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FUNCTIONAL AND CLINICAL OUTCOME OF ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION USING A PERONEUS LONGUS GRAFT

Orthopaedics

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ABSTRACT

Anterior cruciate ligament (ACL) is a strong intra-articular but extra synovial ligament, it is attached anteriorly to the nonarticulating portion of the upper tibial surface in front of the intercondyloid eminence at the anterior attachment of the lateral meniscus. It is directed and backward to attach to the posterior aspect of the inner surface of the lateral condyle of the femur. The anterior cruciate ligament (ACL) is the most frequently injured knee joint ligament, and hence its satisfactory reconstruction is a matter of utmost importance. The use of peroneus longus tendon (PLT) autograft as an alternative to the conventional autograft is a recent development in the field of ACL reconstruction. A total of 20 cases with ACL injury were enrolled in the study and ACL reconstruction using Peroneus Longus tendon graft. It is a Prospective study of one-year duration. Finally, the functional and clinical outcomes were assessed based on the Lysholm knee score. The donor ankle was assessed using the American Orthopaedic Foot and Ankle Score (AOFAS). The mean Lysholm knee score at the end of 45 days follow-up up was70.1±1.63, at the end of 3 months was 77.4±1.174, at the end of 6 months was 83.5±0.707 and at the end of one year follow up of patient treated with PL tendon graft Lysholm score was 86.1±1.19(Excellent). The Mean AOFAS score was 94±1.60 (at final follow-up). Peroneus longus tendon provides an excellent option for ACLR and familiarity with its harvest and use would help in managing multi-ligamentous knee injury.

KEYWORDS

anterior cruciate ligament, peroneus longus tendon, autograft, donor site

INTRODUCTION

Anterior cruciate ligament (ACL) is a strong intra-articular but extra synovial ligament. It is attached anteriorly to the non-articulating portion of the upper tibial surface in front of the intercondyloid eminence at the anterior attachment of the lateral meniscus. It is directed and backward to attach to the posterior aspect of the inner surface of the lateral condyle of the femur.[1] The ACL is the most frequently injured knee joint ligament, and hence its satisfactory reconstruction is a matter of utmost importance. The management of ACL deficiency by anterior cruciate ligament reconstruction (ACLR) using the patient's tendon (autograft) is an extensively performed procedure.[2]

The autografts have been time-tested and consistently associated with good clinical results. The hamstring and the bone patella bone tendon grafts are the forerunners among the autografts with wide acceptability. The other autografts are quadriceps, patellar tendon, fascia lata, etc. Although these grafts are used commonly, disagreements regarding suitable graft choice persist because of some disadvantages.

The use of peroneus longus tendon (PLT) autograft as an alternative to the conventional autograft is a recent development in the field of ACL reconstruction. The advantages are that its strength and mean thickness is nearly the same as that of the native ACL. Removing the PLT does not affect the stability of the ankle.[3] The hamstring tendon has recently been known as a secondary stabilizer for the knee and hip joints, so when the hamstring muscles are weaker than the quadriceps muscles, there will be an imbalance in the movement of the flexor and extensor muscles which results in increased stress on the anterior cruciate ligament.[4]

The purpose of our study is to assess the functional and clinical outcome of ACL reconstruction using a peroneus longus tendon graft.

METHODOLOGY

The prospective study was conducted at the Department of Orthopaedics, RIMS Teaching Hospital Raichur, Karnataka, India. All patients presenting to the Department of Orthopaedics RIMS Hospital with Symptoms of ACL injury.20 consecutive ACL injury patients who come to RIMS from June 2022 to June 2023 and meet our inclusion criteria will be selected for the study. A total of 20 patients were enrolled in the study and followed up for one year.

Inclusion Criteria:

1. Age group 15-65 years.
2. Unilateral ACL injury.
3. Patient fit to undergo surgical procedure.
4. All patients who are willing to give informed consent and written consent for surgery.
5. Patients are willing for a minimum follow-up of one year.

Exclusion Criteria:

1. ACL avulsion fracture.
2. ACL and PCL injury.
3. Patients who are unfit for surgery.
4. Polytrauma.

A total of 20 patients are enrolled in the study, out of which 16 are males and 4 are females. On an acute ACL injury, before reconstruction surgery patient is treated with a knee immobilizer, and physiotherapy with goals of achieving near full range of motion, symmetric quadriceps strengthening, and decreasing joint effusion.

Surgical Technique:

Figure 1: PL tendon identified

The patient was positioned supine with the knee flexed to 90ºusing a footrest and side support. A thigh tourniquet was inflated throughout. PLT autograft was harvested from the ipsilateral ankle. a lateral surgical skin incision of about 2 cm taken over the posterior border of the distal fibula. Identified for the peroneus longus tendon (Figure 1).

The peroneus longus tendon was exposed on its posterolateral surface through the incision after carefully incising the fascia. cut made its distal end and with the help of tendon stripper peroneus longus graft harvesting was done. We did not follow the tenodesis of the distal cut end of the peroneus longus tendon. The incision was closed using absorbable subcutaneous sutures and skin suturing using non-absorbable sutures. Pre-tensioning of the harvested graft was done on a tendon board (Figure 2).

The graft was then looped to constitute a triple graft (Figure 3).

Graft was passed through cylindrical sizers to determine the exact size of the triple graft to be matched with the needed femoral and tibial tunnel (Figure 4).

Figure 2: Harvested PL tendon

Figure 3: PLT After Triple Folding

Standard arthroscopic ACL reconstruction steps were followed and portals were established and through which arthroscopic survey was done. Debridement of torn ACL done. The knee was flexed 70-90º, and then Femoral tunnel created depending upon the size of the graft (Figure 5) and tip of the tibial drill guide was placed into position through the anteromedial portal with the angle of drill guide set to 55º in all cases. The drill sleeve was placed against the medial tibial cortex, and a guide wire was drilled into place emerging at the tibial plateau.

Figure 4: Measuring PL tendon.

Figure 5: Femoral tunnel

A cannulated tibial reamer of the size as determined by the thickness of the harvested graft was used to make the tibial tunnel. Appropriate markings were made on the graft and was passed into the femoral tunnel through the tibial tunnel under arthroscopic guidance (Figure 6). We have used fixed ACL endo buttons and in few cases titanium and in few cases absorbable screw for tibial side aperture fixation.

Figure 6: Post ACL recon

Looked for tautness of ACL with probe. The knee joint was taken though the full range of flexion and extension (cycling of the knee joint up to 30 times) to remove any kinks in the graft. Patient was given antibiotics, analgesics and knee immobilizer. Post-operative x-ray was done to make sureproper placement of the tunnels and the position of the trans-fixation device (Figure 7 a & b).

Figure 7a: PLT graft with Bioabsorbable screw

Figure 7b: PTL graft with Titanium screw

Follow Up And Assessment

On postoperative day 1, continuous passive motion was initiated. Extension exercises (passive extensions, heel props, prone hangs and active assisted extension), flexion exercises (passive flexion and wall slides), quadriceps exercise (isometric contractions and straight leg raises), hamstrings exercise (curls), ankle exercises (dorsiflexion and plantar flexion, passive toe movements, inversion and version movement). Wound inspection was done on the third postoperative day and checked range of movement of knee and ankle. Postop day 6 patient was discharged with knee immobilizer, antibiotic, analgesics and advised to continue exercises at home.

Patients were reviewed on day 12, wound inspected and all sutures removed. Knee immobilizer was continued till one month post operatively. The following exercises were advised after 2 weeks: partial squats, toe raises, stationary bicycling, wall slides, hand assisted heel drags. In the period between 1st and 3rd post-operative month, knee immobilizer was discontinued. Tread mill was introduced (flat only). Leg curls, leg presses and outdoor bike riding on flat road was advised to the patient. After the third postoperative month, the following exercises were introduced: jogging, light running, leg raising with application of sandbags as counterweights, one and two leg jumping, swimming etc.

Clinical and subjective evaluation of the knee was done using Lysholm knee scoring scale at 45 days, 3months, 6 months and 1 year. Clinical

and subjective evaluation of the ankle was done using American Orthopaedic Foot and Ankle Society Score (AOFAS) (Figure8).

Figure 8: During follow up

Statistical Analysis

Statistical analysis was done by using SPSS (Statistical Package for Social Science) software (Version24.0). Comparison of preoperative data and post operative data was done using paired Student t-test and Chi-square test for inferential statistics. Mean, standard deviation, frequency and percentages were used for descriptive statistics. P-value of < 0.05 was considered statistically significant.

RESULTS

The demographic analysis of the present study is shown in Table 1.

Table 1: Demographic Analysis

Age group	28 - 35 years
Male Female	16 4
Right side knee Left side knee	12 8
Sports injury RTA Self fall	4 12 4

Peroneus longus graft harvested in the study ranged from 260-300 mm. The minimum length was 260 mm and maximum length was 300 mm. The mean length was 291.4 mm (Table 2).

Table 2: Length Of Peroneus Longus Tendon Graft

Length of graft (mm)	Patients	%
260 - 270	4	20
271 - 280	6	30
281 - 290	8	40
291 - 300	2	10

The mean thickness of the Peroneus longus graft obtained in this study was 8.5 mm. The maximum thickness of the graft was 9 mm and minimum thickness was 7 mm (Table 3).

Table 3: Thickness Of Peroneus Longus Tendon Graft.

Thickness of graft (mm)	Patients	%
7.5 - 8.0	10	50
8.1 - 8.5	6	30
8.5 – 9.0	4	20

- The follow up Lysholm knee score at 45 days, 8 patients had good score, 12 patients had fair score.
- The follow up Lysholm knee score at 3 months, 3 patients had excellent score, 10 patients had good score and 7 patients had fair score.
- The follow up Lysholm knee score at 6 months, 8 patients had excellent score, 9 patients had good score and 3 patients had fair score.
- Comparison between pre operative and post operative follow up Lysholm knee score at the end of 1 year listed below (Table 4).

The mean Lysholm knee score at the end of 45 days follow up was70.1±1.63, at the end of 3 months was 77.4±1.174 and at the end of 6 months was 83.5±0.707 and at the end of 1 year follow up of patient treated with PL tendon graft Lysholm score was 86.1±1.19 (Excellent).

Table 4: Lysholm Knee Scoring Scale

Grade	Pre OP		Post OP (1 Y)	
	Patients	%	Patients	%
Excellent (95 -100)	0	0	9	45
Good (84 – 94)	0	0	7	35
Fair (65 – 83)	6	30	4	20
Poor (< 64)	14	70	0	0
Total	20	100	20	100

- The follow up AOFAS score at 45 days, 12 patients had excellent score, 8 patients had good score.
- The follow up AOFAS score at 3 months, 13 patients had excellent score, 7 patients had good score.
- The follow up AOFAS score at 6 months, 16 patients had excellent score, 4 patients had good score.
- Comparison between pre operative and post operative follow upAOFAS score at the end of one year listed below (Table 5)

Table 5: AOFAS Scoring Scale

Grade	Pre OP		Post OP (1 Y)	
	Patients	%	Patients	%
Excellent (90 -100)	20	100	18	90
Good (80 – 89)	0	0	2	10
Fair (70 – 79)	0	0	0	0
Poor (< 69)	0	0	0	0
Total	20	100	20	100

The Mean pre op and post follow up at the end of one year AOFAS score was 100±0 and 94±1.60.

No patient experienced ankle joint dysfunction or difficulty in sports activities due to PLT graft transfer. There were no post operative infection in our study.

During follow up, clinically knee joint stability was assessed using Lachman test and anterior drawer test. Grades has been reduced compared to pre operative values. Lachman test showed normal finding in 16 patients (80%), while 3 patients (15%) had 1+ laxity and 1 patient (5%) had 2+ laxity.

DISCUSSION

ACL originates from posterolateral surface of the intercondylar notch (medial surface of the lateral femoral condyle) and inserts on the intercondylar eminence. Anteromedial bundle resists anterior translation of tibia in flexion, but the posterolateral bundleis the primary restraint to anterior tibial translation in extension and also contributing to rotatory stability.

The ACL is the most frequently injured knee joint ligament usually injured during road traffic accident and sports activities, in which forceful valgus and external rotation movement of knee is the most common mechanism and hence its satisfactory reconstruction is a matter of utmost importance. The autografts have been time tested and consistently associated with good clinical results. The hamstring and the bone patella bone tendon grafts are the forerunners among the autografts with wide acceptability. The other autografts being quadriceps, patellar tendon, fascia lata etc. Although, these grafts are used commonly, disagreements regarding suitable graft choice still persist because of some disadvantages. The most widely used BPTB autograft is associated with complaints of anterior knee pain and kneeling pain postoperatively.[5] Ameta-analysis of studies has shown an increased incidence of osteoarthritis in a BPTB autograft ACL reconstruction of knee.[6] We can have other option ACL reconstruction using Hamstring tendon autograft. Harvesting HT may be deleterious in postoperative rehabilitation of ACL reconstruction as HT protects the reconstructed ACL from anterior drawer force, which is exerted by the quadriceps.[7] It might also hinder active kneeFlexion.[8]

The hamstring tendon grafts have greater mechanical strength than a bone-patellar tendon-bone graft. Patients treated with hamstring tendon grafts are less likely to suffer patella/femoral pain and extension loss. Using the hamstring tendon can cause a significant change in hamstring muscle strength. Hamstring function is very important after ACL reconstruction in order to protect the reconstructed ACL from anterior drawer force, which is exerted by quadriceps contraction.[9]

The study conducted by *Rajani A.M. et.al.*[10] and they found that the mean diameter of the PLT graft after tripling was 9 mm and the average length before tripling was found to be 27.07 cm and The mean foot and ankle disability index was 94.8 % of patients had no laxity on clinical examination, and magnetic resonance imaging of all the patients at terminal follow-up showed good graft uptake. In our study we found

that the mean thickness of PLT graft after tripling was 8.5 mm and the average length before tripling was found to be 291.4 mm.

The study conducted by *Agrawal V. et.al.*[11] found that, the mean AOFAS score was 100±0.0 (preoperatively) and 96.0±9.6 (at final follow up). Nopatient experienced ankle pain and instability[11]. In our study we found that the that, the mean AOFAS score was 100±0.0 (preoperatively) and 94+1.60 (at final follow up).

The study done by *Vijay C. et.al.*[12] concluded that the Autologous peroneus longus tendon can be used as a graft of choice in anterior cruciate ligament reconstruction which showed promising results without compromising on the ankle function. Its usage as an alternative source of the graft may be more useful in multi-ligament injuries of the knee joint.

The study done by *Budhiparama N.C. et.al.*[13] found that the mean for the AOFAS-Hind foot Score in the peroneus longus group was 97.3 and they concluded that, the use of peroneus longus autograft in primary ACL reconstruction is a safe procedure with an excellent outcome. Peroneus longus tendon autograft can be recommended as an alternative graft in single-bundle ACL reconstruction. Further study of the functional outcome and knee stability evaluation is recommended.

The study done be *Kumar V. K et.al.*[14] found that Post operatively knee function (IKDC scoring) was rated as normal in 92% (23 cases). They concluded that the Peroneus longus is an appropriate autograft source for ACL reconstruction in view of ease of harvest, adequate size, cosmetically appealing, considering excellent post-operative knee scores. And removing the Peroneus longus tendon has no effect on gait parameters and does not lead to instability of the ankle. So, it can be used as an autogenous graft in orthopaedic surgeries.

The ligament laxity was assessed clinically, and not measured with the help of an arthrometer. The relatively small sample size may be the one of the drawbacks of this study but few studies with the same sample size showed good results.

CONCLUSION

Our study shows that ACLR using peroneus longus graft had excellent clinical and functional outcomes, no graft site morbidity, provided adequate intra operative graft length and thickness with no additional compromise of the native knee anatomy. Hence, Peroneus longus tendon provides an excellent option for ACLR and familiarity with its harvest and use would help in managing multi ligamentous knee injury.

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