

Outcomes of Two-Stage Exchange Arthroplasty for PJI After TKA: Evaluating Success Using MSIS Outcome Reporting Tool Criteria

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INTRODUCTION: Periprosthetic joint infection (PJI) remains a devastating complication following total knee arthroplasty (TKA), frequently necessitating complex interventions such as two-stage exchange arthroplasty. Traditional reporting often provides a single, often variable, success rate, which can limit accurate prognostic assessment. This study aims to address this gap by evaluating the outcomes of two-stage exchange arthroplasty for PJI after TKA within a multi-hospital system, specifically assessing treatment success at 1, 3, and 5 years post-reimplantation, with a minimum one-year follow-up. Our primary objective was to determine the rates of treatment success at these defined time points, utilizing the rigorous criteria of the MSIS Outcome Reporting Tool (ORT). As a secondary objective, we sought to identify patient and microbial characteristics that predict treatment failure at these given time points.

METHODS:

This retrospective cohort study analyzed 140 cases of PJI following TKA treated with two-stage exchange arthroplasty. Data were collected from a unified electronic medical record system across 16 hospitals. Patients had confirmed PJI based on MSIS 2013 and 2018 ICM criteria and underwent two-stage exchange as their initial surgical PJI treatment, excluding those with prior debridement, antibiotics, and implant retention (DAIR). We collected demographic data (age, sex, BMI, ASA class, Charlson Comorbidity Index (CCMI)), microbiological culture results, antibiotic regimens, interstage duration, perioperative complications, and follow-up outcomes (1-year and overall mortality, spacer exchanges). Primary outcomes assessed using MSIS Outcome Reporting Tool (ORT) tiers at 1, 3, and 5 years, defined treatment success as patients in ORT Tiers 1 and 2. A minimum two-year follow-up was achieved for all reconstructive procedures.

RESULTS:

The cohort comprised 140 patients (mean age 67.2 ± 8.9 years; 51% female; mean BMI 33.1 ± 8.2 kg/m²). Mean follow-up was 52.0 ± 25.5 months, with an average hospital stay of 7.4 ± 5.7 days. Spacer exchanges were necessary in 16.4% of patients, and the mean time to reimplantation was 5.1 ± 5.1 months. One-year mortality was 1.4%, and five-year mortality was 4.3%. Overall treatment success (MSIS ORT Tier 1 or 2) reached 66.4% at 1 year, improving to 72.1 % at 3 years, and at 74.9 % at 5 years (n=130 for 5-year data). At 1 year, 56.4% achieved infection control without antibiotics (Tier 1), 10% remained on suppressive antibiotics (Tier 2), and 10.7% had retained spacers (Tier 3F). The most common pathogens were *Staphylococcus aureus* (21.4%), coagulase-negative *Staphylococcus* (18.6%), and *Streptococcus* species (12.1%), with 24.3% of cases being culture-negative.

Treatment success varied by patient characteristics and microbiology. Patients with an ASA classification of 2 showed a 77% 1-year success rate, higher than ASA 3 (67.3%). Infections caused by *Streptococcus* species demonstrated an 82.4% success rate at 1, 3, and 5 years. Conversely, MRSA infections had a lower 1-year success rate of 50%, decreasing to 25% at 3 years. Males exhibited a higher 1-year success rate (72.1%) than females (66.7%) (p=0.49), though females achieved better long-term success at 3 and 5 years (81.9%), p=0.033 and 0.021, respectively.

DISCUSSION AND CONCLUSION: Two-stage exchange arthroplasty for PJI after TKA can achieve long-term treatment success. However, challenges persist, including variability in interstage management and persistent non-reimplantation outcomes. Patient comorbidities, specifically higher ASA classification and CCMI, and pathogens significantly influence treatment success, underscoring the need for individualized care and optimization strategies. Future research should focus on refining protocols and developing targeted therapies to improve outcomes in this complex patient population.

Table 3: Treatment Success and Microbial Growth Type

	Original PJI N(%)	Treatment Success at 1 year	Treatment Success at 3 years	Treatment Success at 5 years
Coagulase-negative Staphylococcus (CoNS)	26 (18.6%)	69.20%	69.20%	73.10%
Staphylococcus Aureus (S. Aureus)	30 (21.4%)	63.30%	63.30%	74.10%
MRSA	4 (2.9%)	50%	25%	50%
MSSA	26 (18.6%)	57.70%	69.20%	69.20%
Streptococcus Species	17 (12.1%)	82.40%	82.40%	82.40%
Enterococcus Species	6 (4.3%)	83.30%	100%	83.30%
Gram-negative Bacilli	5 (2.9%)	100%	100%	60%
Other Organism	10 (3.6%)	70%	60%	80%
Polymicrobial	12 (8.6%)	66.70%	66.70%	75%
Negative Cultures	34 (24.3%)	67.60%	82.40%	76.50%

Table 1: MSIS ORT Tier at 1, 3, and 5 years

	ORT Tier at 1 Year N(%)	ORT Tier at 3 Year N(%)	ORT Tier at 5 Year N(%)
Tier 1. Infection control with no continued antibiotic	79 (56.4%)	91 (65%)	96 (68.5%)
Tier 2. Infection control with the patient on suppressive antibiotic therapy	14 (10%)	10 (7.1%)	9 (6.4%)
Tier 3. Need for reoperation and/or revision and/or spacer retention			
Tier 3A. Aseptic revision at >1 year from initiation of PJI	1 (0.7%)	3 (2.1%)	4 (2.9%)
Tier 3B. Septic revision (including debridement, antibiotics, and implant retention [DAIR]) at >1 year from initiation of PJI treatment (excluding amputation, resection arthroplasty, and arthrodesis)	0	14 (10%)	6 (4.3%)
Tier 3C. Aseptic revision at ≤1 year from initiation of PJI treatment	15 (10.7%)	2 (1.4%)	0
Tier 3D. Septic revision (including DAIR) at ≤1 year from initiation of PJI treatment (excluding amputation, resection arthroplasty, and arthrodesis)	10 (7.1%)	3 (2.1%)	0
Tier 3E. Amputation, resection arthroplasty, or arthrodesis	1 (0.7%)	2 (1.4%)	1 (0.7%)
Tier 3F. Retained spacer	15 (10.7%)	8 (5.7%)	5 (3.6%)
Tier 4A. Death <1 year from initiation of PJI treatment	2 (1.4%)	2 (1.4%)	2 (1.4%)
Tier 4B. Death >1 year from initiation of PJI treatment DAIR - debridement, antibiotics, and implant retention	0	3 (2.1%)	6 (4.3%)
No Follow-up (Missing information)	3 (2.1%)	4 (2.9%)	10 (7.1%)

Table 2: Treatment Success at 1, 3, and 5 year(s) based on ASA Classification, Comorbidities, and Demographics

	Number of Cases	Treatment Success at 1 year	Treatment Success at 3 Years	Treatment Success at 5 Years
ASA Count				
1	0			
2	26	77%	77%	85%
3	101	67.30%	74.30%	70.30%
4	13	69.20%	69.20%	84.60%
CCI Reimplantation				
0	4	25%	50%	50%
1	9	44%	56%	100%
2	19	78.9%	73.7%	84.2%
3	37	75.7%	81.1%	73%
4	29	72.4%	72.4%	75.9%
5	22	63.6%	72.7%	59.1%
6	8	62.5%	75%	62.5%
7	7	71.4%	85.7%	71.4%
8	3	100%	67%	100%
9	1	0%	100%	100%
Gender				
Female	72	66.7%	81.9%	81.9%
Male	68	72.1%	66.2%	66.2%
Other Comorbidities				
Diabetes	56	71.4%	73.2%	71.4%
Rheumatoid Arthritis	11	73%	73%	82%
Smoking Status				
Never	59	66.1%	81.4%	76.3%
Former	60	75%	72%	72%
Current	20	65%	60%	75%