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Functional and clinical outcome of arthroscopic primary single bundle anterior cruciate ligament reconstruction using peroneus longus autograft

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Abstract

Background: Peroneus longus tendon (PLT) autograft has emerged as one of the primary graft options for arthroscopic anterior cruciate ligament reconstruction (ACLR). We aimed to study whether PLT autograft could be used as primary graft for arthroscopic single bundle ACLR, without compromising stability of donor ankle.

Materials and Methods: A prospective observational study of 120 patients, who underwent single bundle arthroscopic ACLR with ipsilateral PLT autograft was done. Functional outcome of patients were evaluated with international knee documentation (IKDC) and Lysholm knee scores after one year. The donor ankle morbidity was assessed using American orthopedic foot and ankle score (AOFAS) and foot and ankle disability index (FADI) scores.

Results: The mean IKDC pre-op subjective score was 55.3 ± 10.7 and after one year follow-up was 91.4 ± 5.86. The mean difference of IKDC score between pre-op and post-op evaluation was 33.1 ± 11.4, with a p-value of <0.001. The pre-operative mean Lysholm score was 67.6 ± 10.8 and on follow-up after 1 year was 93.6 ± 6.3. The mean difference of Lysholm score was 25.1± 10.4, and p-value <0.001. The mean AOFAS score was 98.14 ± 3.16 and the mean FADI score was 98.37 ± 2.71 on one year follow-up.

Conclusion: The significant improvements in IKDC and Lysholm knee scores after using PLT autograft, makes it one of the graft choices for ACLR. The apprehension of donor ankle instability is mitigated by excellent AOFAS and FADI scores reported in the study. PLT is an ideal graft choice for arthroscopic primary single bundle ACLR.

Keywords: anterior cruciate ligament; peroneus longus tendon; autograft; arthroscopy; ACL reconstruction

Introduction

The anterior cruciate ligament (ACL), consisting of posterolateral and anteromedial bundles, stabilizes the knee joint. ACL tears occur in athletes as well as in non-athletes. Arthroscopic ACL reconstruction (ACLR) is the preferred treatment [1, 2]. Bone-patellar tendon-bone (BTB), Hamstrings, Quadriceps tendon & allografts are graft options for ACLR, each with its advantages and disadvantages [2, 3]. The graft selection for the ACL reconstruction have evolved over the years and is still a topic of debate. Most common postoperative complication is anterior knee pain, reported in up to 21.5% patients [4]. patients treated with BTB had a higher incidence (up to 72%) of postoperative anterior knee and kneeling pain compared to those treated with hamstring tendon (up to 44%) [5-7]. Increased isometric quadriceps weakness is seen with quadriceps tendon grafts. Hamstring weakness and reduction in isokinetic flexor strength was seen with hamstring grafts [8, 9]. Allografts have slower graft incorporation, higher rupture rates and concerns about disease transmission [10].

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Recently, peroneus longus tendon (PLT) autograft is used in some centres as a primary graft option for ACLR [11, 12]. Biomechanically peroneus longus tendon is as strong as native ACL and is superior to hamstrings [13, 14]. Since peroneus longus is one of the main evertors of ankle, there are concerns about ankle instability when using peroneus longus as graft.

The aim of present study was to determine whether peroneus longus tendon could be used as primary graft for arthroscopic single bundle ACL reconstruction, without compromising stability of donor ankle.

Materials and Methods

A prospective observational study was done at Government Medical college, Thiruvananthapuram during the period September 2019 to August 2021, after obtaining the Institutional Ethics Committee clearance (HEC.No. 08/08/2019/MCT). All consecutive patients with clinically and magnetic resonance imaging (MRI) confirmed ACL tear managed by arthroscopic ACL reconstruction with peroneus longus autograft were included in the study.

Inclusion criteria were- all patients in the age group 18-50 years, who underwent arthroscopic ACL reconstruction using peroneus longus tendon graft, and who gave informed consent. Exclusion criteria were- patients with associated bony or other ligamentous or tendon injuries or degenerative ligament injuries. Patients with meniscal injuries and patients who were lost to follow-up were also excluded.

There was 120 patients in the study. Lachman test, anterior drawer test and pivot -shift tests were done pre-operatively and post-operatively. All patients were subjected to post-operative anteroposterior and lateral radiographs to determine the tunnel placement and position of endobutton and interference screw. Patients were followed at 6 weeks, 6 months and 1 year and functional outcomes assessed using International Knee Documentation 2000 score (IKDC) and Lysholm knee scoring scale. The scores at 1 year were considered for final evaluation. The donor ankle stability was evaluated using American orthopedic foot and ankle score (AOFAS) and foot and ankle disability index (FADI) score.

Statistical analysis

Data were analysed using Statistical Package for Social Science(SPSS) software version 22 (IBM Corp; Chicago, USA). Pre-operative and post-operative functional outcome of patients were expressed as mean and standard deviation. Mean of the two were compared with independent sample t test. $P<0.05$ was considered significant.

Surgical procedure

All the patients in our study were operated under spinal anaesthesia in supine position. The following tests were done under anaesthesia – anterior drawer test, Lachman test and pivot shift test. Through standard anterolateral portal, diagnostic arthroscopy done. The peroneus longus tendon was harvested through a 2 cm incision given above and behind the lateral malleoli of the ipsilateral limb (Figure 1). Peroneal muscle tendon (longus and brevis) were identified and tenodesis of longus to brevis was done (Figure 2). Peroneus longus was harvested using a long tendon stripper (Figure 3). Incision was closed using absorbable subcutaneous sutures and skin staples. Preparation and Pre-tensioning of the harvested graft was done on a tendon board (Figure 4).

Figure 1: Incision and peroneus longus tendon identification.

Figure 2: Isolating peroneus longus and brevis for tenodesis.

Figure 3: Harvesting PLT graft with tendon stripper.

Figure 4: Preparation of the PLT graft.

The graft was then looped to constitute a quadrupled graft. Femoral fixation device (variable loop button) was attached to one end of the graft. Graft was passed through cylindrical sizers to determine the exact size of the quadrupled graft to be matched with the needed femoral and tibial tunnel. Single bundle ACL reconstruction was done with one tibial tunnel and one femoral tunnel with their centres corresponding to the centre of the native ACL tibial and femoral attachment sites respectively. The femoral tunnel was made using the anteromedial portal thereby creating an anatomic femoral tunnel position. The graft was fixed at the tibial side using bio-screw and at the femoral side using variable loop button.

Immobilisation in knee brace and limb elevation was done in the immediate post op period. Intravenous antibiotics were given post-operatively for 3 days. All patients were given the same ACL rehabilitation program. Partial weight bearing 50 to 75% with crutches for two weeks, Full weight bearing with crutches and knee flexion up to 90 degrees by 4 weeks. Full flexion and weightbearing without crutches by 6 weeks. Return to sports activities were advocated only after 6 months. Patients were followed at 6 weeks, 6 months and 1 year and functional outcomes of knee and ankle assessed.

Results

Total 120 patients were evaluated. Majority were in the age group of 20-25 (36%, N=44). The mean age was 27.1± 6.85. Males constituted 88% (N=106). Most common mode of injury was Road Traffic accidents (RTA) accounting for 55% (N=66). Sports related injury occurred in 37% (N=44). Right knee injury constituted 55% (N=66) (Table 1).

Pre-operatively, 8.3% (n=10) showed negative Lachman test. Those with positive Lachman, 36.7% (n=44) showed mild laxity, 45% (n=54) showed moderate laxity and 10% (n=12) showed severe laxity. Anterior Drawer test was positive in all pre-op patients. 31.7% (n=38) patients had negative Pivot shift test pre-operatively, while 51.6% (n=62) had grade-I, 13.4% (n=16) had grade-II and 3.3% (n=4) had grade-III positive Pivot shift tests. On final evaluation at one year, all patients had negative anterior drawer test. 95% (n=114) had negative Lachman test and 5% (n=6) showed positive Latchman with mild laxity. 98.3% (n=118) had negative pivot shift test after 1 year. 1.7% (n=2) had positive grade-1 pivot shift test (Table 2).

Table 1: Demography and complications.

Age	20-25	44 (36.7%)
	26-30	36 (30%)
	31-35	30 (25%)
	36-40	10 (8.3%)
Gender	Male	106 (88.3%)
	Female	14 (11.7%)
Mode of Injury	RTA*	66 (55%)
	Sports	44 (36.7%)
	Others	10 (8.3%)
Side	Right	66 (55%)
	Left	54
Complications	Superficial wound infection	2 (1.7%)
	Deep wound infection	0
	Neurovascular deficits	0

The highest post-operative mean IKDC subjective score of 92.4±1.6 was in 20-25 years age group. The age group 36-40 years showed the least mean IKDC subjective score of 79.7±3.2. The highest mean Lysholm score was in 20-25 age group (94.5±2.1). Age group 36-40 showed the least mean Lysholm score (86.1±4.2) (Table 3).

The mean IKDC pre-op subjective score was 55.3 ± 10.7 and after one year follow-up was 91.4 ± 5.86. The mean difference of IKDC score between pre-op and post-op evaluation was 33.1 ± 11.4, with a p-value of <0.001. The pre-operative mean Lysholm score was 67.6 ± 10.8 and on follow-up after 1 year was 93.6 ± 6.3. The mean difference of Lysholm score was 25.1± 10.4, and p-value <0.001 (Table 4).

The mean AOFAS score was 98.14 ± 3.16 and the mean FADI score was 98.37 ± 2.71 on one year follow-up (Table 5). Superficial wound infection was reported in 1.7% (n=2) patients at peroneus longus tendon harvest site. There were no deep infections.

Table 2: Clinical examination of knee.

Test	*Pre-operative*	*1 year post-operative*
Lachman test		
Negative	10 (8.3%)	114 (95%)
1+ (0-5mm, mild laxity)	44 (36.7%)	6 (5%)
2+ (6-10mm, moderate laxity)	54 (45%)	0
1+ (11-15mm, severe laxity)	12 (10%)	0
Anterior Drawer test		
Negative	0	120 (100%)
Positive	120 (100%)	0
Pivot shift test		
Negative	38 (31.7%)	118 (98.3%)
Glide (grade I)	62 (51.6%)	2 (1.7%)
Clunk (grade II)	16 (13.4%)	0
Gross (grade III)	4 (3.3%)	0

Table 3: Final post-operative scores according to age.

Score	*Age group*	*Mean score*
IKDC subjective score	20-25	92.4±1.6
	26-30	91.9±2.4
	31-35	88.9±4.1
	36-40	79.7±3.2
Lysholm knee score	20-25	94.5±2.1
	26-30	93.8±2.8
	31-35	91.5±3.6
	36-40	86.1±4.2

Table 4: Comparison of pre-operative and postoperative functional outcomes of knee.

Score	*Test time*	*Mean ± SD*	*Mean difference*	*p value*
IKDC	Pre-operative	55.3 ± 10.7	33.1 ± 11.4	<0.001
	1 year post-op	91.4 ± 5.86		
Lysholm	Pre-operative	67.6 ± 10.8	25.1± 10.4	<0l.001
	1 year post-op	93.6 ± 6.3		

Table 5: Functional assessment ankle on follow-up.

Test	*Range*	*Mean ± SD*
AOFAS	88.10 – 100.00	98.14 ± 3.16
FADI	87.30 – 100.00	98.37 ± 2.71

Discussion

In this study, most of the patients with ACL injury were young patients in the age group 20-30 years (66.7%, n=80). Most of injuries were due to RTA (55%, n=66) or sports injuries (36.7%, n=44). This explains the fact that males are more affected (88.3%, n=106) in the study. In the study by Rhatomy et al [13]; the mean age of patients was 26.70. Majority of injuries were sports injuries (69.3%) and only 8% due to RTA in their study. Males constituted 78.7% of patients, similar to present study.

Pre-operatively all the patients had positive anterior drawer test. On follow-up of one year, none of the patients had a positive drawer test. A positive Lachman test was elicited in 91.3% (n=110) patients pre-operatively, whereas only 5% (n=6) showed mild laxity post-operatively. Pivot shift test was positive in 68.3% (n=82) pre-operative. On post-operative follow-up only 1.7% (n=2), showed Grade-1 pivot shift test. Kumar et al and Ambrosi et al; in their studies showed similar results of improvement in Drawer, Lachman and Pivot shift tests after using peroneus longus tendon as graft [15, 16]. The IKDC score at final follow-up was greatest with the age group 20-25 years (mean 92.4±1.6), and least with 36-40 age group (mean 79.7±3.2). Similarly, the Lysholm score was greatest with 20-25 age group (mean 94.5±2.1) and least with 36-40 age group (mean 86.1±4.2). The results show that better results were achieved in younger patients, and are similar to other studies [17].

IKDC score improved from a pre-operative mean score of 55.3 ± 10.7 to 91.4 ± 5.86, on 1year follow-up. The mean difference was 33.1 ± 11.4, with a statistically significant p-value of <0.001. The Lysholm score improved from a pre-operative mean score of 67.6 ± 10.8 to 93.6 ± 6.3 on follow-up. The mean difference was 25.1± 10.4, which is statically significant (p-value- <0.001). Similar results were reported in previous studies [18, 19]. The significant improvements in IKDC and Lysholm scores after using peroneus longus tendon as autograft, makes it one of the graft choices for ACL reconstruction.

Functional assessment of donor ankle recorded a mean AOFAS score of 98.14 ± 3.16 (range 88.1– 100) and a mean FADI score of 98.37 ± 2.71 (range 87.3 – 100). Similar results were shown in the study by Rhatomy et al [19]. This shows that there was excellent ankle functions even after harvesting peroneus longus tendon. This may be due to the fact that the donor ankle has an intact peroneus brevis. Peroneus brevis has been found to be a more powerful evertor of ankle than peroneus longus [20]. Further, the distal part of peroneus longus

is sutured to the peroneus brevis in all cases. This may contribute some function of peroneus longus to the ankle, when the peroneus brevis is acting.

In addition, peroneus longus tendon is safe and easy to harvest since it is superficially placed. Also, peroneus longus tendon has superior biomechanical properties as described by Palmer et al [21]. Two (1.7%) had superficial wound infection at donor site which was treated with oral antibiotics. There were no cases with deep infections.

The limitations of the study are a small cohort and a short period of follow-up. Biases were minimized with surgery done by same surgical team, using same operative technique and by undergoing similar rehabilitation protocol in all patients.

Conclusion

The significant improvements in IKDC and Lysholm knee scores after using peroneus longus tendon as autograft, makes it one of the graft choices for ACL reconstruction. The apprehension of donor ankle instability after peroneus longus harvest is mitigated by excellent AOFAS and FADI scores reported in the study. Also, peroneus longus tendon is safe and easy to harvest since it is superficially placed. Peroneus longus tendon is an ideal graft choice for arthroscopic primary single bundle ACL reconstruction.

Conflicts of interest

Authors declare no conflicts of interest.

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