Clinical Outcomes of Combined Anterior Cruciate and Anterolateral Ligament Reconstruction Versus Isolated Anterior Cruciate Ligament Reconstruction With Bone-Patellar Tendon-Bone Autograft as a Gold Standard: A Matched-Pair Analysis of 2018 Patients

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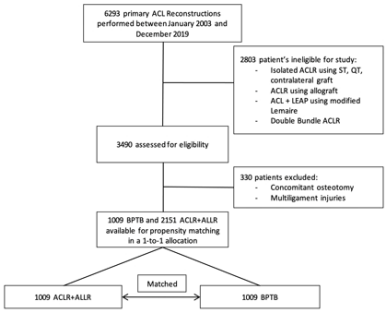
INTRODUCTION:
Bone-patellar tendon-bone autografts (BPTB) are widely considered the gold standard for anterior cruciate ligament reconstruction (ACLR) especially in young, athletic patients. These beliefs are widely held even though numerous meta-analyses have failed to reliably confirm that BPTB is the optimum graft choice. However, it is increasingly recognized, due to numerous comparative studies, that adding a lateral extra-articular procedure confers significantly lower graft rupture rates than isolated ACLR. The aims of this study were to compare the clinical outcomes following “gold standard” ACLR with a BPTB autograft versus ACLR combined with an anterolateral ligament reconstruction (ALLR) using hamstring tendon autografts (HT), in a large series of propensity matched patients. The hypothesis was that combined ACLR+ALLR reconstructions would confer better graft rupture rates and lower non-graft rupture related re-operation rates than isolated ACLR with BPTB
METHODS:
A retrospective analysis of prospectively collected data was performed. Patients undergoing combined ACLR+ALLR using HT between January 2003 and December 2019 were propensity matched in a 1:1 ratio to patients undergoing isolated ACLR using BPTB. Propensity matching was performed based upon the following criteria: age at the time of surgery, gender, body mass index, participation in pivoting sports, participation in contact sports, and the pre-injury Tegner score. At the end of the study period rates of graft rupture, contralateral knee injury and any other re-operations or complications that occurred following the index procedure were identified by database interrogation, review of medical records and standardized telephone interview. It was anticipated that there would be significant differences in the duration of follow-up between the groups due to a larger proportion of patients undergoing combined reconstructions toward the latter part of the study period. For that reason, statistical techniques that are unaffected by any differences in durations of follow up between groups were used to evaluate graft survivorship, re-operation free survivorship and the significance of potentially important risk factors. Specifically, Kaplan Meier survivorship analyses and Cox-proportional hazards models were used because both evaluate time to event data and are independent of the overall duration of follow up.
RESULTS: The study flow is reported in Fig 1. A total of 1009 matched pairs were included. The mean duration of follow-up was 101.3 ± 59.9 months. Kaplan Meier Analysis demonstrated a significantly better graft survivorship in the ACLR+ALLR group when compared to the BPTB group at every time point assessed (Fig 2 and 3). The Cox model demonstrated that patients in the BPTB group were > 3-fold more likely to experience graft failure than those in the ACLR+ALLR group (Hazard Ratio (HR) = 3.554 [1.744;7.243], p = 0.0005). Patients aged less than 20 years were at particularly high risk of graft rupture (HR = 5.65 [1.834;17.241], p = 0.0002) and further analysis of this subgroup demonstrated that isolated ACLR with BPTB also conferred a > 3 fold increased risk of graft rupture in young patients when compared to ACLR+ALLR. Multivariate analysis did not identify any other significant risk factors for graft rupture. Overall, there was a significantly higher reoperation rate following isolated ACLR (BPTB group 20.5%, ACLR+ALLR group 8.9%, p < 0.0001). This finding was accounted for by significantly higher rates of graft rupture (9.9% vs 3.5%, p <0.0001), cyclops syndrome (3.3% vs 1.5%, p <0.0001), and secondary meniscectomy (5% vs 2.9%) in the BPTB group. The overall rate of subsequent contralateral ACL injury was 9.1% for both groups (BPTB 10.2% vs ACLR+ALLR 8.0%, p = 0.09) indicating that second ACL injury risk profiles for both groups were similar.
DISCUSSION AND CONCLUSION:
Patients who underwent isolated ACLR with BPTB autografts experienced significantly worse ACL graft survivorship and overall re-operation free survivorship when compared to those who underwent combined ACLR+ALLR with hamstring autografts. The risk of graft rupture was more than 3-fold higher in patients who underwent isolated ACLR using BPTB.



	BPTB (n=1009)	ACLR + ALLR (n=1009)	Analyzed Population (n=2018)	p-value
Graft survivorship at 24 months, % and 95% CI	95.7 [94.3 - 96.8]	98.4 [97.4 - 99.0]	97.1 [96.2 - 97.7]	**< .0001** (Log-Rank test)
Graft survivorship at 48 months, % and 95% CI	92.9 [91.1 - 94.3]	96.9 [95.6 - 97.9]	94.9 [93.8 - 95.8]	**< .0001** (Log-Rank test)
Graft survivorship at 65 months, % and 95% CI	91.4 [89.5 - 93.0]	96.2 [94.7 - 97.3]	93.7 [92.5 - 94.7]	**< .0001** (Log-Rank test)
Graft survivorship at 96 months, % and 95% CI	90.3 [88.2 - 92.0]	94.9 [91.9 - 96.8]	92.8 [91.5 - 94.0]	**< .0001** (Log-Rank test)
Graft survivorship at 120 months, % and 95% CI	89.4 [87.2 - 91.2]	94.9 [91.9 - 96.8]	91.9 [90.3 - 93.2]	**< .0001** (Log-Rank test)
Graft survivorship at 144 months, % and 95% CI	89.0 [86.8 - 90.9]	94.9 [91.9 - 96.8]	91.5 [89.9 - 92.9]	**< .0001** (Log-Rank test)