

A Comparative Randomized Clinical Study of Arthroscopic Anterior Cruciate Ligament Reconstruction with Patellar Tendon and Hamstring Tendon Autologous Grafts

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ABSTRACT

Aim: To determine and compare differences in the results following arthroscopic anterior cruciate ligament reconstruction using patellar-tendon-bone (PTB) auto-grafts and hamstrings tendon auto-grafts.

Study design: Randomized controlled trial.

Place and duration: Department of Orthopedic Surgery, Shaikh Zayed Hospital Lahore from July 2019 to July 2021.

Methodology: This prospective study included 72 of total patients with clinical diagnosis of having anterior cruciate ligament (ACL) tear who did not have activities like a healthy person and wished to maintain a level of activity as it was before injury. Institutional ethical committee granted approval and a written informed consent was taken. Two groups of study population (patellar tendon and hamstring tendon) were formed. Lottery method was used for randomization of patients. Arthroscopic ACL reconstruction was done according to their respective groups. Patients of patellar tendon group (n=36) and hamstring tendon group (n=36) were under examination for 4 to 5 days and to grant 0 to 90° movement, knee brace was locked. Patients were questioned about their activities on follow up visits.

Results: No significant difference amongst patients of two groups was noted. 14 patients (38.9%) with PTB graft were unable to kneel on their knee as compared to 12 patients (33%) with hamstrings graft. Patients with BTB graft had similar difficulty in bending their knee as compared to the patients of the other group.

Conclusion: Patients from PTB graft group showed comparable results as compared to the hamstrings group in terms of strenuous activity, highest level of activity, rising from a chair and kneeling and squatting on functional outcomes.

Keywords: Anterior Cruciate Ligament, Patellar Auto-graft, Hamstring Auto-graft, Bone Graft.

INTRODUCTION

Anterior cruciate ligament is one of the major ligaments that play a role in stability of the knee joint. Its injury leads to time off work and sports but with focused rehabilitation and physiotherapy along with surgery, function of knee can be restored with rapid and complete return to activity. Recent advancements in investigations for example Magnetic Resonance Imaging (MRI) have led to the management of ACL injuries evolving from conservative to extra-capsular repair and primary tendon repair. The incidence of anterior cruciate injuries has increased lately with more and more professionals and amateurs opting for high-end athletics and sports. The mechanism of injury is a sudden stop or change in direction while playing sports.

Anterior cruciate ligament injuries account for about 20% of sports-related knee injuries. Globally, the estimated prevalence reported in literature ranges from 0.24 to 0.34 ACL injuries per 1,000 population year.¹ In 2018, USA reported 200,000 ACL injuries with half of those requiring reconstructive surgeries.² Without early surgery, these injuries predispose the intra-articular structures of knee joint to secondary injuries and early osteoarthritis as an inevitable, long-term sequel. Large cohort studies in both the Western world and Asian population have reflected upon the epidemiology of the ACL injuries and its relation with ethnicity, gender and certain sports. In Asia, due to lack of web-based registries and insurance policies, exact prevalence is not known. However, it is estimated that about 300,000 surgical ACL reconstruction surgeries are performed annually.³

After arthroscopic ACL reconstruction, it takes about 8 to 18 months for about 90% of the athletes to return to their desired sports, successfully.⁴ Traditionally, auto-grafts are used for ACL reconstruction however recent researches also accept allografts as alternative despite difference in rate of incorporation. Several auto-

grafts can be used for repair of ACL, each with its own merits, demerits and controversies. Its testing has shown that it satisfies the biomechanical need for helping patients return to their pre-injury level of activity. Nevertheless, BPTB grafts are also associated with certain complications for example pain, rotational instability, patellar fractures and subsequent donor site morbidity in as many as 10-20% of patients. Hamstrings tendons (HT) namely Gracilis and Semitendinosus tendons (GST) have been advocated as alternatives to BPTB grafts in order to avoid several complications associated with them. It has several advantages over BPTB graft such as decrease in donor site morbidity, reduced knee pain, smaller skin incision, no loss of extension and less scarring⁵.

The frequency of ACL reconstructions performed per year have increased markedly in the last two decades but there still remains a significant difference in the tendon graft choice by the surgeons⁶. Two of the most commonly used autogenous grafts are central third of the patellar tendon (bone-patellar tendon-bone) and the hamstring tendon (semitendinosus-gracilis) constructs. Possible complications of the preceding procedure include quadriceps muscle weakness, patella-femoral pain, patellar fracture and rupture of the patellar tendon⁷⁻⁹. Possible disadvantages of the second one include stiffness of lower side compared to patellar tendon graft or ACL^{8,10-12} and failure to achieve fixation to the bone¹¹⁻¹³.

There are numerous reports in literature about ACL reconstruction, only four randomized clinical trials studies explain comparison of patellar and hamstring tendon ACL reconstruction procedure¹⁴⁻¹⁶. One previous study, performed and published on national (Pakistan) level, assessed the use of Hamstring auto-graft for ACL reconstruction using open technique with a follow-up of 6 months which mainly focused on clinical parameters for example stability and range of motion¹⁷.

The aim of our study was to compare bone-patellar-tendon-bone graft with hamstrings tendon graft which is more widely used by orthopedic surgeons when repairing ACL.

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MATERIALS AND METHODS

This prospective study included 72 of total patients. Clinical diagnosis confirmed patients were included having ACL rupture who could not perform activities like a healthy person. Patients of patellar tendon group (n=36) and hamstring tendon group (n=36) were under examination for 4-5 days and to grant 0 to 90° movement; knee brace was locked. Patients were questioned about their activities on follow up visit. Patients, who didn't observe advised follow up, were also excluded. Institutional Ethical Committee granted approval and written consent was taken from all participants. Lottery method was used for randomization of patients.

Post-Operative Care: All patients were advised for a fortnightly follow up visit. Knee brace was set 0° to 120° at 4 weeks interval and it was removed after 6 weeks. After 3 months, bicycling was permitted and patients were advised to avoid side stepping until 9 months after surgery.

Testing of outcomes was carried out after 6 months and 1 year duration of surgery. Measurement of supine ROM was done by using effusion, goniometer, patella-femoral crepitation and joint line tenderness. Patients underwent routine clinical examination and other related complications were also noted down. Patients were questioned about their activities on follow up visits. IKDC (International Knee Documentation Committee) score was used for functional outcome of knee at 6 weeks, 3 months, 6 months and 1 year. Patients were asked about pain severity and a scale (IKDC) was set from 0 to 10 (10 being the most severe pain level).

RESULTS

Out of total 72 patients, 19 patients were of the age below 20 years. 14 patients were from age group 21-24. 15 patients from 25-28, 10 from 29-35 and 14 patients were from 36+ age group (Figure 1). Baseline demographics were set. Post-surgery outcome amongst patients of both study groups showed no statistically significant difference in terms of clinical stability, range of movement and general symptoms. 14 patients (38.9%) with BTB graft were unable to kneel on their knee as compared to the 7 patients (19.4%) with hamstring graft. Patients were asked about pain severity and a scale was set from 0-7 (7 being the most severe pain level). No significant difference among patients of two groups was noted (Table 1). Patients with BTB graft had more difficulties in bending their knee as compared to the patients of other group (Table 2). International Knee Documentation Committee (IKDC) Score (Table 3).

Table 1: Baseline demographics data

Age	Procedure type	
	Bone tendon bone graft	Hamstring graft
	27.1±10.3	28.7±9.4
	2.4±1.7	2.4±1.5
During the past 4 weeks, or since your injury, how often have you had pain?	0.0	4 (11.1%)
	1.0	9 (25.0%)
	2.0	9 (25.0%)
	3.0	1 (2.8%)
	4.0	10 (27.8%)
	5.0	2 (5.6%)
	7.0	1 (2.8%)
If you have pain, how severe is it?	3.3±1.7	2.9 ±1.8
	0.0	2 (5.6%)
	1.0	5 (13.9%)
	2.0	8 (22.2%)
	3.0	1 (2.8%)
	4.0	7 (19.4%)
	6.0	0 (0.0%)

Table 2: Post-surgical outcomes

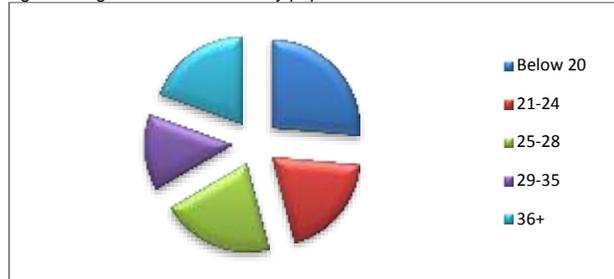
		Bone tendon bone graft	Hamstring graft
During the past 4 weeks, or since your injury, how stiff or swollen was your knee?	Extremely	1 (2.8%)	1 (2.8%)
	Very	0 (0.0%)	3 (8.3%)
	Moderately	8 (22.2%)	14 (38.9%)
	Mildly	22 (61.1%)	11 (30.6%)
	Not at all	5 (13.9%)	7 (19.4%)
What is the highest level of activity you can perform without significant swelling in your knee?	Unable to perform	1 (2.8%)	2 (5.6%)
	Light activities	16 (44.4%)	19 (52.8%)
	Moderate activities	12 (33.3%)	7 (19.4%)
	Strenuous activities	7 (19.4%)	5 (13.9%)
	Very strenuous activities	0 (0.0%)	3 (8.3%)
During the past 4 weeks, or since your injury, did your knee lock or catch?	Yes	0 (0.0%)	1 (2.8%)
	No	36 (100.0%)	35 (97.2%)
What is the highest level of activity you can perform without significant giving way in your knee?	Unable to perform	0 (0.0%)	3 (8.3%)
	Light activities	17 (47.2%)	16 (44.4%)
	Moderate activities	11 (30.6%)	11 (30.6%)
	Strenuous activities	8 (22.2%)	3 (8.3%)
	Very strenuous activities	0 (0.0%)	3 (8.3%)
What is the highest level of activity you can participate in on a regular basis?	Unable to perform	0 (0.0%)	2 (5.6%)
	Light activities	20 (55.6%)	17 (47.2%)
	Moderate activities	9 (25.0%)	11 (30.6%)
	Strenuous activities	7 (19.4%)	3 (8.3%)
	Very strenuous activities	0 (0.0%)	3 (8.3%)
Go up stairs	Unable to do	4 (11.1%)	5 (13.9%)
	Extremely difficult	6 (16.7%)	1 (2.8%)
	Moderately difficult	3 (8.3%)	13 (36.1%)
	Minimally difficult	14 (38.9%)	11 (30.6%)
	Not difficult at all	9 (25.0%)	6 (16.7%)
Go down stairs	Unable to do	4 (11.1%)	5 (13.9%)
	Extremely difficult	5 (13.9%)	2 (5.6%)
	Moderately difficult	4 (11.1%)	11 (30.6%)
	Minimally difficult	6 (16.7%)	13 (36.1%)
	Not difficult at all	17 (47.2%)	5 (13.9%)
Kneel on the front of your knee	Unable to do	14 (38.9%)	7 (19.4%)
	Extremely difficult	3 (8.3%)	5 (13.9%)
	Moderately difficult	0 (0.0%)	10 (27.8%)
	Minimally difficult	16 (44.4%)	11 (30.6%)
	Not difficult at all	3 (8.3%)	3 (8.3%)
Squat	Unable to do	14 (38.9%)	17 (47.2%)
	Extremely difficult	7 (19.4%)	5 (13.9%)
	Moderately difficult	4 (11.1%)	3 (8.3%)
	Minimally difficult	11 (30.6%)	9 (25.0%)
	Not difficult at all	0 (0.0%)	2 (5.6%)
Sit with your knee bent	Unable to do	6 (16.7%)	1 (2.8%)
	Extremely difficult	0 (0.0%)	0 (0.0%)
	Moderately difficult	3 (8.3%)	4 (11.1%)
	Minimally difficult	12 (33.3%)	5 (13.9%)
	Not difficult at all	15 (41.7%)	26 (72.2%)
Rise from a chair	Unable to do	0 (0.0%)	0 (0.0%)
	Extremely difficult	1 (2.8%)	3 (8.3%)
	Moderately difficult	4 (11.1%)	6 (16.7%)
	Minimally difficult	7 (19.4%)	6 (16.7%)
	Not difficult at all	24 (66.7%)	21 (58.3%)
Run straight ahead	Unable to do	11 (30.6%)	14 (38.9%)
	Extremely difficult	6 (16.7%)	7 (19.4%)
	Moderately difficult	2 (5.6%)	6 (16.7%)
	Minimally difficult	12 (33.3%)	2 (5.6%)
	Not difficult at all	5 (13.9%)	7 (19.4%)
Jump and land on your involved leg	Unable to do	17 (47.2%)	20 (55.6%)
	Extremely difficult	9 (25.0%)	6 (16.7%)
	Moderately difficult	8 (22.2%)	8 (22.2%)
	Minimally difficult	1 (2.8%)	1 (2.8%)
	Not difficult at all	1 (2.8%)	1 (2.8%)
Stop and start quickly	Unable to do	5 (13.9%)	9 (25.0%)
	Extremely difficult	5 (13.9%)	5 (13.9%)
	Moderately difficult	8 (22.2%)	10 (27.8%)
	Minimally difficult	0 (0.0%)	5 (13.9%)
	Not difficult at all	18 (50.0%)	7 (19.4%)
Couldn't perform	No limitation daily activities	9.8 ± 1.2	10.0
Cannot perform	No limitation daily activities	5.8 ± 2.1	5.7 ± 2.4

Table 3: IKDC Score Table

Age groups	n	IKDC score new	
		Mean	Std. Deviation
<= 20.0	19	54.63	14.97
21.0 - 24.0	14	49.67	15.76
25.0 - 28.0	15	47.51	12.53
29.0 - 35.0	10	40.46	16.04
36.0+	14	39.08	11.31

P value 0.020*

Figure 1: Age Distribution of study population



DISCUSSION

Ravikumar et al reported patellofemoral pain in 30% patients in the BTB graft group at 6 months follow up while none in the hamstring group comparing ACL reconstruction¹⁸. Razi et al gave a 3-year long follow up period and amongst the BTB group, 92% patients had good to excellent "International Knee Documentation Committee (IKDC)" score as compared to 82% in hamstring group. Regardless, no significant difference in terms of IKDC score amongst the two limbs of the study was recorded ($p > 0.05$)¹⁹. According to Beynnon et al, patients of BTB graft group were superior in terms of knee laxity and pivot shift grading but the two groups had comparable outcomes in terms of patient's satisfaction and knee functional outcomes⁹.

In our study, one-year post surgery follow-up was carried out to compare the both groups. 75% patients of the BTB graft group were able to perform strenuous activities in comparison to 51.6% in the Hamstring group ($p = 0.020$). Our study had a comparatively shorter duration of follow up and a smaller sample size hence findings of this study cannot be generalized. Further studies on reconstruction of ACL using different grafts will result in not only a comparison of the techniques helping orthopedic surgeons in adopting better grafts but also estimating incidence and prevalence rates of ACL injury in the country which so far have not been recorded.

CONCLUSION

Patients from PTB graft group showed comparable results as compared to the hamstrings group in terms of strenuous activity, highest level of activity, rising from a chair and kneeling and squatting on functional outcomes.

Conflict of interest: Nil

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