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Clinical outcomes of reverse total shoulder arthroplasty in patients aged younger than 60 years

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Background: Reverse total shoulder arthroplasty (RTSA) has been indicated primarily for patients aged older than 65 years with symptomatic rotator cuff deficiency, poor function, and pain. However, conditions that benefit from RTSA are not restricted to an elderly population. This study evaluates a consecutive series of RTSA patients aged younger than 60 years.

Methods: We evaluated 36 shoulders (mean age, 54 years) at a mean follow-up of 2.8 years (range, 24-48 months). Of these shoulders, 30 (83%) had previous surgery, averaging 2.5 procedures per patient. The preoperative conditions compelling RTSA were as follows: failed rotator cuff repair (12), fracture sequelae (11), failed arthroplasty (5), instability sequelae (4), cuff tear arthropathy (CTA) (4), and rheumatoid arthritis (2). Follow-up examinations included range-of-motion and strength testing, as well as Single Assessment Numeric Evaluation, visual analog scale, Simple Shoulder Test, American Shoulder and Elbow Surgeons (ASES), and Constant scores. Preoperative and postoperative radiographs were reviewed for component loosening and scapular notching. Failure criteria were defined as undergoing revision, having gross loosening, or having an ASES score below 50.

Results: The mean Single Assessment Numeric Evaluation score improved from 24.4 to 72.0; the visual analog scale pain score improved from 6 to 2.1. The Simple Shoulder Test score improved from 1.4 to 6.2, and the ASES score improved from 31.4 to 65.8. Active forward elevation improved from 56° to 121°. The normalized postoperative mean Constant score was 54.3. In 9 patients (25.0%), we recorded an ASES score below 50, and these cases were considered failures.

Conclusion: RTSA can improve shoulder function in a younger, complex patient population with poor preoperative functional ability. This study's success rate was 75% at 2.8 years. This is a limited-goals procedure, and longer-term studies are required to determine whether similar results are maintained over time.

Level of evidence: Level IV, Case Series, Treatment Study.

Keywords: Reverse total shoulder arthroplasty; RTSA; shoulder; 2-year follow-up; outcomes; under 60 years

Reverse total shoulder arthroplasty (RTSA) has been established as an effective treatment for patients with rotator cuff deficiency, pain, and poor function; typically, cuff tear arthropathy has been the primary diagnosis. However, other shoulder conditions with a dysfunctional or irreparable

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rotator cuff and joint injury have been treated with RTSA.[2,10,13,18,21,23] Outcomes have been shown to be correlated with the preoperative diagnosis and the indication for surgery. Wall et al[23] showed that primary arthropathies result in better outcomes than post-traumatic etiologies or revision cases. Furthermore, Frankel and colleagues[25] described the use of RTSA in proximal humeral malunions, Cazeneuve and Cristofari[4] reported on outcomes for fracture treatment, and Holcomb et al[12] described successful use in the rheumatoid population. The reverse shoulder replacement has become a valuable tool for the shoulder surgeon and can be applied to a variety of pathologies.

Traditionally, the majority of RTSAs are performed in an older patient population with low functional demands on their shoulders.[10,21] However, the conditions that potentially benefit from an RTSA are not restricted to an elderly population. We consider the use of RTSA in patients with symptomatic irreparable rotator cuff deficiency, poor active elevation (<60°), pain, or joint injury (degenerative joint disease [DJD], existing implant, or fracture). Few studies in the literature specifically analyze the clinical outcome of RTSA in a younger (<60 years) population. We hypothesize that younger patients will have improvements in function and pain profiles similar to those seen in an older patient population. The purpose of this study is to report the clinical outcomes (range of motion [ROM], strength, patient function) of patients aged younger than 60 years who underwent a primary RTSA. The preoperative clinical conditions that compelled consideration of an RTSA were evaluated, as were the preoperative diagnoses.

Methods

The records of all patients who had undergone RTSA between February 2007 and September 2009 were retrospectively reviewed. We identified 41 consecutive patients (42 shoulders) who met the study criteria. Six were lost to follow-up. The inclusion criteria were as follows: reverse shoulder arthroplasty and age younger than 60 years at the time of the RTSA surgery. Four fellowship-trained orthopaedic surgeons (G.P.N., A.A.R., N.N.V., and B.J.C.) performed all the surgeries in 1 high-volume clinical practice.

There were 36 shoulders available for follow-up (Table I), with a mean age of 54.4 years (range, 39-59.9 years). The mean follow-up was 2.8 years (range, 2-4.0 years). There were 24 female and 12 male shoulders. Of the 36 shoulders, 30 (83%) had previous surgery, with a mean number of procedures of 2.5 per shoulder (range, 1-7). The preoperative diagnostic conditions were as follows: failed rotator cuff repair (RCR) (12), fracture sequelae (open reduction internal fixation (ORIF), hemiarthroplasty, malunion) (9), failed arthroplasty (5), instability sequelae (locked dislocation with rotator cuff tear and post-dislocation DJD with rotator cuff tear) (4), CTA (4), and rheumatoid arthritis (2).

All procedures were performed through a standard deltopectoral approach. Reverse shoulder arthroplasty used a cemented or uncemented humeral component with a cemented glenoid implant. Patients were kept in a shoulder sling for 1 month with only passive ROM exercises allowed. They were allowed to use the arm in the sling for activities of daily living, but formal physical therapy for the shoulder was not performed. At 1 month, the sling was discontinued and closed-chain deltoid and teres minor exercises at home were initiated.

Patients meeting the study criteria were contacted to participate in the study. Operative reports and clinic notes were reviewed to identify factors of interest including previous procedures, mechanism of injury, diagnosis at the time of surgery, and concomitant procedures. Patients with Hamada criteria grade 1, 2, or 3 were considered to have an irreparable rotator cuff tear without arthritis. Patients with Hamada criteria grade 4 or 5 were considered to have cuff tear arthropathy. Patients were classified as having post-traumatic glenohumeral arthritis if they had glenohumeral arthritis and a history of a proximal humeral fracture.

Preoperative ROM of the problem shoulder, demographic information (age, sex, hand dominance, side of shoulder surgery), occupation, history of diabetes, and tobacco use were recorded. At follow-up, a shoulder examination was performed by a trained, independent observer assessing active and passive ROM and strength. ROM was assessed with a goniometer. Strength of forward flexion and external rotation was quantified with a manual muscle dynamometer (PowerTrackII; JTech Medical, Salt Lake City, UT, USA). Forward flexion strength was measured with the arm in the scapular plane while the patient was standing; external rotation strength was measured with the arm at the side and the elbow in 90° of flexion. The maximum value from 3 trials was used. This value was then divided by the power obtained from the other "healthy" arm to obtain a normalized value. The maximum normalized value allowed was 1.

Each patient was also given a postoperative questionnaire including 4 standardized assessment tools: Single Assessment Numeric Evaluation (SANE) score, pain score on a visual analog scale (VAS), Simple Shoulder Test (SST) score, and American Shoulder and Elbow Surgeons (ASES) score. A normalized Constant-Murley score was computed by calculating each patient's score by use of age- and sex-matched normal Constant-Murley scores reported in the literature.[14]

Preoperative and postoperative anteroposterior and axillary shoulder radiographs were reviewed by 2 independent observers. Preoperative radiographs were evaluated for rotator cuff dysfunction according to criteria described by Hamada et al.[11] Criteria described by Rispoli et al[19] were used to assess glenoid cartilage loss and glenohumeral subluxation.

The most recent postoperative radiographs were assessed for evidence of humeral component loosening, glenoid component loosening, scapular notching, osteoarthritis, fracture, and dislocation. Humeral component loosening was based on criteria described by Sperling et al,[22] where a humeral component was deemed "at risk" for loosening if a lucent line greater than 2 mm in width was present in at least 3 of 8 zones or if 2 of 3 independent observers identified migration or tilt of the component. Glenoid component loosening was based on the 6-part grading scale described by Lazarus et al.[15] Scapular notching is a defect of the bone in the inferior region of the glenoid component. It was assessed based on the 4-part grading scale described by Sirveaux et al.[21]

Preoperative and postoperative ROM and scores were compared with paired tests for all patients. $P < .05$ was considered statistically significant. Clinical failure criteria were defined as a revision, gross loosening of a component, or an ASES score below 50.