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Clinical and functional outcome of arthroscopic anterior cruciate ligament reconstruction with peroneus longus tendon graft

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Abstract

Background: Anterior cruciate ligament (ACL) injuries are exceedingly common. The psychological impact of such an injury can be quite devastating to the individual and should not be underestimated, particularly in the high-level athlete. Typically, an athlete will miss approximately six to nine months of competitive play as a result of the ACL injury.

Aim and Objectives: The aim of the study was to report on both knee, ankle and foot functions via evaluations using clinical examination, functional scores assessment and isokinetic tests after harvesting autogenous peroneus longus tendon for anterior cruciate ligament (ACL) reconstruction focusing on the donor site morbidity with a minimum 1-year follow-up period

Materials and Methods: This Prospective Study was conducted at a tertiary care centre in north kerala. 25 patients undergoing ACL reconstruction with peroneus longus tendon were included in the study. Patients with ACL injury undergoing reconstruction with peroneus longus tendon were followed up at, 6months and one year.

Discussion: Based on the this study, average KOOS score pre op was 76, at 6 months post op it was 85 and 90 at 12 months ($p<0.001$). Average IKDC score pre op was 62, at 6 months post op it was 76 and it was 83.12 at 12 months post op ($p<0.001$). Average Tegner Lysholm knee score pre op was 66.52, at 6 months it was 81 and at 12 month post op it was 85.64 ($p<0.001$).

Conclusion: We recommend peroneus longus may be used as a graft option in ACL reconstruction in the selected group of patients as it is easier to harvest, possess adequate graft thickness and have excellent post-operative knee outcome and ankle outcome scores.

Keywords: Anterior Cruciate Ligament (ACL), sports injuries, peroneus longus tendon

Introduction

ACL is the primary stabilizer against anterior translation of the tibia on the femur and is important in counteracting rotation and valgus stress. Anterior cruciate ligament deficiency leads to knee instability. Rupture of the ACL affects knee stability, resulting in giving way symptoms in daily and sports activities, increased risk of meniscal injuries, and early degeneration of the injured knee.

With an incidence of 25 to 78 per 1,00,000, anterior cruciate ligament injury is a common injury. Among them around a third undergo surgical reconstruction, which makes the procedure one of the common surgeries performed. Various different techniques are described for different steps in the procedure with no consensus on which is the better. The same exists for graft selection, patient / portal positioning, graft fixation and rehabilitation. Long term risk for degenerative arthritis exists both in operated and non-operated patients of ACL injury [1].

Nowadays, bone-patellar, tendon-bone or double-looped semitendinosus/gracilis autografts have become the most common graft choices for anterior cruciate ligament reconstruction. Although the patellar tendon has theoretical advantages, 40-60% of patients who have undergone arthroscopic anterior cruciate reconstruction using patellar tendon autografts have anterior knee problems. Recently, the quadrupled hamstring has become an increasingly popular alternative autograft, and recent reports indicate less graft harvest morbidity and improved device fixation. We all know that hamstrings have got synergistic action with ACL in the knee joint. Similarly majority of the ACL injuries have got some degrees of MCL laxity.

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Many of our cases the hamstring graft diameter is less than 8mm especially in women and short obese patients. We believe that use of hamstrings for ACL reconstruction removes the secondary stabilizer action of the hamstrings in ACL deficient knee leading to more loads on the newly reconstructed ACL. Also it removes the secondary valgus stabilizer in MCL injured knees [2].

We studied the use of autogenous peroneus longus tendon graft for arthroscopic ACL reconstruction. It is much easier to harvest peroneus longus and it provides a thicker graft. Clinical results of anterior cruciate ligament reconstruction with autogenous peroneus tendon graft have been reported in past. However, these studies had no complete evaluation of ankle morbidity in terms of validated scores. The purpose of the present study was to report on both knee ankle and foot functions via evaluations using clinical examination, functional scores assessment and isokinetic tests after harvesting autogenous peroneus longus tendon for Anterior Cruciate Ligament (ACL) reconstruction focusing on the donor site morbidity with a minimum 1-year follow-up period.

Materials and Methods

This Prospective Study was conducted in a tertiary care centre in north Kerala. The objective of the study was to assess clinical and functional outcome of ACL reconstruction with peroneus longus Tendon and to assess ankle & foot morbidity 25 patients undergoing ACL reconstruction with peroneus longus tendon were included in the study. Patients with ACL injury undergoing reconstruction with peroneus longus tendon were followed up at, 6months and one year. Outcome assessed with, KOOS (Knee Injury and Osteoarthritis scale) [3], IKDC [4] (International knee documentation committee) score, Tegner Lysholm scale [5] and American orthopedic foot and ankle score (AOFAS) [6], foot and ankle disability index (FADI) [7]. The strength of the ankle evertors and dorsiflexors were assessed using isokinetic strength testing on both normal and operated limbs after 1 year (with Humac Norm testing and rehabilitation system)

Surgical Technique

Anterior cruciate ligament reconstruction-autogenous peroneus longus tendon harvested by making an incision along the posterior border of the distal fibula, just above the superior peroneal retinaculum (Fig-1). The peroneus longus tendon was exposed on its posterolateral surface through the incision after carefully incising the fascia (Fig-1). The peroneus tendon was sutured with No. 2 of heavy nonabsorbable suture and cut with a scalpel. The released proximal tendon was then retrieved with a tendon stripper. The distal stump of the peroneus tendon was tenodesed to the peroneus brevis tendon using vicryl sutures (Fig-2). Skin incision was closed with No. 3-0 Nylon. Whip stitches were placed using the Bunnel criss-cross technique with a Fiber wire suture (Fig-3). The tendinous portion was made into a 'tube' by approximating both sides of the tendon using a running suture technique with a fiber wire suture. After harvesting and graft preparation, the triple or quadruple peroneus longus autograft was fixed to the femoral aspect with Endobutton cortical fixation technique and used an interference screw / metal screw for graft fixation at the tibial aspect [8] (Fig.4). Each patient was encouraged to stretch the affected ankle gently and actively from first day postoperatively and to perform gentle strengthening exercises with the use of a resistance band when the patient's ankle

reached a nearly full range of motion.

Results

24 (96%) patients were males and (4%) females (Figure-5). 13 (52%) had left side injury and 12 (48%) had right sided injury (Figure 6). 14 (56%) had isolated ACL injury, 2 had ACL with posterior horn of medial meniscus, 5 with bucket handle tear of medial meniscus, 2 patients had ACL with radial tear of medial menisci and 2 had ACL with posterior horn of lateral meniscus injury (chart-3). Youngest among them is 19 years old and the eldest was 42 years old. Majority of our patients were manual labors, office workers, none of them were professional sports person.

Mean KOOS score pre op was 76, at 6 months post op It was 85 and 90 at 12 months ($p<0.001$). Mean IKDC score pre op was 62, at 6 months post op it was 76 and it was 83.12 at 12 months post op ($p<0.001$). Mean Tegner Lysholm knee score pre op was 66.52, at 6 months it was 81 and at 12 month post op it was 85.64. ($p<0.001$). (Table -1)

On isokinetic test done at 12 month post op, peak torque of eversion on ankle mean was 15.16 NM on operated side when compared to 27.16NM on normal side ($p<0.001$). Mean of Peak torque on plantar flexion was 13.52NM on operated side and 21 NM on normal side ($p<0.002$), (At 30 degree/sec). (Table -2).

Mean work done per repetition in eversion was 8.76NM on operated side and 16.88NM on normal side ($p<0.001$). In plantar flexion 7.16 in operated side and 12.88 in normal side ($p<0.002$) (at 30 degree/sec) (Table -3)

Discussion

Anterior Cruciate Ligament injury is a common knee injury, and its reconstructive surgery done arthroscopically is a common knee procedure done by orthopedic surgeons. History of Anterior Cruciate Injury documentation dates from ancient civilizations. After the advent of modern medicine era and development of better surgical instruments and skill, open ACL reconstruction was done in the 18th and 19th century. In the 20th century technique of Arthroscopy was introduced and flourished. Parallel to the evolution of surgical techniques, various graft options and graft fixation options evolved. The gold standard for ACL reconstruction is BPTB graft (Bone-patellar tendon-bone graft) because of its strength, consistency, size of the graft, ease of harvesting and most importantly because of bone-to-bone healing within the tibial and femoral tunnel. Complications of bone patella tendon bone graft include patellar tendon rupture, loss of knee full extension, patellar/tibial fracture, quadriceps weakness, anterior knee pain, difficulty in kneeling and numbness due to injury to the infra-patellar branch of saphenous nerve. Hence it is to be avoided in patients whose occupation or lifestyle requires frequent kneeling [9, 10].

Based on our present study, average KOOS score pre op was 76, at 6 months post op It was 85 and 90 at 12 months ($p<0.001$). Average IKDC score pre op was 62, at 6 months post op it was 76 and it was 83.12 at 12 months post op ($p<0.001$). Average Tegner Lysholm knee score pre op was 66.52, at 6 months it was 81 and at 12 month post op it was 85.64 ($p<0.001$). There is significant improvement in knee outcome based on KOOS (knee injury and osteoarthritis outcome score), IKDC (International knee documentation committee) score and Tegner Lysholm knee scoring scale. The clinical outcomes of knee function after ACL reconstruction using peroneus longus tendon graft seemed to be excellent. Regarding the evaluation of post-operative donor site -ankle

morbidity, based on AOFAS (American orthopaedic foot and ankle score), FADI (foot and ankle disability index) score and isokinetic testing at 12 month showed there is no much deterioration of ankle score (AOFAS and FADI) but there was some deterioration of ankle eversion power and plantar flexion power based on isokinetic testing. Average FADI score pre op was 97.77, at 6 month post op it was 94.95 and at 12 month post op it was 95.52. (P-Value =0.086) Average AOFAS score pre op was 98.12 at 6 month post op it was 95.44 and at 12 month post op it was 96.4 (P-Value 0.091). Isokinetic done on both ankles at 12 month follow up showed the peak torque of eversion on ankle mean was 15.16 NM on operated side when compared to 27.16NM on normal side (p value < 0.001). Mean of peak torque on plantar flexion was 13.52NM on operated side and 21 NM on normal side (p value < 0.002). Mean Work done per repetition in eversion was 8.76NM on operated side and 16.88NM on normal side ($p < 0.001$). In plantar flexion, 7.16NM in operated side and 12.88NM in normal side ($p < 0.002$). These findings revealed excellent knee out come after ACL reconstruction with peroneus longus tendon graft and the ankle outcomes based on functional scores were also good but the power of ankle eversion and plantar flexion decreases based on isokinetic strength testing.

In Tanya Armour's ^[11] study, isokinetic evaluation of internal/external tibial rotation strength after the use of hamstring tendons for anterior cruciate ligament reconstruction, they found that use of autogenous hamstring tendons demonstrate weaker internal tibial rotation power postoperatively at 2

years when compared to the contralateral limb. Thus, use of hamstrings also leads to reduction in isokinetic strength on follow up similar to peroneus longus tendon.

As per S Rhatomye *et al.* ^[12], ACL reconstruction with peroneus longus autografts produces a functional score (IKDC, modified Cincinnati, Lysholm) comparable to that of hamstring autografts at a 1-year follow-up, with the advantages of larger graft diameter was seen as less thigh hypotrophy and excellent ankle function. Similar study Cao HB *et al.* in 2012 ^[13], they stated that harvesting peroneus longus has no effect on ankle joint, but they done ankle morbidity testing only by AOFAS score and no isokinetic was done. Also Kumar V. K *et al.* ^[14], they also assessed donor site morbidity by MRC grading only and no isokinetic or other clinical scores where used their conclusion was also similar that outcome are good based on knee scores and ankle MRC grading.

So we can recommend peroneus longus is a good autograft option for reconstruction in ACL reconstruction especially in multi-ligamentous injury where multiple grafts are required, MCL injury where hamstrings are synergetic to MCL, patients with thin hamstrings especially in females, revised ACL surgery and as a backup graft. At the same time, it is advisable to avoid certain group of patients like Active athlete/ sports person who need ankle pivoting movements, especially football/ badminton players, patients with previous ankle/foot injury and flat foot. Furthermore, we can harvest the graft with same instruments we use for hamstrings, so it's better to drape the ankle area while doing surgery.



Fig 1: Show The peroneus longus tendon was exposed on its posterolateral surface through the incision after carefully incising the fascia

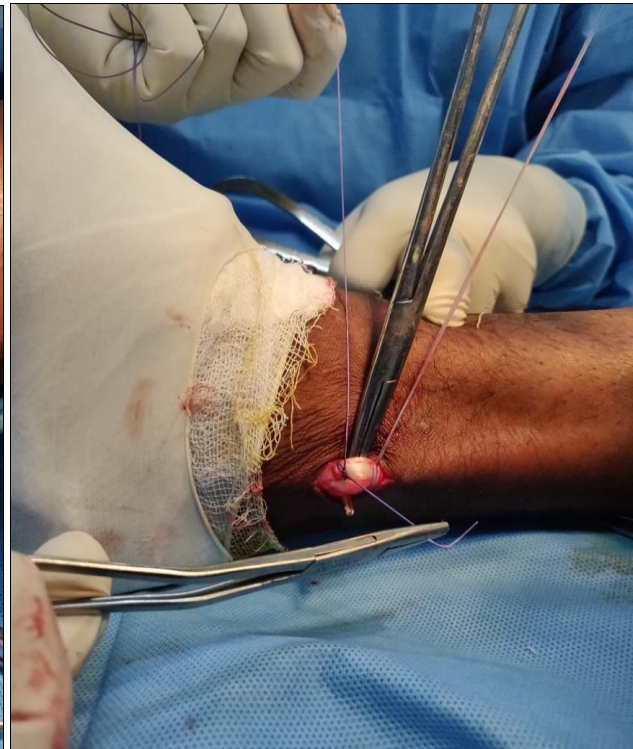


Fig 2: Show The peroneus tendon was sutured with No. 2 of heavy nonabsorbable suture and cut with a scalpel



Fig 3: Show Whip stitches were placed using the Bunnel criss-cross technique with a Fiber wire suture



Fig 4: Show Endobutton cortical fixation technique and used an interference screw / metal screw for graft fixation at the tibial aspect

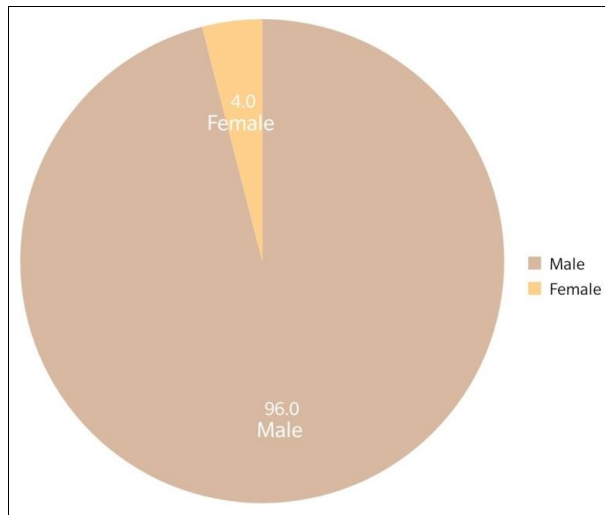


Fig 5: Show 24 (96%) patients were males and (4%) females

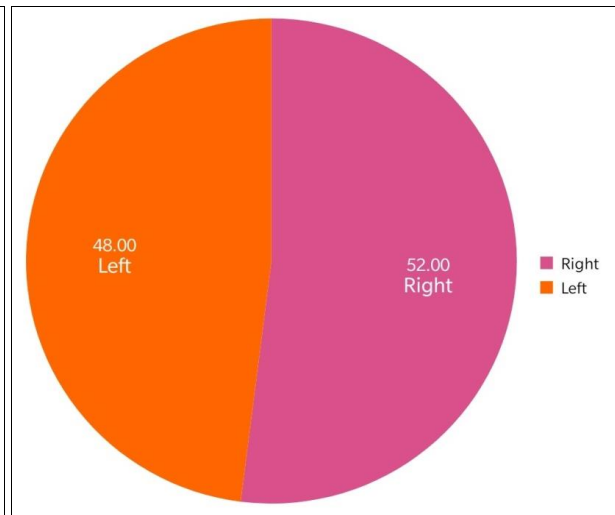


Fig 6: Show 13 (52%) had left side injury and 12 (48%) had right sided injury

Table 1: Descriptive (ANOVA test)

		N	Mean	Std. Deviation	Minimum	Maximum	p-value	Inference
Koos Score	Pre Op	25	76.264	9.72483	52	91.5	< 0.001	There exists significant difference
	6 months	25	85.752	7.23159	74	96.8		
	12 months	25	90.776	6.03789	78	99.2		
	Total	75	84.264	9.80574	52	99.2		
Ikdc Score	Pre Op	25	62.176	10.27644	44.8	82	< 0.001	There exists significant difference
	6 months	25	76.992	10.14684	56.8	88		
	12 months	25	83.12	9.31518	60.9	95.1		
	Total	75	74.096	13.19588	44.8	95.1		
Tegner Lysholm Knee Score	Pre Op	25	66.52	10.8594	48	81	< 0.001	There exists significant difference
	6 months	25	81	10.75484	62	96		
	12 months	25	85.64	10.41185	64	98		
	Total	75	77.72	13.34628	48	98		
Fadi Score	Pre OP	25	97.77	1.721	96	100	0.086	There is no significant difference
	6 months	25	94.956	2.1968	90	98		
	12 months	25	95.52	2.1817	90	98		
Aofas Ankle Scale	Pre Op	25	98.12	1.58955	96	100	0.091	There is no significant difference
	6 months	25	95.44	2.4144	88	98		
	12 months	25	96.4	1.4146	90	98		

Table 2: Isokinetic testing peak torque NM (30 degree/sec)

	GROUP	N	Mean	Std. Deviation	p-value	Inference
Eversion	Affected	25	15.16	3.32516	<0.001	There exists significant difference
	Normal	25	27.16	4.67868		
Planatar Flexion	Affected	25	13.52	2.69444	<0.002	There exists significant difference
	Normal	25	21	3.21455		

Table 3: Isokinetic testing-work per repetition (30 degree/sec)

	Group	N	Mean	Std. Deviation	P-Value	Inference
Eversion	Affected	25	8.76	2.52124	< 0.001	There exists significant difference
	Normal	25	16.88	2.68204		
Planatar Flexion	Affected	25	7.16	2.26716	< 0.002	There exists significant difference
	Normal	25	12.88	4.53982		

Conclusion

Based on our findings, we recommend peroneus longus may be used as a graft option in ACL reconstruction in a selected group of patients as it is easier to harvest, possess adequate graft thickness and having excellent post op knee outcome and ankle outcome scores. Though all patients were clinically asymptomatic at one year follow-up, it causes some donor site morbidity at ankle joint based on isokinetic strength assessment for ankle eversion and plantar flexion. So, it is advisable to avoid peroneus longus graft in patients whose vocation demands active ankle pivoting movements. It can be used as an alternative graft option for patients with multi-ligament knee injury, revision ACL/PCL cases, thin soft tissue graft diameter, MCL injury and as a backup graft.

Conflict of Interest

Not available

Financial Support

Not available

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