

Does Retained Cement or Hardware after 2-Stage Revision Shoulder Arthroplasty for Infection Increase the Risk of Repeat Infection?

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INTRODUCTION:

Prosthetic joint infection (PJI) after shoulder arthroplasty is a morbid complication and is becoming more prevalent as the incidence of primary shoulder arthroplasty increases. Because bacteria can adhere to the implants and cement and form a biofilm that evades the native immune system and antibiotics, complete removal of the implants and cement is typically pursued when attempting to eradicate these infections. However, removal of cemented implants can compromise bone stock that is important for achieving stable revision implants. Therefore, the surgeon must weigh the benefits of completely removing the cement and hardware that is a potential nidus of infection and the risk of resulting intraoperative bone loss that may make future reconstruction more difficult. The purpose of this study is to compare the rates of repeat infection after 2-stage revision for PJI in patients who have retained cement or hardware compared to those who had complete removal.

METHODS:

We retrospectively analyzed all two-stage revision total shoulder arthroplasties (TSAs) performed for infection at two institutions between 2011 and 2020 with minimum two-year follow up from completion of the two-stage revision. Patients were included if they met the International Consensus Meeting (ICM) criteria for probable or definite infection. Operative reports and postoperative radiographs after the first-stage of the revision consisting of prosthesis and cement removal and placement of an antibiotic spacer were reviewed to evaluate for retained cement or hardware in either the humerus or the glenoid. Single-stage revisions were excluded because the recementation techniques during definitive reimplantation obscured the ability to distinguish between retained cement from the index arthroplasty and new cement used during reimplantation of revision components. When retained cement was present, the location of the retained cement in the humerus was defined based on zones previously described by Sanchez-Sotelo et al. for location of humeral loosening. Repeat infection was defined as either ≥ 2 positive cultures at the time of second-stage revision with the same organism cultured during the first-stage revision or repeat surgery for infection after the two-stage revision in patients that again met the ICM criteria for probable or definite infection. The rate of repeat infection among patients with retained cement or hardware was compared to the rate of infection among patients without retained cement or hardware to determine if it was a risk factor for recurrent infection.

RESULTS:

Sixty-four patients underwent two-stage revision and met ICM criteria for probable or definite infection. Twenty-seven were excluded that never had secondstage reimplantation of arthroplasty components and either retained their antibiotic spacer or underwent resection arthroplasty. This left thirty-seven patients who were included in the analysis. The average age at the time of the first-stage revision was 63.9 ± 9.9 years. Twenty-three out of thirty-seven (62%) patients were male, four (11%) had diabetes, the median Charlson Comorbidity Index was 2 (0-8), and average BMI was 30.7 ± 7.4 . The most common bacteria cultured during the first-stage of revision was Cutibacterium and was present in eighteen cases (49%). Six (16%) patients had retained cement and one patient (3%) had two retained broken glenoid baseplate screws after first-stage revision. In all cases of retained humeral cement, the cement was located in Sanchez-Sotelo zone 4, which is distal to the removed humeral stem. Of the ten cases of recurrent infection, 1 case (10%) involved retained cement/hardware. Age at revision (60.9 ± 10.6 vs. 65.0 ± 9.6 , $p=0.264$), BMI (33.4 ± 7.2 vs. 29.7 ± 7.3 , $p=0.184$), Charlson Comorbidity Index (2 (0-8) vs. 3 (0-6), $p=0.289$), male sex (7 vs. 16, $p=0.420$), and presence of diabetes (1 vs. 3, $p=0.709$) were not associated with repeat infection (Table 1). Retained cement or hardware was also not associated with a repeat risk of infection (1 vs. 6, $p=0.374$).

DISCUSSION AND CONCLUSION:

Removing cement and hardware during revision shoulder arthroplasty can lead to compromised bone stock and fracture that can complicate the second-stage reconstruction. We found that the rate of repeat infection was not significantly higher in patients with retained cement or hardware compared to those without. Therefore, we believe that surgeons should consider leaving cement or hardware that is difficult to remove and will likely lead to increased morbidity and future complications.

Table 1. Repeat Infection vs. No Repeat Infection

	Repeat Infection N=10	No Repeat Infection N=27	p-value
Age	65.9(10.6)	65.0(9.6)	0.264
BMI	33.4(7.2)	29.7(7.3)	0.184
Charlson Comorbidity Index	2 (0-8)	3 (0-6)	0.289
Male Sex	7 (50%)	16 (59%)	0.420
Diabetes	1 (10%)	3 (11%)	0.709
Retained consent or hardware	1 (14%)	6 (26%)	0.314

p-value: two-sample t-test for continuous variables, Mann-Whitney U-test for ordinal variables and chi squared test or Fisher's exact test for categorical variables