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Reverse total shoulder arthroplasty in wheelchair-dependent patients

Adam L. Kemp, BS, Joseph J. King, MD, Kevin W. Farmer, MD, Thomas W. Wright, MD*

Department of Orthopaedics and Rehabilitation, University of Florida, Gainesville, FL, USA

Background: Wheelchair-dependent patients have a high incidence of shoulder pathology, often causing severe impairment. This study reports outcomes of wheelchair-dependent lower extremity–impaired patients with symptomatic shoulder arthritis or severe rotator cuff pathology treated with reverse total shoulder arthroplasty (RTSA).

Methods: Data for 19 wheelchair-dependent patients who had an RTSA for symptomatic arthritis or rotator cuff pathology, or both, were obtained from the University of Florida Shoulder Arthroplasty Database. Included were 16 of 19 shoulders with adequate follow-up averaging 40 months. Functional outcome scores included the Simple Shoulder Test, University of California Los Angeles Shoulder Rating Scale, Shoulder Pain and Disability Index, American Shoulder and Elbow Surgeons score, Constant score, and 12-item Short Form (SF-12) health survey. Objective measures were active elevation, external rotation, and internal rotation. Radiographs were evaluated for lucent lines, notching, and prosthetic loosening.

Results: All measured parameters, except the SF-12, significantly improved at the final follow-up. Functional outcome scores included Shoulder Pain and Disability Index, 45; Simple Shoulder Test, 7; American Shoulder and Elbow Surgeons, 73; University of California Los Angeles Shoulder Rating Scale, 30; Constant, 70; and SF-12, 33. Active elevation was 112°, and active external rotation was 29°. Most patients (83%) were satisfied. The complication rate was 25%; baseplate failure and dislocation occurred early, and periprosthetic humeral fracture secondary to infection occurred late. The notching rate was 42%.

Conclusions: Shoulder pain and dysfunction due to arthritis and rotator cuff pathology can result in the loss of independence in wheelchair-dependent patients. We investigated whether RTSA can sustain the increased loads placed by these patients during transfers. Wheelchair-dependent patients can benefit from an RTSA for shoulder pain and dysfunction but must accept worsened impairment during the immediate postoperative period and a higher complication rate than the general population treated with an RTSA.

Level of evidence: Level IV; Case series; Treatment study

Keywords: RTSA; reverse shoulder arthroplasty; paraplegia; lower extremity impairment

In patients who are wheelchair-dependent due to lower extremity impairment (LEI), the shoulder joint is critical to maintaining independence and well-being. Despite the advent of motorized wheelchairs, the shoulder still serves as a weight-bearing joint during transfers, and assisted ambulation results in considerably increased intensity and frequency of

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*Reprint requests: Thomas W. Wright, MD, Department of Orthopaedics and Rehabilitation, University of Florida, 3450 Hull Rd, 3rd Flr, Gainesville, FL 32608, USA.

E-mail address: wrightw@ortho.ufl.edu (T.W. Wright).

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shoulder loading compared with the ambulatory patient. The prevalence of rotator cuff tears is significantly higher (4.2 times) in long-term paraplegic patients.[1,5]

Regardless of the etiology, shoulder pain and loss of function have catastrophic repercussions for wheelchair-dependent patients, leading to a vastly decreased working space (especially if bilateral) and decreased ability to transfer. Subsequent decline in mood, social integration, and personal assessment of health quality is common.[19]

Interventions that decrease shoulder pain and increase function will potentially restore the ability to reach objects, expand working space, facilitate easier transfers, and meaningfully improve mood and social integration.[11] Even small improvements in range of motion (ROM) have been found to restore key activities of daily living (ADLs) to the wheelchair-dependent patient.[12] Considering individual ADLs, the ability to attend to personal hygiene and toileting needs has been identified as particularly difficult but vital to patient satisfaction, particularly in patients with bilateral impairment.[16] Together, these observations demonstrate that although wheelchair-dependent patients with LEI present daunting challenges to shoulder surgeons, they are also individuals for whom improvements in pain and function can have unparalleled benefits.

Despite the high prevalence of shoulder pathology in wheelchair-dependent patients, there is a paucity of discussion in the literature regarding surgical treatment and outcomes, especially reverse total shoulder arthroplasty (RTSA).[7-9,17] At our institution, RTSA has been performed in wheelchair-dependent patients who had pain and dysfunction due to arthritis or rotator cuff dysfunction in 1 or both shoulders that did not respond to nonoperative measures. We favored the use of RTSA over TSA in these patients due to the high incidence of concomitant rotator cuff disease. Here we report the clinical outcomes and complications of these wheelchair-dependent patients who were treated with a RTSA.

Materials and methods

A retrospective study was performed of clinical data obtained in a prospective manner from all patients who consented to the University of Florida Shoulder Arthroplasty Database. All surgeries were done at a tertiary referral center (University of Florida). All but one of these procedures was completed by the senior surgeon (T.W.W.). The inclusion criteria were patients aged 18 years or older who relied on a wheelchair as their primary means of ambulation and who underwent RTSA between January 2006 and May 2013.

The patients were evaluated preoperatively and postoperatively at standard clinical follow-up intervals of 2 weeks, 6 weeks, 3 months, 6 months, and then annually. Functional outcome scores were obtained prospectively at all clinic visits starting at the 3-month postoperative visit. This questionnaire allows for the derivation of the following functional outcome scores: the Shoulder Pain and Disability Index (SPADI),[14] Simple Shoulder Test (SST),[15] American Shoulder and Elbow Surgeons Questionnaire (ASES),[13] University of California Los Angeles Shoulder Rating Scale (UCLA),[2] 12-item Short Form (SF-12) Health Survey, and the Constant shoulder score.[3] These scores report levels of pain, function, mental health, and general health. Absolute and relative changes in these scores with treatment were our primary outcome variables.

ROM was measured preoperatively and at each follow-up assessment by our research assistant, who is a certified athletic trainer, using a goniometer. Objective ROM included active elevation in the scapular plane (scaption), active external rotation with the patient sitting, the elbow by the patient's side and flexed 90°, and active internal rotation.

X-ray images were obtained preoperatively and at postoperative intervals of 2 weeks, 12 weeks, and annually. The radiographs were evaluated for humeral radiolucent lines, any evidence of prosthetic loosening or migration, and scapular notching. The attending surgeon assessed these radiographs and reported the results in the prospective database. A prosthesis was considered loose if it migrated from the 2-week postoperative position shown on the X-ray or if there were circumferential lucent lines around the glenoid or humeral component.

Other variables observed and reported include age, gender, follow-up duration, LEI classification (neurologic vs. non-neurologic impairment), reason for LEI, prior shoulder surgery, additional procedures performed at the time of the RTSA, prosthesis used, and stem cementation.

The small sample size negates any usefulness in statistically comparing the neurologic with the non-neurologic patients. Therefore, the results are described using descriptive statistics only comparing preoperative with final outcome measures.

Surgical technique and rehabilitation

The senior surgeon performed 18 of the 19 shoulder procedures, with the exception being performed by the senior surgeon's partner whom he trained. Therefore, the surgical technique was very consistent. The RTSA was performed through a standard deltopectoral approach. The subscapularis, if present, was peeled off the humerus and not repaired. The glenosphere was inserted in a standard fashion, and care was taken to make sure there was no inferior or posterior glenoid impingement on the humeral cup. The largest glenosphere that was practical was used to ensure glenosphere overhang over the native glenoid inferiorly and posteriorly.

Postoperative management consisted of full-time sling wear except for hand and elbow motion. Passive ROM was initiated at 3 weeks, progressing at 6 weeks to discontinuation of the sling, allowing active and active-assisted ROM. Strengthening was initiated 12 weeks, at which time the patient was allowed to bear weight through the prosthesis during transfers. It is very important to plan before the surgery how the patient will be managed during transfers because he or she will have only 1 good limb. Most patients require placement in a rehabilitation facility for 6 to 12 weeks.

Results

Review of the database identified 19 shoulders represented by 16 patients as potentially eligible for inclusion based on the criteria of our Institutional Review Board. An initial review of these 19 shoulders revealed that the implants failed in 3 patients shortly after surgery for a failure rate of 15.8% of eligible cases performed (Table I). One failure occurred when