SH66: What is the optimal surgical protocol for performing DAIR in patients with acute PJI?

Liaison: Benjamin Zmistowski
Lead delegate: Addie Majed
Supportive delegates: Akin Cil, Reza Omid
Supportive authors: Parag Raval

Response/Recommendation: Unknown. The information available in the published literature does not currently aid in providing an answer to this question. Any literature that has any related information pertains to lower limb arthroplasty but remains vague on the protocol/technique.

Strength of Recommendation: Limited

Rationale: Use of surgical debridement and implant retention (DAIR) in prosthetic joint infection (PJI) management remains an area of debate in the literature, especially within shoulder arthroplasty. Not only on its effectiveness at eradicating infection but also on whether modular component exchange needs to occur as part of a DAIR procedure(1-3). DAIR management consists of prompt debridement with thorough removal of any necrotic tissue, purulent collections and debris around the implant, exchange of mobile arthroplasty components when possible, and prosthesis retention. After obtaining tissue samples, intravenous broad-spectrum antibiotics are administered, and treatment is adjusted according to microbiology sensitivities and microbiology specialty input. Intravenous administration is typically followed by oral antibiotics according to published treatment recommendations(37) similarly to lower limb PJI management(38).

An abbreviated systematic review was carried out according to the PRISMA checklist (Appendix 1). Following a thorough literature search by an information specialist, duplicate articles were removed and a total of 1172 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 25 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 6 papers salient to the study question(4-9). As the flow chart demonstrates a number were found not to discuss shoulder arthroplasty and therefore excluded following full text review.

How to perform a DAIR procedure optimally with a clear protocol that is replicable remains somewhat of a golden chalice. A key in the literature is the adequacy of debridement, which is difficult to quantify due to the subjectivity involved, but surgeons must ensure adequate visualisation of the whole joint including the subdeltoid spaces. Givens et al(4) felt this imperative, particularly in their cohort of patients treated with one-stage revision for infections. They discuss 'the ability of the surgeon to assess the quality of debridement, which includes complete resection of any abnormal bone or tissue, removal of all tissue from around the glenoid, complete capsular resection, complete bursal resection, and debridement of the entire subdeltoid space including areas posterior to the humerus,' all of which are basis for a good debridement.

Dennison et al(2) report on the inferiority of arthroscopically performed DAIR procedures, and an open DAIR procedure is advocated more definitively in other papers(10). One salient review article(11) proposes that only open debridement is suitable, and their results follow on from evidence in lower limb arthroplasty. The literature consistently reports on the importance of antibiotics postoperatively with any empirical dosing narrowed as soon as sensitivities allow. These can be established from intraoperative cultures or preoperative

aspirations or biopsies(12). Furthermore the importance of rifampicin for retaining prosthesis longevity due to its ability to fight against non-resistant bacteria in the biofilm. (13)

The appropriate timing of DAIR relative to symptom onset (a proxy for chronicity of the infection), does appear to be consistent in the literature, with much of the information following on from lover limb arthroplasty evidence. A team from Oxford highlight in hip arthroplasty that the likelihood of infection eradication was higher the sooner a DAIR was performed(14), this has also been reiterated more recently(15, 16). Patients presenting within 6 weeks after their shoulder arthroplasty operation but with acute symptoms of less than 3 weeks, or patients with symptoms less than 3 weeks at any time after any other duration post shoulder arthroplasty may be appropriate for DAIR management(12, 17, 18). In these cases, it was assumed that formation of biofilm would not yet be a profound issue allowing for thorough clearance but retention of implants. Similarly, a post operative regimen of 6 weeks total of antibiotics with a minimum of 2 weeks intravenously administered initially, followed by, if clinical and biochemical investigations confer, 4 weeks of oral antibiotics. The whole management should be done so under multidisciplinary team input and advice(1, 12, 19).

A number of reviews(20-25) and cases series(2, 10, 17, 18, 26-28) were found to discuss DAIR on abstract screening but on reviewing the full text no specific protocol or technique was advised for their DAIR procedure, emphasising the heterogeneity in the current available evidence. Kew et al(17) detail on 17 patients, within their shoulder PJI cohort of 65, undergoing DAIR procedures. They report, similarly to other studies, there being no uniform algorithm and treatment being decided by the individual surgeon. Bordure et al(6) report good outcomes in their cohort of chronic infection with retention of implants with good osseointegration with only modular component exchange with 91% of their cohort not experiencing recurrent infection discussing further the merits of retaining well fixed implants in the setting of infection and only modular exchange.

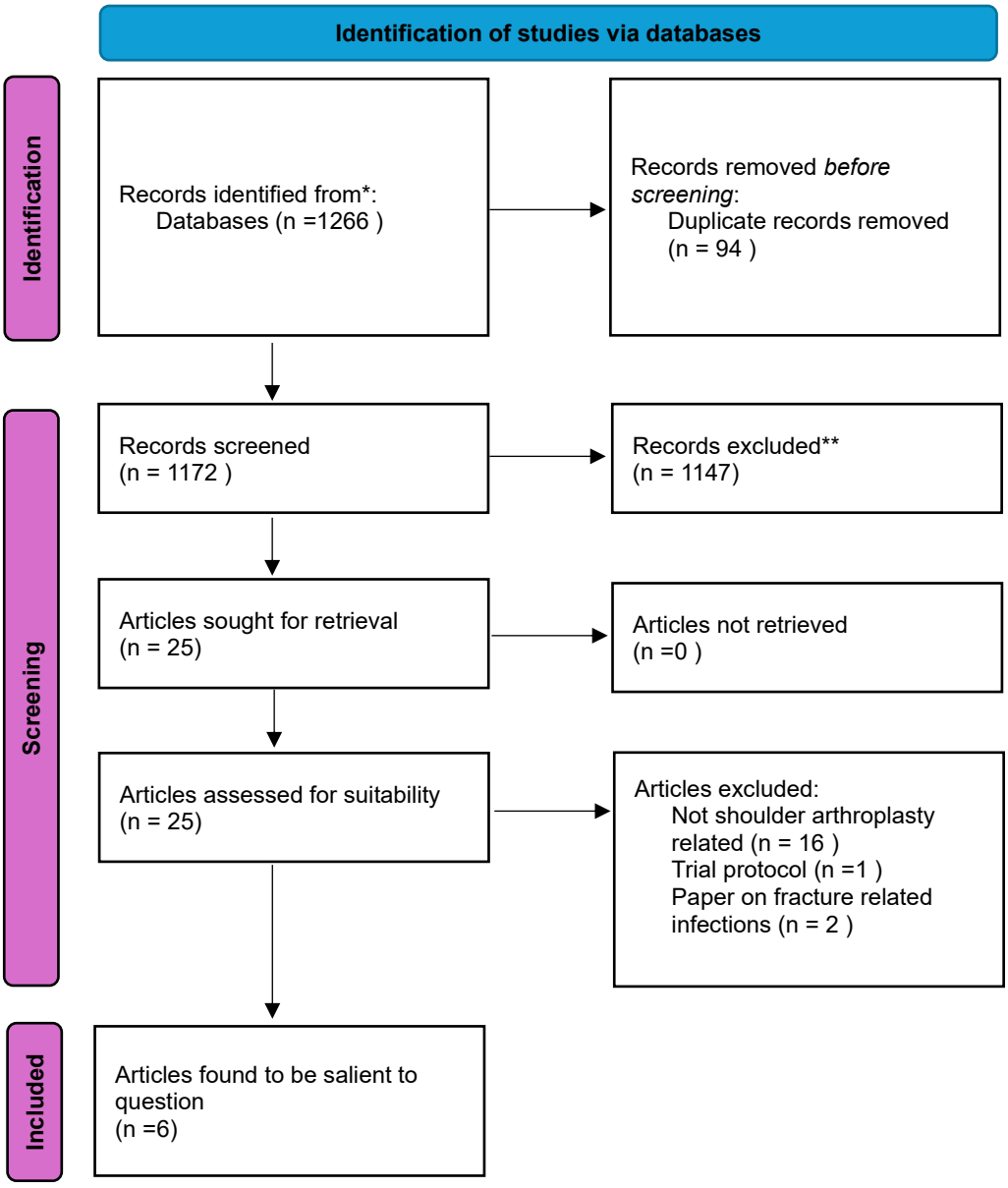
Through the literature screening it was clear that hip and knee arthroplasty have been trying to address this question for a number of years and their use of classifications such as KLIC and CRIME 80(9, 29) may offer some assistance in risk stratification for patients whom may be less successful in undergoing DAIR, whether this data is translatable to shoulder arthroplasty remains an area of uncertainty. Furthermore more longer term hip and knee arthroplasty cohorts have demonstrated factors such as younger age to be disadvantages for DAIR with a higher risk of revision due to recurrent infection(30).

Microbiology input continues to be an essential aspect of PJI management both in finding the organism but in suppressive treatment plans peri and post operatively(31). Cortes-Penfield et al discuss the literature on this thoroughly, discussing patient factors, organism factors and antibiotics factors for treating patients with suppressive antibiotic therapy following DAIR (32). One would consider, although from hip and knee arthroplasty, a lot of the findings pertinent when considering the treatment of the shoulder arthroplasty PJI cohort.

Debate continues in the literature of DAIR versus a staged procedure with some reporting a reinfection rate of 27%(28) to over 50 %(18, 20, 21, 33, 34) whilst others reports a fairly equivocal outcomes with a 2-staged revision procedure(17, 22, 35). Literature also provides little difference in single or double DAIR procedures which offers some further reiteration on the importance of a thorough initial DAIR procedure(36). All of these factors continues to make DAIR an area of discussion with no clear consensus (19).

Although discussion on irrigation use(31) and individual expert protocols are reported in hip and knee arthroplasty(8, 39). Clear surgical techniques and protocols are still required for DAIR procedures within shoulder arthroplasty.

Figure 1: PRISMA flow chart for What is the optimal surgical protocol for performing DAIR in patients with acute PJI?



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Appendix 1: Systematic Review Methodology

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.