

## Original Research Article

# Assessment of donor site morbidity and functional outcome in anterior cruciate ligament reconstruction using peroneus longus autograft

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## ABSTRACT

**Background:** Anterior cruciate ligament (ACL) reconstruction is commonly performed using hamstring tendon or bone–patellar tendon–bone autografts; however, donor site morbidity associated with these grafts has prompted the search for alternative autografts. The peroneus longus tendon (PLT) has emerged as a potential option due to its favorable biomechanical properties and adequate graft length and strength. Concerns remain regarding donor ankle morbidity following PLT harvest. Objective of the study was to assess donor site morbidity of the ankle and functional outcomes of the knee following arthroscopic ACL reconstruction using a peroneus longus tendon autograft.

**Methods:** This prospective observational study included 45 patients who underwent arthroscopic ACL reconstruction using an ipsilateral peroneus longus tendon autograft at a tertiary care center. Patients were followed up for a minimum of 12 months. Knee function and stability were assessed using the International Knee Documentation Committee (IKDC) score, anterior drawer test, Lachman test, and pivot shift test. Donor ankle morbidity was evaluated using the American orthopaedic foot and ankle society (AOFAS) score and muscle strength assessment of ankle eversion and first ray plantar flexion using the Medical Research Council (MRC) scale. Statistical analysis was performed using statistical package for the social sciences (SPSS) version 20.0, with  $p < 0.05$  considered statistically significant.

**Results:** The majority of patients were aged 26–40 years (55.6%) and were male (68.9%). Sports-related injuries were the most common mechanism (60%). At 12 months follow-up, 93.3% of patients achieved excellent or good IKDC scores, with the mean IKDC score improving significantly from  $60 \pm 2.2$  preoperatively to  $97.5 \pm 4.8$  postoperatively ( $p < 0.01$ ). Objective knee stability was restored, with negative anterior drawer and Lachman tests in 95.6% and 93.3% of patients, respectively, and a negative pivot shift test in 100% of patients. Donor ankle function was preserved, with a mean AOFAS score of  $98.4 \pm 3$  at final follow-up. Grade V muscle strength was maintained in 91.1% of patients for ankle eversion and 95.6% for first ray plantar flexion, with no patient demonstrating strength  $\leq$  grade 3.

**Conclusions:** Arthroscopic ACL reconstruction using the peroneus longus tendon autograft provides excellent knee stability and functional outcomes with minimal donor ankle morbidity. The PLT autograft is a reliable and effective alternative to conventional autografts for ACL reconstruction.

**Keywords:** Anterior cruciate ligament reconstruction, Peroneus longus tendon, Autograft, Donor site morbidity, IKDC score, AOFAS score

## INTRODUCTION

The anterior cruciate ligament (ACL) is a key stabilizing structure of the knee joint, playing a vital role in controlling anterior tibial translation and rotational stability. ACL injuries are among the most common ligamentous injuries of the knee, particularly affecting

young, active individuals and athletes involved in pivoting sports.<sup>1,2</sup> Untreated or inadequately managed ACL injuries can lead to recurrent instability, secondary meniscal and chondral damage, early onset osteoarthritis, and significant functional impairment. Consequently, ACL reconstruction has become the standard of care for symptomatic ACL-deficient knees.<sup>3-5</sup>

Autografts remain the most commonly used grafts for ACL reconstruction due to their superior biological incorporation and lower risk of disease transmission compared to allografts. Traditionally, bone–patellar tendon–bone (BPTB) and hamstring tendon autografts have been widely used. However, each of these grafts is associated with specific donor site morbidities.<sup>3,6</sup> BPTB grafts are linked to anterior knee pain, kneeling discomfort, and patellar fractures, while hamstring grafts may result in hamstring weakness, altered knee flexion strength, and potential impact on dynamic knee stability. These concerns have prompted the search for alternative autograft sources that provide adequate graft strength while minimizing donor site complications.<sup>7,8</sup>

The peroneus longus tendon has emerged as a promising alternative autograft for ACL reconstruction. Biomechanically, the peroneus longus tendon has been shown to possess tensile strength and diameter comparable to commonly used hamstring grafts, making it suitable for ligament reconstruction.<sup>9</sup> Harvesting the peroneus longus tendon offers several theoretical advantages, including preservation of the hamstring musculature, potentially faster rehabilitation, and avoidance of anterior knee pain associated with BPTB grafts. Additionally, the synergistic action of the peroneus brevis muscle may compensate for the loss of the peroneus longus tendon, thereby maintaining ankle stability and function.<sup>10,11</sup>

In this context, evaluating both donor site morbidity and functional outcomes following ACL reconstruction using a peroneus longus autograft is of clinical importance. Such assessment helps determine whether the functional stability achieved at the knee is not offset by morbidity at the ankle or foot. The present study aims to systematically assess donor site morbidity and functional outcomes in patients undergoing ACL reconstruction using the peroneus longus autograft.

## METHODS

This prospective observational study was conducted in the Department of Orthopaedics, Government Medical College, Kottayam, over a period of one year from 01 January 2025 to 31 January 2026. The study population comprised patients diagnosed with ACL injury, with or without associated meniscal injury, who underwent arthroscopic ACL reconstruction using an ipsilateral peroneus longus tendon autograft. A total of 45 patients were included in the study and were followed up for a minimum duration of 12 months. The sample consisted of 31 male and 14 female patients, aged 18 years and above, all of whom sustained acute ACL injuries. Patients were selected using a convenient sampling method after obtaining informed written consent.

Patients were included if they had undergone primary arthroscopic ACL reconstruction with a peroneus longus tendon autograft and had a preoperative ankle eversion strength of at least grade 4 on the Medical Research

Council (MRC) scale on the donor side. Patients with pre-existing ankle deformities, ankle arthritis, previous ankle surgeries, prior peroneal tendon injuries, congenital foot disorders, bilateral or revision ACL reconstruction, associated posterior cruciate ligament or collateral ligament injuries, and contralateral ACL deficiency were excluded from the study.

Preoperative evaluation included a detailed clinical examination of the knee and ankle. Knee function and stability were assessed using the International Knee Documentation Committee (IKDC) subjective score, anterior drawer test, Lachman test, pivot shift test, range of motion assessment, and quadriceps muscle strength grading using the MRC scale. Donor ankle assessment included evaluation of ankle function using the American Orthopaedic Foot and Ankle Society (AOFAS) score and muscle strength assessment of ankle eversion and first ray plantar flexion using the MRC scale.

All surgeries were performed by a single senior knee surgeon under spinal anaesthesia using a standardized surgical technique. The peroneus longus tendon was harvested through a small longitudinal incision just proximal and posterior to the lateral malleolus, taking care to protect the sural nerve. The tendon was tenodesed to the peroneus brevis, harvested proximally using a tendon stripper, and prepared appropriately depending on its length and diameter. Arthroscopic ACL reconstruction was then performed with anatomical tunnel placement, femoral fixation using an Endobutton, and tibial fixation using a bioabsorbable interference screw. Intraoperative stability was confirmed using standard clinical tests.

Postoperatively, all patients followed a structured rehabilitation protocol. Early knee extension exercises were initiated immediately, with gradual progression of knee flexion and weight-bearing as per protocol. Ankle mobilization exercises were started from the first postoperative day, followed by gradual strengthening and proprioceptive training. Patients were followed up at 6 and 12 months postoperatively, during which knee and ankle assessments were repeated using the same clinical tests and scoring systems. Postoperative complications, if any, were documented.

Data were entered and analyzed using statistical package for the social sciences (SPSS) version 20.0. Categorical variables were expressed as frequencies and percentages, while quantitative variables were expressed as mean±standard deviation. A p value of less than 0.05 was considered statistically significant.

## RESULTS

A total of 45 patients who underwent arthroscopic anterior cruciate ligament reconstruction using a peroneus longus tendon autograft were included in the study and followed up for a minimum period of 12 months. The majority of patients were between 26 and 40 years of age (55.6%),

followed by those aged 18–25 years (28.9%), with only 15.6% being older than 40 years. Male patients predominated in the study population, accounting for 68.9% of cases. The left knee was more commonly involved (53.3%) compared to the right knee (46.7%). Sports-related injuries were the most frequent mechanism of ACL rupture (60.0%), followed by road traffic accidents (26.7%) and falls (13.3%). Isolated ACL tears were observed in 66.7% of patients, while associated meniscal injuries were present in 33.3%, with medial meniscal tears being more common than lateral meniscal tears (Table 1).

**Table 1: Demographic characteristics and injury profile of the study population (n=45).**

Variables	Category	N (%)
Age (years)	18–25	13 (28.9)
	26–40	25 (55.6)
	>40	7 (15.6)
Gender	Male	31 (68.9)
	Female	14 (31.1)
Side involved	Right knee	21 (46.7)
	Left knee	24 (53.3)
Mechanism of injury	Road traffic accident	12 (26.7)
	Fall	6 (13.3)
	Sports injury	27 (60.0)
Associated injuries	Isolated ACL tear	30 (66.7)
	Medial meniscus tear	9 (20.0)
	Lateral meniscus tear	3 (6.7)
	Both menisci	3 (6.7)

Functional assessment of the donor ankle using AOFAS score demonstrated excellent outcomes in all patients preoperatively. At 6 months postoperatively, 88.9% of patients had excellent scores and 11.1% had good scores, with no patients showing fair or poor outcomes. At 12 months follow-up, excellent AOFAS scores were observed in 95.6% of patients, while the remaining 4.4% had good outcomes. The mean AOFAS score improved from 96.9±4 at 6 months to 98.4±3 at 12 months, indicating preservation of ankle function with minimal donor site morbidity (Table 2).

Muscle strength assessment of the donor ankle using the MRC scale revealed no clinically significant weakness following peroneus longus tendon harvest. All patients had grade 5 ankle eversion and first ray plantar flexion strength preoperatively. At 6 and 12 months postoperatively, 91.1% of patients demonstrated grade 5 eversion strength and 8.9% had grade 4 strength, with none showing strength less than grade 4. First ray plantar flexion strength remained grade 5 in 95.6% of patients at both 6 and 12 months, while only 4.4% demonstrated grade 4 strength. No patient had grade 3 or lower power at any follow-up interval (Table 3).

Clinical evaluation of knee stability showed significant improvement following reconstruction. Preoperatively, all patients had positive anterior drawer and Lachman tests, while 80.0% demonstrated a positive pivot shift test. At 6 months postoperatively, 95.6% of patients had a negative anterior drawer test and 93.3% had a negative Lachman test. The pivot shift test was negative in all patients at both 6 and 12 months follow-up, indicating restoration of rotational stability (Table 4).

**Table 2: Donor ankle functional outcome assessed by AOFAS score.**

Time of assessment	Excellent, N (%)	Good, N (%)	Fair, N (%)	Poor, N (%)	Mean±SD
Preoperative	45 (100)	0	0	0	100±0
6 months postoperative	40 (88.9)	5 (11.1)	0	0	96.9±4
12 months postoperative	43 (95.6)	2 (4.4)	0	0	98.4±3

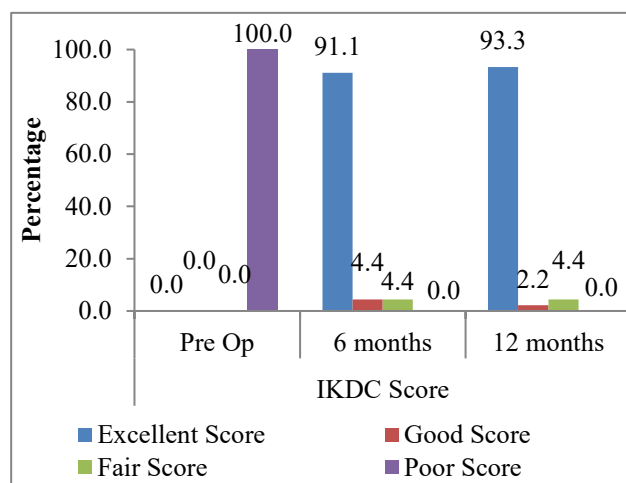
**Table 3: Donor ankle muscle strength assessment using MRC scale.**

Muscle action	Time of assessment	Grade 5, N (%)	Grade 4, N (%)	≤Grade 3, N (%)
Ankle eversion	Preoperative	45 (100)	0	0
	6 months postoperative	41 (91.1)	4 (8.9)	0
	12 months postoperative	41 (91.1)	4 (8.9)	0
First ray plantar flexion	Preoperative	45 (100)	0	0
	6 months postoperative	43 (95.6)	2 (4.4)	0
	12 months postoperative	43 (95.6)	2 (4.4)	0

**Table 4: Postoperative knee stability assessment following ACL reconstruction.**

Parameter	Preoperative, N (%)	6 months postoperative, N (%)	12 months postoperative, N (%)
Anterior drawer test – negative	0	43 (95.6)	43 (95.6)
Lachman test – negative	0	42 (93.3)	42 (93.3)
Pivot shift test – negative	9 (20.0)	45 (100)	45 (100)

Functional outcome assessment using IKDC score demonstrated marked improvement following surgery. Preoperatively, all patients had poor IKDC scores. At 6 months postoperatively, 91.1% of patients had excellent scores and 4.4% each had good and fair scores. At 12 months follow-up, excellent outcomes increased to 93.3%, with no patient remaining in the poor category. The mean IKDC score improved from  $60\pm 2.2$  preoperatively to  $96.5\pm 5.7$  at 6 months and  $97.5\pm 4.8$  at 12 months postoperatively, reflecting significant functional recovery of the knee joint (Figure 1).



**Figure 1: Functional outcome of the recipient knee assessed by IKDC score.**

## DISCUSSION

In our study, ACL reconstruction using PLT autograft resulted in excellent functional outcomes of the recipient knee with minimal donor ankle morbidity. Although hamstring tendon (HT) and bone–patellar tendon–bone (BPTB) autografts are widely used, their associated complications have prompted the search for alternative graft options. The PLT has gained attention due to its biomechanical properties, with studies demonstrating tensile strength and thickness comparable to the native ACL.

The majority of patients in our study were young adults aged 26–40 years (55.6%), with a male predominance (68.9%). Sports-related injuries were the most common mechanism of ACL rupture (60%), and isolated ACL tears were seen in 66.7% of cases, while 33.3% had associated meniscal injuries. These findings are consistent with previously published literature and reflect the typical epidemiology of ACL injuries in active populations.

Recipient knee outcomes in our study were highly satisfactory. At final follow-up, 91.1% of patients regained full range of motion, with a mean knee ROM of  $136\pm 4.71$  degrees. Six patients reported mild knee pain during strenuous activities, but none developed fixed flexion deformity or extension lag at one year. Good adherence to

postoperative physiotherapy was observed in a substantial proportion of patients, and early initiation of rehabilitation focusing on strengthening, proprioception, and gradual range-of-motion exercises played a crucial role in preventing postoperative stiffness and optimizing recovery.

Objective knee stability assessment demonstrated significant postoperative improvement. At final follow-up, the anterior drawer test was negative in 95.6% of patients and the Lachman test was negative in 93.3% of patients. The pivot shift test, which reflects rotational stability, was negative in 100% of patients postoperatively. These results are comparable to those reported by Kerimoglu et al, who also observed favorable stability outcomes following ACL reconstruction using the PLT autograft.<sup>12</sup>

Functional evaluation using IKDC score showed marked improvement in our study. Preoperatively, all patients (100%) had poor IKDC scores. At 6 months postoperatively, 91.1% achieved excellent scores, which further increased to 93.3% at 12 months. The mean IKDC score improved significantly from  $60\pm 2.2$  preoperatively to  $96.5\pm 5.7$  at 6 months and  $97.5\pm 4.8$  at 12 months ( $p < 0.01$ ). These outcomes are superior to those reported by Kerimoglu et al and closely comparable to the results of Khajotia et al and Agarwal et al.<sup>12-14</sup>

Donor ankle morbidity was minimal in our study. The mean AOFAS score remained high postoperatively, with scores of  $96.9\pm 4$  at 6 months and  $98.4\pm 3$  at 12 months compared to a preoperative score of  $100\pm 0$ , indicating preservation of ankle function. Muscle strength assessment using the MRC scale showed that 91.1% of patients retained grade V ankle eversion strength and 95.6% retained grade V first ray plantar flexion strength at final follow-up. No patient demonstrated eversion or plantar flexion power  $\leq$  grade 3. These findings are consistent with those reported by Rhatomy et al and Agarwal et al.<sup>4,14</sup> Patients with mild reduction in eversion strength were noted to be non-adherent to rehabilitation protocols, highlighting the importance of structured postoperative ankle rehabilitation. The study has certain limitations as it was conducted with a relatively small sample size at a single center and had a follow-up duration limited to 12 months, which restricts assessment of long-term outcomes. The absence of a comparative control group using other grafts limits direct comparison, and muscle strength evaluation was based on the MRC scale rather than objective dynamometric testing. Variations in patient adherence to postoperative rehabilitation may also have influenced functional outcomes.

## CONCLUSION

In our study, anterior cruciate ligament reconstruction using the peroneus longus tendon autograft resulted in excellent functional outcomes of the recipient knee with minimal donor ankle morbidity. At 12 months follow-up, 93.3% of patients achieved excellent or good IKDC scores,

with the mean IKDC score improving significantly from  $60 \pm 2.2$  preoperatively to  $97.5 \pm 4.8$  postoperatively ( $p < 0.01$ ). Objective knee stability was restored in the majority of patients, with negative anterior drawer and Lachman tests in 95.6% and 93.3% of cases, respectively, and a negative pivot shift test in 100% of patients. Donor ankle function was well preserved, with a mean AOFAS score of  $98.4 \pm 3$  at final follow-up, and grade V muscle strength maintained in 91.1% of patients for ankle eversion and 95.6% for first ray plantar flexion. These findings suggest that the peroneus longus tendon autograft is a reliable and effective alternative for ACL reconstruction, providing excellent knee stability and function without significant donor site morbidity.

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