



Self-assessed and radiographic outcomes of humeral head replacement with nonprosthetic glenoid arthroplasty

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Background: Active and young patients who place frequent demands on their shoulder present a treatment dilemma when glenohumeral arthritis progresses to a point at which surgical intervention is considered. Humeral head replacement with nonprosthetic glenoid arthroplasty (“ream-and-run”) has been proposed to address the limitations of total shoulder arthroplasty and hemiarthroplasty in this population. Several reports from a single institution have shown substantial improvement in self-assessed comfort and function after this procedure. However, to the best of our knowledge, no clinical results pertaining to this technique have been reported from other institutions.

Methods: Hemiarthroplasty with nonprosthetic glenoid arthroplasty was performed in 17 patients with a minimum 2-year follow-up. Patients were clinically evaluated preoperatively and postoperatively with physical examination, Simple Shoulder Test (SST), American Shoulder and Elbow Surgeons score, visual analog scale, and standardized radiographs. Preoperative radiographs and patient demographics were assessed for correlation with outcome measures.

Results: Improvement of >30% of preoperative SST score was noted in 14 of 17 patients at a mean follow-up of 3.9 years (range, 2.0-6.8 years). SST score improved from mean 3.2 ± 3.1 preoperatively to 10.0 ± 2.6 at latest follow-up ($P < .0001$). American Shoulder and Elbow Surgeons score improved from mean 42 ± 23 to 90 ± 13 ($P < .0001$). Male patients had higher SST scores ($P = .03$) and greater external rotation ($P = .03$) at latest follow-up.

Conclusions: Nonprosthetic glenoid arthroplasty demonstrated results that correlate with prior data published by the center at which the procedure was initially described. Patients with concentric glenoid morphology preoperatively did not demonstrate results superior to those of patients with eccentric glenoids.

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

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Keywords: Glenohumeral arthritis; hemiarthroplasty; ream-and-run

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Long-term experience with total shoulder arthroplasty (TSA) has led to concern for loosening of the glenoid component, with a recent series of 15- to 20-year follow-up demonstrating a 73% rate of glenoid loosening and a 31% rate of revision.²¹ In another recent series with minimum 20-year follow-up, the estimated survival of TSA was 83%,

and 8 of 19 glenoid components were noted to be at risk for loosening.²⁵ In addition, revision of a failed TSA is associated with inferior outcomes compared with primary shoulder replacement.^{6,13,19,20,23,27} As a result of these concerns, surgeons have been shown to place more restrictions on patients who have had TSA compared with those undergoing humeral head replacement alone.⁹

Concerns about the long-term durability of polyethylene glenoid prostheses in terms of wear and loosening have prompted some surgeons to favor humeral head replacement in young and active patients with glenohumeral arthritis, even though clinical outcome studies and meta-analyses have indicated that overall, TSA provides better results than humeral head replacement alone with regard to pain relief, motion, and level of activity.^{1,2,5,7,12}

Despite good early and midterm results with hemiarthroplasty, progressive glenoid erosion and painful glenoid arthritis are the most common reasons for failure and reoperation.^{7,10,11,14,28} Moreover, the results of conversion of a hemiarthroplasty to TSA have proved to be less predictable than those of primary TSA secondary to limited range of motion, unpredictable improvement in pain, and the more frequent need for subsequent operations.^{3,10,14,26}

In view of the limitations of both humeral head replacement and TSA, active and young patients with degenerative joint disease involving both the humeral head and glenoid present a treatment dilemma once the clinical condition progresses to the point that shoulder arthroplasty is necessary. Whereas chronologic age is important, active patients who place greater demands on the glenohumeral joint require a personalized clinical pathway that takes into account the patient's expectations, physiologic age, recreational activity level, and functional demands. For these patients, the ideal operative solution would provide extended durability with respect to pain relief and functional outcome while minimizing the complications of both painful glenoid erosion associated with hemiarthroplasty and glenoid component failure associated with TSA.

Humeral head replacement performed in conjunction with concentric reaming of the glenoid bone to a specified spherical concavity in patients with glenohumeral arthritis was first described in 2007 by Clinton et al⁴ and Lynch et al¹⁶ in an attempt to address the limitations of conventional TSA and humeral head replacement arthroplasty. Subsequent reports from the same institution have demonstrated midterm and long-term improvements in self-assessed shoulder comfort and function comparable to those of patients with TSA.^{8,24}

To the best of our knowledge, no clinical results from this technique have been reported from other institutions. The purposes of this report were (1) to report the effectiveness of humeral head replacement in conjunction with concentric reaming of the glenoid in patients with glenohumeral arthritis and (2) to assess patient demographic, clinical, and radiographic characteristics for correlation with outcome measures.

Methods

Patients

A retrospective review was conducted of 21 consecutive shoulders (20 patients) treated with hemiarthroplasty with nonprosthetic glenoid arthroplasty for glenohumeral arthritis between March 2007 and June 2011. One patient died for reasons unrelated to surgery before 2-year follow-up was obtained. Three patients were lost to follow-up. This resulted in 17 shoulders that were included in the analysis with minimum 2-year follow-up and median follow-up of 4.3 years (range, 2.0-6.8 years). Ten patients (11 shoulders) were male and 6 were female with a mean age of 55 years (range, 24-69 years). Prior surgeries were reported in 8 of 17 shoulders, including rotator cuff repair in 2, stabilization procedures in 2, arthroscopic débridement in 1, unknown open surgery in 1, and multiple procedures in 2. The inclusion criteria for the study were a diagnosis of glenohumeral arthritis that limited the activities of daily living combined with pain in the shoulder that was refractory to conservative measures for a minimum of 12 months; patients with activity expectations that included work or sports involving impact, heavy lifting, or strenuous use of the upper extremity; and patients who had requested surgical intervention but did not wish to undergo TSA for various reasons, including activity level, age, and the desire to avoid the risks associated with a prosthetic glenoid prosthesis. In this clinical scenario, humeral head replacement in conjunction with concentric reaming of the glenoid was offered as an alternative to patients who understood the potential for both longer recovery time and functional outcome less than that expected for TSA.^{4,16,24} No specific upper age limit was set because of a wide range of physiologic health states and functional levels. All patients in the study gave full verbal and written consent for the operative treatment and participation in this study.

Radiographic analysis

Axillary lateral radiographs and anteroposterior radiographs made perpendicular to the plane of the scapula with the humerus externally rotated 30° were made for all patients. All radiographs were made in standardized digital fashion in accordance with the institutional University Health System Radiology Protocol Policy. The radiographic analysis included assessment of glenohumeral subluxation, glenoid erosion, and the glenohumeral joint space. Glenohumeral subluxation was evaluated on the preoperative and final postoperative axillary lateral radiographs with respect to the direction and amount of translation of the center of the humeral head relative to the center of the glenoid according to the method of Iannotti and Norris.¹⁰ The glenohumeral joint space was measured on the preoperative, immediate postoperative, and final postoperative anteroposterior radiographs in millimeters. Glenoid erosion was measured on both the preoperative and final postoperative axillary radiographs according to the method of Iannotti and Norris.¹⁰ This was accomplished by drawing a straight line parallel to the scapular body. A line perpendicular to this line was drawn from the anterior glenoid margin, and the amount of bone from the posterior edge of the glenoid to the perpendicular line was measured in millimeters. Mild glenoid bone loss was considered to be <5 mm; moderate loss, between 5 and 10 mm; and severe loss, >10 mm. Preoperative axillary radiographs were

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