HK55: How many Debridement, Antibiotics, and Implant Retention (DAIR) procedures are acceptable before consideration should be given to resection arthroplasty?

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Response/Recommendation: Limited evidence suggests that after two failed debridement, antibiotics, and implant retention (DAIR) procedures resection arthroplasty, should be considered.

Level of Evidence: Limited

Delegate Vote:

Rationale:

Periprosthetic joint infections (PJI) represent one of the most serious complications in total hip arthroplasty (THA) and total knee arthroplasty (TKA). Prompt management of PJI is critical to preserve implant retention and improve outcomes. The Debridement, Antibiotics, and Implant Retention (DAIR) procedure is often used to manage early or acute infections. However, its efficacy diminishes with repeated attempts. Limited studies have investigated the rate of DAIR procedures and associated failure before considering resection arthroplasty in the context of total hip and knee arthroplasty.

Studies suggest that DAIR is most successful when performed as soon as feasible after symptom onset[1]. A 2019 study of 58 primary TKA patients treated with DAIR after acute PJI reported a success rate of 90% at two years if the DAIR procedure was performed within 90 days of the index TKA[2]. This level of success has not been consistently reported in the literature, with multiple studies reporting between 55 and 90% success rates in the primary setting[3]. A systematic review analyzed 14 studies involving 710 patients who underwent DAIR for early septic or late acute hematogenous PJI following hip or knee surgery. The average success rates for infection eradication were 45.9% after a single procedure and 52% after repeated procedures, with a mean follow-up of 53.3 months. Despite some methodological limitations and heterogeneity among the studies, the review concluded that DAIR has a relatively poor success rate with high rates of failure after multiple failed attempts[4]. Furthermore, in a study of 91 patients undergoing DAIR for suspected early PJI following primary TKA or THA, multivariate analysis revealed that higher failure rates were multifactorial, including multiple DAIR procedures ($\geq$ two)[5]. These results have also been reported in the setting of DAIR for revision arthroplasty. The study by Veerman et al., carried out in the setting of revision arthroplasty, showed that DAIRs performed with an interval of > 30 days after the index revision procedure (odds ratio (OR) 0.24 (95% confidence interval (CI) 0.08 to 0.72); $P = 0.008$) and a repeated DAIR within 90 days (OR 0.37 (95% CI 0.14 to 0.97); $P = 0.040$) were associated with a significantly reduced success rate of 68% at two years[6].

Patient health status, including the presence of comorbidities such as diabetes, immunosuppression, or obesity, can influence the success of DAIR[7]. Immunocompromised patients or those who have multiple comorbidities may have poorer outcomes with repeated DAIR attempts[8]. For these patients, resection arthroplasty should be considered earlier, even

after a single failed attempt[9]. In cases where the implant has been compromised by the infection (e.g., loosening or mechanical failure), resection arthroplasty should be considered after even a single failed DAIR attempt, as continuing with DAIR may not resolve the infection or restore function[10].

The investigation of a planned second DAIR procedure was reported in a study that evaluated the failure rate of a second DAIR procedure in patients who have an acute PJI of the hip or knee, with the authors finding a 25.7% failure rate in 144 cases. Independent predictors of failure included positive cultures during the second DAIR and chronic renal insufficiency. Despite the failure rate, the study suggests that a second DAIR can still be a viable option for infection control and implant retention in acute PJIs, particularly when the soft tissue remains intact[11]. In addition, unplanned second DAIR procedures and subsequent failure have been investigated by Lin et al. In a 2024 study, a total of 138 patients, comprising 112 with initial DAIR and 26 with an unplanned second DAIR, were investigated. The overall success rate for two-stage exchange arthroplasty was 87%, with factors such as reinfection with the same pathogen, high pre-DAIR C-reactive protein (CRP) levels, and a history of PJI within two years linked to higher failure rates after a single or unplanned second DAIR procedure. Implant failure rates remained consistent across all exchange arthroplasty cases, regardless of whether the DAIR procedure was initial or unplanned[12].

The largest systematic review and meta-analysis on multiple DAIR procedures was conducted by Salman et al. in 2024[13]. This review examined nine observational studies composed of 1,104 participants, focusing on the effectiveness of single, double, and triple DAIR procedures in treating acute periprosthetic joint infections (PJI) following TKA and THA. The cohort had a mean age of 58.4 years (range, 25.8 to 91.0) and an average BMI of 31.43 (range, 28.9 to 35.0). The studies had a mean follow-up period of 58.4 months (95% CI: 25.8 – 91.0.), with a low overall risk of bias as indicated by an average MINORSspell out please score of 17.6 ± 3.46. The review found no significant difference in success rates between single and double DAIR procedures. The success rate for single DAIR was 67% (95% CI: 64 - 71%), while double DAIR had a slightly higher success rate of 70% (95% CI: 48 - 86%), with no statistically significant difference ($P = 0.740$). For triple DAIR, success rates ranged from 50 to 60%, suggesting diminishing returns with increasing numbers of procedures.

The study concludes that double DAIR is a valid treatment option for acute PJI following TKA and THA, showing a success rate comparable to single DAIR. However, the effectiveness of triple DAIR appears to be lower, with a success rate that ranges between 50 and 60%. Interpretation of this data is difficult due to heterogeneity across the included studies, particularly in terms of patient comorbidities, DAIR protocols, and antibiotic regimens. The number of DAIR procedures performed is a crucial factor. Success rates for DAIR drop markedly after one failure, and after two failed DAIR procedures, the likelihood of retaining the prosthesis diminishes.

Conclusion

In conclusion, the threshold for considering resection arthroplasty in total hip and knee arthroplasty following multiple DAIR procedures in acute cases is typically set at two failed DAIR attempts; however, there is limited data without robust randomized controlled trials for comparison. Factors such as infection timing, microbial resistance, and patient health status all play a role in this decision. After two failed DAIR procedures, particularly in cases with chronic infection or resistant organisms, resection arthroplasty should be strongly considered as the next step in management. Early intervention is key to optimizing outcomes and preventing further complications.

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