Treatment Failure Rates Significantly Decrease at 1.2 Years Following Initiation of Two-Stage Exchange for Chronic Periprosthetic Joint Infection in Total Knee Arthroplasty

Michael F Shannon, Scott David Rothenberger, Victoria Rose Wong, Eduardo Drummond, Andrew Frear, Kenneth Urish

INTRODUCTION: Periprosthetic joint infection (PJI), the most common cause of failure following total knee arthroplasty (TKA), is a significant source of morbidity, mortality, and healthcare costs. Two-stage exchange is the preferred treatment for chronic PJI to promote biofilm eradication and maximize chances of success. Previous work has evaluated the optimal duration of follow-up for TKA PJI after debridement with implant retention. However, a gap in knowledge remains surrounding the optimal follow-up period for staged revision. The objectives of this study were to: a) determine the length of time that TKA PJI should be monitored after two-stage, and b) deduce the time point by which the majority of two-stage failures occur.

METHODS: This was a retrospective cohort study performed using data from 16 hospitals within a regional health system. Patients who initiated two-stage revision for chronic periprosthetic joint infection between 2005 and 2022 were identified via searches of the electronic medical record. Failure was classified using 2019 Musculoskeletal Infection Society Outcome Reporting Tool (MSIS ORT) criteria. Failure was defined as ORT Tier 3 (sub-tiers 3A-3F) or Tier 4 (sub-tiers 4A and 4B). If a patient met criteria for failure, the data of failure was recorded. For patients who retained their antibiotic spacer > 6 months (Tier 3F), failure was defined using patient-centered criteria: the date of symptomatic recrudescence or intolerable discomfort was used as the date of failure. Bayesian regression with Monte Carlo Markov Chain simulation was employed to identify significant breakpoints in cumulative failure curves.

RESULTS: Overall, 148 patients met criteria for inclusion in this study. The average patient age was 67.52 ± 9.36 years. Average duration of follow-up was 4.38 ± 2.13 years. Single breakpoint model demonstrated a significant change in failure rate at 1.20 years (95% CI: 1.03-1.47 years). Across the entire cohort, 58.5% of all failures occurred by this break point (Figure 1). The Tier 1 failure rate prior to 1.20 years was estimated to be 5.41 times greater than failure rate after 1.20 years (95% CI: 4.81-6.01, $p<0.001$). The double breakpoint model identified breakpoints at 1.11 and 2.42 years, although the strength of fit was superior for the single breakpoint model.

DISCUSSION AND CONCLUSION: This study suggests that most failures for chronic TKA PJI treated with two-stage exchange occur just over the one-year mark (approximately one year and 10 weeks), with significant breakpoints in failure rate identified at approximately 1.2 and 2.4 years. Our results suggest that a postoperative monitoring period of one year is not unreasonable for patients following two-stage exchange.