

Increased Operative Time is an Independent Risk Factor for Developing Surgical Complications Following Isolated Anterior Cruciate Ligament Reconstruction in Skeletally Immature Patients

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INTRODUCTION:

In the context of recent trends towards early sport specialization and intensive year-round training amongst youth athletes, there has been a drastic increase in the incidence of ACL reconstructions performed in skeletally immature patients. There is a growing interest in identifying and minimizing surgical complications for these patients. Although the literature in adult ACL reconstruction has demonstrated an association between prolonged operative time and risk of surgical complications, this has not been explored in skeletally immature patients. The purpose of this study was to determine whether operative time is an independent risk factor for developing complications following ACL reconstruction in skeletally immature children and adolescents.

METHODS:

A prospective, multicenter surgeon-driven quality improvement registry of consecutive patients was reviewed to identify skeletally immature patients who underwent a primary isolated ACL reconstruction, with minimum 8-month follow-up. Demographics, surgical characteristics, operative time, and complications were recorded. During analysis, operative time was divided into 15-minute increments to determine whether a 15-minute extension of operative duration predicted increased complication risk. Cases were excluded if operative time was > 2 standard deviations above the mean, to eliminate outlier effects. Continuous variables were compared via independent t-test or ANOVA, and categorical variables were compared via Chi-squared or Fisher's exact tests. Comparisons were deemed to be statistically significant using a threshold of $p < 0.05$. Multiple logistic regression analysis was performed to control for demographic and surgical characteristics.

RESULTS:

Preoperative Characteristics

A total of 711 patients, from a registry of 9,351 patients at the time of analysis, were included with mean follow-up of 17.6 ± 8.6 months (range 8-30 months). 479 (67.4%) were male. Mean age was 13.2 ± 1.9 years and mean BMI percentile by age was 69.8 ± 25.5 . Mean operative time was 112.3 ± 38.8 minutes (**Table 1**). Obese patients, patients who underwent surgery in a surgery center, patients who received only regional anesthesia, patients without a tourniquet placed during surgery, and patients who had combined transphyseal ACL reconstruction with IT band lateral extraarticular tenodesis (LET) all experienced longer operative times (**Table 2**).

Complications

The overall complication rate for the cohort was 15.19%. The most common complications included graft failure (4.78%), arthrofibrosis (2.95%) and surgical site infection (2.39%) (**Table 3**). Patients who developed a complication had on average an approximately 12-minute longer operative time versus patients who did not develop a complication (122.3 ± 38.8 vs. 110.5 ± 35.5 minutes, $p = 0.002$) (**Figure 1**). After adjusting for demographic and surgical characteristics, increased operative time remained an independent risk factor for developing a surgical complication in general (OR = 1.17, $p = 0.02$) (**Table 3; Figure 2**). Specifically, increased operative time was an independent risk factor for developing a surgical site infection (OR = 1.25, $p=0.045$) or arthrofibrosis (OR = 1.40, $p=0.001$) (**Table 3**).

DISCUSSION AND CONCLUSION:

A review of a prospective, multicenter surgeon-driven quality improvement registry revealed that increased operative time was associated with an increased risk of developing surgical complications following ACL reconstruction for skeletally immature patients, when controlling for demographic and perioperative patient characteristics. Specifically, increased operative time was associated with an increased risk of surgical site infection and arthrofibrosis. Future efforts to increase operative efficiency are warranted in order to reduce operative time and thereby improve patient outcomes.

