J Shoulder Elbow Surg (2018) ■■, ■■–■■

ELSEVIER

Journal of Shoulder and Elbow Surgery

www.elsevier.com/locate/ymse

ORIGINAL ARTICLE

Risk factors for failing to achieve improvement after anatomic total shoulder arthroplasty for glenohumeral osteoarthritis

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Background: Although anatomic total shoulder arthroplasty (TSA) successfully improves pain and function, not all patients improve clinically. This study was conducted to determine patient-related factors for failure to achieve improvement after primary TSA for osteoarthritis at 2 years postoperatively.
Methods: This prospective study reviewed an institutional shoulder registry for consecutive patients who underwent primary TSA for osteoarthritis from 2007 to 2013 with baseline and 2-year postoperative American Shoulder and Elbow Surgeons (ASES) Standardized Shoulder Assessment Form scores. A failed outcome was defined as (1) a failure to reach the ASES minimal clinically important difference of 16.1 points or (2) revision surgery within 2 years of the index procedure, or both. Univariate and multivariable analyses of clinical and demographic patient factors were performed using logistic regression.
Results: Of 459 arthroplasties that met inclusion criteria, 411 were deemed successful by the aforementioned criteria, and 48 (10.5%) failed to achieve a desirable outcome. Clinical risk factors associated with failure included previous surgery to the shoulder ($P = .047$), presence of a torn rotator cuff ($P = .025$), and presence of diabetes ($P = .036$), after adjusting for age, sex, race, and body mass index. A higher preoperative ASES score at baseline was associated with failure ($P < .001$).
Conclusion: Previous shoulder surgery, a rotator cuff tear requiring repair during TSA, presence of diabetes, surgery on the nondominant arm, and a higher baseline ASES score were associated with a higher risk of failing to achieve improvement after anatomic TSA.
Level of evidence: Level II; Prospective Cohort Design; Treatment Study

Keywords: Total shoulder arthoplasty; glenohumeral arthritis; risk factors; MCID; postoperative outcomes; satisfaction; poor improvement; ASES score

The Hospital for Special Surgery Institutional Review Board approved this study (IRB #2013-014).

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1058-2746/$ - see front matter
https://doi.org/10.1016/j.jse.2017.12.018

Anatomic total shoulder arthroplasty (TSA) has demonstrated an excellent clinical track record, with improvements in patient-reported pain relief, shoulder function, range of motion, and quality of life indices.[25,27,28,33] Most large shoulder arthroplasty series have focused on implant survival and included patients who underwent TSA or hemiarthroplasty for their shoulder condition.[16,28] Despite generally good results, a subset of patients experience suboptimal results. Data regarding patient-specific or surgical elements that may portend poor clinical outcomes after TSA are limited.[2,4,16]

As the landscape of health care economics evolves to prioritize cost-efficient and effective care, providers are incentivized to select patients who are most likely to experience significant functional improvement. Furthermore, as the Centers for Medicare and Medicaid Services investigates shifting financial risk to providers via bundled payment and outcomes-based reimbursement models, care providers must be able to identify which patients pose the highest risk for costly complications, revisions, and adverse outcomes.[6,29,36] Understanding such risk factors is also valuable preoperatively to effectively manage surgeon and patient expectations. The purpose of this study was to determine patient-related factors for failure to achieve improvement after primary TSA for osteoarthritis at a minimum of 2 years postoperatively.

Materials and methods

Data collection

Prospective data from 2007 to 2013 were collected as part of an institutional shoulder arthroplasty registry. The registry collects preoperative, intraoperative, and postoperative information regarding shoulder arthroplasties performed at the Hospital for Special Surgery. Inclusion criteria consisted of patients who underwent a primary anatomic shoulder replacement for a diagnosis of osteoarthritis and for whom presurgical baseline data and 2-year follow-up data were available. The analysis excluded TSAs for a diagnosis other than osteoarthritis. Data collection at both points of interest was standardized and accomplished by mailed questionnaires and a web-based system with an interface that allowed patients to enter information directly online.

Defining failure to improve

Functional outcome after TSA was assessed using the American Shoulder and Elbow Surgeons (ASES) Standardized Shoulder Assessment Form score.[35] This patient-reported outcome is graded on a scale of 0 (worst) to 100 (best) and consists of questions concerning pain, function, and stability in regards to the affected shoulder. The ASES has demonstrated adequate responsiveness for patients undergoing TSA and has shown excellent validity and reliability, with minimal administrator and responder burden.[1,38] ASES improvement has been shown to plateau at 2 years postoperatively in the TSA population, indicating that at our 2-year assessment, patients will have achieved close to maximum functional improvement.[34]

To assess poor postoperative improvement after TSA, a definition of "failure to improve" was established. First, any patient who self-reported a revision arthroplasty or an additional surgical intervention to the joint within the 2-year follow-up period was defined as a patient who failed to improve after the index procedure.[45]

Our second definition of failure to improve was modeled after the minimal clinically important difference (MCID) of the ASES score reported by Werner et al[45] for the anatomic TSA population. Werner et al[45] used a method that anchored the patients' 2-year change in ASES scores to their postoperative satisfaction responses. We selected from their study the reported MCID of 16.1-point improvement as our cutoff.

We therefore defined failure to improve as those patients who underwent a subsequent operation within 2 years or failed to achieve an MCID of a 16.1-point improvement on the ASES questionnaire, or both.

Patient satisfaction

As a secondary outcome, patient satisfaction with the surgery was assessed against the definition of failure to improve. Patient overall satisfaction with surgery, with pain relief, with ability to return to work, and with ability to return to recreational activities were assessed by a 5-point Likert scale that varied from 1 (very satisfied) to 5 (very dissatisfied). Satisfaction with the operation's ability to improve quality of life was assessed by a 6-point Likert scale that ranged from 1 (more improvement than ever dreamed possible) to 6 (quality of life is worse). To convert the Likert scales to binary variables, patients who rated the procedure as a 1 or a 2 for a given satisfaction metric were considered to be "satisfied," and patients who rated the procedure lower than 2 were considered to be "dissatisfied." Satisfaction between patients who improved vs. those who failed to improve was then assessed using χ^2 tests.

Patient-specific factors

Multiple patient-specific factors were assessed against the outcome of interest, including demographic variables, social history variables, and medical history elements. Sex, age at the time of surgery, body mass index (BMI), race, education level, and living arrangement composed the primary demographic and social variables. The medical comorbidities considered were the presence of heart disease, hypertension, lung disease, diabetes, ulcer/stomach disease, kidney disease, liver disease, anemia or other blood diseases, cancer, depression, osteoarthritis (in a joint other than the one being operated on), back pain, rheumatoid arthritis, and an open write-in field that was assessed by a surgeon. The sum of medical comorbidities for a given patient was also included to assess the effect of the total comorbidity burden on outcome. Also assessed were the American Society of Anesthesiologists (ASA) Physical Status Classification, previous use of bisphosphonates, use of narcotic pain medication preoperatively, whether the operation was performed on the patient's dominant arm, and history of surgery to the affected joint. The preoperative clinical assessments analyzed included the Mental Component Score of the 12-Item Short Form Health Survey questionnaire, a visual analog scale (VAS) pain score, a VAS instability score, and the patient's score on the Marx Activity Scale.[5]