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ORIGINAL ARTICLE

The effect of patient gender on outcomes after reverse total shoulder arthroplasty

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Background: Gender differences may exist for patients undergoing shoulder arthroplasty. Limited data suggest that women may have worse preoperative disability and outcomes. Our objective was to determine whether gender influences preoperative disability and patient-reported outcomes after reverse total shoulder arthroplasty.

Methods: Data were prospectively collected for patients who underwent reverse total shoulder arthroplasty for rotator cuff arthropathy or osteoarthritis with a rotator cuff tear at a single institution between 2009 and 2015. Range of motion, visual analog scale, 12-Item Short Form Health Survey (SF-12), and American Shoulder and Elbow Surgeons (ASES) scores were collected at the preoperative, 1-year, and 2-year postoperative time points. Data were analyzed using multivariate mixed-effect regression analysis.

Results: There were 117 patients included. Men and women had similar demographics, preoperative range of motion, pain, and function. Length of stay was similar (men, 2.32 days; women, 2.58 days; $P = .18$). Controlling for patient variables, men achieved higher ASES function ($P = .009$) and SF-12 Physical Component Summary ($P = .008$) scores compared with women. There was no difference between men and women in ASES pain and SF-12 Mental Component Summary scores, visual analog scale score, or range of motion.

Conclusion: Improvements in pain and range of motion were similar in men and women; however, men achieved higher ASES function and SF-12 Physical Component Summary scores. Women may be more functionally impaired on the basis of differences in activities of daily living. These results may be used to guide discussion about expected benefits after reverse shoulder arthroplasty.

Level of evidence: Level II; Retrospective Design; Prognosis Study

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Keywords: Reverse total shoulder arthroplasty; patient-reported outcomes; gender; shoulder arthroplasty outcomes; ASES score; SF-12 score

An increasing number of reverse total shoulder arthroplasties (RTSAs) are being performed for shoulder disease, such as rotator cuff arthropathy, proximal humerus fractures, glenohumeral osteoarthritis, and revision shoulder arthroplasty.[10,24,25,27] Whereas shoulder arthroplasty has overall

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been a successful procedure, a subset of patients are dissatisfied with their results.[5,8] Differences in shoulder arthroplasty patients exist on the basis of their age, gender, body mass index (BMI), body habitus, underlying disease, and geographic location, but the effects of these differences have yet to be clearly determined.

Recently, evaluation of the success of arthroplasty procedures has shifted toward patient-reported outcome measures.[18,23] Patient-reported outcome measures can expand our understanding of a patient's preoperative level of pain and function.[2,30] Our group and others have shown that preoperative patient-reported outcomes predict clinically meaningful improvement after hip, knee, and shoulder arthroplasty.[1,2,4,9,19] These studies suggest that preoperative pain and function can forecast expected benefits after arthroplasty and guide shared decision-making.

The patient's gender is not traditionally considered a factor affecting postoperative outcomes after shoulder arthroplasty. However, current studies have described gender differences after various orthopedic procedures including hip and knee arthroplasty. Female candidates for total knee arthroplasty (TKA) and total hip arthroplasty (THA) had greater disability than male candidates in comparing stair climbing and timed up-and-go tests.[12] Perioperatively, women have previously been found to have longer hospital stays for both TKA and THA as well as after shoulder arthroplasty.[16,29] One study showed gait speed and quadriceps strength to be lower in women and obese patients after TKA.[21] However, other studies show no differences based on gender after THA.[19]

As the number of shoulder arthroplasties being performed continues to increase, it is important to understand factors that may predict postoperative function. One possible explanation for gender differences in arthroplasty patients is that women have worse preoperative disability.[12] In addition, there are differences in activities of daily living (ADLs) between women and men (eg, grooming of longer lengths of hair and donning clothing behind one's back) that may require different ranges of motion of the shoulder and may be challenging after RTSA. Functional status for patients after RTSA may be different for men compared with women because of the inherent limitations in shoulder rotation due to the reverse prosthetic design. After RTSA, improvements have been demonstrated in forward flexion and abduction range of motion during ADLs, but limited or no improvement has been shown for internal or external rotation.[15,26] We are not aware of prior studies that have investigated the association between preoperative function of the patient, gender, and reverse shoulder arthroplasty outcomes.

Our objective was to determine whether gender influences preoperative disability and patient-reported outcomes after RTSA We hypothesized that there are gender differences in outcomes in patients undergoing RTSA and that these differences may persist in the long term. Our specific hypotheses were that women undergoing RTSA will have worse disability preoperatively compared with men, that women will have a longer length of hospital stay, and that there is no difference in 12-Item Short Form Health Survey (SF-12) Mental Component Summary (MCS) scores and American Shoulder and Elbow Surgeons (ASES) pain scores from baseline to 2 years of follow-up between men and women. We hypothesized that there will be differences in functional scores between men and women, specifically that there will be difference in SF-12 Physical Component Summary (PCS) scores and ASES function scores.

Materials and methods

The study design was prospectively collected data from the institution's shoulder arthroplasty outcomes database. Three sports medicine and shoulder fellowship-trained orthopedic surgeons performed the shoulder arthroplasty operations included in this database. Patients from the orthopedic sports medicine clinic were recruited to this study by the principal investigators and the research assistant, and informed consent was obtained if they agreed to participate. Descriptive data including age, gender, BMI, Charlson Comorbidity Index (CCI), and diagnosis or indication for surgery were collected. These data were entered into a privacy-protected electronic database (Research Electronic Data Capture [REDCap] system).

Range of motion of the affected shoulder (forward flexion, abduction, external rotation, and internal rotation) and visual analog scale (VAS) scores were recorded for the preoperative, 1-year, and 2-year postoperative time points. Range of motion was measured according to the ASES shoulder assessment form with a goniometer by trained research assistants under the supervision of the shoulder arthroplasty surgeons. At the same time points, the SF-12 version 2 PCS and MCS scores as well as the ASES pain and function scores were assessed from patients who underwent RTSA with Food and Drug Administration-approved implants (Zimmer Trabecular Metal Reverse Total Shoulder System, Warsaw, IN, USA) at a single institution between 2009 and 2015. The hospital length of stay was calculated from data collection from the electronic medical record. Patients included in the study had diagnosis of either rotator cuff arthropathy or osteoarthritis with a rotator cuff tear, preoperative patient-reported outcome scores, and at least 1 year of postoperative follow-up. The criteria for 1-year follow-up were based on literature that supports significant improvement in pain, function, range of motion, and return to sports within 1 year of RTSA.[6,14,17,20] Exclusion criteria were patients with a pathologic fracture and malignant lesion. The ASES and SF-12 scores were determined using the published scoring algorithms for each outcome measure.[22,28]

Baseline characteristics were analyzed using Mann-Whitney *U* test for continuous variables and χ^2 for categorical variables. The primary outcome measures of shoulder range of motion, SF-12, ASES, and VAS scores and hospital length of stay were analyzed using Student *t*-test for normally distributed data and Mann-Whitney *U* test for non-normally distributed data. Multivariate mixed model repeated-measures regression analysis was performed to control for patient variables including age, BMI, CCI, smoking history, preoperative diagnosis, and surgery performed on the dominant arm. Missing data were multiply imputed to reduce chance of systematic error. Multivariate analysis of variance was performed on the nonimputed data to confirm accuracy of model assumptions. Multiple

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