

Evaluation of the Results of Arthroscopic Anterior Cruciate Ligament Reconstruction with Peroneus Longus Autograft

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Abstract:

Background: Restoring functional knee stability often involves reconstructing the anterior cruciate ligament (ACL). Due to its robustness, consistent clinical results, and minimal donor-site injury, the peroneus longus tendon is a good graft option. **Methods:** Our study was a retrospective study that samples ACL repair patients sequentially from February 2023 to June 2024. Based on history, clinical examination and MRI findings, an ACL rupture was diagnosed. Twenty patients were undergoing ACL reconstruction using peroneus longus tendon autograft after fulfilling inclusion criteria and obtaining informed consent. They were assessed preoperatively postoperatively and follow up for 1 year. **Results:** Mean age of the patients was 27.4 ± 7.26 years. At final follow up, 2 patients had positive Lachman and anterior drawer test. The average

length of the peroneus longus tendon was 28.7 ± 1.11 cm and the average diameter was 8.4 ± 0.28 mm. Average hospital stay was 3.7 ± 0.79 days. The IKDC, modified Cincinnati and Tegner-Lysholm score were improved significantly after 12 months of operation. The mean AOFAS scores and mean FADI score were 95.50 ± 6.16 and 114.90 ± 24.50 respectively after 12 months. There was one postoperative infection which was healed after antibiotic prescription. One patient had postoperative stiffness which was persisted after 1 year. **Conclusion:** Arthroscopic ACL reconstruction with PLT appears to be a promising alternative to traditional graft options, such as hamstring or patellar tendons.

Keywords: ACL reconstruction, Peroneus longus tendon, sports injury

J Com Med Col Teachers' Asso Jan 2025; 29(1): 26-31

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Introduction:

A significant portion of sports medicine procedures are related to ligament and tendon problems¹. Restoring functional knee stability often involves reconstructing the anterior cruciate ligament (ACL). Depending on the injury severity and the patient's determination to change their ergonomics and avoid actions that could make it worse, reconstruction may not always be required for these injuries in non-athletic patients. Furthermore, unlike an athletic patient, these patients' knees are neither strained or stressed. Because it stops the tibia from anteriorly translating over the femur, the ACL is the main stabilising ligament of the knee. It is a crucial arrangement for preserving proper knee mobility since it increases the knee's dynamic stability². Untreated ACL injuries may worsen into meniscal injuries and, in the end, cause degenerative arthritis of the knee joint³.

ACL injuries can be repaired (isolated or augmented) or reconstructed (allograft or autograft) surgically, or they can be treated conventionally with a knee support and physiotherapy. A number of factors, such as age, work demand, concomitant injury, and activity level, must be taken into account while making a judgement on this matter⁴.

Both autografts and allografts may be an option when reconstructing the ACL is necessary. The disadvantages of allografts include increased expense, delayed integration, increased risk of disease transmission, and immunological responses. The usual autografts are the double- or quadrupled semitendinosus or gracilis graft, or bone patellar tendon bone (BPTB). The quadriceps tendon, the fascia lata, and the iliotibial band are further choices⁵.

In reconstruction, the BPTB graft is the best treatment option⁶. The biomechanical strength of BPTB and native ACL are comparable. Operation with BPTB can be rehabilitated early with low risk of graft failure^{6,7}. On the other hand, patellofemoral pain, immobility, and patellar fracture are possible morbidities associated with BPTB at the site of graft harvesting⁸.

As an alternative, hamstring tendon (HT) autografts can be performed; however, the strength of the hamstring muscles may be significantly altered^{9,10,11,12,13}. Harvesting the HT may result in medial insecurity of the knee joint if there is both an ACL damage and a medial collateral ligament lesion. Maintaining normal hamstring function is crucial for patients who have had ACL reconstructions^{14,15}. Anaesthesia over the medial aspect of the leg can result from harvesting the hamstring from the medial side, which can harm the saphenous nerve. The disadvantages of the often utilised autografts mentioned above call for the development of a substitute graft material.

In order for a donor area to be considered a prime source for autografts, it must meet two requirements: the autograft must possess a sufficient level of strength and be able to be extracted from the donor site in a safe and straightforward manner without causing evident functional damage. With its high failure loading and stiffness, the peroneus longus tendon (PLT) is a promising candidate for autografting due to its good biomechanical features¹⁶. Due to its robustness, consistent clinical results, and minimal donor-site injury, the peroneus longus tendon is a good graft option^{17,18,19,1}. Studies on biomechanics and kinematics

have demonstrated that the removal of the complete PLT has no impact on ankle stability or gait¹.

In certain orthopaedic surgeries, such as medial patellofemoral ligament (MPFL) reconstruction²⁰ deltoid ligament reconstruction²¹, and spring ligament reconstruction²², autografts of the PLT are frequently utilised. The synergistic activity of the peroneus brevis and longus makes this possible. According to certain papers, the peroneus brevis is more efficient ankle eversion, which supports the harvesting of the PLT²³. Due to its limited donor site morbidity and positive clinical outcome, some earlier study^{24,25} PLT is better for ACL reconstruction. However, some studies disagreed^{26,4} because of donor site morbidity. Tensile strength did not significantly differ between the hamstring and PLT, according to a 2017 study by Rudi et al.⁴.

This study is to find out the functional outcome and complication of peroneus tendon graft ACL restoration. The use of PLT autograft as the preferred graft in ACL reconstruction is examined in this study.

Methods:

Our study was a retrospective study that samples ACL reconstructed patients with peroneus longus tendon sequentially from February 2023 to June 2024. This study was conducted at the Orthopaedic Department of Comilla Medical College Hospital. This study included all patients who were diagnosed with an anterior cruciate ligament (ACL) rupture and were between the ages of 18 and 45, provided they had isolated ACL injuries without any associated conditions. Patients were excluded if they had ACL ruptures accompanied by other injuries such as meniscal tears or damage to other ligaments. Additionally, individuals were not eligible for inclusion if they had any other pathology affecting the lower extremities or if there was an abnormality present in the opposite knee.

Data Collection:

Data was collected in a preformed data sheet. Informed consent were taken from the patient. During operative procedure. Demographic data such as age, sex, occupation, affected side, hospital stay and complications were taken.

The primary outcomes were measured by presence or absence of pain, swelling, giving way and knee function. Secondary outcomes were measured by the Modified Cincinnati, Tegner-Lysholm, and IKDC, AOFAS and FADI score.

Prior to the procedure, the Modified Cincinnati, Tegner-Lysholm score, and International Knee Documentation Committee (IKDC) scores were documented. In order to complete the rehabilitation procedure and achieve peak function following an ACL damage, a post-operative follow-up was carried out at 6 and 12 months following the operation. We also documented some ankle score e.g. The American Orthopaedic Foot & Ankle Society (AOFAS) score and the Foot and Ankle Disability Index (FADI) score.

Data processing and analysis:

A structured questionnaire will be used for collecting the information. All the data will be processed with Microsoft Excel and SPSS 26. The data will be presented in tables, charts and graphs. Statistical analysis will be carried out in percentage and mean with standard deviation. Outcomes were measured using paired t-test.

Operative procedure for arthroscopic ACL reconstruction. Under spinal anaesthesia, each patient underwent the procedure in a supine position, with bleeding control provided by a pneumatic tourniquet. A 2 cm incision was made just above the upper peroneal retinaculum along the posterior edge of the distal fibula in order to harvest the PLT. Deepening the incision exposes the tendon (Fig. 1). The tendon was harvested with a long tendon stripper after being sutured and sliced with a knife using number 2 nonabsorbable suture. The collected graft was pretensioned on a tendon panel and its length was recorded. The graft was run through the cylindrical sizers after being folded to double-stranded graft and measure its diameter. In every instance, the same helper took the calibration.

An arthroscopic survey was conducted and standard arthroscopic portals created. Using a femoral offset aimer, a guidewire was introduced into the posteromedial side of the lateral femoral condyle in each case based on the harvested graft diameter. A reamer of the right size was used to produce a femoral tunnel. After bending the knee to a range of 70° to 90°, the tibial drill guide tip was positioned via the anteromedial portal, and its angle was ultimately changed to 45° to 55°. The guidewire was penetrated into position, emerging at the tibial plateau, after the drill sleeve was placed on the medial cortex of the tibia. A cannulated tibial reamer was used to form the tibial tunnel. Under arthroscopic observation, the graft was accurately labelled and transferred via the tibial tunnel and into the femoral tunnel. Following the application of steady traction and the insertion of a guidewire, the

graft was secured with endobutton (suspensory fixation) for femoral fixation and interference screw for tibial fixation in our centre.

Follow-up and rehabilitation

The identical postoperative ACL rehabilitation program was used for all patients¹⁸. After three weeks following surgery, patients were trained to perform full weight bearing exercises on the leg that had been injured. Following surgery, knee extension was initiated right away. Knee flexion was gradually increased from 0° to 90° until total flexion was reached three weeks after surgery. Running was allowed after three months, but returning to sports was not allowed until after the six-month mark.

Results:

During study, 20 patients underwent arthroscopic ACL with PLT autograft fixation. Mean age of the patients was 27.4±7.26 years with age range from 18 to 40 years old. Almost all (19) patients were male and only one patient was female. Most of the ACL injuries were caused by sports injury (16 cases). Out of 16 cases, 15 patients injured while playing football and one player injured during cricket match. Three patients were injured due to RTA and one patient had history of accidental fall.

Table-I: Demography of the Patient

Characteristics	Mean±SD	Number of Patient (Percentage)
Age	27.4±7.26 years	
Male		19 (95%)
Female		5 (5%)
Mechanism of Injury		
Sports Injury		16 (80%)
Other		4 (20%)
Length of Graft	28.7±1.11 cm	
Diameter of Graft	8.4±0.28 mm	
Hospital stay	3.7±0.79 days	

The average length of the PLT was 28.7±1.11 cm and average diameter was 8.4±0.28 mm. Average hospital stay was 3.7±0.79 days.

There was one postoperative infection which was healed after antibiotic prescription. One patient had postoperative stiffness which was persisted after 1 year. At final follow up, 2 patients had positive Lachman and anterior drawer test.

Table-II: Outcome after 6 and 12 months of surgery

Score	Follow - up Time	Score (Mean±SD)	P Value
IKDC	Preoperative	41.15±11.79	<0.01
	At 6 months	54.70±15.76	
	At 12 months	71±16.80	
Modified Cincinnati	Preoperative	44.45±15.40	<0.01
	At 6 months	71.40±14.06	
	At 12 months	87.60±18.43	
Tegner-Lysholm	Preoperative	48.95±15.91	<0.01
	At 6 months	71.75±23.24	
	At 12 months	85.50±19.97	
AOFAS score	At 6 months	87.15±8.63	
	At 12 months	95.50±6.16	
FADI score	At 6 months	99.40±21.08	
	At 12 months	114.90±24.50	

Results of mean preoperative IKDC score was 41.15±11.79 and postoperative scores were 54.70±15.76 at 6 months follow-up and 71±16.80 after 12 months. There was significant improvement of IKDC score after 12 months of operation. Preoperative modified Cincinnati score was 44.45±15.40. Postoperatively it was improved to 71.40±14.06 and 87.60±18.43 after 6 months and 12 months respectively. Modified Cincinnati score improved meaningfully after 12 months. The Tegner-Lysholm score was also improved significantly. It was 48.95±15.91, 71.75±23.24 and 85.50±19.97 at preoperative, 6 and 12 months after surgery.

Functional evaluations of the ankle using AOFAS and FADI scores at every follow-up demonstrated positive outcomes for the assessment of donor site.

The mean AOFAS scores were 87.15±8.63 and 95.50±6.16 after 6 months and 12 months respectively. The mean FADI scores were 99.40±21.08 and 114.90±24.50 after 6 and 12 months of operation respectively.

**Figure 1:** Harvesting of PLT, Arthroscopic view of reconstructed ACL, Graft preparation

Discussion:

The patellar and hamstring tendons were the most often utilized autografts for ACL restoration. The use of the old autograft may be complicated by knee discomfort, particularly in people who spend a lot of time on their knees for athletic, cultural, or religious purposes. Hamstring harvesting may result in medial instability, saphenous nerve injury if the ACL rupture is accompanied by a medical collateral ligament injury. One of the primary ankles evertors is the peroneus longus. Ankle instability is therefore the main issue with peroneus longus.

Peroneus longus and four-strand hamstrings did not significantly differ in tensile strength, according to a prior biochemical investigation²⁴. Functional results after ACL restoration using the peroneus longus tendon were favorable. One of the most crucial factors to take into account while undergoing knee ACL restoration surgery is the diameter graft. Failure rates are reduced when quadrupled-strand hamstring autografts with a diameter of 8 mm or more are used for ACL restoration²⁷. It was discovered that grafts larger than 8 mm had a protective effect on patients under the age of twenty-seven²⁷.

The PLT in our findings had a average diameter of more than 8 mm and a average length of more than 28 cm. This type of graft characteristics has similarities with others reported case.

Rhatomy et. al. showed average diameter of the peroneus longus graft was 8.38 ± 0.68 mm²⁸. Hossain et. al. obtained peroneus longus graft with 8.15 mm average diameter and average length of 28.17 cm²⁹. Trung et. al. showed mean diameter more than 7 mm³⁰.

Both Rhatomy et. al. and Hossain et. al. found significant improved functional outcome of ACL reconstructed patient measured by modified Cincinnati, IKDC, and Tegner-Lysholm score after 24 months of follow-up^{28,29}. Our study also demonstrated significant functional improvement in all scores after 1 year of follow-up.

Using the peroneus longus tendon, Anghong et al. previously reported potential donor site morbidity, which included lower peak torque eversion and inversion, impaired ankle function, and concerns about ankle stability²⁶. After harvesting the peroneus longus tendon, we discovered that the donor ankle's function was outstanding based on the FADI and AOFAS scores from the ankle functional test. It is due to intact peroneus brevis, which is a more effective ankle evertor²³.

There were some limitations in our study as the sample was very low only 20 and follow-up was for 12 months. But our strength was all the operations were done in single center.

Conclusion:

In conclusion, ACL reconstruction with PLT autograft appears to be a promising alternative to traditional graft options, such as hamstring or patellar tendons. The outcomes suggest that the peroneus longus graft provides sufficient strength, stability, and functionality, with comparable or potentially superior results in terms of graft healing, joint stability, and overall patient satisfaction. Additionally, the use of the peroneus longus tendon minimizes donor site morbidity and preserves key muscle functions, which may contribute to faster recovery and a more favorable rehabilitation profile. While further long-term studies are needed to confirm these results and assess any potential long-term complications, the current findings support the viability of the PLT as an effective autograft choice for ACL reconstruction, particularly in patients where alternative graft options are not ideal.

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