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Outcomes of reverse total shoulder arthroplasty in a senior athletic population

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Background: This study evaluated the clinical and radiographic outcomes of reverse total shoulder arthroplasty (RTSA) in a senior athletic population playing both low- and high-impact sports.
Materials and methods: We evaluated 41 RTSAs performed in 40 patients who continued to play both low- and high-impact sports after surgery. The mean age was 73 years, and the mean follow-up period was 43 months, with a minimum of 35 months. Clinical and radiographic outcomes were examined.
Results: Ninety-five percent of patients indicated that they were able to return to sports at the same level as before surgery or at a higher level, and only 13% reported increased pain after playing their sport after undergoing an RTSA. The median American Shoulder and Elbow Surgeons score improved from 31 preoperatively to 72 postoperatively ($P < .001$). The median Constant score improved from 25 preoperatively to 83 postoperatively ($P < .001$). The median Subjective Shoulder Value improved from 27% preoperatively to 90% postoperatively ($P < .001$), and the median visual analog scale score improved from 7.2 preoperatively to 1.1 postoperatively ($P < .001$). The overall complication rate was 7%. One zone of lucency was noted in 17% of humeral stems, with 1 case of early subsidence but no cases with loosening at final follow-up. The glenoid notching rate was 7%, with no cases of glenoid subsidence, lucency, or loosening.
Conclusion: RTSA in senior athletes can be safely performed with good clinical results. No prominent mode of mechanical or clinical failure has been identified with short-term follow-up.
Level of evidence: Level IV, Case Series, Treatment Study.

Keywords: Reverse shoulder arthroplasty; athlete; senior; sports; complications

Reverse total shoulder arthroplasty (RTSA) was introduced by Paul Grammont in the 1980s and gained popularity in the treatment of cuff tear arthropathy. Since then, the indications for RTSA have been expanded to include the treatment of massive irreparable rotator cuff tears, rotator cuff tears with pseudoparalysis, inflammatory and noninflammatory arthritis, osteoarthritis in the octogenarian with an at-risk rotator cuff, fractures, and tumors.[3,8,9,11,18-21] Historically, RTSA has been seen as a salvage operation, used to gain pain relief and restoration of overhead function in low-demand older (aged >70 years) patients. However, as the indications for RTSA have been expanded, so too have the

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demographic characteristics of patients in whom RTSA prostheses are considered. Surgeons continue to implant RTSA prostheses in younger patients and patients with higher activity levels.[7,12,16,17] There is a lack of consensus on the appropriate activity level and return to sports after RTSA. We are not aware of any study in the peer-reviewed literature that specifically evaluates the clinical and radiographic outcomes of RTSA in a senior athletic population that places increased stress and demand on the prosthetic shoulder.

We hypothesized that senior athletic higher-demand patients would have improvements in function and pain relief similar to historically low-demand patients reported in the literature without any increase in radiographic loosening or mechanical complications. The purpose of this study is to report the short-term and midterm clinical and radiographic outcomes of RTSA in a senior athletic high-demand population.

Materials and methods

We reviewed the records of 255 RTSA cases performed in 245 patients between 2007 and 2012. All operations were performed by a single high-volume, fellowship-trained shoulder surgeon (R.W.S.). We identified 67 patients (70 RTSA cases) who indicated that they played a high- or low-impact sport[10,14] or engaged in strenuous athletic activity before undergoing RTSA. Forty-three of these patients (44 RTSA cases) indicated a return to sports and hence high-demand use of their prosthetic shoulder after RTSA. Three patients were lost to follow-up before their 2-year evaluation. This yielded a study group of 41 RTSA prostheses in 40 patients. Thus, the inclusion criteria included patients who underwent an RTSA, a return to sports after surgery, and greater than 2 years' follow-up.

In all cases, the RTSA was performed through the deltopectoral interval. Each case was performed with an RTSA prosthesis characterized by a medialized center of rotation; a laterally offset humerus; a proximal grit-blast humeral stem; and a concave-backside, oblong glenoid baseplate secured by a grit-blast bone cage with between 3 and 6 compression, variable-angle, locking screws (Equinoxe; Exactech, Gainesville, FL, USA). The subscapularis was uniformly not repaired. Various glenosphere and humeral tray sizes were used to maximize stability and intraoperative range of motion (ROM). The components used included 1 extended-cage baseplate, 2 superiorly augmented baseplates, 3 posteriorly augmented baseplates, 35 standard baseplates, two 46-mm glenospheres, fifteen 42-mm glenospheres, twenty-two 38-mm glenospheres, and two 38-mm expanded (+4 mm lateral offset) glenospheres. All of the 41 polyethylene trays but 1 were nonconstrained. Stems were either press fit or cemented with Cemex antibiotic-impregnated cement (Tecres SPA, Verona, Italy) depending on radiographic and intraoperative considerations. Twenty-four stems were cemented, and 17 were press fit. Each stem was placed at between 20° and 25° of retroversion. Postoperative immobilization in an abduction sling, along with passive ROM and isometric exercises, was prescribed for 4 weeks. Patients progressed through active ROM and strengthening at 6 weeks and 12 weeks, respectively. A return to sports was permitted at 4 months postoperatively.

Variables recorded for each patient included age, sex, hand dominance, time of follow-up, shoulder diagnosis, whether the surgical procedure was a primary or revision operation, previous surgical procedures, procedures performed concomitantly with RTSA, size of the stem and glenosphere used, type of glenoid baseplate used, height and constraint of the polyethylene used, and whether the humeral stem was cemented or press fit. All patients underwent both clinical and radiographic evaluation. Evaluation took place preoperatively and then 2 weeks, 6 weeks, 3 months, 6 months, and 1 year after surgery, as well as every subsequent year thereafter. In the event that any particular follow-up appointment was missed, evaluation was resumed at the next appropriate time point.

Clinical evaluation included the recording of each patient's Subjective Shoulder Value and visual analog scale score. The recorded ROM included active flexion, active abduction, active external rotation with the shoulder adducted, and active internal rotation with the shoulder adducted. Internal rotation was assigned a numeric value beginning with 0 for reaching the anterior superior iliac spine, 1 for reaching the posterior iliac spine, and so on, with T10 assigned the value of 9. This helped with statistical analysis. Strength was recorded in abduction using a digital dynamometer (Chatillon, Largo, FL, USA). In addition, American Shoulder and Elbow Surgeons (ASES) and Constant scores were recorded at each visit.[5] Sports activity was recorded including frequency; level of sport compared with preoperative abilities (better, same, or worse); time at which the patient reported being able to return to sports after surgery; and whether the patient had increased pain after playing a sport. Complication type, frequency, and treatment were also recorded.

Radiographic evaluation was performed at each visit and included anteroposterior, axillary lateral, and scapular-Y radiographic views. The radiographs were assessed for humeral stem lucencies according to the classification of Gruen adapted to the humerus[15]; subsidence; and loosening, which was determined if 3 or more zones of greater than 2 mm of lucency were identified. In addition, radiographs were assessed for signs of inferior scapular notching using the Nerot classification,[19] glenoid lucency, glenoid subsidence, and osteophyte formation along the scapular neck and glenoid rim. Radiographs were also evaluated for heterotopic ossification, stress shielding of the humerus, and tuberosity resorption.

Statistical evaluation was performed using Wizard (version 1.5.2; Boston, MA, USA). Preoperative and postoperative values were compared using a paired t test.

Results

Of the 67 patients who played a sport before undergoing RTSA, 40 (60%) reported a return to sports after surgery. These 40 patients (41 RTSA prostheses) are the focus of the reported results. The mean age of these patients was 73 ± 7.2 years (range, 61-88 years). There were 25 women and 15 men. Of the RTSAs, 30 were performed on the dominant shoulder and 11 on the nondominant side. One patient underwent staged bilateral RTSA procedures. The frequency of diagnosis is reported in Table I. The mean follow-up period was 43 ± 12 months (range, 35-63 months). The frequency of sports played after surgery is listed in Table II.