

## Original Research Article

# Comparative study of complications and final outcome between bone patellar tendon bone and hamstring autograft in ACL reconstruction

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## ABSTRACT

**Background:** The most common current graft choices in ACL reconstruction are the bone-patellar tendon–bone (BPTB) graft and the quadrupled Hamstring graft. Though BPTB is considered to be the gold standard; hamstring tendon (HT) grafts have increased in popularity over last decade. Our aim in this study is to assess the complications, comorbidities, difficulties and final outcome between BPTB and Hamstring grafts in ACL reconstruction.

**Methods:** 71 male patients with isolated tear of ACL between age group of 18-45 years were included in the study. 35 patients in group A underwent ACL reconstruction using bone patellar tendon bone autograft and 35 patients in group B were managed by reconstructing ACL using quadrupled Hamstring autograft. All the patients in both the groups were followed up at 08 weeks, 06 months and 01 year post surgery and evaluated by Lysholm knee scoring system.

**Results:** The Lysholm scoring scale scores in anterior cruciate ligament reconstruction showed that BPTB group and Hamstring group have similar outcome. One case (2.8%) each of patellar fracture and graft contamination occurred in BPTB group. There were 09 cases of superficial infection of which 03 were from BPTB group and 06 were from Hamstring group.

**Conclusions:** There is statistically no significant difference in the overall clinical outcome between bone-patellar tendon- bone and Hamstring autografts. With precise surgical techniques, meticulous attention to sterility and proper wound closure most of the complications in both the techniques can be minimized or avoided.

**Keywords:** Bone patellar tendon bone autograft, Hamstring autograft, ACL reconstruction

## INTRODUCTION

The most popular and successful surgical replacements for the anterior cruciate ligament have been biologic tissue grafts because of their potential for graft remodeling and integration into the joint. The most common current graft choices are the bone-patellar tendon-bone graft and the quadrupled Hamstring graft.<sup>1,2</sup> The bone-patellar tendon-bone graft has been popular replacement graft because of its high ultimate tensile load (approximately 2300 N), its stiffness (approximately 620

N/mm), possibility for rigid fixation with its attached bony ends and rapid incorporation into bony tunnel.<sup>3</sup> During the last decade, hamstring tendon (HT) grafts have increased in popularity as an alternative to the bone–patellar tendon–bone graft.<sup>4</sup> Though both the graft have their own advantage and pitfalls; BPTB graft have been associated with more morbidity and complications as compared to its Hamstring tendon counterpart.<sup>5-7</sup> Our aim in this study is to assess the complications, comorbidities, difficulties and final outcome in both procedures.

## METHODS

This prospective study is carried out at the tertiary care hospital of Indian Navy in Mumbai from May 2007 to July 2009 involving fighting fit soldiers with isolated tear of anterior cruciate ligament. Institutional approval was obtained from the institutional ethics committee prior to the initiation of the study. Initially 121 patients with clinical and radiological features of ACL deficiency were included in the study; however patients with meniscal tears requiring partial or total meniscectomy/repair were excluded from the study after confirming diagnosis at the time of arthroscopic evaluation. Thus 71 male patients with isolated tear of ACL between age group of 18-45 years were included in the study. Patients with multiligamentous injury, previous surgery in ipsilateral knee/hip and ankle were also excluded from the study. Patients were divided into two groups by computer generated random number table. 35 patients in group A underwent ACL reconstruction using bone patellar tendon bone autograft and 35 patients in group B were managed by reconstructing ACL using quadrupled hamstring autograft. 01 patient in group A had to undergo revision of procedure due to reinjury and hence kept out of the study. In group A titanium reverse cutting interference screws were used on both femoral and tibial side and in group B titanium endobutton on femoral side and suture disc on tibial side was used to fix the soft tissue graft. All the procedures were done arthroscopically by single surgeon. Same post-operative rehabilitation protocol was followed for all the patients. All the patients in both the groups were followed up at 08 weeks, 06 months and 01 year post surgery and evaluated by Lysholm Knee Scoring Scale method (Figure 1 and 2).



Figure 1: BPTB graft and implants.

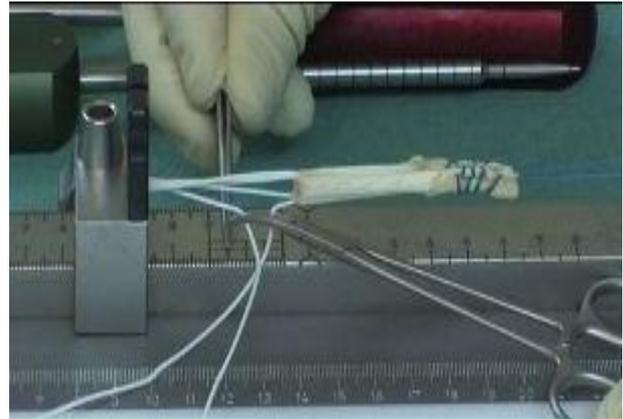


Figure 2: Hamstring graft.

### Statistical analysis

Data analysis was conducted on an intention to treat basis. Statistical analysis was done using SPSS windows software. Distributions of the gender, age, side of knee were assessed using SPSS windows software. Statistical difference between continuous variables was assessed using Student t-test. Categorical variables were compared using Chi square test. Statistical significance was set at P value of 0.05 or less.

## RESULTS

The mean age of patients (in years) in our study in hamstring tendon graft group was  $31.15 \pm 2.41$  and in bone patellar tendon bone (BPTB) graft group was  $31.00 \pm 2.53$ . The two groups were analyzed statistically and there was no statistical significance between both the groups ( $p=0.849$ ). Similarly there was no statistically significant difference between weight of the patients in both the groups ( $p=0.975$ ) and duration of symptoms till time of surgery ( $p=0.079$ ). Thus both the groups were comparable in these parameters (Table 1).

The average anterior cruciate ligament reconstruction surgery time in BPTB technique group was 54.89 minutes and of Hamstring technique group was 61.54 minutes. There was no statistically significant difference between them ( $p=0.4$ ). After a short learning curve, time taken for anterior cruciate ligament reconstruction for both procedures came down substantially. At the end of the study the operative time for both the procedures was nearly equal (Table 2).

Table 1: Demographic profile of the patients in both groups.

Groups	No. of patients	Mean age (years)	Mean weight (kg)	Duration of symptoms (months)
BPTB	35	$31.15 \pm 2.41$	$74.50 \pm 5.09$	$12.45 \pm 10.34$
HT	35	$31.00 \pm 2.53$	$74.45 \pm 4.77$	$7.90 \pm 4.09$
P value		0.849	0.975	0.079

**Table 2: Mean operative time in both groups.**

Group	Mean operative time in minutes	P value
A	54.89	0.4
B	61.54	

**Table 3: Complications in both groups.**

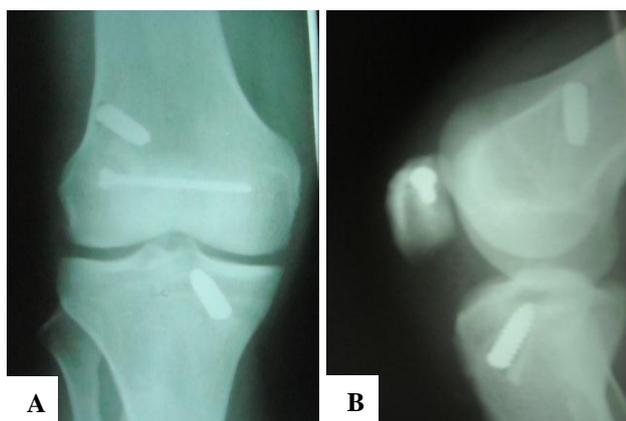
S. No.	Complications	BPTB group	Hamstring group	Total percentage (%)
1	Fracture patella	1	0	1.4
	% with in groups	2.8	0	
2	Graft contamination	1	0	1.4
	% with in groups	2.8	0	
3	Wound infection	3	6	12.7
	% with in groups	8.3	17.1	
4	Knee effusion	0	1	1.4
	% with in groups	0	2.8	

**Table 4: Comparison by Lysholm scoring system for both groups.**

S. No.	Lysholm score	At 06 months post-operative		At 01 year post-operative	
		Group A	Group B	Group A	Group B
1	Excellent (98-100)	8	07	12	10
2	Good to excellent (93-97)	19	18	19	20
3	Fair to good (82-92)	8	10	04	5
4	Fair (66-81)	0	0	0	0
5	Poor (<65)	0	0	0	0
<b>P value</b>		0.318		0.694	

**Complications**

There is potential risk of fracture of patella while harvesting BPTB graft especially in small hypoplastic patella. In our study there was intra-operative fracture of patella in one case (2.8%) which was fixed with transverse 4.5 mm screw and patient eventually did well after union of fracture (Figure 3).



**Figure 3 (A and B): Intra-operative patellar fracture fixed with 4.5 mm screw during BPTB technique.**

During anterior cruciate ligament reconstruction by bone patellar tendon bone technique the harvested graft accidentally fell on the floor in one case (2.8%). The graft

was thoroughly washed with the 4% chlorhexidine and immersed in the triple antibiotic solution for 30 minutes and rinsed with normal saline before fixation. This patient had an uneventful post-operative recovery.

One patient (2.8%) who underwent hamstring tendon auto grafting developed joint effusion post operatively. The patient was monitored regularly and settled gradually over 6 weeks.

Total of nine cases developed superficial wound infection. All of them settled with proper wound care and antibiotics. Of these three cases were bone patellar tendon bone technique group (8.3%) and six were hamstring quadruple autograft group (17.1%) (Table 3).

Both the BPTB technique and Hamstring technique groups were assessed at the end of 06 months and 01 year. The Lysholm scoring scale scores in anterior cruciate ligament reconstruction showed that BPTB group and Hamstring group have similar outcome. However in both the groups quadriceps wasting of 1-2 cms measured 15 cms above the superior pole of patella or at maximum girth site were found in 26 out of 35 patients i.e. 74.28% (Table 4).

**DISCUSSION**

The BPTB and Hamstring grafts (HT) are the most common currently used grafts for ACL reconstruction.

BPTB autografts have been used for years with excellent results at long term follow-up. BPTB autograft does have several disadvantages that have been described in the literature. First, the bone-patellar tendon-bone graft is a fixed length graft and, as such, is vulnerable to graft tunnel mismatch when tunnel length is not accordingly adjusted. Another well documented disadvantage of BPTB autografts is a higher incidence of anterior knee pain. BPTB grafts demonstrated a trend towards reduced extension strength. Patella fracture is another concern following ACL reconstruction using BPTB autograft.

The average operative procedure time in bone patellar tendon autograft group was 55 minutes and that of hamstring quadruple group was 62 minutes in our study. After a short learning curve, time taken for anterior cruciate ligament reconstruction for both procedures came down substantially. At the end of the study the operative time for both the procedures was nearly equal. Similar results were obtained by Hantes, Georgios et al in their study, average 9 minutes more time was required for harvesting of hamstring tendon and making quadruple graft with strong suture material.<sup>8</sup>

The risk of fracture with aggressive bone plug harvest in a small hypoplastic patella is high. Whenever an osteotome is used to lever a bone plug that has not been cut adequately, there is a potential risk of fracture of patella. This complication can be avoided with careful bone plug harvest keeping oscillating saw blade angle of approximately 30° to the centre and of 45° to sagittal cut. Excessive long and deep cuts (>6 mm) may create a stress riser that could lead to the fracture of patella either intra operatively or post operatively. The transverse 4.5 mm cortical screw fixation at fracture site gives stable fixation. Incidence of patellar fracture while harvesting patellar tendon is reported to be 0.2%-2.3%.<sup>9,10</sup> In our study it was found to be 2.8%, (one case) which was managed by fixation with 4.5 mm cancellous screw and healed well eventually.

The possibility of graft contamination is ubiquitous, regardless of the type of graft used and despite use of standard sterile procedures. Contamination usually is the result of human error, such as dropping the graft because of carelessness during transport. The graft should not be transported from person to person. In my study incidence of this complication was 1.4% i.e. 1 in 71 cases. Once the graft contamination occurs, the recommended treatment modalities are either alternative graft source/allograft or the sterilization technique of the graft using 4% chlorhexidine followed by a triple antibiotic solution. Hantes et al in their study found that the high rate up to (12%) of autograft contamination can be expected during autograft preparation for anterior cruciate ligament reconstruction. The contamination rate is almost equal for both bone-patellar tendon-bone and hamstring tendon autografts.<sup>8</sup>

Nine cases developed superficial wound infection. All of them settled with proper wound care and antibiotics. Of these three cases were from BPTB group technique and six were from Hamstring technique group. More number of Hamstring technique infections could be due to foreign body reaction to the ethibond suture used in the surgery. Kim HJ et al in their short study reported 7 cases (7.1%) of infection (5 deep and 2 superficial) in 98 cases of anterior cruciate ligament (ACL) reconstruction using hamstring autografts in a 17-month period.<sup>11</sup> Judd et al reported that hamstring grafts were associated with a higher incidence of infection. Soft tissue injuries involved in harvesting the tendons and creating a tibial tunnel and the use of an additional metallic post, washer, and braided sutures in subcutaneous position could be the causes of wound complications. With proper wound closure and burying of hardware under soft tissue sleeve may minimize this complication.<sup>12</sup>

The postoperative ROM was less in bone patellar bone tendon group in first two weeks. This improved gradually and was almost equal to the hamstring quadruple group after 8 weeks. This could be because of patellar tendon graft harvest site tissue morbidity. Similar results were found by Ian et al and Aglietti et al in their respective studies.<sup>13,14</sup>

Lysholm scoring scale scores showed that bone patellar tendon bone autograft and hamstring quadruple (Semitendinosus and gracilis) autograft in anterior cruciate ligament reconstruction have similar outcomes. 89.5% of the patellar tendon group and 85.7% of the hamstring tendon group had good to excellent scores on Lysholm Scoring Scale assessment. Similar results were found in many studies comparing the BPTB and hamstring tendon graft.<sup>13-15</sup>

Over all BPTB technique does have fewer complications intra-operatively which can be avoided with meticulous surgical skills. Long term follow-up and probably larger sample size may be needed to arrive at the conclusion.

## CONCLUSION

There is statistically no significant difference in the overall clinical outcome between bone-patellar tendon-bone autograft with interference screw fixation and quadrupled hamstring autograft with endobutton and suture disc fixation in ACL reconstruction. With precise surgical techniques, meticulous attention to sterility and proper wound closure most of the complications in both the techniques can be minimized / avoided.

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