Outcomes of Allograft Anterior Cruciate Ligament Reconstruction in Adolescent Patients

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INTRODUCTION:

A common complication of anterior cruciate ligament reconstruction (ACLR) is graft failure, with adolescent patients being at higher risk of rerupture compared to adults. Allograft ACLR has potential advantages over autograft, including decreased operative time and no donor site morbidity; however, numerous studies have demonstrated that allografts have an increased risk of rerupture. Despite this risk, there still may be a role for allograft reconstruction in select lower demand adolescent patients. Therefore, the purpose of this study was to compare clinical outcomes, complications, and graft failure rates in adolescent patients undergoing ACLR with bone-patellar tendon-bone (BPTB) allograft and autograft.

METHODS:

We performed a retrospective matched cohort study of skeletally mature patients <18 years old at time of surgery who received a BPTB allograft or autograft ACLR by a single orthopaedic surgeon at a metropolitan children's hospital from 2012 to 2020. Select patients were offered allograft if they did not intend to return to pivoting or cutting sports (Sports Classification Level I) and were willing to wait a full year prior to returning to lower-intensity sports. The BPTB autograft cohort was matched 1:1 based on age, sex, and follow-up time. The following were criteria for exclusion: skeletal immaturity, multi-ligamentous knee injury, prior ACL reconstruction on the same knee, concomitant realignment procedure, and <2 years of follow up. Patient demographics, injury characteristics, and surgical treatment data were collected. Patients were contacted via phone survey to obtain patient-reported outcomes and graft failure rates. Specific outcomes measures included SANE (Single Assessment Numerical Evaluation), surgery satisfaction rate, pain scores, Tegner Activity Scale, and the Lysholm Knee Scoring Scale. Independent samples t-test and Pearson's chi-squared were used for group comparison at a significance level of $p<.05$.

RESULTS:

Of the 68 patients who received a BPTB allograft, 40 met inclusion criteria, and n=28 (70%) were successfully contacted. Among the 456 patients who received a BPTB autograft during this timeframe, 40 were matched, and n=26 patients (65%) were successfully contacted. Table 1. depicts demographic and injury characteristics data for the ACLR cohorts. One patient (3.6%) in the BPTB allograft cohort had a rerupture four years after surgery and underwent revision around that time. Two (7.7%) of patients in the autograft group required manipulation under anesthesia (MUA) and arthroscopic lysis of adhesions for arthrofibrosis following their initial surgery. Table 2. depicts outcome measures in the two cohorts.

DISCUSSION AND CONCLUSION:

Graft failure rate was 3.6% in patients receiving a BPTB allograft, which was not statistically different than the 0% rate observed in our BPTB autograft cohort. Furthermore, there were no differences in patient-reported outcomes between the allograft and autograft cohorts. There were two complications in the BPTB autograft group requiring additional surgery (lysis of adhesions for arthrofibrosis) whereas there was one patient who required revision ACL surgery in the allograft group. These findings may support the use of BPTB allograft in select lower demand adolescent patients; however, more data is needed to determine appropriate indications for this graft choice.

Table 1. Demographics and Injury Characteristics in BPTB Allograft and Autograft Cohorts

(± SD or %)	BPTB Allograft (n=28)	BPTB Autograft (n=26)	Total Cohort (n=54)	p-value
Demographics				
Age at Surgery	16 ± 1.1	16 ± 1.3	16 ±1.2	.74
Sex (Female)	24 (86)	24 (92)	48 (89)	.44
Height (m)	1.6 ± .08	1.6 ± .09	1.6 ± .08	.95
Weight (kg)	70 ± 16	63 ± 14	67 ± 15	.12
BMI (kg/m^2)	27 ± 5.7	24 ± 3.6	25 ± 4.9	**.04**
Primary Injury Characteristics				
Mechanism (Sport)	24 (86)	25 (96)	49 (91)	.19
Laterality (Right)	14 (50)	14 (54)	26 (52)	.77
Meniscal Tear Requiring Treatment	19 (68)	17 (65)	36 (67)	.85
Chondral Injury Requiring Treatment	0 (0)	0 (0)	0 (0)	.99
Postoperative Follow Up (months)	53 ± 20	54 ± 22	54 ± 21	.82

Significant at p<.05; BPTB = bone-patellar tendon-bone, BMI=body mass index, SD = standard deviation

Table 2. Clinical Outcomes and Graft Failure Rates

(± SD or %)	BPTB Allograft (n=28)	BPTB Autograft (n=26)	Total Cohort (n=54)	p-value
Outcomes				
Graft failure	1 (3.6)	0 (0)	1 (1.9%)	.33
SANE Score (-/100)	91 ± 6.6	93 ± 7.7	92 ± 7.1	.51
Surgery Satisfaction (-/10)	9.8 ± .64	9.7 ± .53	9.8 ± .59	.77
Pain Score (-/10)	1.0 ± 1.8	1.0 ± 1.8	1.04 ± 1.8	.99
Tegner Score (-/10)	5 ± 2	6 ± 2	5 ± 2	.21
Lysholm Score (-/100)	94 ± 5.7	94 ± 8.6	94 ± 7	.62

Significant at p<.05; BPTB = bone-patellar tendon-bone, SD = standard deviation