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QUESTION 10: Does performing a debridement, antibiotics and implant retention (DAIR) affect the outcome of a subsequent two-stage exchange arthroplasty?

RECOMMENDATION: Unknown. Based on the available evidence, it is not known if prior DAIR adversely affects the outcome of a subsequent two-stage exchange arthroplasty.

LEVEL OF EVIDENCE: Limited

DELEGATE VOTE: Agree: 93%, Disagree: 6%, Abstain: 1% (Super Majority, Strong Consensus)

RATIONALE

There are several surgical treatment options for periprosthetic joint infection (PJI), including irrigation and debridement (I&D) with modular component exchange and one- or two-stage exchange arthroplasty, with the ultimate choice depending on a number of variables, including chronicity of infection, organism and antibiotic sensitivity patterns, host factors and experience of surgeon. I&D with implant retention has been an attractive strategy in select circumstances as it is less morbid for the patient and less costly to the healthcare system overall. However, the failure rate of I&D is not insignificant, averaging 68% in the literature (61–82%). Following

treatment failure of an I&D, the recommendation for subsequent treatment is often a two-stage exchange arthroplasty. The question remains whether the initial attempt at I&D adversely affects the outcome of the subsequent two-stage exchange arthroplasty.

Two earlier studies and one very recent study on this subject seemed to indicate that failure of an initial I&D and modular component exchange leads to a higher than expected failure rates of subsequent two-stage exchange arthroplasty. Sherrell et al. performed a multicenter retrospective review of periprosthetic knee infections treated with a two-stage procedure following an initial treatment

with I&D [1]. Of the 83 knees that had undergone prior I&D, 28 (34%) failed subsequent two-stage revision and required reoperation for persistent infection. With the numbers available, there was no difference between success and failure with respect to age, gender or American Society of Anesthesiologists (ASA) grade. The other earlier study was a retrospective review of 44 patients who had undergone I&D for acute periprosthetic knee infections identified from the HealthEast Joint Replacement Registry and the Minneapolis Veterans Affairs Medical Center (MVAMC) total knee arthroplasty (TKA) database [2]. Of the 25 (57%) patients who failed an attempt at an I&D, 19 went on to an attempted two-stage revision procedure, and in only 11 of these 19 cases (58%) was the two-stage revision procedure ultimately successful. In a very recent retrospective review of 184 PJIs, Rajgopal et al. reported a 23.86% (21/88) failure rate after two-stage exchange following failed I&D compared to 15.62% (15/96) after direct two-stage exchange [3]. The success rate of the subsequent two-stage exchange arthroplasty procedures in all of these series is lower than historical published results, which the authors conclude may be due to the infection becoming more entrenched in the soft tissues and bone.

Two more recent studies on this topic report the opposite findings, namely that I&D before a two-stage exchange does not increase the risk of failure. Brimmo et al. used the California and New York State Inpatient Databases to identify all two-stage exchange revision TKA patients and compared failure rates, as defined as subsequent surgery due to infection within four years, between those with and without prior I&D [4]. Of the 750 patients who underwent two-stage exchange arthroplasty from 2005-2011, 57 (7.6%) had undergone a prior I&D. After four years, the estimated failure rate was 8.7% (95% confidence interval (CI), 1.9%-16.9%) in the group with prior I&D and 17.5% (95%CI, 14.7%-20.4%) in the group without prior I&D. After adjusting for sex, race, insurance, median household income and comorbidities, the hazard ratio for the group with a failed I&D was 0.49 ($p = 0.122$, 95% CI, 0.20-1.20) which the authors indicate revealed a lower risk of failure compared to the group without prior I&D. Nodzo

et al. reviewed their single institutional experience of patients who underwent two-stage exchange arthroplasty for PJI of total knee replacements, which included 132 who had not had an I&D and 45 patients who had a prior failed I&D [5]. The success rates between groups were similar at 82.5% and 82.2%, respectively, and the only variable they studied which decreased the odds of reoperation was the use of greater than 2gm of vancomycin in the spacer construct.

As is evident from the current literature, there is no conclusive evidence whether performing a DAIR affects the outcome of a subsequent two-stage exchange arthroplasty. All of the articles included, whether single institution, multicenter or database derived reported on a small number of patients who actually had a two-stage exchange arthroplasty after a failed I&D ($n = 83, 25, 88, 57, 45$) and therefore small differences in accuracy of coding or interpretation of data could potentially sway the results significantly. For those that support the belief that a failed I&D is associated with a decreased success rate for subsequent two-stage exchange arthroplasty, it may not be due to the infection becoming more established in the periarticular tissue, but that it is a patient or organism selection bias/confounding variable, and those individuals that fail an I&D inherently have a higher risk of failing a subsequent two-stage exchange arthroplasty.

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QUESTION 11: How many debridement, antibiotics and implant retention (DAIR) procedure(s) are acceptable in management of patients with acute periprosthetic joint infection (PJI) of a primary arthroplasty before removal of components needs to be performed?

RECOMMENDATION: After one failed DAIR procedure, strong consideration should be given to removal of components.

LEVEL OF EVIDENCE: Limited

DELEGATE VOTE: Agree: 86%, Disagree: 13%, Abstain: 1% (Super Majority, Strong Consensus)

RATIONALE

A systematic review of the literature was conducted utilizing the Medline/PubMed (www.ncbi.nlm.nih.gov/pubmed), Embase (www.embase.com), and SCOPUS (www.scopus.com) databases. Studies in which there was a standard protocol for a second surgery other than DAIR (i.e., repeat surgery to remove antibiotic beads or planned multiple irrigation and debridement) were not included in this review.

The majority of the studies reviewed are limited by their retrospective nature, small sample sizes and lack of differentiation between acute postoperative PJI and late-hematogenous PJI. Most researchers viewed failure of DAIR as an indication for a different

therapeutic procedure; thus, most studies were limited to a single DAIR. Studies in which multiple DAIRs were performed had given limited insight in their methodology as to why and when a second procedure was performed. Multiple DAIR procedures were only performed in a small portion of the sample size [1,2].

A retrospective review by Triantafyllopoulos et al. attempted to address the appropriate number of DAIR procedures a patient should undergo before resection arthroplasty should be performed. In this retrospective series of 141 patients who underwent DAIR for treatment of a deep periprosthetic infection after primary or revision total knee arthroplasty (TKA) or total hip arthroplasty (THA),