SH69: Can material (cement, metal, plastic etc) be retained in the setting of one or two stage debridement without impact on final recurrence?

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Response/Recommendation: Unknown. There are no prospective studies looking at whether material retention affects the rate of final recurrence in one or two stage debridement in the context of infected shoulder arthroplasty. The two retrospective studies related to shoulder arthroplasty, limited by low sample size, show no statistical difference in infection recurrence when material is retained.

Strength of Recommendation: Limited

Rationale: A comprehensive literature review was performed to identify all studies on material retention in the setting of one or two stage debridement and its effect on final recurrence. Searches for the terms "cement", "metal", "plastic", "material", "one-stage debridement", "two-stage debridement", "prosthesis retention", "revision arthroplasty", "shoulder arthroplasty", "shoulder peri-prosthetic joint infection", "shoulder prosthetic joint infection", "PJI", "infection control", "recurrence", "success rate" were performed using the search engines PubMed, Embase and Google Scholar which were searched through November 2024. We also reviewed the references of identified articles to maximise the number of studies. Inclusion criteria for our systematic review were all English studies (Level I-IV evidence) that reported on material retention in revision shoulder arthroplasty (one or two-stage) for prosthetic joint infection. Exclusion criteria were non-English language articles, non-human studies, retracted papers, case reports, review papers. PRISMA (preferred reporting items for systematic reviews and meta-analyses) criteria were followed. After only identifying 2 articles that met all criteria, we widened out search to involve other joints of the upper extremity and lower extremity joints, to discuss on our review.

Whilst both one and two stage approaches are recognised treatment options for addressing shoulder PJI the evidence looking specifically at material retention and its impact on infection recurrence is very limited. We have identified two studies specifically looking at this issue with regards to shoulder arthroplasty.

Schiffman et al (2024) retrospectively analysed two-stage revisions performed for infection across two institutions in a 9-year period. They included 37 patients in their analysis, 7 patients having retained cement/hardware (6 retained cement, 1 retained broken baseplate screws) and 30 patients with no retained material. Their overall infection recurrence rate was 27% with only 1 patient in the retained cement of hardware group (14%) and 9 patients with no retained hardware/cement (30%). Although the rates of recurrence were lower in the material retention group this was not statistically significant. The number of patients in this study are low and it is challenging to draw definitive conclusions.

Bordure et al (2021) retrospectively compared two treatment strategies for dealing with chronic prosthetic joint infection following reverse shoulder arthroplasty. The first strategy was a partial one stage exchange with implant retention when there was macroscopic osseo-integration. The second strategy included those undergoing either one or two-stage revision with removal of all prosthetic material before re-implantation. They included 18 patients in their analysis, 11 patients had hardware retention and 7 patients underwent a complete exchange of implants (6 single stage and 1 two stage). They found no difference in terms of

recurrence of infection between the two groups (91% success for partial exchange vs 100% for complete exchange) but a significantly higher functional outcome (Constant Score) in the partial exchange group post-operatively [55 vs 44 (p=0.03)]. Although these results may favour the option of hardware retention in certain cases, the numbers are too small to inspire confidence in the conclusions, and the perceived improvement in functional outcome may be explained by the higher starting Constant score of the partial exchange group [pre-operative Constant score 40 vs 28 (p=0.05)].

We widened our inclusion criteria to involve other joints of the upper limb. Martinez-Catalan et al (2022) evaluated retained cement in 52 infected total elbow arthroplasty revisions. They performed an analysis following removal of infected total elbow arthroplasties as part of a two-stage approach to treatment and reported that those with cement retention had a 3.3 times higher risk of recurrence of infection (p=0.04). Cement removal in a revision elbow setting is technically challenging due to the anatomy of the proximal ulna and distal humerus and this would potentially have had a bearing on such decision making.

There is evidence from revision surgery for infection in total hip arthroplasty, specifically looking at cement in cement revision. Leijtens et al (2016) had poor results when reviewing their series of cement in cement revisions in infective total hip arthroplasty, where the original cement mantle was maintained when it was stable and not poor quality. They found they had an 80% reinfection rate (8 out of 10 patients) at an average of 26 month follow up. The numbers for this study are smaller, however, than the studies published by Morley et al (2012) and Fishley et al (2022) who report better results when retaining the original cement mantle. Morley et al (2012) retained the original cement mantle during a two-stage approach, and report only one recurrent infection out of 15 patients. Fishley et al (2022) also utilised a two-stage approach, retaining the original cement mantle and then performing a cement in cement revision for the 2nd stage, and reported a 7.9% recurrence rate in 89 patients. It is important to note that both Morley et al (2012) and Fishley et al (2022) mention aggressively burring the intramedullary surface of the original cement mantle, in an attempt to remove the biofilm, as opposed to the Leijtens et al (2016) who did not discuss this, which would suggest that this step could play an important role in reducing the risk of infection recurrence.

There are also studies from infected hip arthroplasty looking at implant retention. Ji et al (2017) looked at a partial implant exchange in a single stage revision, with exchange of all modular components, but retention of any well-fixed components (acetabular cup or femoral stem), with thorough exposed component brushing and antiseptic soaking. Only 4 patients out of 31 (12.9%) had a recurrence of infection at a mean follow up time of 15 months. This is similar to the recurrence rate published by El-Husseiny and Haddad (2016). They looked at cases where the femoral or acetabular component had been retained in the setting of a single stage revision for infection where patients had either ingrown femoral stems or complex acetabular components with no radiological evidence of loosening. They had 3 recurrences of infection from 18 patients (16.6%), with a minimum of 5 year follow up. Both these studies suggest implant retention is possible, with a reasonable success rate if the surgeon is concerned about potential damage caused by removing a well-fixed implant.

Overall, the lack of high- quality evidence relating to shoulder arthroplasty makes it difficult to draw an evidence based conclusion. Caution needs to be exercised when drawing conclusions from studies related to other joint arthroplasties due to a distinct clinical and microbiological profile of the shoulder joint infections. Our recommendation would be for the surgeon to adopt a pragmatic approach when it comes to retention of osteo-integrated implants or cement, taking into account the potential of bone loss or damage caused by such removal. Additionally, removal of biofilm from the surface of a retained components using mechanical techniques, may be considered.

References:

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