this systematic review were LOE I-IV, English language, shoulder arthroplasty studies that included patients who underwent treatment for PJI using I&D with component retention (polyethylene and or glenosphere exchange without stem or baseplate removal was included). Exclusion criteria were non-English language articles, review papers, technique papers, non-human studies, and studies that only presented data on one-stage or two-stage revision, hip or knee arthroplasty articles. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria were used manage the data of this review. Our initial search produced 66 abstracts; 61 were excluded, because they did not fulfill the inclusion criteria, and the remaining 4 manuscripts were obtained and reviewed to assure inclusion criteria. Additionally, the references of these manuscripts were reviewed to ensure no additional material would be missed. This left four studies for analysis, only one of which evaluated the role for I&D with implant retention for the treatment of acute shoulder PJI.

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QUESTION 2: What are the indications for irrigation and debridement (I&D) with component retention in subacute or chronic shoulder periprosthetic joint infection (PJI)?

RECOMMENDATION: I&D with component retention alone for subacute/chronic shoulder PJI in the literature is less successful than component explant, but may play a role in select patients.

LEVEL OF EVIDENCE: Limited

DELEGATE VOTE: Agree: 96%, Disagree: 0%, Abstain: 4% (Unanimous, Strongest Consensus)

RATIONALE

A systematic review was performed using PubMed and Google Scholar databases in February 2018 to identify studies regarding the treatment outcomes after shoulder arthroplasty. The keywords included "shoulder AND (replacement OR arthroplasty) AND infection." This identified 46 articles with relevance to surgical treatment of shoulder PJI; 10 of which described treatment with debridement and implant retention for subacute/chronic infection.

I&D with component retention for shoulder PJI in the subacute and chronic setting has shown low rates of eradication of infection [1–10]. Of the 51 surgical cases identified in studies with a reported eradication rate, approximately half (n = 24, 47%) were successfully cured with debridement alone. The majority of these successful treatments were from two recent studies that integrated modular component exchange with partial component retention [1,2].

Stone et al. [1] reported on patients with shoulder PJI treated with one-stage partial component exchange compared to patients with one-stage complete hardware removal and two-stage revisions. The greatest success rate was with complete one-stage revisions (96% eradication of infection) compared to only 63% eradication for partial one-stage revisions. The authors concluded that there are some circumstances in which retaining a prosthesis may be preferred (such as well-fixed components), but that the surgeon must be aware of a higher risk of recurrent infection.

A French multicenter study reported on 32 patients who underwent revision for infection after reverse shoulder arthroplasty (RSA); of these, 13 patients underwent debridement, modular component exchange and partial component retention [2]. Only 7 patients (54%) were successfully cleared of infection with debridement alone. However, the 15% complication rate reported with debridement was lower than that reported for resection (33%), one-stage revision (20%) or two-stage revision (36%). The authors propose that initial debridement be considered for primary treatment of infected RSA given that more than half of patients were successfully treated with relatively few complications.

Primary treatment of subacute/chronic shoulder PJI with debridement, irrigation and component retention is an option, particularly in patients in which the risks of more aggressive surgery outweigh the potential benefits. However, patients and surgeons should be aware that the published rate of recurrence is substantially greater with this strategy compared to one- or two-stage revision.

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QUESTION 3: Should modular components be exchanged during irrigation and debridement (I&D) of acute shoulder periprosthetic joint infection (PJI)?

RECOMMENDATION: Whilst there is logic in exchanging non-fixed modular components, such as the bearing surfaces, to allow thorough I&D of the entire effective joint space and removal of as much biofilm as possible, there is insufficient literature to provide clear guidance.

LEVEL OF EVIDENCE: Limited

DELEGATE VOTE: Agree: 100%, Disagree: 0%, Abstain: 0% (Unanimous, Strongest Consensus)

RATIONALE

A thorough search of the PubMed database for manuscripts addressing the exchange of modular parts during shoulder I&D for acute PJI was undertaken. Five papers were found that recorded if modular components were exchanged [1–5], totalling 53 patients. The pooled infection-free survivorship was 65% in the "modular exchange group" (19/29) versus 58% (14/24) in the "no exchange group" ($p = 0.77$ Fisher's exact test).

Of these papers, three [1,3,5] specified the outcome for patients with acute debridement and retention with and without modular exchange. In total, 10 patients underwent acute debridement and retention of prosthesis without modular exchange with an infection free survivorship of 70% (7/10). Eight patients are recorded as having undergone poly exchange during debridement of an acute infection, with an infection free survivorship of 62.5% (5/8; $p > 0.05$).

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QUESTION 4: Should modular components be exchanged during irrigation and debridement (I&D) of subacute or chronic shoulder periprosthetic joint infection (PJI)?

RECOMMENDATION: We defer to the response for the Question 5: "Should well-fixed glenoid components be removed during surgical treatment for subacute or chronic shoulder PJI?"

It would seem that the recommendation, although of limited strength, would be for well-fixed components to be removed during surgical intervention for subacute/chronic shoulder PJI. Therefore, it can be extrapolated that modular components, which can be exchanged to remove biofilm with far less morbidity than well-fixed components, should likewise be either exchanged or removed and replaced with an antibiotic spacer.

LEVEL OF EVIDENCE: No Evidence

DELEGATE VOTE: Agree: 95%, Disagree: 5%, Abstain: 0% (Unanimous, Strongest Consensus)