

Comparison of Peroneus Longus Tendon Graft versus Bone-Patellar Tendon-Bone Graft in Anterior Cruciate Ligament Reconstruction

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ABSTRACT

Objective: To determine the effectiveness of peroneus longus tendon (PLT) graft versus bone-patellar tendon-bone (BPTB) graft in anterior cruciate ligament (ACL) reconstruction.

Methodology: It was a quasi-experimental study conducted in the Orthopedics Department of the Sharif Medical City Hospital, Lahore. After obtaining ethical approval, 30 patients were included in the study by a non-probability convenient sampling technique. Written informed consent was taken from all the patients. The patients were divided into two groups. Patients in group A were treated with an arthroscopic assisted bone-patellar tendon-bone graft and group B with an arthroscopic assisted peroneus longus tendon graft. Functional treatment outcomes were determined by the Cincinnati Knee Rating System (CKRS) and International Knee Documentation Committee (IKDC) scores, preoperatively, and 6 months after surgery. The data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 25.

Results: The operative time was less in group B (45 ± 10 min) as compared to group A (75 ± 15 min). Average graft thickness in both groups was almost similar with a relatively larger graft harvest in group B patients (8.4 ± 1.3 mm). There was no significant difference in CKRS and IKDC scores between the two groups, preoperatively, and after 6 months.

Conclusion: Peroneus longus tendon is the first-line, safe, and effective graft for anterior cruciate ligament reconstruction. The functional outcome of the peroneus longus tendon graft is comparable to that of the bone-patellar tendon-bone graft.

Keywords: Knee injury. Patellar tendon. Anterior cruciate ligament reconstruction.

INTRODUCTION

Anterior cruciate ligament (ACL) injury is the most common knee injury. The incidence of ACL rupture ranges from 30 to 78 per 100,000 person annually.¹ The ligament has no blood supply so it cannot heal itself. This leads to a significant physical and economic burden for patients and affects their quality of life. The anterior cruciate ligament prevents anterior displacement. It consists of two bundles twisted around in a spiral fashion and is attached from the anterior part of the tibial spine to the medial part of the lateral femoral condyle. It is usually injured by a rotating force.² Contact sports like football and squash are the most common sports involved in the injury of ACL. It can also be damaged by trauma especially road traffic accidents (RTA) involving twisting injury around the knee.¹

Anterior cruciate ligament tear frequently occurs in young adults with the age ranging from 16 to 39 years. Male patients are more frequently affected.³ Patients usually present with pain and swelling in the acute phase. Later on, they develop instability and locking of the knee.⁴ The torn ACL can be clinically diagnosed with certain knee examination techniques like Lachman and anterior drawer tests. However, the

diagnosis is confirmed by the use of magnetic resonance imaging (MRI).³

Surgical treatment is essential to maintain the blood supply. Surgery can be performed by open and arthroscopic methods. The most common method of ACL reconstruction is the utilization of a bone-patellar tendon-bone graft. It contains the distal portion of the patella, the central half of the patellar ligament, and the middle portion of the tibial tuberosity.⁵ This graft is usually considered the gold standard and the reconstructed graft has a strength of approximately 600 Newton. The graft, however, affects postoperative rehabilitation and can also result in weakness of the quadriceps.⁶ Other available options are quadrupled hamstring tendon graft using semimembranosus and gracilis tendons. This graft has the advantage of sparing the quadriceps but weakens the hamstring. The strength of the graft is also inferior compared to the bone-patellar tendon-bone graft.⁶ Peroneus longus tendon graft is taken from the lateral compartment of the leg and both the major muscle groups around the knee are spared. The eversion of the foot is not affected as there is the synergistic action of evertors with peroneus brevis. The sparing of quadriceps and hamstring results in earlier rehabilitation and earlier return to sports.⁷

Anterior cruciate ligament injury is frequently encountered in Orthopedics and its successful treatment is a great challenge for clinicians. Despite the availability of surgical treatment, the chronic pain and instability of the knee is a major cause of morbidity and affect the quality of life of the patients.⁴ Autografts can be taken from different muscles but still, there is a lack of consensus regarding the best graft for ACL reconstruction. This study was planned to determine

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the results of the peroneus longus tendon graft and compare it with the traditional bone-patellar tendon-bone graft in ACL reconstruction. It will help us to utilize peroneus longus tendon graft in the future for the reconstruction of ACL.

METHODOLOGY

It was a quasi-experimental study conducted in the Orthopedics Department of the Sharif Medical City Hospital, Lahore, after approval by the institutional ethical committee (Letter No: SMDC/SMRC/191-21, 08-06-2021). After obtaining ethical approval, 30 patients were included in the study by a non-probability convenient sampling technique. The patients with ACL injury for greater than 6 weeks were included in the study. The patients with a history of ankle trauma, recent steroid injection within 6 months, severe anemia, thrombocytopenia, and bleeding disorder were excluded from the study. The patients were divided into two groups with 15 patients in each group. Group A patients were treated with an arthroscopic assisted bone-patellar tendon-bone graft and group B with an arthroscopic assisted peroneus longus tendon graft. Spinal anesthesia was given to all the patients. Using the aseptic technique, under spinal anesthesia, the patients in group A were operated on by bone-patellar ligament graft. The surgery was done by arthroscope and the graft was secured by standard non-absorbable polyetheretherketone (PEEK) screws. Group B patients were operated on by harvesting the graft from a mini-incision above the lateral malleolus. Peroneus longus tendon graft was harvested by using a tendon stripper and the stump was tied with peroneus brevis using poly braided sutures. The graft was prepared by using a tensiometer and secured with the help of non-absorbable (PEEK) screws. All the patients were operated on by the same orthopaedic surgeon. After the

treatment, all the operated patients went through a 6 to 8 weeks rehabilitation program. Two scores, Cincinnati Knee Rating System (CKRS) and International Knee Documentation Committee (IKDC) were obtained preoperatively, and after 6 months to assess the functional outcome.

STATISTICAL ANALYSIS

The data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 25. Mean and standard deviation for quantitative variables such as age and CKRS score were calculated. The qualitative variables such as gender were represented by frequency and percentage. An independent t-test was applied to compare preoperative and postoperative CKRS and IKDC scores. The p-value ≤ 0.05 was taken as significant.

RESULTS

The present study included a total of 30 patients including 23(77%) males and 7(23%) females. The age range of the study participants was 23-34 years. The majority of the patients (57%) had a history of road traffic accident (RTA). Ten (33%) patients presented with ACL injury due to contact sports. Football (65%) and cricket (35%) were the major sports in these patients. Three (10%) patients presented with fall from ramps or stairs (Table 1).

The operative time in group B patients was less as compared to group A. Average graft thickness in both groups was almost similar and no significant difference was found when graft thickness in both groups was compared. There was no significant difference in CKRS and IKDC scores between the two groups preoperatively, and after 6 months (p-value=0.5630) (Table 2).

Table 1: Demographic Data of Study Groups

Demographic Variables		Group A	Group B
Age (Years)	Mean±SD	31±5	32±6
	Gender		
Frequency & Percentage	Male	12(40%)	11(37%)
	Female	3(10%)	4(13%)
Mode of Injury Frequency & Percentage	RTA	9(30%)	8(27%)
	Sports Injuries	4(13%)	6(20%)
	Fall	2(7%)	1(3%)

Table 2: Preoperative and Postoperative Functional Assessment of Study Groups

Study Variables	Group A	Group B	p-value
Preoperative			
CKRS	65.54±9.2	66.76±7.2	0.6890
IKDC	70±9.2	72.23±6.5	0.4497
Postoperative after 6 Months			
CKRS	89.67±7.04	93±5.7	0.1656
IKDC	88.7±6.1	89.43±4.6	0.7141
Mean Operative Time (min)	75±15	45±10	0.0001*
Mean Thickness of Graft (mm)	8.1±1.5	8.4±1.3	0.5630

*Significant p-value

DISCUSSION

Anterior cruciate ligament reconstruction is a very commonly performed surgery in Orthopedics. The surgery aims to restore the injured ACL as it does not heal itself.⁸ The choice of graft is the prime consideration in reconstruction surgery. An appropriate graft with careful tunnel placement provides adequate knee stability and helps to prevent reinjury.⁹ The most common grafts used for ACL reconstruction are bone-patellar tendon-bone, hamstring tendon, and peroneus longus tendon grafts. However, the harvesting of grafts is difficult and the risk of postoperative complications is high.¹⁰ Anterior knee pain and stiffness in the postoperative period are the most common postoperative complications.¹¹

In our study, 77% of patients were males and 23% were females, having an age range of 23-34 years. Another study reported that the age range of the patients with ACL injury was 18 to 36 years with 75% males and 25% females.¹² Our study reported that road traffic accident was the most common cause of ACL injury (57%), followed by sports (33%) and fall (10%). Similar results were reported in another study with RTAs as the most common cause of ACL injury (39.58%), followed by sports (35.41%), assault (14.5%), and domestic accidents (10.41%).¹²

In this study, we compared BPTB with PLT graft to repair the ACL injury. We found that the mean operative time was shorter when using PLT graft as compared with BPTB graft because the harvesting time of the PLT graft was less. Also, our study showed that the diameter of the PLT graft was 8.4 mm and BPTB was 8.1 mm. A study conducted by Joshi et al. showed similar results with less harvesting graft time (7.4 min) for PLT graft and the diameter of PLT graft was 7.9 mm with a range of 7 to 9 mm.¹² In another study, the diameter of the PLT graft was found to be 8.5 mm.⁷ A study by Rhatomy et al. indicated that the thickness of

peroneus longus tendon and hamstring grafts were 8.8 mm and 8.2 mm, respectively with a significant difference of 0.6.² Comparable results were found in the present study which indicated that the PLT graft is a better treatment option.

A study by Kumar et al. indicated that the peroneus longus graft is an appropriate autograft because it is easier to harvest. Also, it is of adequate size as well as cosmetically appealing and gives excellent postoperative knee scores.¹³

Another study showed that ACL reconstruction with PLT graft had a good IKDC score after 2 years of follow-up. So, it is a safe and effective option for reconstruction surgery of ACL injury.¹² Rhatomy et al. compared peroneus longus autograft to hamstring autograft in ACL reconstruction. The results showed no significant difference in IKDC and CKRS scores between the two groups preoperatively and at one year follow-up. However, PLT graft was associated with greater graft diameter, less hypertrophy of the thigh, and better ankle function.²

In another study, the patients with ACL injury underwent reconstruction with PLT and hamstring grafts. The IKDC and CKRS scores were not significantly different between the two groups. But as hamstring graft is associated with significant risks, PLT graft is a better option for ACL reconstruction.⁶ Saeed et al. reported that there was no significant difference in IKDC and the American Orthopedic Foot and Ankle Society (AOFAS) scores in the PLT and HT groups.¹⁴ A study conducted by Bi et al. determined the effectiveness of the single-bundle anterior half of PLT in ACL reconstruction. At the 2 year follow-up, the IKDC score improved from 52.0±8.27 to 94.2±2.61. The muscle strength of the patients in ankle eversion and plantar flexion was of grade 5 with the best functional scores and no complications.¹⁵

CONCLUSION

The peroneus longus tendon is the first-line, safe, and effective graft for anterior cruciate ligament reconstruction. The functional outcome of the peroneus longus tendon graft is comparable to that of the bone-patellar tendon-bone graft. But as compared to BPTB graft, PLT graft is associated with increased tensile strength, less operative time, increased diameter of graft, and no postoperative complications.

LIMITATIONS & RECOMMENDATIONS

Despite the PLT graft as the best treatment option for ACL injury, the choice of graft depends on various factors such as associated injuries, patient activities, co-morbidities, and postoperative rehabilitation plan. The association of these factors with PLT graft was not considered in our study. The follow-up period in our study was 6 months. Further studies with a minimum of 1 year follow-up are recommended.

REFERENCES

- Gans I, Retzky JS, Jones LC, Tanaka MJ. Epidemiology of recurrent anterior cruciate ligament injuries in National Collegiate Athletic Association Sports: the injury surveillance program, 2004-2014. *Orthop J Sports Med.* 2018; 6(6):2325967118777823. doi:10.1177/2325967118777823.
- Rhatomy S, Asikin AIZ, Wardani AE, Rukmoyo T, Lumban-Gaol I, Budhiparama NC. Peroneus longus autograft can be recommended as a superior graft to hamstring tendon in single-bundle ACL reconstruction. *Knee Surg Sports Traumatol Arthrosc.* 2019; 27(11):3552-9. doi:10.1007/s00167-019-05455-w.
- Diermeier T, Rothrauff BB, Engebretsen L, Lynch AD, Ayeni OR, Paterno MV, et al. Treatment after anterior cruciate ligament injury: panther symposium ACL treatment consensus group. *Orthop J Sports Med.* 2020; 8(6):325967120931097. doi:10.1177/232596712093107.
- Gerami MH, Haghi F, Pelarak F, Mousavibaygei SR. Anterior cruciate ligament (ACL) injuries: a review on the newest reconstruction techniques. *J Family Med Prim Care.* 2022; 11(3):852-6. doi:10.4103/jfmpc.jfmpc_1227_21.
- Ertogrul R, Sezer HB, Armagan R, Kanar M, Eren OT. Comparison of clinical outcomes after anterior cruciate ligament reconstruction with autogenous hamstring tendons and peroneus longus allograft. *Orthop J Sports Med.* 2017; 5(2 suppl 2):2325967117S00042. doi:10.1177/2325967117S00042.
- Kusumastutia AH, Rukmoyo T, Rhatomy S, Sakti YM. Anterior cruciate ligament reconstruction with peroneus longus tendon autograft: functional outcome and donor site morbidity. *Orthop J Sports Med.* 2020; 8(5 suppl 5):2325967120S000. doi:10.1177/2325967120S00084.
- Wiradiputra AE, Febyan Aryana GNW. Peroneus longus tendon graft for anterior cruciate ligament reconstruction: a case report and review of literature. *Int J Surg Case Rep.* 2021; 83:106028. doi:10.1016/j.ijscr.2021.106028.
- Sasetyo D, Rhatomy S, Pontoh LA. Peroneus longus tendon: the promising graft for anterior cruciate ligament reconstruction surgery. *AP-SMART.* 2017; 9:25. doi:10.1016/J.ASMART.2017.05.033.
- Decary S, Fallaha M, Belzile S, Martel-Pelletier J, Pelletier JP, Feldman D, et al. Clinical diagnosis of partial or complete anterior cruciate ligament tears using patients' history elements and physical examination tests. *PLoS One.* 2018; 13(6):e0198797. doi:10.1371/journal.pone.0198797.
- Raines BT, Naclerio E, Sherman SL. Management of anterior cruciate ligament injury: what's in and what's out? *Indian J Orthop.* 2017; 51(5):563-75. doi:10.4103/ortho.IJOrtho_245_17.
- Mohtadi NG, Denise S, Chan S. Return to sport-specific performance after primary anterior cruciate ligament reconstruction: a systematic review. *Am J Sports Med.* 2018; 46(13):3307-16. doi:10.1177/0363546517732541.
- Joshi S, Shetty UC, Salim MD, Meena N, Kumar RS, Rao VKV. Peroneus longus tendon autograft for anterior cruciate ligament reconstruction: a safe and effective alternative in nonathletic patients. *Niger J Surg.* 2021; 27(1):42-7. doi:10.4103/njs.NJS_22_20.
- Kumar VK, Narayanan SK, Vishal RB. A study on peroneus longus autograft for anterior cruciate ligament reconstruction. *Int J Res Med Sci.* 2020; 8(1):183-8. doi:10.18203/2320-6012.ijrms20195904.
- Saeed UB, Awan J, Manzoor B. Comparison of double peroneus longus with quadrupled hamstring in primary anterior cruciate ligament reconstruction. *J Pak Orthop Assoc.* 2021; 33(4):145-51. Available from: <https://www.jpoa.org.pk/index.php/upload/article/view/578/375>.
- Bi M, Zhao C, Zhang Q, Cao L, Chen X, Kong M, et al. All-inside anterior cruciate ligament reconstruction using an anterior half of the peroneus longus tendon autograft. *Orthop J Sports Med.* 2021; 9(6):2325967121991226. doi:10.1177/2325967121991226.

