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Outcome and value of reverse shoulder arthroplasty for treatment of glenohumeral osteoarthritis: a matched cohort

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Background: Total shoulder arthroplasty (TSA) is commonly used to treat glenohumeral osteoarthritis (GHOA) with an intact rotator cuff. Recently, reverse shoulder arthroplasty (RSA) has been used for GHOA patients who are elderly or have eccentric glenoid wear. We evaluated patients with GHOA scheduled to have TSA but who were changed to RSA because of intraoperative difficulties with the glenoid component or instability and compared them with a cohort that underwent TSA to determine if the groups had similar outcomes.

Methods: We identified 24 consecutive GHOA patients who underwent RSA and matched them to 96 patients who underwent TSA. Glenoid wear and rotator cuff musculature were assessed with preoperative computed tomography scans. Direct hospital costs of the procedure were collected.

Results: Postoperative American Shoulder and Elbow Surgeons score, Simple Shoulder Test score, and range of motion were similar between the 2 groups. Five TSA patients had radiographic glenoid loosening, whereas no RSA patients did. Neither group required a revision. One RSA patient required surgery for treatment of a periprosthetic fracture. RSA was $7274 more costly than TSA, related mainly to implant cost.

Conclusions: Patients with GHOA who were converted intraoperatively to RSA because of improper seating of the glenoid trial or persistent posterior subluxation had outcomes comparable to those of a similar group of patients in whom TSA was performed. At midterm follow-up, TSA is associated with lower cost than RSA. The higher rate of radiographic loosening in the TSA group warrants longer follow-up to assess revision costs. In cases in which a TSA cannot be performed with confidence, RSA is a reasonable alternative.

Level of evidence: Level III, Retrospective Cohort Design, Treatment Study.

Keywords: Reverse shoulder arthroplasty; total shoulder arthroplasty; glenohumeral arthritis; intact rotator cuff; glenoid wear patterns

This study was determined to be exempt from review by the Western Institutional Review Board.

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Total shoulder arthroplasty (TSA) is a predictable and successful operation for the treatment of symptomatic glenohumeral osteoarthritis (GHOA) with an intact rotator cuff. Recently, attention has been focused on identifying patients who are at increased risk of early failure after TSA. Eccentric glenoid wear patterns, excessive retroversion, rotator cuff quality, and patient age have been cited as potential risk factors for early failure.[4,7,11,13,15,17,20,27,47] Achieving long-term glenoid fixation has been identified as an important factor in increasing survivorship in TSA.[4,8,21,23,41] Numerous factors contribute to the stability of glenoid component fixation, including symmetric implant loading, preservation of glenoid subchondral bone, use of a curved-back pegged polyethylene glenoid, and proper cementation technique.[2,3,10,11,19,22,23,30,48] Walch et al[47] have reported that eccentric glenoid wear and excessive retroversion lead to increased loosening and revision in patients who underwent TSA. For reasons not fully understood, these patients have a tendency to remain preferentially subluxated posteriorly after TSA. In many instances, it is not possible to correct posterior glenoid erosion with reaming alone.[5,12,18,31,47] Current trends for addressing this problem are eccentric reaming, glenoid bone grafting, augmented glenoids, and reverse shoulder arthroplasty (RSA).[5,12,16,18,26-29,31,35,40,47,49,52] The use of RSA is an attractive option in patients with static posterior subluxation and excessive retroversion because of the inherent stability provided by the semiconstrained nature of the implant design. RSA also provides increased freedom to correct glenoid version and increased glenoid fixation in cases of bone loss. Some authors have demonstrated encouraging results with the use of RSA for treatment of these patients.[26,49]

The aim of this study was to determine whether RSA was a reasonable option in a select group of patients with GHOA, in whom intraoperatively TSA was thought to be a poor option secondary to difficulties in glenoid preparation or because of persistent posterior subluxation. Our hypothesis was that the patients with RSA would have equivalent clinical outcomes compared with a similar cohort of patients who underwent TSA. Secondarily, we sought to identify whether a difference in cost existed between the 2 interventions and whether the difference in cost contributed to a difference in the value of the procedure.

Materials and methods

Study design

Our prospective joint arthroplasty database was retrospectively reviewed to identify patients who underwent RSA with a diagnosis of GHOA. An a priori power analysis suggested that a study group with a minimum of 22 patients who underwent RSA and a matched group of 88 patients (1:4 ratio) who underwent TSA for a diagnosis of GHOA would be necessary to detect a minimum clinically important difference of 12 points on the American Shoulder and Elbow Surgeons (ASES) scoring system and 2 points on the Simple Shoulder Test (SST).[34,42] Variance was estimated to be 18 points on the basis of an analysis of outcomes across all RSAs performed by the senior author (M.A.F.) during the study time frame.

Twenty-four patients with GHOA who underwent RSA by the senior author (20 patients) and a collaborating fellowship-trained shoulder surgeon (A.G.K.; 4 patients) were identified between September 2005 and September 2011. Both surgeons used the same implants (DJO Surgical, Austin, TX, USA) and surgical technique for RSA and TSA, which reduced heterogeneity. The study population represented 3% (20 of 665) of all primary RSAs performed by the senior author and 1.5% (4 of 270) of all primary RSAs performed by the collaborating author during the study time frame. A control group consisting of 96 patients, matched at a 1:4 ratio, who underwent TSA for the treatment of GHOA during the same time period was identified. The purpose of the control group was not to identify identical patients but to limit bias in outcomes and complications that were related to age, gender, glenoid wear pattern, severity of arthritis, and rotator cuff muscle quality. The control group represented 15% (96 of 651) of all primary TSAs performed during the study time frame. Average length of follow-up was similar for the 2 groups: 42 months (24-92) for RSA vs. 49 months (25-97) for TSA. All patients signed consent preoperatively for inclusion into the database. The study protocol was approved by the Institutional Review Board before data analysis. The data and manuscript were prepared according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement.[44]

Inclusion and exclusion criteria

For inclusion, patients had to have a primary diagnosis of symptomatic GHOA with intraoperative confirmation of an intact rotator cuff and a minimum clinical and radiographic follow-up of 2 years. Patients were required to have preoperative and postoperative ASES and SST scores, range of motion measurements, standard radiographs, and preoperative computed tomography (CT) scans.

Patients were excluded if they had a primary diagnosis other than GHOA, previous arthroplasty, proximal humerus fracture, or rotator cuff repair or if a full-thickness rotator cuff tear was identified intraoperatively. Patients with significant supraspinatus fatty infiltration (Goutallier grade >1) on preoperative CT scan were also excluded regardless of intraoperative findings of cuff integrity.

During the study time frame, 112 patients were identified as having undergone RSA with an intact rotator cuff. Seventy-eight patients were excluded because of a primary diagnosis other than GHOA. Of the excluded patients, 34 were revision anatomic arthroplasties, 27 had acute fractures, and 17 were treated for post-fracture sequelae.

Thirty-four patients had a primary diagnosis of GHOA, and 24 of those patients fulfilled inclusion and exclusion criteria. Eight patients did not have adequate postoperative follow-up, and 2 were excluded for Goutallier grade 2 fatty infiltration of the supraspinatus on preoperative CT. Within the same time point, 487 TSA patients met inclusion and exclusion criteria; 96 patients were blindly selected from this group on the basis of gender, age, glenoid wear pattern, arthritis grade, and rotator cuff muscle quality as the comparative cohort.