Patient and Operative Risk Factors for Subsequent Surgical Intervention following Primary Anterior Cruciate Ligament Reconstruction: A Cohort Study of 41,976 Patients

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INTRODUCTION: Using data from a US-based multicenter healthcare system, we sought to identify patient and operative factors that associated with subsequent surgical reintervention after primary anterior cruciate ligament reconstruction (ACLR).

METHODS:
Data from a US healthcare system's ACLR registry was used to conduct a cohort study. Primary ACLR patients were identified (2009-2020); patients with a diagnosis of osteoarthritis prior to their ACLR were excluded. Patient factors considered included age, body mass index (BMI), gender, race/ethnicity, smoking status, American Society of Anesthesiologist's classification, and medical comorbidities identified through the Elixhauser algorithm. Meniscal or chondral injuries identified at the time of the ACLR, multi-ligament injury, graft type, and tibial tunnel drilling technique were procedure factors evaluated. Postoperative factors included new diagnosis of knee pain and new diagnosis of osteoarthritis; any postoperative factor needed to occur prior to the outcome of interest to be considered. The outcome of interest was a subsequent surgical intervention during follow up, including subsequent graft revision or other reoperation where the graft was left intact (e.g., meniscal repair). Patients who did not experience the outcome of interest were censored for regression analysis at date of healthcare membership termination, death, or study end date (December 31, 2020), whichever came first.
The association of these specified factors with subsequent surgical intervention following primary ACLR was modeled as a time to event using Cox proportional hazard regression. Factors were selected into the final multivariable model by stepwise regression using the Akaike Information Criteria, which quantifies the amount of information lost if a factor is left out of the model. Hazard ratios (HR), and 95% confidence intervals (CI) are reported only for the factors that were included in the final model; $p < 0.05$ was the threshold for statistical significance.
RESULTS:
The study sample included 43,123 primary ACLR. The median age was 26 years and more patients were male (60.1%). At the time of index ACLR, 25.6% had cartilage, 38.2% had medial meniscus, and 40.8% had lateral meniscus injuries.
The 10-year cumulative incidence of subsequent surgery after index ACLR was 14.7%, which included 5.9% graft revision (3.5% meniscus or cartilage-related procedures also performed at the time of revision and 2.4% revision only) and 8.8% other reoperation (5.4% meniscus or cartilage-related and 3.4% for other reasons).
Risk factors for subsequent surgical intervention included knee pain >1 year after the ACLR (HR=10.59, 95% CI=9.68-11.59), diagnosis of osteoarthritis after >1 year after the ACLR (HR=1.93, 95% CI=1.65-2.26), age <22 vs ≥22 years (HR=1.54, 95% CI=1.44-1.64), medial meniscus injury and treated (HR=1.49, 95% CI=1.39-1.60), BMI <30 vs. ≥30 kg/m2 (HR=1.33, 95% CI=1.23-1.43), White race vs. other races (HR=1.16, 95% CI=1.10-1.23), no cartilage injury at index (HR=1.16, 95% CI=1.08-1.25), and allograft use (HR=1.14, 95% CI=1.07-1.22).
DISCUSSION AND CONCLUSION: Patients presenting with knee pain or a diagnosis of osteoarthritis more than 1 year after the primary were the strongest risk factors for subsequent surgical intervention after primary ACLR. Allograft use was the only identified risk factor that is within the control of the surgeon at the time of ACLR. Surgeons should consider these factors when counseling patients and to manage expectations on their risk subsequent surgical reintervention.