

High Failure Rate of Two-Stage Revision for the Infected Total Elbow Arthroplasty: A Single Institution's Experience

Corey J Schiffman¹, William Baker, Daniel Kwak, Matthew Lee Ramsey, Luke Stanford Austin, Surena Namdari¹

¹Rothman Institute

INTRODUCTION:

Prosthetic joint infection (PJI) after total elbow arthroplasty (TEA) is a devastating complication for the patient and costly for the healthcare system. When elbow PJI is present or suspected, a 2-stage revision with explantation of prosthetic components and placement of an antibiotic spacer is often performed. The purpose of this study was to report on a single institution's experience with two-stage revisions for elbow PJI and determine risk factors for failed eradication of infection.

METHODS:

We retrospectively analyzed all two-stage revision TEAs performed for infection at a single institution between 2006 and 2020. Data collected included demographics, and treatment course prior to, during, and after 2-stage revision. Radiographs obtained after explantation and operative reports were reviewed to evaluate for retained cement. The primary outcome was failed eradication of infection, defined as the need for repeat surgery to treat infection after the second stage revision. Patients that experienced repeat infection were compared to those who did not to identify risk factors for failed eradication of infection.

RESULTS:

Twenty-one patients were included, with eleven (55%) being male and an average age of 66.3 ± 13.1 at the time of index TEA. The indication for TEA was posttraumatic arthritis in thirteen (62%) patients, inflammatory arthritis in six (29%) patients, and distal humerus fractures in two (9%) patients (Table 1). Eleven (50%) patients had surgeries in between the index arthroplasty and the 1st-stage of the 2-stage revision, with six (29%) being debridement for infection with retention of components. At the time of the 1st-stage of the revision, sixteen (76%) had grossly loose components and thirteen (72%) had positive cultures with the most common bacterium being five patients with *Staphylococcus epidermidis* and five with methicillin-sensitive *Staphylococcus aureus*. Eight (38.1%) had either the humeral or ulnar component retained and eleven (52.4%) had retained cemented in either the humerus or ulna after the 1st-stage. Five (24%) patients had repeat debridement and antibiotic spacer exchange between the 1st-stage and final reimplantation because of concerns for persistent infection, with one patient needing three repeat debridement procedures. The 2nd-stage was performed at an average of 5.1 ± 4.0 months after the 1st stage and nine (43%) patients had allograft strut used during reimplantation and reconstruction due to poor remaining bone stock. Allograft strut was more commonly used during the 2nd-stage of revision when components were found to be grossly loose during the 1st-stage of the revision ($p=0.081$, OR 7.00). Nine (43%) patients failed to eradicate the infection after 2-stage revision and had repeat surgeries for infection. Demographic data and indication for index TEA was similar between the repeat infection and non-repeat infection groups. Six (55%) patients with retained cement experienced reoperation for infection compared to three (30%) patients with full cement removal ($p=0.387$, OR 2.62) (Table 2). Two (25%) patients with a retained component experienced reoperation for infection compared to seven (54%) patients with full component removal ($p=0.367$, OR 0.31). There was no association between grossly loose components or species of bacteria cultured during the 1st-stage of revision or the use of allograft strut during the 2nd-stage of revision and recurrence of infection.

DISCUSSION AND CONCLUSION: Two-stage TEA revision is a challenging operation because patients have often had multiple prior surgeries and complete removal of cement and well-fixed components risks bone loss and intraoperative fracture. Nearly half of the patients failed to eradicate infection after 2-stage revision and needed another procedure to address repeat infection. This is valuable information for surgeons when counseling patients preoperatively. Leaving a well-fixed component in place at the 1st-stage of revision did not increase the risk of repeat infection and can be considered to minimize the risk of fracture or compromising bone stock for future reconstruction. When poor bone stock was encountered at the 2nd-stage of the revision, the use of allograft strut did not increase the risk of repeat infection. The best management of cement that is technically difficult to fully remove at the time of the 1st-stage of the revision remains unclear.

Table 1. 2-Stage TKA characteristics

Surgery time to finish TKA	10 (8 patients) (38%)
ORIP distal femora fracture	4 (60%)
Debridement for arthritis	2 (20%)
Removal of hardware	1 (10%)
Ulnar nerve decompression	1 (10%)
Surgery between Index TKA and 2-stage Revision	6 (55%)
Irrigation and debridement	6 (55%)
Trocar insufflation	1 (9%)
Periprosthetic fractures	2 (18%)
Asymptomatic loosening	2 (18%)
1-Stage Revision	
Positive cultures	13 (52%)
Cocci/bacteria species	1 (8%)
MRSA	1 (8%)
MSSA	5 (38%)
Staphylococcus epidermidis	5 (38%)
Staphylococcus multiaureus	1 (8%)
Stain test	4 (29%)
Positive	10 (40%)
Negative	11 (42%)
Increased pre-op inflammatory markers	
Creatinine level component	14 (70%)
Retained cement component	2 (10%)
Retained liner component	4 (20%)
Retained cement	11 (52%)
Allograft liner used at 2 nd stage (Reimplantation)	9 (43%)

Table 2. Repeat Infection vs. Non-Repeat Infection

	Total	Non-Repeat Infection	Repeat Infection	Odds Ratio (OR)	P Value
Retained Component:					0.367
No	13 (61.9%)	6 (50.0%)	7 (77.8%)		
Yes	8 (38.1%)	6 (50.0%)	2 (22.2%)	0.31 [0.03;2.07]	
Retained Cement:					0.587
No	10 (47.6%)	7 (58.3%)	3 (33.3%)		
Yes	11 (52.4%)	5 (41.7%)	6 (66.7%)	2.62 [0.41;19.0]	
Allograft:					0.396
No	12 (57.1%)	8 (66.7%)	4 (44.4%)		
Yes	9 (42.9%)	4 (33.3%)	5 (55.6%)	2.36 [0.39;16.1]	