Sex Differences in Factors Associated with Patient-Reported Outcomes After ACL Reconstruction at Minimum 10-Year Follow-Up

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INTRODUCTION: Anterior cruciate ligament reconstruction (ACLR) is one of the most commonly performed procedures in sports medicine. Previous studies have identified higher BMI, older age, being a smoker, and lower baseline scores as risk factors for poorer patient-reported outcome measure (PROM) scores after ACL reconstruction, yet there is a scarcity of research that investigates these outcome measures 10 or more years after surgery. Our goal was to describe the characteristics of patients who had good vs poor outcomes at a minimum of 10 years after ACL-R and report on the factors associated with the greatest likelihood of success.

METHODS: Patients who underwent ACLR at our institution between 2008 and 2013 were contacted via email questionnaires, including the Marx Activity Rating Scale (MARS), International Knee Documentation Committee Subjective Knee Evaluation Form (IKDC-SKEF), the PROMIS-10 Global Health Questionnaire (split into Physical Health and Mental Health T-scores), the Tegner Activity Scale, and the Single Assessment Numeric Evaluation (SANE). Demographic data as well as information regarding subsequent diagnoses or surgeries on the surgical knee were collected. Revision ACLR cases were excluded. We defined "good" and "poor" outcomes as those above or below an IKDC score of 75, which has been previously defined as a threshold value for the Patient-Acceptable Symptom State (PASS). Those who scored in the top quartile of the IKDC score distribution were used to characterize those with the greatest success. Multivariate analysis was performed by creating multiple linear regression models and comparing estimated marginal means. Estimated marginal means were reported with 95% confidence intervals. Odds ratios were calculated and compared using Chi-Square Tests to identify the associations between outcomes and sex, graft type, age at the time of surgery, body mass index (BMI), and concurrent procedures performed at the time of surgery.

RESULTS: 228 total patients (128 female, 100 male) were included in this study. Mean age at the time of surgery was 38.1±12.9 years. The average time to follow-up was 11.9±1.8 years. Grafts included bone-patellar tendon-bone (BTB) autograft (87), hamstring autograft (22), or allograft (119). Using multivariate linear regression, we found that males with BTB grafts scored higher than females with BTB grafts on all outcome measures, especially for Marx (males=7.14 [5.49. 8.79], females=5.57 [3.84, 7.29], p=0.11), PROMIS-10 Physical Health (males=54.0 [51.3, 56.8], females=50.8 [48.0, 53.7], p=0.056), PROMIS-10 Mental Health (males=56.3 [53.5, 59.2], females=53.5 [50.5, 56.5], p=0.10), and Tegner scores (males=6.26 [5.68, 6.84], females=5.70 [5.10, 6.31], p=0.11). Males with allografts had significantly higher Tegner scores than female allografts (males=6.28 [5.77, 6.79], females=5.36 [4.91, 5.82], p=0.002). 3 patients (1.3%) had a subsequent revision ACLR, of which all were males with BTB autografts. 8.3% of patients reported having a subsequent diagnosis of osteoarthritis in their knee, and there were no significant differences in the odds of having a subsequent OA diagnosis between males and females (OR=1.36 [0.52, 3.85]; p=0.52). 69.7% of patients achieved the PASS threshold score (IKDC>=75), and those who did not had significantly lower scores for all other PROMs including global physical and mental health. No significant difference in age at surgery was found between patients who achieved the PASS and those who did not (37.7±13.2, 39.1±12.1, p=0.49). The odds of not achieving the PASS were not significantly different between males and females (OR=1.11 [0.62, 1.98]; p=0.71) or graft types. The odds of having an "unsatisfactory" IKDC score was higher for patients over a BMI of 30 (OR=1.72 [0.86, 3.40]; p=0.11). Those who scored in the top quartile of the IKDC (IKDC>=93) were mostly (88.3%) under a BMI of 30 but was otherwise not significantly different between males and females (OR=1.03 [0.57, 1.88]; p=0.92) or any graft type.

DISCUSSION AND CONCLUSION: At a mean follow-up of 11.9 years, 69.7% of patients reported good outcomes, without significant differences in satisfaction rates based on sex or graft types. Males with BTB grafts scored higher than females with BTB grafts on all outcome measures, especially for the activity scores. Males with allografts scores significantly higher than females with allografts on the Tegner scale, suggesting higher levels of sport and activity for this group. No differences between males and females were noted for revision rate or having a subsequent OA diagnosis. A longer-term minimum follow-up may be necessary to accurately evaluate the potential for degenerative disease. This study suggests good outcomes can be attained in the majority of patients at minimum ten years after ACLR, but further study is needed to evaluate the differences in outcomes and activity levels between males and females after surgery.