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EVIDENCE BASED REVIEW IN ORTHOPEDICS

Quality of Life Following ACL Reconstruction: Baseline Predictors of Patient-Reported Outcomes

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Abstract The study by Dunn et al., "Baseline Predictors of Health-Related Quality of Life after Anterior Cruciate Ligament Reconstruction: A longitudinal analysis of a multicenter cohort at two and six years," evaluates patient factors that are predictive of outcomes following anterior cruciate ligament reconstruction. The current review critically analyzes the findings of this study in light of the current body of literature on the subject and assesses its contribution to the development of evidence-based guidelines. The authors' primary endpoint, the Short Form-36 (SF-36), is used ubiquitously in health care research and allows their results to be compared across different disease states and studies. Despite its widespread use, the SF-36 has been shown to be sensitive to outcomes following anterior cruciate ligament reconstruction. The authors' use of generic health-related quality of life outcome as a primary endpoint represents an important contribution to the field, and their findings allow for improved preoperative counseling by identifying baseline patient factors that predict outcomes following anterior cruciate ligament reconstruction. Furthermore, by deriving utilities from SF-36 scores, the authors are able to assess the value of anterior cruciate ligament reconstruction as compared to other medical and surgical procedures.

Keywords ACL reconstruction · quality of life · SF-36 · Multicenter Orthopaedic Outcomes Network (MOON)

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Introduction

An estimated 200,000 anterior cruciate ligament reconstructions (ACLRs) are performed annually in the USA [11] but there is sparse literature regarding predictors of medium- to long-term outcomes following this procedure. Currently, clinical outcomes after ACLR are thought to be associated with gender [1], graft choice [6–8, 10, 15, 16], the presence of concomitant knee injuries [13, 22], and patient smoking status [2, 9]. However, studies that have identified these associations have limitations [19]. A previously conducted cohort study of 314 ACLR was limited by 69% follow-up and lack of preoperative data [20]. Similarly, data from the Swedish National ACL Registry includes information on 16,351 ACL reconstructions, but only 64% of those patients have preoperative data available, and their response rate was less than 50% at follow up [2, 9]. The Multicenter Orthopaedic Outcomes Network (MOON) is a multicenter effort to provide prospective longitudinal outcome data following ACL reconstructions in the USA [11]. Their research aim is to identify patient-specific outcome data that will guide preoperative counseling and ultimately help define evidenced-based surgical recommendations [11, 19].

Patient-reported outcome measures are generally divided into disease-specific or generic health measures. The Short Form-36 (SF-36) is an example of the latter and includes questions about general health, emotional issues, physical activities, pain, and personal feelings. As a generic measure of health-related quality of life (HRQoL), the SF-36 encompasses a wide spectrum of illnesses and is designed to allow for comparison across various disease states and different studies. Despite its broad application, the SF-36 has been shown to correlate with certain disease-specific measurements of knee function [18] and to be responsive to ACL reconstruction [14, 18]. The primary reasons for using an HRQoL measure, such as the SF-36, in assessing outcomes following orthopedic procedures are to evaluate the overall impact on a patient's health and to assess the value of a

procedure compared with that of another medical or surgical treatment. Furthermore, utilities can be derived from SF-36 scores with the use of the Short Form-6 dimension (SF-6D), which ultimately allows for cost-effectiveness analysis [12].

Reviewed here, Dunn et al. sought to determine patient factors that were predictive of higher or lower SF-36 scores and to quantify the utility gained following ACLR [5]. The aims of the current review are (1) to critically evaluate the findings of this study in light of the current body of literature on the subject and (2) to assess its contribution to identifying the value of ACLR and developing evidence-based guidelines.

The Article

Baseline Predictors of Health-Related Quality of Life after Anterior Cruciate Ligament Reconstruction: A longitudinal analysis of a multicenter cohort at two and six years

Dunn WB, Wolf BR, Harrell FE, Reinke EK, Huston LJ, MOON Knee Group, Spindler KP. J Bone Joint Surg Am. 2015;97:551–7 April 1

This multicenter cohort study prospectively enrolled 1516 patients who underwent unilateral ACLR from 2002–2004. Fourteen hundred and eleven of these patients (93%) had at least one postoperative SF-36 questionnaire and were included in the analysis. They obtained 87% follow-up at 2 years and 86% at 6 years. The authors sought to determine: (1) How does ACLR impact SF-36 scores at 2 and 6 years follow-up as compared to preoperatively? (2) What baseline variables are predictive of higher and lower SF-36 scores? (3) How effective is ACLR in terms of quality-adjusted life years (QALY)? The primary outcome evaluated was the physical component summary (PCS) and mental component summary (MCS) score of the SF-36. The utility gained in terms of QALYs was assessed as a secondary outcome.

The authors found that ACLR was associated with statistically and clinically significant improvements in the PCS (at 2 years and maintained at 6 years), but not in the MCS. Significant predictors of higher PCS scores included: having a higher baseline score (OR 1.57), younger age (OR 2.04), lower baseline BMI (OR 1.35), having >50% of the lateral meniscus excised (OR 2.45), and having no treatment done for a lateral meniscus tear (OR 1.27). Significant predictors of a lower PCS score included shorter follow-up time (OR 0.64), revision ACLR (OR 0.51), current smoker (OR 0.52), fewer years of education (OR 0.70), and chondromalacia of the lateral tibial plateau (OR 0.53). The mean utility gained in this cohort at 6 years was 5.3 QALYs.

Commentary

This review will use a question-driven format to critically examine their findings in light of the current body of literature on the topic.

How does ACL reconstruction impact SF-36 scores at 2- and 6-year follow-up as compared to preoperatively? The authors showed that the PCS component of the SF-36 score significantly improves after ACLR, and those improvements are sustained at 6 years. This finding is consistent with previous publications demonstrating that the SF-36 is responsive for patients who undergo ACLR [14, 18]. This is also similar to previous publications from this cohort, which show improvement in a number of patient-reported outcome measures, including the Knee Documentation Committee (IKDC) questionnaire, the Knee injury and Osteoarthritis Outcome score (KOOS), and the Marx Activity Scale [19].

The SF-36 is used ubiquitously in health care research, and their use of this as a primary endpoint allows for comparisons across a wide spectrum of disciplines and diseases states. Another reason for using a health-related quality of life measure to assess outcomes following ACLR is to identify the impact of the procedure on the patient's overall health, rather than knee function in isolation. Although only one of the 36 questions included in the SF-36 applies directly to knee function, [23] it has been shown to correlate with certain disease-specific measurements of knee function and to be responsive to ACL reconstruction.[14, 18] . However, it is important to note that preoperative SF-36 scores may not accurately represent pre-injury health status, and it is possible that similar improvements in PCS would be observed without surgical intervention. Although such limitations should be acknowledged, it should also be recognized that they are often inherent, and even unavoidable, in prospective studies of surgical procedures.

Which baseline factors predict better SF-36 scores after ACLR? Consistent with previous publications from the MOON cohort, the authors identified a number of patient-related factors as predictors of worse outcomes, including baseline functional status, smoking status, previous ACLR, and level of education.[19] The reproducibility of these findings with a variety of metrics is convincing, and the results provide valuable information for preoperative counseling. However, clinicians should note that the majority of these baseline factors are not modifiable and that their presence did not contraindicate operative management in this cohort.

On the contrary, the relationship that the authors identified between ACLR and meniscal injuries is quite intriguing and ultimately may have the potential to impact operative management of associated injuries. Although the long-term outcomes of meniscectomy could not be addressed in the present study due to limited follow-up,[17] the association between lateral meniscus tears and improved outcome scores is thought-provoking: Why do patients who have larger lateral meniscus excisions do better than those with an intact lateral meniscus? Why does having no treatment for a lateral meniscus tear result in better outcomes than patients with an uninjured lateral meniscus? This finding may reflect forces being absorbed by the lateral meniscus rather than the articular cartilage at the time of injury.[4] This would be consistent with the finding of a lower PCS score in patients with lateral tibial plateau chondromalacia.

Interestingly, lateral meniscus tears (and, specifically, excision of >50% of the lateral meniscus) were also associated with improved outcomes on the IKDC and KOOS questionnaires in the MOON cohort [19]. However, additional intra-articular pathology, including medial meniscus

injury and high grade articular lesions, were correlated with poorer outcomes on the IKDC and KOOS questionnaires, but not the SF-36 [4]. Furthermore, when analyzed in isolation, patients who had undergone a meniscal repair with ACLR had a 14% rate of failure at 6 years [21]. Further investigation with this cohort demonstrated that a previous meniscectomy plays a greater role in future chondral damage than an isolated ACL rupture [3]. The discrepancies between these studies not only underscores the need for long-term outcome data but also raises the question of which metric(s) should be used to develop evidence-based guidelines.

What is the utility of ACLR? The authors claim in the introduction that this value should provide "justification for expenditures related to patients with ACL injuries," which leads the reader to expect a cost-effective analysis. However, despite previously published cost-effectiveness data [12], the authors only provide a QALY value. This value indirectly supports the procedure's cost-effectiveness by comparing it to the utility gained by other procedures and provides the baseline for a cost-effectiveness study. Further, a QALY value of 5.3 is exceptionally high, especially compared to the gain in QALYs following coronary artery bypass surgery (0.3). However, it is important to note that this value (5.3) does not reflect the change in utility gained from ACL reconstruction procedures, as that would require an understanding of the QALYs gained for patients with ACL injuries who did not undergo surgery. Such dramatic results may not have been seen if the authors compared this value (5.3) to a control group of non-operative patients at similar time points.

In conclusion, the strength of this study is the fact that it is a longitudinal, multicenter prospective cohort study with 86% follow-up at 6 years. Their medium-term results demonstrate that ACLR improves quality of life, and identifies baseline factors that predict outcome, which allows for improved preoperative patient counseling.

Disclosures

Conflict of Interest: Christine C. Johnson, MD, Grant H. Garcia, MD, and Matthew R. Garner, MD, have declared that they have no conflict of interest. Robert G. Marx MD, MSc, FRCSC reports personal fees from Journal of Bone & Joint Surgery, Springer, Demos Health and Mend, outside the work.

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