SH81. Should modular components be exchanged during irrigation and debridement of subacute or chronic shoulder PJI?

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Methdology: A comprehensive literature review was performed to identify all studies on use of irrigation and debridement of subacute or chronic shoulder PJI. Searches for the terms "irrigation and debridement", "DAIR", "debridement, antibiotics, and implant retention" "shoulder prosthetic infection", "shoulder irrigation infection" and "shoulder debridement infection" were performed using the search engines PubMed and Scopus which were searched through October 2024. We also reviewed the references of the identified articles to gather the maximum number of studies. Inclusion criteria for our systematic review were all English studies (Level I-IV evidence) that reported on irrigation and debridement of subacute or chronic shoulder PJI. Exclusion criteria were non-English language articles, nonhuman studies, retracted papers, case reports, review papers, studies with less than <2 patients undergoing irrigation and debridement, studies without clinical follow-up/infection rates, and technique papers without patient data. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) criteria were followed. We identified 8 articles from PubMed and Scopus that met all criteria. Data regarding the timeframe, modular components exchange or retrieving, type of shoulder arthroplasty, and reinfection was collected, and a narrative synthesis was performed.

Response:

Debridement and irrigation (DAIR) has been used infrequently in shoulder PJI surgery. There are no prospective studies, and there is inconsistency across studies with the definition of what constitutes an acute, a subacute, or a chronic infection. In some studies, the modular components were routinely exchanged during DAIR with variable rates of reinfection. Other studies report a variable rate of exchange, showing better outcomes when the components were exchanged. The lack of evidence on shoulder PJI management makes literature from hip and knee arthroplasty appealing for guiding treatment strategies, where almost all studies indicate that there is a benefit in exchanging the modular components whenever possible during a DAIR procedure.

Strength of Recommendation: Limited

Rationale:

Debridement and irrigation (DAIR) is infrequent in shoulder PJI surgery. In the series by Austin and colleagues, only 23 patients (9.1%) were treated with DAIR out of 253 septic revision shoulder arthroplasty procedures, with high rates of mortality but comparable to other procedures. [1] Corso and colleagues analyzed the United States hospital billing database and suggested that the rates of DAIR are significantly lower

compared to other treatment modalities for PJI: in reverse shoulder arthroplasty (RSA), the incidence was 0.1% for DAIR compared to 2.1% for revision procedures/device removals and in anatomic total shoulder arthroplasty (aTSA) it was 0.2% and 1.9%, respectively. [2] The high incidence of low-virulence microorganisms, such as Cutibacterium acnes, may influence decision-making in the management of shoulder PJI, as a delayed diagnosis allows the development of biofilm, which is not amenable to implant retention.

The main indication for DAIR is an acute or late hematogenous PJI. In this setting, Dennison and colleagues retrospectively reviewed a series of 10 PJI treated with DAIR and retention of the modular components in all cases. Reinfection occurred in 3 out of 10 cases, with poor outcome in patients with comorbidities or treated arthroscopically. [3]

However, there is limited evidence regarding the necessity of exchanging modular components during DAIR in the subacute and chronic stages of shoulder PJI. No prospective studies have been published, and there is some inconsistency across studies in defining the timeframe for PJI as acute, subacute, or chronic.

In some studies, the modular components are routinely exchanged during DAIR with variable rates of reinfection. Stone and colleagues reported on 15 RSA treated with DAIR, all of them with exchange of modular components, with 4 of 15 (27%) reinfections with a minimum of 1 year of follow-up. There were 12 subacute or chronic PJIs (>3 months), but the logistic regression analysis failed to determine if the time to PJI was a predictive factor for reinfection. [4] Ortmaier and colleagues reported on 7 RSA treated with DAIR, all of them with exchange of modular components. There were 3 subacute or chronic PJIs (>2 months) and they all failed due to reinfection. [5] Bdeir and colleagues reported on 8 TSA treated with DAIR, all of them with exchange of modular components. There were 2 chronic PJIs followed up 18 and 88 months and none of them suffered a reinfection. [6]

Other studies report a variable rate of exchange, showing better outcomes when the components were exchanged. Jacquot and colleagues reported on 13 RSA treated with DAIR, and 6 (46.2%) resulted in reinfection. The polyethylene (PE) and glenosphere were exchanged in 10 and 3 patients, respectively. There were 6 subacute or chronic PJIs (>2 months) and 3 (50%) failed due to reinfection. Overall, the healing rate reached 75% when both PE and glenosphere were changed (3 of 4) but only 44% (4 of 9) when the glenosphere was left in place. Therefore, they recommend to exchange every piece of the prosthesis that could be easily removed, including the PE liner and the glenosphere. [7] Zavala and colleagues reported on 7 RSA treated with DAIR with modular component exchange in 4 patients (57.1%). There were 2 subacute PJIs (>3 months, <1 year), one of which did not undergo modular component exchange and resulted in reinfection. Overall (acute and subacute), 2 out of 3 PJIs without modular component exchange resulted in reinfection, whereas none occurred in the exchange group. [8] Lemmens and colleagues reported on 6 DAIR in chronic shoulder PJIs (>4 weeks after implantation or with symptoms for >3 weeks), all of them with serious comorbidities. Mobile parts were exchanged only in 2 of 6 cases (33%) and 4 patients (66%) resulted in reinfection. Data is insufficient, but at least 2 of the reinfections must have occurred in patients who did not undergo component exchange. [9] Sperling and colleagues reported 6 shoulder PJIs

treated with debridement and prosthesis retention. The infection was diagnosed as acute (<3 months), subacute (3 months to 1 year) and late (>1 year) with 2 shoulders per group. There were 4 TSA (3 primary, 1 revision) of which 2 did not undergo glenoid component replacement. All cases in which the glenoid was not replaced became reinfected, while none of the cases where the glenoid was replaced experienced reinfection. The remaining 2 PJIs were monoblock hemiarthroplasties, not amenable for modular component exchange. [10]

A recently published study by Kew and colleagues reports on 65 shoulder PJIs, 17 treated with DAIR at a mean time from shoulder arthroplasty of 12.6±22.9 months. Compared to revision procedures, patients in the DAIR cohort were diagnosed with PJI significantly earlier. Five (29.4%) patients initially treated with DAIR experienced recurrent PJI, 1 of whom was treated with a single-stage revision whereas the remaining 4 patients underwent 2-stage revision. They suggest that the results of DAIR failure may be confounded because they included includes patients with aTSA and RSA. In RSA the PE component can be exchanged, whereas in TSA, the glenoid component is a monoblock PE that is cemented to the native glenoid and difficult to revise. Therefore, not exchanging the polyethylene glenoid component in DAIR for TSA may lead to increased failure rates. [11]

The lack of evidence on shoulder PJI management makes literature from hip and knee arthroplasty appealing for guiding treatment strategies. However, shoulder PJI is often diagnosed later in the infection timeline due to low-virulence pathogens, so these extrapolations should be interpreted with caution, as shoulder PJI may require different management strategies compared to hip and knee cases. Nevertheless, almost all studies indicate that there is a benefit in exchanging the modular components whenever possible during DAIR procedure in total hip arthroplasty (THA) and total knee arthroplasty (TKA). In a retrospective series of 575 acute hip PJI by Svensson and colleagues, exchange of modular components during DAIR improved success in treating PJI: the exchange of components was associated with a lower rate of reoperations (28.0%) compared with non-exchange (44.1%) and the Kaplan-Meir implant survival rate at 2 years for exchange was 71.4% compared with 55.5% for non-exchange. Adjusting for confounders they estimated a hazard ratio for a reoperation of 0.51 [95% CI = 0.38 to 0.68] when components were exchanged. [12] In the retrospective series by Tirumala and colleagues, 149 patients with acute hip and knee PJIs with at least 3 years of follow-up were treated with DAIR and exchange of modular components with acceptable rates of reinfection (13.0% in culture-negative PJI and 19.4% in culture-positive PJI). [13] Hirsiger and colleagues studied 112 PJIs (69 THA, 41 TKA, and 1 TSA) treated with DAIR with a median time delay between implantation and infection of 4.3 months. Exchange of mobile parts was performed in 48 patients (43%) and was protective for reinfection (hazard ratio [HR] 1.9; 95% CI = 1.2–2.9). [14] In the series by Grammatopoulos and colleagues with 122 acute hip PJI, exchanging modular components at DAIR was an independent factor for a 4-fold increased eradication of infection and improved long-term implant survival. [15] In a systematic review and meta-regression analysis including 65 studies and 6630 patients treated with DAIR, Gerritsen and colleagues found that modular component exchange could be beneficial in reducing PJI recurrence rate. However, they also restricted the analysis to studies after the year 2004, to reflect more modern PJI

treatment protocols, and found no effect on the rate of component exchange on success rate of reinfection. [16]

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