

Functional outcome of arthroscopic reconstruction of anterior cruciate ligament tear using ipsilateral peroneus longus tendon autograft: A prospective study of 100 cases

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Citation this Article: Khajotia B.L., Kumar Manish, Lohiya Ramprakash, Mehra Chetan, Kumar Rakesh, “Functional outcome of arthroscopic reconstruction of anterior cruciate ligament tear using ipsilateral peroneus longus tendon autograft: A prospective study of 100 cases”, IJMSIR- May - 2023, Vol – 8, Issue - 3, P. No. 15 – 20.

Type of Publication: Case Study

Conflicts of Interest: Nil

Abstract

Background: The anterior cruciate ligament (ACL) is the most important in terms of stability and morbidity following Knee joint injury. The most preferred treatment of ACL tear nowadays, is by surgical reconstruction of the ligament by using an autograft in the form of a quadrupled Semitendinosus and Gracilis tendons (STG), a free Hamstring graft, a free ‘bone Patellar tendon bone graft’ (BPT) or a less commonly performed Quadriceps graft. Use of Peroneus Longus tendon (PLT) as an alternative to the conventional autograft is recent development in the field of ACL reconstruction.

Method: This prospective, observational study was performed in 100 cases of ACL Tear managed with

arthroscopic reconstruction using ipsilateral peroneus longus tendon autograft. The study was carried out in the department of Orthopaedics, Sardar Patel Medical College and associated group of hospitals, Bikaner. Total follow-up period was 1 Year.

Results: IKDC score final assessment at 1 year post operative all cases had normal and near normal and AOFAS was excellent in most of cases (96%). Ankle movement was comparable to the normal side.

Conclusion: Arthroscopic ACL reconstruction using peroneus longus autograft is a viable option given its strength, its thickness, its favorable outcome after reconstruction regards to the knee and the ankle.

Keywords: ACL Reconstruction, Peroneus Longus Tendon, Autograft, IKDC, AOFAS.

Introduction

The anterior cruciate ligament (ACL) is the most important in terms of stability and morbidity following Knee joint injury¹. The ACL is commonly damaged in forceful valgus – external rotation injury. Most commonly an acute ACL injury is associated with injury to lateral meniscus and a chronic ACL injury is associated with medial meniscus injury².

The most preferred treatment of ACL tear nowadays, is by surgical reconstruction of the ligament by using an autograft in the form of a quadrupled Semitendinosus and Gracilis tendons (STG), a free Hamstring graft, a free ‘bone Patellar tendon bone graft’ (BPT) or a less commonly performed Quadriceps graft³. Use of Peroneus Longus tendon (PLT) as an alternative to the conventional autograft is recent development in the field of ACL reconstruction. The advantages are

- 1) The strength of the PLT equals that of the native ACL⁴.
- 2) Mean thickness of the PLT is nearly same as that of the ACL⁵.
- 3) Removing the Peroneus Longus tendon (PLT) has no effect on gait parameters and stability of the ankle joint⁶.
- 4) Easy to harvest and harvest site is away from the knee joint.

Methods

This prospective, observational study was performed in 100 cases of ACL Tear managed with arthroscopic reconstruction using ipsilateral peroneus longus tendon autograft. This study was conducted after getting permission from the institutional ethical committee. The study was carried out in the department of Orthopaedics, Sardar Patel Medical College and associated group of hospitals, Bikaner between the period of July 2017 to June 2022. Total follow-up period was 1 Years.

Inclusion criteria

- Complete ACL rupture both acute and chronic with or without meniscus tear
- Functional instability at Knee Joint
- Age group 20 to 50 years both male and female

Exclusion criteria

- Bony avulsion of tibial spine with ACL
- ACL tear with posterior cruciate ligament (PCL) tear
- ACL tear with collateral ligament tear
- ACL tear with Compound Knee injury
- Neuromuscular disorder
- Osteoarthritis of knee joint
- Active infection in the knee joint
- Loss of motion in the knee joint that is secondary to adhesions and/or arthrosis.
- Patient with highly unrealistic expectations
- Patient who was unwilling to participate in the postoperative rehabilitation programme.

Patients randomly chosen according to the criteria mentioned above. Patients were considered for procedure once swelling and pain subsided. Until then brace was applied along with analgesics and Physiotherapy.

Surgical Techniques

The surgery was performed under spinal or epidural anesthesia. Before surgery, thorough examination of the injured knee was performed under anesthesia. Pneumatic tourniquet was applied on the thigh. Knee was hanging at 80-90 degrees from the edge of the table with its foot end attachment removed. Limb was prepared and draped in the usual manner under all aseptic conditions.

Standard anteromedial and anterolateral arthroscopic portals were established. Sheath with trochar was introduced in the joint with the knee in full extension and it was made sure that all structures of the knee joint were within the reach of the sheath. Survey of the knee was

performed starting from the suprapatellar pouch and then the medial gutter, medial joint space, intercondylar notch, lateral joint space and the lateral gutter in that sequence looking for synovitis, loose bodies, plicae, degeneration, meniscal tears, chondral defects etc.

Probing of ligaments was done to confirm tear. The intercondylar notch of the femur was prepared and medial wall of the lateral femoral condyle was debrided.

Graft harvest

After diagnostic arthroscopic confirmation of ACL tear. About 2 cm long incision was given above and posterior to the lateral malleolus of Ipsilateral limb. After identifying the Peronei muscles tendon (longus and brevis) just behind the lateral malleolus, both tendons were tied using vicryl sutures. Ethibond no. 5 was used to ligate the Peroneus Longus tendon. Peroneus longus tendon was cut to free it from the peroneus brevis muscle tendon. Peroneus Longus tendon was harvested using a long tendon stripper and graft placed in a solution containing gentamycin from where it was placed on a tendon board for graft preparation. Incision was sutured using Ethilon 2-0. Dressing was done along with compression bandage.



Fig. 1: Peroneus longus and brevis tendon identification



Fig. 2: Peroneus longus tendon is retrieved using a long tendon stripper after releasing it from peroneus brevis

Graft preparation

Removal of excess muscular tissue from tendon graft is performed, and unstable portions of the tendon are removed. Both ends of tendon was sutured using Ethibond no. 5 suture. The tendon is folded to effectively divide the tendon into 3 equal parts. One-third of the tendon is loaded in adjustable loop device and tied up with Ethibond used previously on end of tendon. Intermittent circular absorbable suture applied on tendon. Graft was passed through cylindrical sizers to determine the exact size of the triple graft diameter was to be matched with femoral and tibial tunnel reamers.



Fig. 3: Pre-Tensioning of the graft on tendon board
Femoral tunnel and tibial tunnel were made as per standard procedure. Triple layered Peroneus longus graft was pre-tensioned on tendon board and fixation done with the help of adjustable loop device.

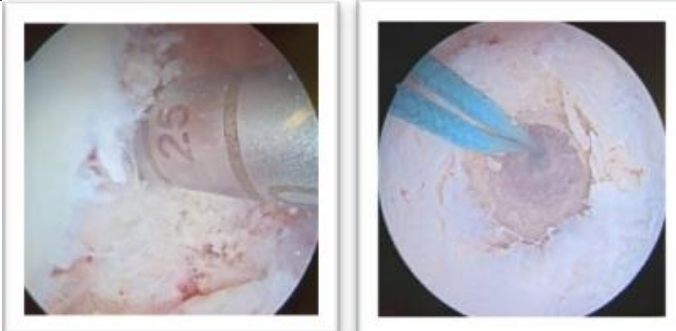


Fig. 4: Femoral tunnel preparation

Post-Operative Care And Follow UP

Active Toe Movement, Ankle Pump and Static Quadriceps contraction exercises was started as soon as spinal/epidural anesthesia effect wean off. Dressing was done on the second and eighth post-operative day. Suture removal done on 14th post operative day.

After discharge patient was recalled after 1 month, 1.5-month, 2-months, 3 month, 6 months and yearly for clinical assessment. Patients was asked to follow Rehabilitation Protocol stated below. Functional assessment was done at the end of 1 Year post operative using IKDC Score and AOFAS Ankle-Hindfoot score.



Fig. 5: Post operative Xray film

Rehabilitation Protocol:

Stage 1 (0- 2 weeks): Quadriceps Isometric exercise, Active and Passive Toe Movement, Ankle Pump up exercise, Knee flexion (closed chain), Heel props, Sleep in Brace locked in extension

Stage 2 (2-4 weeks): In addition to stage I exercises, SLR with knee brace, Hamstring Curls, Hip Adduction, abduction extension exercise

Stage 3 (4 -12 weeks): Brace to be discontinued after 1 month post operative. All exercises advised in 1st month will be continued in addition of Leg presses and Leg curls, Stationary Bicycling.

Stage 4 (12 -24 weeks): After 3rd post op month in addition to the exercises mentioned Jogging, Light running, One and two leg jumping and swimming also introduced.

Results

Most of patients (90%) having ACL injury were male. ACL Injury was seen in age group 20-30 years with 54% affection and mean age was 30.15 years. Mean duration of patients reported to the hospital after injury was 9.81 months. Road traffic injury was the most common mode of injury (54%) followed by sports injury (40%). Right knee was more frequently injured (70%) than the left knee (30%). Knee instability (giving way of the knee joint) was the most consistent symptom associated with tear of the ACL. About 28% patient reported all the symptoms but giving way was the common in all patients having ACL tear.

Lachman Test Grading	Pre-Operative Percentage	Post-Operative Percentage
Negative	0	52
1+	0	48
2+	24	0
3+	67	0
4+	09	0

Table 1: Pre and post Operative Lachman test

Pre-Operative Lachman Test grading 2+,3+,4+ in all case which was improved in all cases after ACL reconstruction negative to 1+.

During arthroscopic survey 78 cases accounted for mid substance ACL tear against 84 cases in MRI finding and 5 case accounted for tear from the tibia against 7 cases in MRI finding and avulsion from Femur site in 17 cases.

Arthroscopy showed almost same result in term of meniscus tear as of MRI and about half of the patient having medial meniscus tear and only 7 case (7%) having both meniscus injury.

Harvested graft from Peroneus longus tendon measured for length and thickness after removal of muscle fibres and observed that length of Peroneus longus graft was ranging from 8 to 11 cm. Mean length of triple layered graft was 9.62 cm. Femoral side thickness of peroneus longus triple layered graft was ranging from 7 to 9 mm and mean thickness was 8.18 mm. Tibial thickness of peroneus longus graft was observed ranging from 8.0 mm to 9.5 mm and mean thickness was 9.03 mm.

Final assessment was done at 1 year post operatively. According to IKDC score all cases had normal and near normal IKDC score at the end of 1 year post operatively and AOFAS on final assessment at 1-year post-operative was excellent in most of cases(96%). Ankle movement was comparable to the normal side.

Discussion

Anterior Cruciate Ligament has been realized to have an important role in maintaining the stability of the knee along with the other ligaments. Its rupture most commonly occurs during road traffic accidents or sports injuries.

Bone-patellar tendon-bone graft, Peroneus Longus tendon graft, Quadriceps tendon graft, Hamstring tendon autografts are commonly used as the graft sources, which graft is the most suitable has still been controversial.

Donor site morbidity has been reported following the application of autologous patellar tendon grafts including kneeling pain, tendon shortening, patellar

chondromalacia, patellar fractures, patellar tendon ruptures, patellofemoral pain syndromes and persistent quadriceps weakness.

Disadvantages of Quadriceps tendon graft include the same intraoperative and postoperative risks of Patellar fracture as are seen with BPTB graft and a decrease of up to 20% of quadriceps strength.

Using hamstring tendon caused an important alteration on the strength of the hamstring muscle. Although the primary function of the hamstring muscles is to flex the knee or to decelerate extension of the knee, the hamstring muscles also regulate rotation, and control anterior translation of the tibia. 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. Therefore, preservation of the hamstring muscle strength is of particular importance for athletes with ACL injuries. Harvesting the semitendinosus-gracilis tendons may impact on the functioning of active knee flexion.

Peroneus longus tendon protected dynamic support supplied from hamstring muscles to the reconstructed ACL. Knee joint complications involving patellar and hamstring tendon grafts in ACL reconstruction, PLT graft has been preferred. Biomechanically, PLT is as strong as native ACL. Noyes et al.⁷ reported that the maximum tensile load of ACL is 1725 N. PLT was preferred because of this biomechanical behavior. No extension or flexion loss and no patellofemoral pain was reported by our patients.

The mean **thickness of the triple layered peroneus longus graft** obtained in this study was 8.6 mm as compared to thickness of 7.5mm in **Kerimoglu's**⁴ study. The maximum thickness of the graft was 9.5 mm and minimum thickness was 7.5mm. In 44% (11 cases) graft of 8 mm thickness was harvested.

The Functional outcome was assessed by IKDC score and AOFAS. **Kerimoglu et al.**⁴ assessed final outcome by Lysholm criteria and IKDC score. **Angthong et al.**⁸ elucidated the outcome by using IKDC criteria.

According to the IKDC score 58% cases were rated as normal and nearly normal in 42% cases as against 17 cases(58.6%) out of 29 patients in the study conducted by **Kerimoglu et al.**⁴ No cases were rated as abnormal or severely abnormal in our study as against 12 cases(41.4%) as elucidated by **Kerimoglu et al.**⁴ This study showed mean IKDC score was 88.64 at 6 months postoperative compare to the study of **Angthong et al.**⁸ in which mean IKDC score was 58.6.

One patient developed **stiffness** of the knee joint which was mobilized under general anaesthesia 10 days post-operatively. One patient developed **mild effusion** of the knee joint at day 8 post operatively who was treated by aspiration. Culture sensitivity was sterile.

Light **crepitations** was identified in patella-femoral joint in 4 cases but no patella-femoral pain was reported. **Kerimoglu et al.**⁴ reported knee crepitations in 6 cases and they did not have any patella-femoral pain.

Reference

1. Arnoczky, S. P. Anatomy of the anterior cruciate ligament. Clin. Orthop. 19–25 (1983).
2. Smith, J. P. & Barrett, G. R. Medial and lateral meniscal tear patterns in anterior cruciate ligament-deficient knees. A prospective analysis of 575 tears. Am. J. Sports Med. 29, 415–419 (2001).
3. Freeman, J. & Kwansa, A. Recent Advancements in Ligament Tissue Engineering: The Use of Various Techniques and Materials for ACL Repair. Recent Pat. Biomed. Eng. 1, 18–23 (2008).
4. Kerimoğlu, S., Aynaci, O., Saraçoğlu, M., Aydin, H. & Turhan, A. U. [Anterior cruciate ligament

reconstruction with the peroneus longus tendon]. Acta Orthop. Traumatol. Turc. 42, 38–43 (2008).

5. Sakti, M. et al. Predicting the peroneus longus tendon autograft size in ACL reconstruction by using anthropometric parameters: A study in South Sulawesi population. J. Orthop. 22, 1–4 (2020).
6. Nazem, K., Barzegar, M., Hosseini, A. & Karimi, M. Can we use peroneus longus in addition to hamstring tendons for anterior cruciate ligament reconstruction? Adv. Biomed. Res. 3, 115 (2014).
7. Noyes, F. R., Matthews, D. S., Mooar, P. A. & Grood, E. S. The symptomatic anterior cruciate-deficient knee. Part II: the results of rehabilitation, activity modification, and counseling on functional disability. J. Bone Joint Surg. Am. 65, 163–174 (1983).
8. Angthong, C. et al. The Anterior Cruciate Ligament Reconstruction with the Peroneus Longus Tendon: A Biomechanical and Clinical Evaluation of the Donor Ankle Morbidity. 98, (2015).
9. Liu, C.-T., Lu, Y.-C. & Huang, C.-H. Half-peroneus-longus-tendon graft augmentation for unqualified hamstring tendon graft of anterior cruciate ligament reconstruction. J. Orthop. Sci. 20, 854–860 (2015).