Bipolar Hemiarthroplasty for Chronic Rotator Cuff Tear Arthropathy

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Abstract: Massive rotator cuff tears associated with glenohumeral arthritis are currently an unsolvable clinical entity. We review our series of 14 patients with rotator cuff tear arthropathy (RCTA) who underwent a bipolar prosthesis of the shoulder. The average follow up was 27.8 months (range, 24–48 months), and the average age was 71 years (range, 57–84 years). Of these 14 patients, 9 were men and 5 women. None of these patients had undergone previous shoulder surgery, and all patients underwent conservative treatment that failed to improve their symptoms or range of motion. Preoperatively, the average active forward flexion was 30°, active external rotation was 10°, and the American Shoulder and Elbow Society (ASES) score was 25 points. Postoperatively, the average active forward flexion improved to 88°, active external rotation increased to 37°, and the ASES score improved to 80 points. Of the 14 patients, 12 stated that they had no pain with activities of daily living. Two patients continued to have moderate pain in everyday activity. **Key words:** rotator cuff, bipolar, hemiarthroplasty, shoulder.

The term *rotator cuff tear arthropathy* (RCTA) was first introduced by Neer, Craig, and Fukuda [1] in 1983, defining a chronic full-thickness rotator cuff tear associated with restricted sore shoulder motion and osteoarthritic changes of the osseous structures of the shoulder (Fig. 1). Based on our review, only 2 previous papers discussed the use of bipolar hemiarthroplasty of the shoulder for rotator cuff tear arthropathy. However, other series in the literature have defined the use of bipolar hemiarthroplasty for primary osteoarthritis, rheumatoid arthritis, and previous fractures. This article strictly defines the use of bipolar hemiarthroplasty for RCTA.

Numerous treatment methods for RCTA are noted in the literature. Arthroscopic debridement of the shoulder joint and rotator cuff is an option that temporizes pain, with variable results [2,3]. Arthrodesis [4,5], hemiarthroplasty [6–8], and total joint arthroplasty [9–11] are other available options. Very little documentation exists regarding the efficacy of bipolar arthroplasty for RCTA [12,13]. Many of the reports evaluating bipolar arthroplasty include results with various previous operations or mixed diagnoses that include primary osteoarthritis, rheumatoid arthritis, and previous fractures [13–16]. The purpose of this study is to evaluate the efficacy of the bipolar hemiarthroplasty as a means of treating RCTA in patients who had no previous shoulder operations and an intact coracoacromial arch.

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Submitted May 23, 2002; accepted September 25, 2002.
No benefits or funds were received in support of this study.

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0883-5403/03/1802-0008$30.00/0
doi:10.1054/arth.2003.50041

Fig. 1. Radiograph of a patient with rotator cuff tear arthropathy. Note the superior migration of the head and the erosion of the glenohumeral joint.

Materials and Methods

Between 1993 and 1998, 14 patients with RCTA underwent a bipolar hemiarthroplasty of the shoulder. The senior author (D.G.S.) performed the surgeries on all patients. Follow-up ranged from 2 to 4 years, with an average follow-up of 27.8 months. The average patient age was 71 years (range, 57–84 years). The patients included 9 men and 5 women and 10 right shoulders and 4 left shoulders. No patients included in this study had undergone a previous shoulder procedure, fracture, or other pathologic entity of the shoulder.

All patients underwent preoperative physical therapy averaging at least 5 months, and 13 of 14 patients had undergone at least 1 previous cortisone injection of the involved shoulder with minimal or no relief. All patients underwent anterior, posterior, auxiliary, lateral, and subacromial arch radiographs, with evidence of erosion, osteophytes, cysts, and joint space narrowing present in association with superior migration of the humeral head. In 8 patients (11 shoulders), evidence of acromioclavicular joint arthritis was seen. Five patients presented with magnetic resonance imaging (MRI) scans ordered by their primary care physicians. All scans showed massive retracted rotator cuff tears with evidence of glenohumeral arthritis and fibrosis of the rotator cuff muscles.

The chief complaint in all patients was severe pain with activities of daily living and at night. Secondary complaints included restricted motion of the shoulder with activities of daily living and recurring effusions of the shoulder joint. Preoperative forward active flexion averaged 30° and average active external rotation was 12°. All of the patients were evaluated using the American Shoulder and Elbow Surgeon's (ASES) scoring scale; the average score was 25 points.

Surgical Technique

A standard anterior deltopectoral approach was used, with the patients in a semi-seated position under scalene block anesthesia and sedation. The subscapularis tendon was taken moved 1 to 2 cm from its insertion, leaving an adequate cuff for repair. After preparation of the humeral shaft, a cemented bipolar prosthesis was inserted with the head placed higher than the great tuberosity to avoid impingement. The radius of the shell used in each patient was almost equal to the preoperative calculation of the sum of the radius of the glenoid and subacromial space on the anteroposterior radiograph (Fig. 2). This was done to improve the mechanical advantage and stability. No attempt was made to repair any of the chronic full-thickness rotator cuff tears or to decompress the subacromial space. Despite noting arthritis of the acromioclavicular joint in 10 patients, to preserve the coracoacromial arch, no resection of the distal clavicle was performed. Resection of inferior osteophytes at the

Fig. 2. The optimum position of the bipolar prosthesis.

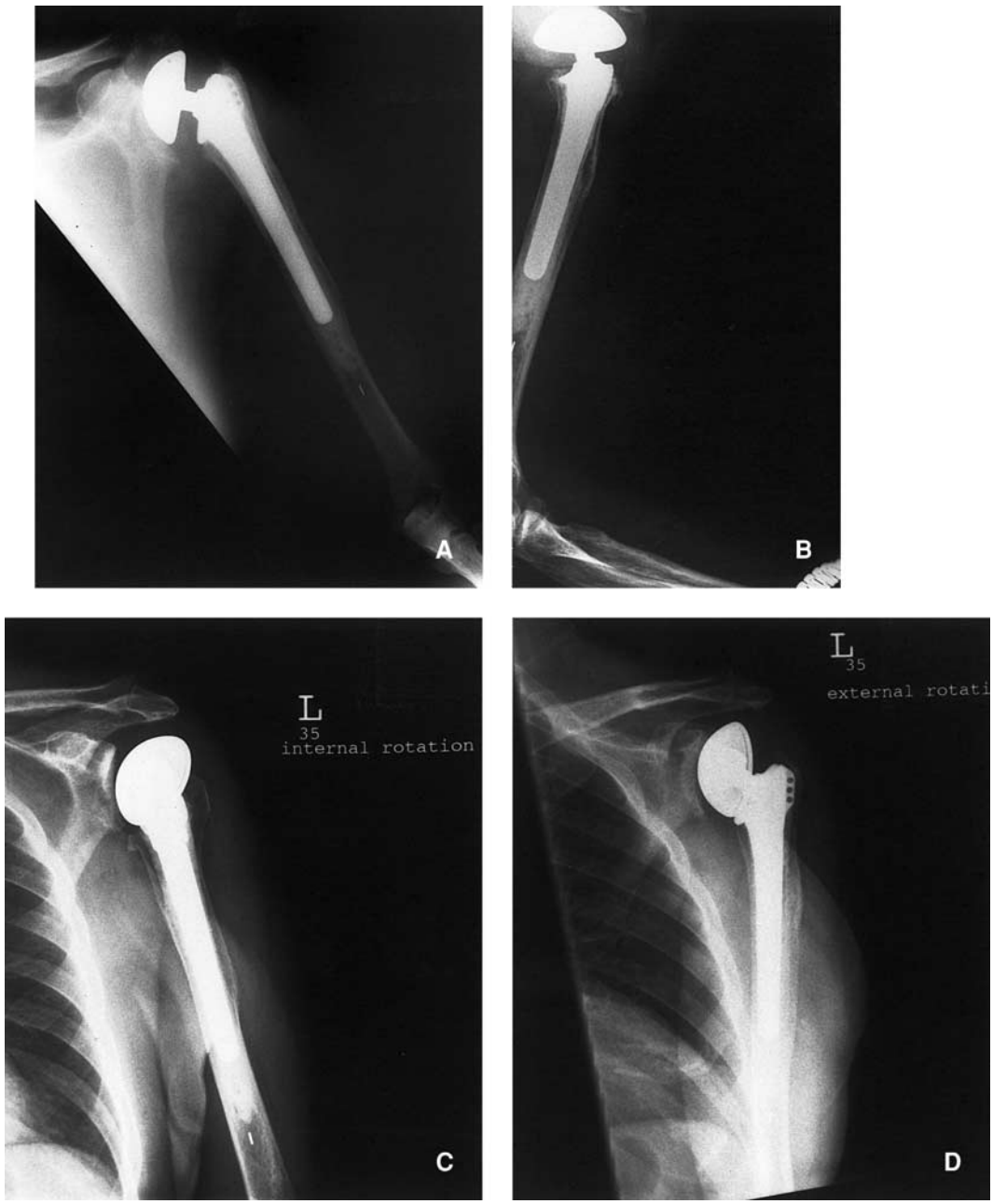

Fig. 3. One-year follow-up included (A) anteroposterior, (B) lateral, and (C, D) rotational radiographs of the shoulder joint.

acromioclavicular joint was performed to obtain optimal congruity between the prosthetic shell and the articulated osseous structures. The subscapularis was repaired, tendon-to -tendon, with nonabsorbable No. 2 sutures. Intraoperatively, all shoulders were tested for stability and were considered stable in the anterior and posterior plane. Intraoperative radiographs were performed on all patients. The average hospital stay was 2 days.

Postoperative physical therapy was initiated on day 1 including passive range of motion with pendulum exercises. Active range of motion was not begun until 3 weeks after surgery. All patients underwent intraoperative anteroposterior and lateral radiographs and radiographs at 6 and 12 weeks and 1 year after surgery. Radiographs at 1 year after surgery also included internal and external rotation views of the shoulder (Fig. 3).

Results

Forward flexion, external rotation, and pain were evaluated according to the ASES scale. The average active forward flexion improved to 88° (range, 75°–148°) with a gain of 58°. The average active external rotation improved to 37° (range, 29°–45°) with a gain of 27°. Only 5 patients (36%) achieved less than 90° of active forward flexion. The average ASES score was 80, with a gain of 55 points.

Of 14 patients, 12 (86%) were extremely pleased with the resultant pain-free activities of daily living. Four patients resumed their previous light work activities, 5 patients (36%) had moderate pain after unusual activity, and 2 patients (14%) had only fair pain relief after the operation. All patients were able to resume pain-free sleep, and 12 of 14 patients (86%) were happy with the outcome of the operation and would undergo the procedure again. We noted no dislocation, subluxation, superior migration, or prosthetic losing in our postoperative follow-up. These 12 patients believed that the results were good to excellent, and 2 patients rated their results as fair.

Discussion

Bipolar hemiarthroplasty of the hip has been criticized in the literature for creating protrusio acetabulei as well as loosening motion between the shell of the bipolar prostheses and the prosthetic head. We believe that the shoulder, which is a nonweightbearing joint, is far less likely to undergo erosive changes compared with hip bipolar arthroplasty. Furthermore, in the literature several shoulder studies have used cineradiography to document persistent motion between the head and shell of the prosthesis even as long as 5 years after surgery [13]. Based on these cases, we believe that bipolar hemiarthroplasty is an option for treating rotator cuff tear arthropathy of the shoulder.

Hemiarthroplasty of the shoulder has been noted to have good results in terms of pain relief, although range of motion does not improve significantly [6–8]. Many of the criticisms of hemiarthroplasty point to persistent pain at the subacromial articulation of the prosthesis. We believe that Swanson and De Groot et al [21], Worland and Jessup et al [13], and Petroff and Mestagh et al [12] may be correct in suggesting that bipolar hemiarthroplasty is superior to the plain hemiarthroplasty based on the birotational nature and the lateralizing effect of the shoulder joint. The birotational nature of the bipolar prosthesis provides stability of the shoulder joint, decreased wear, and, consequently, decreased pain at the acromion and more concentric forces. The prosthesis offset lessens the impingement against the greater tuberosity and increases the moment arm between the fulcrum and the deltoid muscle insertion.

The motion between the head and shell of a shoulder bipolar prosthesis has been shown (with cineroentgenography) to survive for more than 5 years [13], more than 4 years (2 to 4 years follow up) [12] (with videofluroscopy), and more than 14 months [15] (with video fluoroscopy and NIH computer software) with an average range of 22.3° of 50° that the prosthesis permits. We believe that this occurs because of the nonweightbearing nature of the shoulder joint as compared with the hip joint.

Other treatment methods for rotator cuff tear arthropathy include arthroscopic debridement of the rotator cuff and arthritic shoulder joint, total shoulder arthroplasty, constrained total arthroplasty, shoulder fusion, and resection arthroplasty. Each of these respective methods has their merits and risks. The literature clearly notes that hemiarthroplasty is the option of choice for treatment of RCTA.

Our 86% good or excellent results correlates with the 91% results reported by Petroff and Mestagh et al [12] and the 95% reported by Worland and Jessup et al [13]. In both of these studies, the average forward flexion improved to 85° (Petroff and Mestagh et al [12]) and to 67° (Worland and Jessup et al [13]), respectively. In our series, the average forward flexion improved to 88°. We believe that the lower forward flexion score in the study by Worland and Jessup et al [13] was probably indicative of the study's inclusion of patients with violated coracoacromial arches. In some cases in our series, we noted that patients with poor preoperative ROM improve their postoperative ROM more than patients with a better preoperative ROM.

In summary, only 2 previous studies have documented the results of bipolar arthroplasty for RCTA [12,13]. Of these, only Petroff and Mestagh et al [12] included the use of bipolar hemiarthroplasty in 12 patients with intact coracoacromial arches. All other studies have researched the results of bipolar hemiarthroplasty for avascular necrosis, rheumatoid arthritis, previous fractures, and violated coracoacromial arches. Our results parallel the results of previous studies [12,13] of use of bipolar hemiarthroplasty for cuff tear arthropathy in patients with intact coracoacromial arches.

Conclusion

Based on a review of the literature and this series, we believe that bipolar hemiarthroplasty is a good option for the treatment of RCTA. Based on the literature reviewed, bipolar hemiarthroplasty provided more reliable pain relief than hemiarthroplasty. Our series clearly showed that the range of motion achieved is extremely variable and may be related to the preoperative muscular condition of the patient.

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