IKDC self-assessment questionnaire. The overall surgical results and the final IKDC score were also significantly increased. According to the results of our study, all patients were satisfied with the surgery, the optimal effectiveness of this treatment method makes it the best option for the treatment of cruciate ligament rupture. Therefore, we recommend ACL repair surgery to patients.

Keywords: Ligament, IKDC, Reconstruction, Anterior Cruciate Ligament.

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Introduction

ACL[1] injury is the most common sports-related injury in young people and is often associated with meniscal tears and cartilage lesions, which affect 250,000 people in the United States annually. Arthroscopic ACL reconstruction (ACL-R) is the gold standard in the treatment of ACL injuries (1-4). With the rupture of this ligament, the knee becomes unstable in an anterior direction and the tibia moves abnormally forward in relation to the femur. Not only does this movement increase the likelihood of damaging other elements of the knee, but over time it also leads to erosion of articular cartilage and eventually knee arthritis. After the surgery, only 65% of the patients return to their sporting level before the injury (5-7). A clinical study of people undergoing ACL reconstruction showed that those who underwent meniscus repair along with ACL repair had higher long-term functional scores than those who underwent partial meniscus removal (8-12). With the increase in ACL reconstruction surgery, the number of re-surgery has increased. Recent studies have reported that ACL reconstruction failure has increased from 8% to 25%, with a higher incidence in the young and active population. ACL reconstruction is one of the most common orthopedic procedures with satisfactory clinical results; however, instability during rotation after reconstruction has been observed, particularly in activities beyond walking. This constant rotational instability causes problems during exercise, but it can also lead to secondary meniscus and cartilage problems (13-18) . Preparing an athlete to return to sport after ACL reconstruction and determining if they are ready to return safely is challenging. Recognizing the changes in stroke biomechanics during rehabilitation can help physicians and therapists assess athletes, set rehabilitation goals, and make decisions about returning to sport (19-21).

Current studies do not consider surgery to be sufficient given what is expected of the treatment for people with cruciate ligament tears. Evidence shows that after cruciate ligament ruptures, people should first undergo non-surgical procedures, and then they should have surgery (22). In this study, due to the high referral rate of people with ACL injuries, we decided to investigate the short-term efficacy of anterior cruciate ligament reconstruction surgery in patients with ACL tears at Valiasr Qaemshahr Hospital.

Methods

This cross-sectional study was conducted on patients who had undergone 1-year anterior cruciate ligament reconstruction surgery using a hamstring tendon in 2017 to 2018. These patients were hospitalized at Valiasr Qaemshahr Hospital And it was done in the operating room of the same hospital. Sample collections were available and 135 patients were included in the study and after application of the exclusion criteria, 100 people were examined. Inclusion criteria include: a) a history of an anterior cruciate ligament rupture, b) a history of an anterior cruciate ligament reconstruction surgery, c) the surgery was performed using the tendon of the thigh muscle, d) between 12 and 14 months have elapsed since the patient e) availability appropriate access to the patient to complete the questionnaire. Exclusion criteria include: a) Incorrect information in the questionnaire, b) Non-surgery by the patient when carrying out the examinations, c) Lack of consent from the patient to participate in the study. Before the start of the study, all patients gave written informed consent and were hospitalized for 3 days and underwent surgery.

First, 135 files on cruciate ligament reconstruction surgeries were extracted by reviewing all patient records in the archive. They were invited to attend. The patients completed questionnaires. In addition, the patients were examined by a specialist. After considering the exclusion criteria, the information of 100 patients was coded and entered into the Excel software. The translated IKDC questionnaire , whose validity and reliability had been previously confirmed, was used. The questionnaires were completed by the patients, and the postoperative examination information was entered into the corresponding checklist by the researcher and in collaboration with experienced surgeons. In this retrospective study, we asked patients one year after

[1] Anterior Cruciate Ligament

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ACL ligament reconstruction surgery to complete the IKDC self-report questionnaire once for the preoperative conditions and once for the postoperative conditions. We attempted to measure the clinical outcomes of this surgery in our patients by comparing these two questionnaires.

Data analysis was performed in SPSS version 21. P value ≤ 0.05 was considered as statistically significant. A mean and standard deviation were used to express the quantitative data, while numbers and percentages were used to express qualitative data. Paired Samples Test, Chi-Square test, Correlation Coefficient and ANOVA were used to analyze the relevant variables.

The relationship between the incidence of pain, stiffness, knee swelling and knee obstruction and the amount of activity without inflating the knee and the relationship between the maximum normal activity of the knee before surgery and the overall improvement of knee function after surgery have been measured using Spearman's statistical test.

Ethical considerations: IR.IAU.SARI.REC.1399.039

Results

This study examined 100 patients undergoing an anterior cruciate ligament reconstruction surgery using the tendon of the thigh muscle, 94 cases (94%) were men and only six of them were women.

A comparison of knee activity level, pain level, and number of pain episodes before and after anterior cruciate ligament reconstruction surgery is shown in Table 1. Patients' activity levels had significantly improved after surgery (P < 0.001). Patients' pain intensity was significantly lower after surgery (p < 0.001). The frequency of pain decreased significantly after surgery (P<0.001). (Table No. 1).

Table 1. Comparison of knee activity level, pain level and number of pain episodes before and after anterior cruciate ligament reconstruction surgery

Maximum activity	**before the surgery (person)**	**after the surgery (person)**
Very intense activity	0	0
intense activity	0	90
Medium activity	10	6
Light activity	89	4
Inability to perform the above activities	1	0
The amount of pain	Before the surgery (person)	after the surgery (person)
mild	13	99
medium	86	1
intense	1	0
Pain frequency	Before the surgery (person)	after the surgery (person)
low (0-3)	12	99
medium (4-6)	88	1
high (7-10)	0	0

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Comparison of swelling before and after anterior cruciate ligament reconstruction surgery is shown in Table 2. Before the surgery, all patients had mentioned different degrees of movement without swelling and knee stiffness, and there was no patient who did not report swelling. While after surgery, 96 people were equivalent to 96% of people without swelling and this difference was highly significant before and after surgery ($p<0.001$). Determination of the incidence of knee stiffness and knee lock before and after ACL reconstruction is shown in Table 3. Fifty one percent of the patients mentioned the problem of knee blockage before the operation, while no patient mentioned this problem after the operation. As a result, surgery was significantly effective in solving this problem ($P<0.001$).

Table 2. Comparison of swelling before and after anterior cruciate ligament reconstruction surgery

Mobility without swelling	before the surgery (person)	after the surgery (person)
very intense	0	96
intense	29	2
medium	55	1
Low	16	1
None of the above activities	0	0

Table 3. Determination of the incidence of knee stiffness and knee lock before and after ACL reconstruction

Knee lock	before the surgery (person)	after the surgery (person)
Yes	51	0
no	49	100
Total	100	100

As you can see in the table above Before surgery, 90 patients (90%) were only able to perform light activities, after surgery, eight patients (8%) were able to perform moderate activities, and 90 patients were able to perform vigorous activities. Patients' routine activity increased significantly after surgery ($P < 0.001$). Before surgery, 90 patients (90%) could only do light activities, while after surgery eight patients (8%) could do moderate activities and 90 patients could do vigorous activities. Patients' routine activity increased significantly after surgery ($P < 0.001$).

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Table 4. A comparison of the amount of activity without knee defecation and peak daily activity before and after ACL reconstruction

The amount of activity without emptying the knee	**before the surgery** (person)	**after the surgery** (person)
low	88	2
medium	12	8
intense	0	90
Amount of daily activity	**before the surgery** (person)	**after the surgery** (person)
low	90	2
medium	10	8
intense	0	90
very intense	0	0

Before surgery, the IKDC score averaged 33.91 (6.66), while after surgery, this number increased to 50.18 (1.98), indicating significant improvement (P<0.001). There was a strong inverse correlation between the level of initial knee function and their rate of recovery, meaning that the weaker the initial knee function, the more the patient will benefit from surgery (correlation coefficient = -0.95 and P<0.001). The relationship between the preoperative pain level and the overall improvement in knee function after surgery showed that there is a significant association between these two factors. That is, the greater the pain before surgery, the greater the recovery rate (rho=-0.13 and P=0.16).

The relationship between the incidence of pain before surgery and the overall improvement in knee function after surgery was measured using Spearman's statistical test, which showed that there was a significant relationship between these two factors (rho = -0.11 and P = 0.25). The relationship between stiffness and swelling before surgery and the overall improvement in knee function after surgery was measured using Spearman's statistical test, which showed that there was a significant inverse relationship between these two factors (rho = -0.59 and P< 0.001). The relationship between the degree of blockage before surgery and the overall improvement in knee function after surgery was measured using Spearman's statistical test, which showed that there was a significant inverse relationship to the mean correlation coefficient between these two factors (rho = -0, 62 and P<0.001). The relationship between the amount of activity without deflating the knee before surgery and the overall improvement in knee function after surgery was measured using Spearman's statistical test, which showed that there was an inversely significant relationship between these two factors with a weak correlation coefficient (rho = -0.31 and P = 0.001). The relationship between peak normal knee activity before surgery and overall improvement in knee function after surgery was measured using Spearman's statistical test, which showed that there was an inversely significant relationship with a weak correlation coefficient between these two factors (rho = -0 .27 and P = 0.006).

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Discussion

In this study, it was found that ACL ligament reconstruction surgery using a tendon of the thigh muscle significantly improved all criteria of the IKDC self-assessment questionnaire. The overall surgical results and the final IKDC score were also significantly increased. This finding was consistent with other reviewed studies such as the study by Alentorn-Geli (23). However, the patients' self-reported IKDC rate in the studies reviewed by Nwachukwu (24).was significantly higher than in this study, which could be due to cultural differences, differences in translation, the physician's and researcher's level of knowledge of the disease conditions, and the questionnaire Questions. However, the crucial point is the optimal effectiveness of this treatment method, which makes it the best option for the treatment of cruciate ligament tears.

The study of Zare et al. In 2012, in Yazd, they compared the arthroscopic reconstruction of the anterior cruciate ligament using the medial hamstring and the patellar tendon. They concluded that arthroscopic anterior cruciate ligament repair with patellar tendon and medial hamstring autograft is effective in the short term and is associated with favorable clinical and functional results. The type of graft has no effect on the short-term results of arthroscopic reconstruction of this ligament (25). Khair et al. during their retrospective study in 2014-2011. Differences between patient and surgeon expectations for ACL reconstruction Patients participated in their study and their expectations were rated on most of the 23 items and a score was calculated for each. In their study, the patient's expectations matched the surgeon's expectations. Older, less mobile patients and those preferring allografts to autografts were at higher risk of compromising surgical quality (26).

In 2016, Farahini et al. During a case-control study in Tehran, patients underwent anterior cruciate ligament reconstruction surgery on patellar patellar tendon and medial thigh muscle tendons. They used history, stability testing, knee arthrometry, and Lysholm and IKDC criteria. Before the operation, there was no difference between the two groups. They observed that anterior knee pain, kneeling pain, and bending limitation were more common in the patellar tendon group, and the short-term statistical results between these two groups were not significantly different based on Lysomal and IKDC criteria. However, at three-year follow-up, the hamstring group had better scores on the Lysholm criterion. They concluded that both techniques have favorable clinical results in the short term (27).In a 2019 US prospective study, Ann et al. conducted a two-year follow-up of patients undergoing ACL reconstruction surgery. In this study, 10.7% of surgeries were unsuccessful and 7.1% of patients underwent reoperation. In this study, the result of the operation was measured with different criteria. The mean subjective IKDC after surgery was 90 (28) . They evaluated the surgical results as good and acceptable from the point of view of doctors and patients (28).In 2019, Nwachukwu et al. A systematic review of the outcomes of ACL reconstruction surgeries in the United States. They reviewed 28 studies, and the preoperative IKDC score was evaluated in four studies, with a mean reported range of 94 to 100. This rate was evaluated postoperatively in 10 studies that reported mean IKDC scores ranging from 54.3 to 100. They concluded that the results of ACL reconstruction were more favorable than their repair (24).

Rostami Hajiabadi and colleagues in a study in 2013 in Isfahan. Male athletes who underwent ACL reconstruction. They examined muscle torque, proprioception and range of motion after a rehabilitation period. The results showed that although the amount of rehabilitation performed after surgery cannot increase the strength of the injured leg to the level of the healthy leg, rehabilitation can improve the range of motion and proprioception in the knee joint (29).

It is recommended that further studies be conducted to determine the local aspects of the problem and to consider the factor of distance to operations. Unfortunately, in this study, due to existing limitations, we only used IKDC self-report measures, so it is recommended that future studies be conducted with more decisive measures of surgical outcome in order to have more validity and accuracy. It is also recommended to investigate the effect of surgery in patients who have meniscus and cruciate ligament tears at the same time.

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Conclusion

In this study, it was found that ACL ligament reconstruction surgery using a tendon of the thigh muscle significantly improved all criteria of the IKDC self-assessment questionnaire. The overall surgical results and the final IKDC score were also significantly increased.

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Conflicts of interest:
There are no conflicts of interes.

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