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Short Term Result of Anatomic Single Bundle ACL Reconstruction with Peroneus Longus Autograft

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ABSTRACT

Background: Common knee injuries pertaining to the anterior cruciate ligament (ACL) have traditionally been treated with a variety of graft repair techniques involving groups of grafts for bone, patellar tendon, and hamstrings.

Objective: The aim of the current study was to assess the donor site and functional outcome morbidity of single bundle ACL Peroneus tendon grafting for reconstruction.

Patients and methods: At the Orthopedic Department of Zagazig University Hospitals, a prospective cohort study was carried out, on 18 patients with ACL tear during the period from January 2022 to July 2022. Arthroscopic Peroneus longus tendon autograft was used for anatomic single bundle ACL repair on all patients.

Results: IKDC score considerably increased from 45.83 (SD 7.46) to 78.12 (SD 6.04); 15 (83.3%) patients had excellent score and 3 (16.7%) patients had good score in AOFAS. complications 13 (72.2%) cases were non-complicated and 27.8% were complicated (hemarthrosis 5.6%, loss of terminal flexion 5.6%, pain 5.6%, superficial infection 5.6% and Transient apraxia sural nerve 5.6%).

Conclusion: Peroneus longus tendon is effective and secure autograft for arthroscopic anterior cruciate ligament reconstruction; restoration of knee function is adequate, with few donor site morbidities.

Keywords: Anterior cruciate ligament, Peroneus longus tendon, Knee**,** Cohort study, Zagazig University**.**

INTRODUCTION

One of the most frequent knee injuries is an anterior cruciate ligament (ACL) tear, with an incidence rate about 85 per 100,000 in patients aged between 16 and 39 years. Anterior and rotatory instability results from a deficit in the ACL, This serves as the knee's primary stabilizer and limits internal rotation and anterior tibial translation. Noncontact injury occurs most frequently when the knee is slightly flexed and in the valgus position and you pivot, cut, and jump [(1)].

Typically, physical examination, mechanical tests, imaging, and arthroscopy are used to make the diagnosis of ACL rupture. Numerous physical exam measures have been suggested to evaluate ACL stability, used both as a diagnostic tool and for clinical follow-up after ACL reconstruction. The three most common tests are the Lachman test, anterior drawer test, and pivot shift test often utilized physical examinations [(2)].

The anteromedial (AM) and posterolateral (PL) bundles make up the two components of the functional ACL bundles. Similar forces act on the graft of the reconstructed ACL and the natural ACL in the same anatomical locations. The various ACL reconstruction methods strive to provide a result that is as close to a natural anatomic reconstruction as is practicable [(3)].

For people who are active, surgical reconstruction of torn ACLs is typically favored over non-operative care since it allows for a quick return to function. Since the advent of ACL surgery in the late 1960s, the techniques for reconstruction have rapidly advanced [(4)].

Numerous graft forms, including well-researched autograft, increase knee stability and function. After replacement relating to ACL 2 of the more typical autografts for ACL restoration are four-strand bone-patellar tendon-bone (BPTB) and hamstring autografts, each of which has benefits and drawbacks [(5)].

The strength of a hamstring autograft is comparable to that of the original ACL, and it is simple to harvest with little donor site morbidity. However, it has uncertain graft size and may result in a loss of hamstring strength. This is vital for some sportsmen who need powerful hamstring power [(6)].

As a result, the peroneus longus tendon is being considered for usage by some orthopedic surgeons as an ACL autograft. The ideal autograft donor must be strong enough to be used, an appropriate size, and be simple and safe to harvest. Peroneus longs tendon (PLT) has been suggested in some literature as an alternative autograft for ACL restoration. PLT is strong and large enough to function in an ACL reconstruction as an autograft. With reference to strength, safety, and donor site morbidity, PLT is recognized as an efficient autograft option for ACL repair because complete removal of the PLT has no impact on gait or ankle stability. According to certain studies, Ankle erector power is even greater because to the peroneus brevis [(7)].

The aim of the current study was to assess the donor site and functional outcome morbidity of single bundle ACL Peroneus tendon grafting for reconstruction.

PATIENTS AND METHODS

A total of 18 patients who received a single bundle of surgery for ACL repair at Zagazig University

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Hospitals, during the period from January 2022 to July 2022, were recruited for the current study.

Inclusion criteria: ACL tear in patients aged between 18-45 years. All skeletally mature patients with ACL tear. Body mass index (BMI) ≤30.

Exclusion criteria: Foot and ankle deformity. Lower limb mal alignment (varus or valgus). Infection. Patient has other ligament injury. Patient with knee osteoarthritis.

Complete history was taken, in the outpatient clinic, both before and after ACL reconstruction, a clinical evaluation was performed by a skilled blinded examiner right before the walking activities. The evaluation's anterior drawer test, pivot shift test, and Lachman test with the help the evaluation of the subjects used the Lysholm Knee Scoring Scale, in addition to the IKDC (International Knee Documentation Committee) rating.

Lateral and AP pictures of the injured and healthy knees were taken using an X-ray machine before and after repair. Ensure that there are no additional knee issues to rule out the ACL injury, and assess the graft placement, tunnel location, signal intensity, quality, and ligamentization after reconstruction; magnetic resonance imaging was carried out. Investigations conducted at the lab included full-color blood picture Random blood sugar readings, PT, PTT, and INR. All patients underwent arthroscopic anatomic single bundle ACL restoration using autograft peroneus longus tendon.

Preoperative:

All reconstruction operations were conducted while sedated in the spine. On the lower limb, a pneumatic tourniquet is applied close and inflated. All patients had examinations while sedated prior to ACL restoration to confirm ACL deficit using the results of the Pivot shift and Lachman tests.

Nearly 30 minutes prior to surgery, all patients received an antibiotic; one gram of ceftriaxone was administered intravenously after performing a sensitivity test. Using an electric razor, the place to be approached is properly shaven around the knee and lateral aspect of the ankle was done and sterilized with betadine applied good drapes.

The Lysholm knee score was employed to assess the subjective criteria. The objective criteria were assessed using the IKDC knee examination. Both the scale and shape come from the American Orthopedic Foot and Ankle, Hindfoot.

Postoperative care:

- Following surgery, the patients spent two days in the hospital.
- To achieve passive knee extension, the limb was elevated on a pillow.
- For one week, two 50 mg tablets of diclofenac sodium were administered.
- Ceftriaxone 1 gm IV, a prophylactic antibiotic, was administered for 2–3 days.
- After 48 hours, suction drains were taken out.
- The third day saw the patient's discharge.
- All patients underwent surgery and underwent expedited recovery.

Follow up:

Follow up of all patients after 9 months included clinical examinations, Lysholm knee scores, and the IKDC 2000. Additionally, an X-ray of the knee was carried out from the front and side to assess degenerative changes and the tunnel's location.

Ethical Approval

This study was ethically approved by the Institutional Review Board of the Faculty of Medicine, Zagazig University (ZU-IRB #9345- 23-2-2022). Written informed consent was obtained from all participants. This study was executed according to the code of ethics of the World Medical Association (Declaration of Helsinki) for studies on humans.

Statistical Analysis

The collected data were introduced and statistically analyzed by utilizing the Statistical Package for Social Sciences (SPSS) version 20 for windows. Qualitative data were defined as numbers and percentages. McNemar's test was used for qualitative paired variables. Quantitative data were tested for normality by Kolmogorov-Smirnov test. Normal distribution of variables was described as mean and standard deviation, and Wilcoxon signed-rank test was used for quantitative paired variables. P value ≤0.05 was considered to be statistically significant.

RESULTS

Table 1 summarizes the demographic data and anterior cruciate ligament tears of the studied patients.

Table (1): Distribution of the studied patients according to demographic data

Variable		Mean ± SD	Range
Age (years)		**27.39 ± 5.41**	**19 – 33**
Time before surgery (year)		**0.792 ± 0.39**	**4 months – 1.5 year**
	Variable	**N=18**	**%**
Sex	Female	**5**	**27.8%**
	Male	**13**	**72.2%**
Smoking:	No	**15**	**83.3%**
	Yes	**3**	**16.7%**
Mechanism of injury	Sports injury	**11**	**61.1%**
	Traffic accident	**7**	**38.9%**
Side:	Left	**3**	**16.7%**
	Right	**15**	**83.3%**
Associated injuries	No	6	33.3%
	Medial meniscus	5	27.8%
	Posterior horn medial meniscus	7	38.9%
	Comorbidities:		
	No	17	94.4%
	Diabetes	1	5.6%

Table 2 and 3 show that total LYSHOLM score and **IKDC total score** improved significantly postoperatively.

Table (2): Total LYSHOLM score distribution among studied patients.

Parameter	Pre	Post	Paired t	P
Total score	**54.33 ± 14.04**	**94.37 ± 8.14**	**19.477**	**0.00****

Table (3): IKDC total score distribution between pre and post-operative of the studied patients.

Parameter	Pre	Post	Paired t	P
IKDC SCORE	**45.83 ±7.46**	**78.12 ± 6.04**	**24.628**	**0.00****

Regarding anterior drawer examination, preoperatively 9 (50%) patients were grade III, and 9 (50%) patients were grade IV. At final follow up postoperatively, 18 (100%) patients were grade I (**Table 4**).

Table (4): Pre- and Post-operative Anterior drawer test among the studied patients.

Parameter			Time		P
			Pre	Post	
Anterior drawer test	**GI**	**Number of cases**	0	19	**<0.001****
		Percentage	0.0%	100.0%	
	GII	**Number of cases**	0	0	
		Percentage	0.0%	0.0%	
	GIII	**Number of cases**	9	0	
		Percentage	50.0%	0.0%	
	GIV	**Number of cases**	9	0	
		Percentage	50.0%	0.0%	
Total		**Number of cases**	18	18	

P-value for McNemar's test. **P≤0.001 is statistically highly significant.

Regarding Lachman test preoperatively 7 (38.9%) patients were test +2 (C), and 11 (61.1%) patients were test +3 (D). At final follow up postoperatively, 14 (77.8%) patients had normal test (A) and 4 (22.2%) patients were test +1 (B). Before surgery, 12 (66.7%) patients had Pivot shift test +3 (D), and 3 (33.3%) patients had Pivot shift test +2 (C). After surgery, 3 (16.7%) patients had Pivot shift test +1 (B), and 15 (83.3%) patients had normal test (A) (**Table 5**).

Table (5): Pre- and Post-operative Lachman and Pivot shift test.

Parameter	A		B		C		D	
	No	%	No	%	No	%	No	%
Preoperative	0	0%	0	0%	7	38.9%	11	61.1%
Postoperative	14	77.8%	4	22.2%	0	0%	0	0%
P-value	<0.001**							
Preoperative	0	0%	0	0%	6	33.3%	12	66.7%
Postoperative	15	83.3%	3	16.7%	0	0%	0	0%
P-value	<0.001**							

P-value for McNemar's test. **P≤0.001 is statistically highly significant.

Table 6 summarizes AOFAS score of the studied patients.

Table (6): Distribution of the studied patients according to AOFAS score.

AOFAS score	Mean score	Range	N	%
Excellent	93.42 ± 1.7	90-100	15	83.3%
Good	82.3 ± 3.6	75-89	3	16.7%

Table 7 summarizes return to activity duration of the studied patients.

Table (7): Return to activity distribution among studied group.

Parameter	Return to activity/month
Mean ± SD	**2.47±0.75**
Median (Range)	**1.5 – 4.5**

Table 8 summarizes complications of the studied patients.

Table (8): Distribution of the studied patients, according to complications.

Parameter	N=18	%
Non complicated	13	72.2%
Complicated		
Hemarthrosis	1	5.6%
Loss of terminal flexion	1	5.6%
Pain	1	5.6%
Superficial infection	1	5.6%
Transient apraxia sural nerve	1	5.6%

DISCUSSION

The present investigation revealed that the average age was 27.39 (5.41) years. There were 13 (72.2%) males and 5 (27.8%) females, which in line with the analysis of **Rhatomy *et al.*** [8] who found that among the 75 patients in their study, 59 (78.7%) patients were males and 16 (21.3%) patients were women. The patients' average age was 26.7 (SD 8.57) years, with a range of 18–45 years.

The current analysis revealed that the lesion's concerning side, 15 patients had right side lesion and 3 patients had left sided lesions which is consistent with the research of **Ertogrul *et al.*** [9] who found that in a study included 20 patients treated with peroneus longus tendon, 15 (75%) of them had surgery on their right knee, while 5 (25%) had it done on their left. Also, **Khajotia *et al.*** [10] stated that 16 (64%) patients had right side lesion and 9 (36%) patients had left sided lesions. Also, similar results obtained by **Singh *et al.*** [11] who stated that 23 (59%) patients had injuries to their right knee and 16 (41%) individuals suffered left knee injuries.

The current study showed that on investigating about associated injuries, only 6 (33.3%) patients had no injuries (33.3%) and 3 (16.7%) patients had medial meniscus lesion. **Lewis *et al.*** [12] they discovered found the medial meniscus was injured in 58% of patients at the time of ACL repair being the most often affected. They also came to the conclusion that meniscal resection or repair had no impact on the result.

According to the current study, the overall LYSHOLM score increased from 54.33 preoperatively to 94.37 postoperatively with a significant difference.

Similarly to our results, **Trung *et al.*** [13] reported that the study group's average Lysholm score following surgery is 95.13 (highest is 99 and the smallest is 80) Compared to Lysholm prior to surgery, it is 59 (the greatest score is 69, the lowest is 56), and there was a statistically significant difference between the two.

The current study revealed that the distribution of the time to return to activity duration was 2.47 (SD 0.75) weeks with minimum 1.5 and maximum 4.5 months.

Pandey *et al.* [14] reported that 36.3% and 46.3% of surgeons set a cut-off time of 6 and 9 months for the return to sports, respectively, while 16.4% of surgeons permit return to sports after a year.

The recent investigation revealed that IKDC SCORE considerably increased from 45.83 (SD 7.46) to 78.12 (SD 6.04), which is consistent with the research of **Singh *et al.*** [11] They discovered that the mean IKDC subjective score prior to surgery was 47.77 while the mean score following surgery (at 6 months) was 87.9 with a considerable increase in both the pre-operative and post-operative IKDC scores (P<0.05).

Rhatomy *et al.* [15] found that Result of mean IKDC score pre-operative was 54.66 and post-operative was 95.69 with a substantial variations in IKDC and Tegner-Lysholm score between preoperative and postoperative scores (P<0.05).

The present investigation revealed that in relation to anterior drawer examination preoperatively 9 (50%) patients were grade III, and 9 (50%) patients were grade IV. At final follow up postoperatively, 18 (100%) patients were grade I.

Vijay *et al.* [16] showed that Regarding anterior drawer test in Peroneus Longus group grade 0 (1-2 mm) was 0 preoperatively and 17 postoperatively, grade 1 (3-5 mm) was 0 preoperatively and 6 postoperatively, grade 2 (6-10 mm) was 12 preoperatively and 0 postoperatively and grade 3 (>10 mm) was 11 preoperatively and 0 postoperatively, while in hamstring group grade 0 (1-2 mm) was 0 preoperatively and 14 postoperatively, grade 1 (3-5 mm) was 0 preoperatively and 7 postoperatively, grade 2 (6-10 mm) was 12 preoperatively and 1 postoperatively and grade 3 (>10 mm) was 10 preoperatively and 0 postoperatively.

Trung *et al.* [13] reported that the results of the anterior drawer test were used to assess the stability of the knee following surgery: the percentage of negative is 96.7%; level 1 is 3.3% and no longer level 2 or 3. Compared to the Lachman before surgery, it was 96.7 positive.

Singh *et al.* [16] tests including the anterior drawers test, Lachman's test, and pivot shift test demonstrated that none of the patients displayed any clinical instability at follow-up intervals of 6 weeks, 3 months, and 6 months.

The current study showed that Regarding Lachman test preoperatively 7 (38.9%) patients were test +2 (C), and 11 (61.1%) patients were test +3 (D). At final follow up postoperatively, 14 (77.8%) patients had normal test (A) and 4 (22.2%) patients were test +1 (B).

Vijay *et al.* [16] showed that Regarding Lachman test in Peroneus Longus group grade 0 (1-2 mm) was 0 preoperatively and 18 postoperatively, grade 1 (3-5 mm) was 0 preoperatively and 5 postoperatively, grade 2 (6-10 mm) was 10 preoperatively and 0 postoperatively and grade 3 (>10 mm) was 13 preoperatively and 0 postoperatively, while in hamstring group preoperatively grade 0 (1-2 mm) was 0 preoperatively and 13 postoperatively, grade 1 (3-5 mm) was 0 preoperatively and 8 postoperatively, grade 2 (6-10 mm) was 14 preoperatively and 1 postoperatively and grade 3 (>10 mm) was 8 preoperatively and 0 postoperatively.

Kerimoglu *et al.* [17] reported that the Lachman test was used to evaluate the ACL's stability, and the results were normal in 12 (41.4%) patients, while 9 patients had 1+, five patients had 2+, and three patients had 3+ anteroposterior laxity.

The current study showed that 12 (66.7%) patients had Pivot shift test +3 (D), and 3 (33.3%) patients had Pivot shift test +2 (C), after surgery, 3 (16.7%) patients had Pivot shift test +1 (B), and 15 (83.3%) patients had normal test (A).

Khajotia *et al.* [10] stated the in 15 (60%) cases, pivot shift was described as negative, positive glide was observed in 9 (36%) cases, and gross pivot shift was documented in 1 patient.

Vijay *et al.* [16] showed that Pivot shift test in Peroneus Longus group preoperatively was 6 and postoperatively 19. While Glide 1 was 3 preoperatively and 4 postoperatively, Clunk II was 8 preoperatively and 0 postoperatively, and Gross III was 6 preoperatively and 0 postoperatively. In hamstring group Glide 1 was 5 preoperatively and 17 postoperatively, Glide 1 was 8 preoperatively and 5 postoperatively, Clunk II was 6 preoperatively and 0 postoperatively and Gross III was 3 preoperatively and 0 postoperatively.

The current study showed that, on investigating about AOFAS score, all patients had good or excellent grades.

Trung *et al.* [13] reported that before surgery, the ankle joint's function based on the AOFAS score is 97.3 (SD 1.67) and after surgery is 97.3 (SD 1.54); smallest is 93 and highest is 100 scoring.

The current study showed that 13 (72.2%) cases were non-complicated and 27.8% were complicated (hemarthrosis, loss of terminal flexion. pain, superficial infection and Transient apraxia sural nerve)

Khajotia *et al.* [10] found that regarding difficulties, 1patient experienced knee joint stiffness that required mobilization under anesthesia 10 days after surgery. ACL surgery was performed on one patient three weeks later restoration was found to have had haemarthosis.

Kerimoglu *et al.* [17] reported that At the PLT donor location, 2 (6.9%) patients reported experiencing pressure pain that is mild to moderate, paresthesia, and dysesthesia. Due to No patient has complained of ankle joint dysfunction or issues with sports participation after the PLT graft transfer.

The cohort in this study is too small, there is no comparison group, the follow-up period was brief, and stability and range of motion were not assessed. We were unable to assess either the long-term clinical efficacy or the long-term consequences since the follow-up time was so brief. The results might not be generalizable to a larger population because of the small sample size.

CONCLUSION

Peroneus longus tendon is effective and secure autograft for arthroscopic anterior cruciate ligament reconstruction; restoration of knee function is adequate, with few donor site morbidities.

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