

Evaluating the Influence of Prior DAIR on Two-Stage Exchange Arthroplasty Outcomes in Hematogenous Total Knee Arthroplasty PJI: A Retrospective Cohort Analysis

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INTRODUCTION: The management of periprosthetic joint infection (PJI) is influenced by several factors, and surgeons are often faced with critical decisions regarding treatment strategy. Debridement, antibiotics, and implant retention (DAIR) is often attempted in acute PJI cases, but its effect on subsequent two-stage exchange arthroplasty remains unclear. Prior studies evaluating failed DAIR before two-stage exchange arthroplasty excluded successful DAIR cases, limiting the ability to assess whether initiating treatment with DAIR compromises overall outcomes. Our goal was to assess if initiating PJI treatment with DAIR compromises overall treatment success. To do this, we aimed to (1) compare success rates of two-stage exchange arthroplasty with and without a preceding failed DAIR, and (2) evaluate overall success rates between these two groups, including patients successfully treated with DAIR alone. A hematogenous PJI cohort was used to ensure a homogeneous population.

METHODS: This retrospective cohort study reviewed patients who were diagnosed with PJI ≥ 1 year from primary total knee arthroplasty (TKA) and managed with DAIR or two-stage exchange arthroplasty between December 1, 2015, and December 31, 2022, across 16 hospitals. Institutional review board (IRB) approval was obtained, with a waiver of informed consent due to the retrospective design of the study. Data were obtained from a unified electronic medical record (EMR) system, and diagnoses were confirmed against Musculoskeletal Infection Society (MSIS) or 2018 International Consensus Meeting (ICM) criteria for PJI diagnosis. Exclusion criteria included patients who had an additional DAIR or two-stage exchange before starting present therapy and those with a PJI in another joint within one year. Patient variables obtained included demographics (age, sex, body mass index, American Society of Anesthesiologists [ASA] physical status scores), risk factors (diabetes mellitus, rheumatoid arthritis, smoking status) including the Charlson Comorbidity Index (CCI) at the time of surgery. Surgical variables included the date of primary TKA, date of initial surgical treatment for PJI, type of procedure, and duration of PJI symptoms. Culture and laboratory results were obtained in accordance with the 2018 ICM criteria. Variable collection was repeated for subsequent reoperations for PJI. Groups were based on patients who initially received a DAIR and those who initially received a two-stage exchange. Among those who failed initial DAIR, an additional category was created which included those who subsequently received a two-stage exchange. Successful DAIR was defined as no reoperation for infection after initial DAIR, or if infection clearance was achieved with subsequent two-stage. Successful two-stage was defined according to MSIS criteria, with Tier 1 and Tier 2 classified as success. Follow-up duration was calculated as the time between initial PJI surgery (DAIR or initial component explant) and the date of last documented visit in the EMR. Statistical analysis included t-tests, Chi-square, Kaplan-Meier survival curves, and Cox proportional hazards models adjusted for key covariates ($p < 0.05$).

RESULTS: A total of 193 patients were included in the study (89 male, 104 female). Of these, 94 initially received a DAIR while 99 initially received two-stage exchange arthroplasty. Among those who failed initial DAIR, 22 received a subsequent two-stage exchange. There were no statistically significant demographic differences. Prior DAIR was not significantly associated with reduced success when comparing primary two-stage exchange arthroplasty to two-stage exchange arthroplasty after DAIR (Hazard Ratio = 0.49, $p = 0.21$). At follow-up timepoints 3, 6, 12, and 24 months, survival probabilities were lower for the group that underwent two-stage following prior DAIR. A survival curve illustrating the estimated conditional survival probabilities, adjusted for clinical and demographic factors based on the Cox proportional hazards model, is displayed in Figure 1. Similarly, with initial DAIR successes included, there were no statistical differences in survival (Hazard Ratio = 0.44, $p = 0.27$), though success rates consistently favored two-stage exchange (Figure 2). Additionally, higher CCI was associated with decreased success in this comparison ($p = 0.01$).

DISCUSSION: Overall success rates were suboptimal for each group. Our model did not provide strong evidence of a significant survival difference between two-stage exchange arthroplasty with prior DAIR versus two-stage exchange arthroplasty as initial treatment. Although not statistically significant, there was a trend towards a slightly lower probability of success when an initial DAIR had been performed. This trend was also noted when success rates of the initial DAIR were included in the analysis. Our results suggest that, when an infection appears acute, DAIR should be completed. This is because while DAIR failure rate may be high, it does not seem to strongly affect two-stage success rates negatively, which are already low. Further studies that address these variables, incorporate a larger sample size, and have higher statistical power are needed to determine whether the observed differences are clinically meaningful.

SIGNIFICANCE/CLINICAL RELEVANCE: This study supports the use of DAIR as an initial treatment strategy for hematogenous TKA PJI presenting with acute symptoms, even when subsequent two-stage exchange arthroplasty may be necessary. By including successful DAIR cases in the analysis, the findings provide a more comprehensive understanding of DAIR's effect on treatment success.

IMAGES AND TABLES:

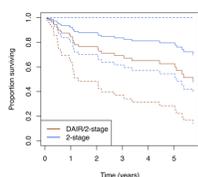


Figure 1

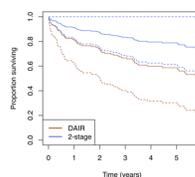


Figure 2