

SH65: What is the role and benefit of multiple spacers in the setting of two-stage exchange with persistent positive cultures?

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Response/Recommendation: Unknown. The data available in the literature pertaining to this topic does not allow for specific conclusions in support of or against the use of multiple spacers to treat persistent positive cultures during two-stage exchange for shoulder PJI.

Strength of Recommendation: Limited

Rationale: Whilst cement spacers are often described in orthopaedic literature, there is a very little about the effectiveness of treatments and no level 1 evidence to support their use. Cement spacers are often used to help maintain the void left from a previous implant which then prevents the soft tissues contracting and scarring filling in the cavity or remaining bony morphology. Cement spacers are commonly antibiotic eluting and offer dispersion of localised antibiotic to help with treatment of the PJI. There is a dearth of information on the benefit of multiple spacers to treat persistent positive culture in shoulder arthroplasty PJI management.

An abbreviated systematic review was carried out according to the PRISMA checklist. Following a thorough literature search by an information specialist (Appendix 1), duplicate articles were removed and a total of 1175 articles were title and abstract screened according to the study question by the 2 authors (PR and AM) any conflicts were discussed, and consensus agreed. This provided 28 articles deemed potentially suitable and carried forward for full text review. Figure 1 demonstrates the PRISMA Flow chart for the literature screening process. The process yielded 8 papers salient to the study question(1-8) for qualitative synthesis. As the flow chart demonstrates a number were found not to discuss spacers in the full text or were not about shoulder arthroplasty and therefore excluded following full text review.

Antibiotic-loaded cement spacers are used for two main reasons: (1) a void filler to prevent scarring of the anatomical space following implant removal maintaining a soft tissue tension thereby making a second stage reimplantation easier(6), and (2) local administration of antibiotic treatment following debridement and clearance. The second reason has been shown to be especially beneficial in the setting of known organisms and appropriate sensitivities(9). Some evidence suggests the use of spacers although not necessarily providing optimal function outcomes can be beneficial in infection eradication(2).

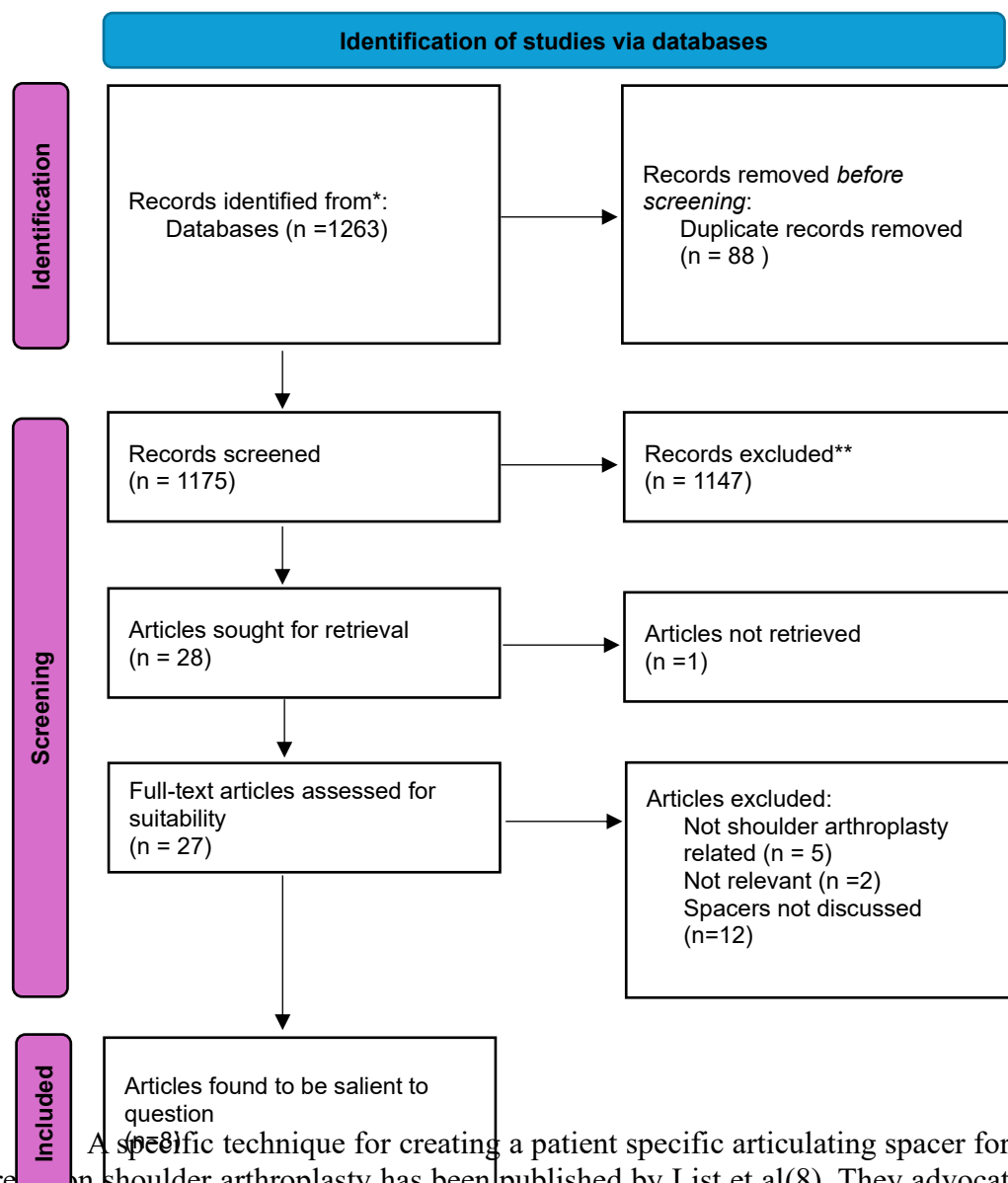
Verhelst et al(10) discussed a cohort of patients comparing hand-made gentamicin loaded cement spacers either as a spherical spacer or stemmed spacer versus simple resection arthroplasty. 21 patients were included in the study. Four patients had a spherical spacer implanted and 6 patients had a stemmed spacer. Likely due to low sample size, there was no statistical difference in clinical outcome, within the resection arthroplasty groups, between the non-spacer and spacer groups although 2/11 had low grade infection diagnosed at final follow up.

Jawa et al(7) have one of the largest cohorts for the use of prosthesis of antibiotic-loaded acrylic cement (PROSTALAC) for eradication of chronic shoulder arthroplasty PJI with no evidence of infection persistent or recurrent in 82% of patients. Another elbow cohort demonstrated similar success with eradication with PROSTOLAC in treatment of elbow arthroplasty PJI with low recurrence rates(11). Polymethyl methacrylate (PMMA) is commonly used for spacer creation and recently beads have been suggested for use in

arthroplasty, evidence suggests that actually the antibiotic benefit locally may be no better than parental use(3). Furthermore often the antibiotic used is a aminoglycoside due to stability of use when combined with cement, however the efficacy of aminoglycoside used against biofilm may well be reduced(3).

Pelligrini et al have reported that functional outcomes may well be improved in younger patients undergoing two-stage revision with spacer in between compared to more elderly patients(5). Spacers are often bridging the gap between first and second stage procedures, however the spacer use itself should not be felt as benign. Ascione et al report unfavourable outcomes from prolonged spacer use especially over 11 weeks(12). This should be borne in mind when creating the spacer or deciding on the likelihood of second stage to ensure a sound method of articulating with reasonable fixation. Whilst some evidence purports to the risks of spacers others report on the functional superiority and benefits of their use in shoulder arthroplasty PJI(13).

Figure 1: PRISMA flow chart for What is the role and benefit of multiple spacers in the setting of 2 stage (revision) with persistent positive culture?



A specific technique for creating a patient specific articulating spacer for a two-staged revision on shoulder arthroplasty has been published by List et al(8). They advocate the use of a

metal Steinmann pin to help recreate a tube to fill the humeral diaphysis and an acetabular shell to recreate the head. They report good function outcomes in their cohort and 86% proceeding to second stage(8). Alternative other techniques involve use of smaller prosthesis covered in cement to replicate the articulating components(4).

Whilst lower limb arthroplasty continues to discuss the merits of use of PROSTOLAC, CUMAR and other spacer entities the discussion for the use in shoulder arthroplasty remains sparse in comparison. In aggregate, the available studies do not show supportive evidence for the use of multiple cement spacers in the management of shoulder arthroplasty PJI.

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Appendix 1: Systematic Review

With assistance from a university information specialist, a comprehensive literature search was performed to identify all studies on irrigation and debridement with implant retention (DAIR) when treating acute shoulder PJI, and surgical protocol for performing DAIR in patients with acute PJI, benefit of multiple spacers in the setting of two stage (revision) with persistent positive culture. The search was performed in 2024 in four databases: Medline, Embase, Web of Science, CINAHL, Scopus, Cochrane, Clinicaltrial.gov and PubMed.

The search terms were Periprosthetic Joint Infection or Prosthesis-Related Infections, Shoulder or Shoulder Pain or Shoulder Joint or shoulder*, Shoulder Joint or Arthroplasty, Replacement, Shoulder or Arthroplasty, Replacement or shoulder* arthroplasty or Joint Prosthesis, Surgical Wound Infection or Shoulder Prosthesis or Anti-Bacterial Agents or intrawound shoulder or Vancomycin, Arthroplasty, Replacement, Shoulder/ or Prosthesis-Related Infections or Anti-Bacterial Agents or chronic shoulder* periprosthetic joint* infection* or Shoulder Joint, debridement, antibiotics and implant retention, Two-stage prosthesis exchange or, Two-stage prosthesis revision, persistent positive culture or positive culture, Orthopaedic/orthopedic Procedures or orthopaedic/orthopedic Surgical protocols or Postoperative Complications, antibiotic spacer or spacer*.

Inclusion criteria for the search were English language articles, all papers include the shoulder arthroplasty, or Periprosthetic Joint Infection.

Exclusion criteria were non-English language articles, animal studies, single case studies, case report studies, cancer, dentistry, knee, hip, ankle, spine, and elbow papers.

The systematic review software Rayyan was used to deduplicate the articles and for the literature screening process.