# Risk of Revision and Reoperation after Anterior Cruciate Ligament Reconstruction: Comparison of Quadriceps Tendon, Bone-Patellar Tendon-Bone, and Hamstring Autografts in a US-based Cohort Study of 19,960 Patients

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INTRODUCTION: There remains controversy with the optimal graft choice for anterior cruciate ligament reconstruction (ACLR), especially with the gaining popularity of quadriceps tendon (QT) grafts. The Danish Registry published a comparison of QT with bone-patellar tendon-bone (BPTB) and hamstring tendons and found a higher risk of revision with QT grafts. A subsequent study by the same group reported no differences when two low volume hospitals were eliminated. Understanding the risk of revision and reoperation associated with graft type is important since graft choice is modifiable risk factor. The purpose of this study was to evaluate risk for subsequent surgical outcomes, including revision and reoperation, for a cohort of primary ACLR patients according to autograft selection.

METHODS: Data from a US healthcare system's ACLR registry was used to conduct a cohort study. Primary isolated autograft ACLR patients were identified (2012-2020); those with prior procedures in the same knee were excluded. The exposure of interest autograft type: QT, BPTB, and hamstring tendons. Multivariable Cox proportional hazard regression models were used to evaluate the risk for revision and risk for reoperation within 3-years follow up according to autograft selection. Age, body mass index, gender, race/ethnicity, American Society of Anesthesiologist's classification, activity at the time of injury, prior contralateral ACLR, lateral meniscus injury, medial meniscus injury, femoral fixation method, femoral tunnel drilling technique, average annual surgeon volume, operative time, and operative year were considered as covariates in regression analysis; models also included a cluster term for operating surgeon to account for correlation of ACLR performed by the same surgeon. Hazard ratios (HR) and 95% confidence intervals are reported. Two-sided tests were calculated with $p<0.05$ the threshold for statistical significance.

RESULTS:

The study sample comprised 19,960 ACLR performed by 280 surgeons at 51 hospitals. QT, BPTB, and hamstring autograft were used in 733 (3.7%), 8578 (43.0%), and 10,649 (53.3%) ACLR, respectively. The **Figure** presents the cumulative incidence of revision (left panel) and reoperation (right panel) during follow up by graft type; number of patients still at risk for each year of follow up is presented along the x-axis.

In adjusted models, no significant differences were observed in revision risk (HR=1.52, 95% CI=0.83-2.80, p=0.177) or reoperation risk (HR=1.00, 95% CI=0.63-1.59, p=0.742) within 3-years follow up when comparing QT ACLR to BPTB ACLR. Additionally, no differences in 3-year revision (HR=0.89, 95% CI=0.46-1.74, p=0.742) or reoperation (HR=1.21, 95% CI=0.74-1.99, p=0.442) risks were observed when comparing QT ACLR to hamstring ACLR. BPTB were noted to have a significantly lower risk of revision (HR=0.68, 95% CI=0.52-0.89, p=0.006) compared to hamstring tendons but no difference in risk of reoperation (HR=1.24, 95% CI=0.95-1.65, p=0.113).

DISCUSSION AND CONCLUSION: The results of this large multicenter study using data from an ACLR registry found no difference in the risk of revision or reoperation when QT was compared to BPTB or hamstring autograft with the numbers available, but did find a 1.5 times higher risk of revision when hamstring tendon autograft was compared with BPTB autograft. Surgeons may use this information when choosing the appropriate graft for ACLR in their patients.