

Comparison of bone-patellar tendon-bone graft and semitendinous-gracilis tendon graft among patients undergoing arthroscopically assisted anterior cruciate ligament reconstruction

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Objective: To compare the bone-patellar tendon-bone (BPTB) graft and semitendinous-gracilis (STG) tendon graft approaches in terms of post-surgery knee stability, knee functions, graft-site related morbidities and range of motion (ROM) among patients undergoing arthroscopically assisted anterior cruciate ligament (ACL) reconstruction.

Methodology: This prospective, open label, comparative trial was conducted at Department of Orthopedic Surgery, Lahore General Hospital, Lahore, from January 2019 to July 2020. A total of 60 patients (30 in BPTB group and 30 in STG group) undergoing single incision arthroscopically assisted ACL reconstruction adopting either BPTB or hamstring auto graft without extra articular augmentation were enrolled.

Results: Mean age of patients was 28.58 ± 6.18 years. Majority of the patients, 39(65.0%) had their

left side affected. Daily living activities were the most frequent 32(53.3%) mode of injury. No statistically significant difference was noted among patients in terms of clinical stability, ROM and general symptoms except patellofemoral pain at 6 months (PTB=26.7% vs STG=3%, $p=0.0114$) and graft site morbidity at 1 year (PTB=16.7% vs. STG=0%, $p=0.0200$).

Conclusion: Hamstring tendon and patellar tendon graft approaches were found to have similar outcomes in terms of clinical stability, ROM and pain. Hamstring tendon approach had significantly less chance of graft site morbidity as well as anterior knee pain during follow up. (Rawal Med J 202;46:94-97).

Keywords: Anterior cruciate ligament, bone-patellar tendon-bone graft, semitendinous-gracilis tendon graft.

INTRODUCTION

Anterior cruciate ligament (ACL) tear is known to be the commonest ligamentous injury related to knee joint.¹ ACL tears are estimated to account for 20% of knee injuries while data from USA shows 120000 ACL injuries every year.^{2,3} Deficiency in ACL can lead to knee instability which can further progress into recurrent injuries and raised chances of "intra-articular damage", specifically meniscus.⁴ Main objective of ACL reconstruction is the reinstate stability related to knee and bringing back daily routine activities. The "bone-patellar tendon-bone (BPTB)" and "hamstring tendon graft (HTG)" are the most frequently used autograft aiming reconstruction of ACL.

In the last couple of decades, arthroscopically assisted approaches have come out as commonly done methods aiming reconstruction of ACL.⁵ Not

much data is available regarding comparison of hamstring tendon autograft and patellar tendon autograft which can significantly help patients and surgeons choosing the better graft. Scarcity of data also exists regarding fictional outcomes following ACL reconstruction comparing BPTB and combined semitendinosus and gracilis hamstring tendon graft. Outcome of ACL reconstruction are linked to graft choice, surgeon's expertise and experience, appropriate graft positioning, selection of graft fixation and post-surgery rehabilitation.⁶ When compared with open reconstruction, elimination of capsular incisions, reduction in trauma to fat pad, evasion of dryness of articular cartilage, improved visualization of femoral attachments and less chances of post-surgery patella-femoral pain are some of the benefits of arthroscopically assisted anterior cruciate ligament reconstruction.⁷

However, arthroscopically assisted techniques are considered to have a long learning journey and needs technical expertise. The BPTB autografts have high success rate and are considered to be "gold standard" for ACL reconstruction but donor site morbidities along with extensor mechanism issues linked with BPTB are leading surgeons to consider hamstring tendon graft as another choice aiming ACL reconstruction.⁸ Not much work has been done in Pakistan to compare outcomes among arthroscopically assisted ACL reconstruction adopting PTB and semitendinous-gracilis (STG) tendon graft. So, we aimed this study evaluating post-surgery knee stability, knee functions, graft-site related morbidities and range of motion (ROM) comparing these two approaches.

METHODOLOGY

This prospective, open label, comparative trial was performed at Department of Orthopedic Surgery, Lahore General Hospital, Lahore, from January 2019 to July 2020. Approval from Institutional Ethical Committee was taken and written informed consent was sought from all participants. Diagnosis ACL tear was done by positive Lachman, anterior "Drawer and Pivot shift" test. All patients were otherwise healthy, experiencing knee instability in daily routine activities. Confirmation of ACL tear was done with pre-surgery MRI scan. All patients having contralateral ACL deficiency, bilateral ACL reconstruction, recurrent ACL surgery, past history of knee surgery, concomitant extra articular reconstruction and concomitant medical ailment and those having complex ligament injuries were excluded. Patients missing advised follow ups were also excluded.

Thirty patients underwent BPTB autograft while 30 were done STG. Type of graft tissue used for reconstruction among both groups were randomized. Randomization was done through lottery method. Knee brace was locked to grant 0 to 90° knee motions on the 2nd or 3rd post-surgery day and the patients were discharged. Weight bearing as per individual's tolerability was permitted using axillary crutches. Upon individual's own comfort and choice, complete weight bearing using support was permitted.

Fortnightly follow-ups were advised to all patients for the monitoring of wound and suture removal. Brace set to 0 to 120° at 4-weeks and removal was done at 6 weeks. Bicycling was permitted in around a period of 3 months while other strengthening exercises continued. Pivoting as well as side stepping was not allowed up until 9-months post-surgery.

Outcome testing was done by the end of 6 months and 1 year post-surgery. Supine ROM was measured using goniometer, effusion, joint line tenderness and patellofemora 1 crepitation. Associated complications were also noted. Stability testing comprised of Lachman test, anterior drawer test and pivot shift test. Ligamentous laxity was graded as 1+ (0 to 2 mm), 2+ (3 to 5 mm), 3+ (6 to 9 mm), 4+ (≥10 mm). Single legged hop for distance was taken for functional testing. Test was performed 3 times and average was considered. We used visual analog scale (VAS) scoring for pain.

Statistical Analysis: Statistical analysis was performed using SPSS version 26. P<0.05 was considered significant.

RESULTS

Out of a total of 60 patients, 49 (81.7%) were male and 11 (18.3%) female. Mean age was 28.58±6.18 years. Majority of the patients, 39 (65.0%) had their left side affected. Daily living activities were the most frequent 32 (53.3%) cause of injury (Table 1). No significant difference was noted among patients of both study groups (p>0.05).

Table 1. Characteristics of patients among both study groups.

Characteristics		Groups		P-Value
		PTB (n=30)	STG (n=30)	
Gender	Male	23 (76.7%)	26	0.6482
	Female	6 (23.3%)	5	
Age in Years, (Mean±SD)		27.41±7.5	29.04±8.1	0.4220
Side Affected	Right	12 (40.0%)	9	0.4168
	Left	18 (60.0%)	21	
Mechanism of Injury	Daily Living Activities	15 (50.0%)	17 (56.7%)	0.7691
	Road-Traffic Accidents	9 (30.0%)	9 (30.0%)	
	Sports Activities	6 (20.0%)	4 (13.3%)	

Table 2. Post-surgery outcome.

Post-Surgery Outcome	Groups		P-Value
	PTB (n=30)	STG (n=30)	
Performing Strenuous Activities at 1 years	24 (80.0%)	17 (56.7%)	0.0520
Knee Effusion at 6 Months	2 (6.7%)	2 (6.7%)	1
Extensor Lag < 3° at 6 months	22 (73.3%)	25 (83.3%)	0.3472
Extensor Lag < 3-5° at 6 months	10 (33.3%)	5 (16.7%)	0.1360
Extensor Lag < 3-5° at 1 year	3 (10.0%)	2 (6.7%)	0.6404
Lack of flexion 0-5° at 6 months	23 (76.7%)	25 (83.3%)	0.5186
Lack of Flexion 6-15° at 6 months	7 (23.3%)	4 (13.3%)	0.3168
Lack of Flexion 6-15° at 1 year	3 (10.0%)	2 (6.7%)	0.6404
ACL Laxity 3-5mm at 1 year	5 (16.7%)	2 (6.7%)	0.2276
Patellofemoral pain at 6 months	8 (26.7%)	1 (3.3%)	0.0114
Graft Site Morbidity at 1 year	5 (16.7%)	0 (0%)	0.0200
Single Leg Functional Hop Test at 6 months	19 (63.3%)	17 (56.7%)	0.5982
Single Leg Functional Hop Test at 1 year	25 (83.3%)	22 (73.3%)	0.3472

Post-surgery outcome among patients of both study groups showed no statistically significant difference among patients in terms of clinical stability, ROM and general symptoms except patellofemoral pain at 6 months (PTB=26.7% vs STG=3%, $p=0.0114$) and graft site morbidity at 1 year (PTB=16.7% vs. STG=0%, $p=0.0200$) (Table 2).

DISCUSSION

Interestingly, post-surgery graft site morbidity at one year was significantly lower among hamstring tendon group. Very similar to our findings, donor site related morbidities are the most frequently found drawback of BPTB graft as has been seen by previous researchers.⁹ We noted that all cases in the BPTB group had disturbance of anterior knee sensation that sustained for some duration but it turned to be normal within one year of follow-up

period in our study. Contrary to BPTB graft group, STG group patients had almost no sensory disturbance while they were also observed to have better cosmesis as well. Ravikumar et al comparing arthroscopically assisted ACL reconstruction found that 30% patients in the BPTB graft group had patellofemoral pain at 6 months follow up while none in the STG group.¹⁰

Razi et al comparing BPTB graft with STG graft among cases undergoing ACL reconstruction stated that at 3 year follow up period, 92% patient of BPTB groups had good to excellent "International Knee Documentation Committee (IKDC)" score while in STG group, it was 82%. No significant different in terms of IKDC score among two study was observed ($p>0.05$).¹¹ Beynnon et al, comparing outcomes of BPTB grafts with 2-strand hamstring grafts among patients undergoing ACL reconstruction, recorded that patients of BPTB graft group was superior in terms of knee laxity and pivot shift grading but both groups had comparable outcomes in terms of patient's satisfaction and knee functional outcomes.¹²

In the present study, we noted that 80% patients in the BPTB group were able to perform strenuous activities at one year post-surgery follow up in comparison to 56.7% in the STG groups, however, the difference could not reach statistical significance ($p=0.0520$). A meta-analysis by Yunes et al found that patients undergoing BPTB graft had 20% increased chances of attaining pre-injury activity level but overall, both (BPTB and STG) techniques were noted to have good outcomes.¹³ A recent review suggested that ACL reconstruction adopting BPTB was better for knee stability outcomes but was seen to have higher rates of post-surgery complications in comparison to STG.⁵ Our study had a comparatively shorter duration of follow up and comparatively small sample size so findings of this study cannot be generalized.

CONCLUSION

Hamstring tendon and patellar tendon graft approaches were found to have similar outcomes in terms of clinical stability, range of motion and pain. Hamstring tendon approach was found to be linked with significantly less chance of graft site morbidity as well as anterior knee pain during follow up.

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