Symptomatic Glenoid Loosening Complicating Total Shoulder Arthroplasty

Bradley S. Raphael, MD · Joshua S. Dines, MD · Russell F. Warren, MD · Mark Figgie, MD · Edward V. Craig, MD · Stephen Fealy, MD · David M. Dines, MD

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Abstract Glenoid component loosening is one of the most common causes of failed total shoulder arthroplasty. Previous reports indicate that it is desirable to reimplant the glenoid component during revision shoulder arthroplasty. The purpose of our study was to retrospectively evaluate the satisfaction of patients undergoing glenoid revision (reimplantation or resection) following total shoulder replacement specifically for symptomatic glenoid loosening. Twenty-eight shoulders that developed symptomatic glenoid loosening following primary total shoulder arthroplasty were included in the study. Patients were retrospectively evaluated at a minimum of 2 years postoperatively. Patients either underwent resection followed by reimplantation of the glenoid component (13) or resection of the component with or without bone grafting (15). Each patient was evaluated with the UCLA Shoulder Scale and the Constant–Murley Shoulder Assessment. There were seven excellent, 13 good, five fair and three poor results on the UCLA score. Functional outcome scores trended higher in the reimplantation group but were not statistically significant. Both groups reported equal pain relief and satisfaction. Five out of 15 patients underwent arthroscopic resection of the glenoid, and these patients scored as well on the UCLA and Constant scores as the reimplantation group. When symptomatic glenoid loosening is the indication for revision

total shoulder replacement, patients tend to achieve good to excellent results. Though functional scores were slightly higher in the reimplantation group, satisfaction was equally high in both groups. Resection, when indicated, should be performed arthroscopically as this improved functional outcome in our series.

Keywords revision shoulder arthroplasty · glenoid · loosening · reimplantation

Introduction

Component loosening remains one of the most common indications for revision of total shoulder arthroplasty with the glenoid component being affected more often than the humeral component [14]. Indications for revision of the glenoid component include symptomatic loosening causing pain or stiffness, material failure, and malposition or wear, causing instability. The decision to reimplant versus resect the glenoid component is a difficult one and is often based on bone quality at the time of surgery. In view of the numerous reports of successful patient outcomes following shoulder hemiarthroplasty, glenoid component resection has been used as a viable treatment option for component loosening [3, 4, 10, 13].

Previous reports have indicated that glenoid implant resection offers satisfactory pain relief but may be inferior to component reimplantation in terms of pain relief and function [2, 6, 11, 18]. Recent studies have shown satisfactory pain relief in both techniques but a clinically unimportant decreased range of motion in the glenoid resection groups [5, 8]. In our previous analysis of outcomes following revision total shoulder replacements, we found that, despite slightly improved functional outcomes of patients undergoing reimplantation, there was no statistically significant difference in the postoperative satisfaction of those patients versus patients treated with glenoid resection for symptomatic glenoid loosening [9]. Our previous results, may, in part, be related to the initial

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B. S. Raphael, MD · J. S. Dines, MD (✉) · R. F. Warren, MD · M. Figgie, MD · E. V. Craig, MD · S. Fealy, MD · D. M. Dines, MD
Department of Orthopedic Surgery,
Hospital for Special Surgery,
535 East 70th Street,
New York, NY 10021, USA
e-mail: dinesj@hss.edu

indications for total shoulder replacement. Underlying pathologies such as rheumatoid arthritis can predispose patients to glenoid component loosening, which may compromise scores on outcomes measures. However, given their preexisting conditions, these patients may be equally as satisfied with their postoperative outcome when compared with healthier patients undergoing reimplantation.

Based on the results of our previous analysis, we hypothesized that patients undergoing glenoid revision for symptomatic glenoid loosening would have equal postoperative satisfaction, regardless of treatment type (resection or reimplantation) [9]. This paper is not a comparison of treatment techniques for glenoid loosening, as there is inherent bias in the way patients are treated. Typically, resection is reserved for patients with more severe pathology or who are less medically fit to undergo a more involved procedure. The purpose of this study is to evaluate the results of each procedure by analyzing three long-term postoperative concerns: (1) function based on both the UCLA Shoulder Score [1] and Constant–Murley Shoulder Assessment [7]; (2) pain based on a pain scale previously published by Neer [14] and Cofield [6]; and (3) satisfaction, using an assessment described by Antuna [2]. We also hypothesize that, if arthroscopic surgery is a feasible option, the outcomes are favorable to an open procedure.

Materials and methods

Revision of a total shoulder was performed in 114 consecutive patients from 1997 to 2004 by one of four surgeons (DMD, RFW, MPF, EVC). Of these, revision of the glenoid component for symptomatic loosening was performed in 41 consecutive patients. All patients had radiographic evidence of loosening prior to revision (Fig. 1). Patients with loosening secondary to infection

Fig. 1. This is an AP radiograph of a shoulder exhibiting loosening of the glenoid component

and those with fractured glenoid components were excluded from the present study. Nine patients were lost to follow-up, and four patients had died of causes unrelated to the shoulder surgery. Of the nine patients who were lost to follow-up, five had undergone glenoid resection, and four underwent glenoid reimplantation.

Twenty-eight patients completed a follow-up questionnaire at a minimum 2-year follow-up and comprised the study group. The primary symptom caused by component loosening that led to revision included pain ($n=12$), stiffness ($n=6$), and instability due to component loosening ($n=10$).

The group included 15 women and 13 men. Initial indication for total shoulder replacement was osteoarthritis in 16 (eight reimplantation, eight resection), rheumatoid arthritis in six (two reimplantation, four resection), post-traumatic arthrosis in three (one reimplantation, two resection), and avascular necrosis (two reimplantation, one resection) secondary to steroid use in three. Average age at the time of revision was 62 years old, with no significant age difference between those undergoing resection (64.3 years) and those undergoing reimplantation (59.5 years). Mean interval between primary total shoulder arthroplasty and index revision procedure was 46.8 months (range, 4–156 months).

All patients were evaluated postoperatively at a minimum of 2 years by a single observer blinded to surgical procedure and clinical results who was not involved in any of the patient care (JSD). Outcomes were collected using the UCLA Shoulder Score [1], the Constant–Murley Shoulder Assessment [7], a pain scale previously published by Neer [14] and Cofield [6], and a satisfaction assessment as described by Antuna [2]. Both the UCLA Shoulder Score and Constant score evaluate patients' pain, strength, motion, and function. Pain was graded as no pain (1 point), slight pain (2 points), pain after unusual activities (3 points), moderate pain (4 points), severe pain (5 points). Satisfaction was based on how patients felt after revision surgery compared with the way they felt prior to the procedure: much better (grade 1), better (grade 2), same (grade 3), worse (grade 4).

Data were analyzed using SPSS software. A two-tailed t test was used to compare both the parametric and non-parametric data from each group. A p value less than 0.05 was considered statistically significant.

Results

Global shoulder function at the time of follow-up was considered good as judged from the Constant and UCLA shoulder assessments. On both functional outcome measures, the patients undergoing reimplantation scored higher than patients undergoing glenoid resection. However, this was not statistically significant (Table 1). The average UCLA score for all patients was 20.2 (range, 8–30); reimplantation had slightly higher scores (21.3 vs 19.3), but these were not statistically different ($p=0.6$). The average Constant–Murley Score equaled 61.3 (range, 21–96); reimplantation had slightly higher scores (66.0 vs 57.2), but these were also not statistically different ($p=0.4$). In the glenoid resection group, the break-

Table 1 Overall results delineated by outcome measure

Cohort	UCLA	Constant–Murley	Pain	Satisfaction
Overall	20.2	61.3	2.2	1.75
Reimplantation	21.3	66.0	2.4	1.53
Resection	19.3	57.2	2.1	1.95
<i>P</i> value (reimplantation vs. resection)	0.6	0.4	0.6	0.7

down of results on the UCLA score was as follows: excellent 4; good 6; fair 2; poor 3. Three patients undergoing resection had poor outcomes based on the UCLA Shoulder Score. One of the three patients who scored a “poor” on the UCLA scale was a patient with severe rheumatoid arthritis. She had previously undergone bilateral total shoulder replacements, bilateral total elbow replacements, and a total wrist replacement on the side of glenoid resection. One patient had a large subscapularis tear requiring repair at the time of revision surgery. The third patient never received pain relief after resection and eventually underwent a delayed reimplantation with partial pain relief. For the purposes of this study, they were grouped with the resection cohort based on intent to treat grouping.

Five of the patients underwent arthroscopic glenoid removal (Fig. 2a, b). These patients had slightly increased functional scores than the rest of the resection group, but the number was too small to determine significance (UCLA, 25.5 vs. 16.2; Constant Score, 82 vs. 44.8).

Regarding the pain assessment, the mean score was 2.24, and satisfaction averaged 1.75. Regarding patient’s current pain level, five had no pain, five had slight pain, one had pain after unusual activities, three had moderate pain, and one had severe pain. In the reimplantation group, two reported no current pain; four patients had slight pain; seven had pain after unusual activities.

In terms of Antuna scores measuring satisfaction after surgery as compared with prior to revision, eight patients felt much better, four felt better, and three were worse. Overall, in the reimplantation group, three patients scored excellent, seven good, and three fair. After surgery, seven patients felt much better, five felt better, and one felt the same.

Discussion

The purpose of this study was to evaluate the results of revision surgery for symptomatic glenoid loosening by analyzing three long-term postoperative concerns: (1) function, (2) pain, and (3) satisfaction. We also hypothesize that, if arthroscopic surgery is a feasible option, the outcomes are favorable to an open procedure. Our results indicate that one can reasonably expect good results for patients undergoing revision shoulder replacements secondary to glenoid component loosening.

A major limitation to this study is its retrospective nature without any preoperative data for comparison, and results can also be variable when comparing different surgeons. However, our data is comparable to previously

published reports. It is important to note that our series was not a comparison of two surgical techniques to treat the same pathology. There is selection bias as this was not a prospective study comparing two groups. Despite lower scores on many outcomes instruments, patients undergoing glenoid resection were equally as likely to report being satisfied with their outcome as patients undergoing reimplantation. Typically, patients treated with reimplantation were, on average, younger, had undergone fewer prior surgical procedures, and had less concomitant pathology at the time of revision. In contrast, patients undergoing resection have worse bone stock and more advanced disease. However, they may be just as satisfied after surgery because their expectations were lower (Fig. 3). This may explain their lower scores on the UCLA and Constant–Murley scales and their relatively higher scores on the satisfaction outcome measure.

The apparent superior pain scores in the resection group versus the reimplantation group can most likely be attributed to two reasons. First, 1/3 of the group underwent arthroscopic revision, which is less traumatic and may be associated with decreased pain when compared with a large

Fig. 2. **a** Note the arthroscopic view of a loose glenoid component. **b** This is an arthroscopic view exhibiting a “mirror effect” of the glenoid surface after arthroscopic removal

Fig. 3. This is an AP view after arthroscopic removal and revision to hemiarthroplasty with a good clinical result

arthrotomy. Second, though there is an apparent difference, it may be related to selection bias. Patients undergoing reimplantation typically have less advanced disease and are more functional at baseline. It might be the case that the resection group does not even have the function to do unusual activities. In summary, the groups are different; the resection group had more previous surgeries and advanced disease, making it difficult to draw comparisons.

Recent studies have shown similar results to our findings. Deutsch et al. compared glenoid revision surgery to revision hemiarthroplasty in cases of glenoid component loosening in 32 patients. They found significant pain relief, improved function, and satisfaction in both populations. However, reimplantation offered greater improvements in pain and external rotation [8]. Cheung et al. examined the results of 68 shoulders after revision for glenoid component loosening: 33 shoulders with revision glenoid components and 35 patients with component removal and bone grafting. They concluded there is a slight clinical benefit to glenoid reimplantation. Yet, there was not a statistically significant difference between the groups in terms of pain, range of motion, nor rate of survival [5]. Antuna et al. retrospectively reviewed 48 patients who underwent glenoid revision surgery [2]. Thirty patients had a new glenoid implanted, whereas 18 underwent resection and bone grafting. Overall, shoulders revised for glenoid pathology had significant improvements in pain relief, active elevation, and external rotation. However, patients who underwent resection were less satisfied than those who had a new glenoid component implanted. Rodosky et al. assessed 25 glenoid revisions and noted slightly better results in the reimplantation group, specifically with regards to pain relief and function. However, a significantly higher percentage of

patients in the replacement group had an intact deltoid and rotator cuff (69% vs 33%) [17].

Our paper did elucidate the benefit of possibly using arthroscopy in the revision setting as a diagnostic and therapeutic tool [16]. O'Driscoll et al. described the arthroscopic technique for removing glenoid components for failed total shoulder arthroplasties in five patients [15]. Five patients in our series were treated with arthroscopic-assisted resection of the glenoid component. Standard diagnostic arthroscopy was performed to confirm loosening of the component, after which osteotomes were used to split the component into smaller pieces. The implant was then removed through a portal created in the rotator interval, taking care to maintain the integrity of the subscapularis. In our series, patients undergoing arthroscopic resection of the glenoid scored much higher than those undergoing open resection, especially with regards to postoperative range of motion and function. Indications for arthroscopic removal included patients with symptomatic loosening and bone loss significant enough that reimplantation was not going to be considered as a treatment option. In one of our cases, severe medical comorbidities necessitated the use of arthroscopic removal. In addition, there are cases in which the loosening of the glenoid component may be hard to determine; arthroscopy can be an excellent diagnostic tool in these situations [12]. Technically, cement removal may be difficult. We find it helpful to use small osteotomes to remove the cement. Arthroscopic burrs can be used to remove the small, remaining areas of cement. Despite better results, these were not statistically significant, and larger studies need to be done.

Three patients had poor outcomes. One patient with severe rheumatoid arthritis had a poor functional outcome. She had previously undergone bilateral total shoulder replacements, bilateral total elbow replacements, and a total wrist replacement on the side of glenoid resection. It is likely that at least part of her inferior functional score on the UCLA Scoring scale was due to less than normal function of her extremity secondary to the previous arthroplasties. One patient had a large subscapularis tear requiring repair at the time of revision surgery. Previous studies have shown that soft tissue pathologies requiring surgical repair are associated with the worst functional outcomes following revision shoulder arthroplasty [9]. It is likely that this patient's rotator cuff tear contributed to their inferior outcome. The third patient never received pain relief after resection and eventually underwent a delayed reimplantation. They actually did well following reimplantation but were analyzed as part of the resection group based on intent to treat analysis.

Based on our review, treatment with either reimplantation or resection can provide good functional results, and patients are usually satisfied with the procedure. We did find that, despite the inferior functional outcomes, the component resection group had similar satisfaction after surgery, supporting our initial hypothesis. However, if the patient has sufficient bone

stock and good rotator cuff function, reimplantation typically provides slightly better outcomes. When resection is indicated, arthroscopic-assisted removal may lead to improved results.

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