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ORIGINAL ARTICLE

Revisions for aseptic glenoid component loosening after anatomic shoulder arthroplasty

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Background: Glenoid component loosening is a common indication for revision shoulder arthroplasty. The objective of this study is to assess the longer-term outcomes of patients undergoing revision specifically for aseptic loosening.

Materials and methods: Between 1985 and 2005, 34 revision shoulder arthroplasties were performed for aseptic glenoid loosening. Three patients were lost to follow-up. Treatment included component reimplantation in 20 shoulders (group I) or component removal with bone grafting in 11 shoulders (group II). We identified 9 cases of instability with or without rotator cuff tearing prior to revision. The mean follow-up period was 8.3 years.

Results: The rate of survival free of reoperation at 10 years was 78.9% in group I and 83.9% in group II ($P = .5$). Pain relief occurred in 26 of 31 shoulders, with no difference between groups ($P > .99$). Active elevation and external rotation improved in both groups ($P = .8$). Five shoulders in group I had radiographically loose glenoids, with two requiring reoperation. Nine shoulders in group II had medial glenoid erosion, with two requiring reoperation for pain. There was a trend toward reoperation in those with preoperative instability (5 of 8 re-revisions).

Discussion and conclusion: Glenoid revision surgery in the absence of infection provides satisfactory results, especially when instability is not coexisting. When glenoid bone stock permits, reimplantation of a new glenoid component in an active patient with an intact rotator cuff and no instability is reasonable. When the remaining glenoid bone will not support a new component, conversion to a hemiarthroplasty is also reasonable.

Level of evidence: Level III; Retrospective Cohort Design; Treatment Study

Keywords: Glenoid; shoulder arthroplasty; rotator cuff; instability; loosening; revision

The number of total shoulder arthroplasties (TSAs) performed annually has been increasing rapidly, tripling from 2000 to 2008.[13,19] Glenoid component loosening continues to be a common mode of failure and indication for revision surgery following TSA.[7,12,14,18] Glenoid component removal with or without bone grafting and glenoid component reimplantation following removal of a loosened glenoid component continue to be treatment options for this complication. Previously, Cheung et al[6] reported on 68 shoulders that underwent revision surgery for glenoid component loosening, demonstrating a small but significant outcome advantage for glenoid reimplantation compared with glenoid removal. Current literature reports similar findings.[2,9] Deutsch et al[9]

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demonstrated that reimplantation of a new glenoid component led to better pain relief and improved external rotation compared with glenoid removal.

Our earlier cohorts included shoulders with positive joint cultures and signs of infection, which may have affected outcomes.[2,6] A subset of patients also had concomitant instability with or without rotator cuff tearing, possibly confounding our earlier results. Newer techniques in the surgeon's armamentarium include reverse arthroplasty, not only to potentially improve glenoid component fixation but also to address rotator cuff and instability issues. The objective of this study is to assess the longer-term clinical outcomes, complications, and survivorship of revision anatomic arthroplasty for aseptic glenoid component loosening, as well as to define any effects of concomitant instability with or without rotator cuff tearing.

Materials and methods

Between January 1, 1985, and December 31, 2005, 34 consecutive revision shoulder arthroplasties were performed in 34 patients primarily for aseptic glenoid loosening at a single institution. Charts were reviewed retrospectively. All shoulders with signs of active infection, frozen-section pathologic findings notable for acute inflammation, or positive cultures at the time of surgery were excluded. Three patients were lost to follow-up. This left 20 shoulders treated with glenoid reimplantation (group I) and 11 shoulders treated with glenoid component removal and bone grafting (group II). All shoulders were included in the survivorship analysis until the time of last known follow-up. Patients were analyzed at a minimum of 2 years' follow-up or until reoperation. The mean follow-up period was 8.3 years (range, 0.3-20.3 years). The mean age was 66 years (range, 32-78 years), and 18 men were included. The dominant extremity was involved in 22 cases (71%). The failed glenoid components were cemented in 22 shoulders and an ingrowth design in the remaining 9. Eleven of the cemented components were all polyethylene, whereas the rest of the components were metal backed. The mean time interval from the primary arthroplasty to revision was 3.6 years (range, 0.4-11.1 years).

Operative findings and techniques

A deltopectoral approach with a subscapularis tenotomy was used in 22 shoulders, with an anteromedial approach in 9. Revision of the humeral component was required in 15 of 31 shoulders for component malposition, component loosening, or glenoid exposure in the setting of a monoblock humeral component.

Glenoid bone loss was graded and recorded in the operative reports (Table I).[2] The primary surgeon in each instance assessed the stability of a trial glenoid component and available bone stock to determine whether reimplantation or component removal with bone grafting should be undertaken. Of the 20 shoulders that underwent reimplantation, 4 accepted an uncemented metal-backed glenoid. The remaining 16 components were cemented in place, 12 of which were all polyethylene. Nine of the 20 required cancellous allograft to supplement bone stock to allow for adequate and secure fixation.

Additional procedures were performed as indicated. Three rotator cuff tears were repaired during the operation, 1 of which required a fascia lata allograft. All of the rotator cuff tears were in group I. Posterior capsular plication was performed in 3 shoulders for intraoperative posterior instability, acromioplasty with coracoacromial ligament repair was performed in 1, reattachment of the greater tuberosity was performed in 1, and stabilization of an intraoperative humeral fracture with cerclage cables was performed in 2.

Table I Extent of glenoid bone loss

Glenoid bone loss grade	Reimplantation (group I), n	Component removal (group II), n
Peripheral		
Mild	0	0
Moderate	2	0
Severe	2	0
Central		
Mild	2	0
Moderate	10	1
Severe	1	5
Combined		
Mild	0	0
Moderate	1	1
Severe	2	4

Clinical, functional, and radiographic assessments

Preoperative and postoperative pain was graded as previously described by Neer et al.[17] Active elevation and external rotation were graded in degrees. Internal rotation was graded based on the spinal level reached by the patient's thumb. These were measured in the clinic by residents, fellows, or fellowship-trained surgeons or via a validated patient questionnaire.[20,24] Given the time frame for patients included in this study, American Shoulder and Elbow Surgeons scores were not available uniformly. The modified Neer result rating system was used for postoperative functional assessment.[23]

Preoperative, immediate postoperative, and most recent radiographs of the shoulder were analyzed. Preoperative radiographs were available for 27 of 31 shoulders, whereas postoperative radiographs at a minimum of 1 year were available for 28 of 31 shoulders. The mean radiographic follow-up period was 7.1 years (range, 1-16.3 years). Subluxation of the glenohumeral joint[2] and periprosthetic humeral and glenoid lucency were recorded as previously described.[22] A radiographically "at-risk" glenoid component was noted if a shift in position or a complete lucent line at least 1.5 mm wide was observed. In each of the 2 groups, shoulders with medium, large, or massive rotator cuff tears or with moderate to severe instability (6 shoulders in group I and 3 shoulders in group II) were identified.[8]

Statistical methods

The 2 treatment methods were analyzed for differences in range of motion, pain, satisfaction, and modified Neer rating using *t* tests. A subgroup analysis was similarly performed on shoulders with rotator cuff tearing and clinical instability at the time of revision surgery. Statistical significance was considered at $P < .05$. Survival free of reoperation was assessed using the Kaplan-Meier method for each group as a function of time from the date of revision surgery. All 34 shoulders were included in the survivorship analysis, which was assessed using a Kaplan-Meier survival technique.