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Original Article

Removal of an Infected Total Hip Arthroplasty: Risk Factors for Repeat Debridement, Long-term Spacer Retention, and Mortality

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ABSTRACT

Background: Two-stage exchange arthroplasty remains the preferred approach to treatment of chronic periprosthetic joint infection (PJI) following total hip arthroplasty (THA). The objective of the present study is to investigate the fate of antibiotic spacers placed for periprosthetic joint infection after THA and evaluate risk factors for outcomes other than reimplantation.

Methods: A national database was queried for Medicare patients who underwent removal of an infected hip prosthesis and placement of an antibiotic spacer. Patients with a study end point within 1 year postoperatively were included: (1) in-hospital mortality, (2) repeat debridement without reimplantation within 1 year, (3) resection arthroplasty, and (4) reimplantation of a hip arthroplasty. Independent patient-related risk factors for these end points were evaluated with a multivariate logistic regression analysis.

Results: A total of 7146 patients met all inclusion and exclusion criteria. Within 1 year postoperatively, 464 patients (6.5%) died in a hospital setting, 775 patients (10.8%) had a repeat debridement procedure, 404 patients (5.7%) had a resection arthroplasty, 1202 patients (16.8%) retained their spacers, and the remaining 4301 patients (60.2%) were reimplanted at an average of 124.4 ± 39.3 days. Numerous independent patient-related risk factors for these were identified.

Conclusion: At 1 year only 60% of patients undergo reimplantation. One-sixth of patients retain their spacer and approximately 10% require repeat debridement. Death occurred in at least 6% of the population. Several independent patient-related risk factors exist for repeat debridement, no reimplantation or death within 1 year following index THA removal.

Periprosthetic joint infection (PJI) following total hip arthroplasty (THA) remains one of the most devastating, costly, and challenging complications of total joint arthroplasty [1]. With the annual number of primary THA projected to increase 174% by 2030, so will the prevalence of deep infection and the requirement for revision surgery due to PJI [2–4]. The current gold standard surgical treatment of chronic PJI in the United States is a 2-stage exchange arthroplasty [5]. The first stage involves explantation of the infected prosthesis and antibiotic spacer placement, followed by a second stage involving reimplantation of a new prosthesis after a prolonged course of antibiotics.

While the ultimate goal of a staged revision is infection eradication, the definition of a successful staged treatment of PJI following THA is variable and has recently been called into question. Several studies reporting on outcomes following staged revision primarily focus on patients who have undergone reimplantation and often exclude patients who do not undergo reimplantation, possibly resulting in an overestimation of certain outcomes [6–12]. Furthermore, a recent study suggested that the number of patients who do not undergo reimplantation is not inconsequential and these studies might neglect nearly 20% of 2-stage treatment failures [13]. The limited literature that has investigated the natural history and outcomes of this subset of patients who do not undergo reimplantation has reported sobering data on the high morbidity, mortality, and infection persistence

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that can occur during this interstage period [13–16]. Studies evaluating the clinical course of patients following explantation and antibiotic spacer placement are often smaller, retrospective, institutional reviews that are inadequately powered to evaluate risk factors for various outcomes other than reimplantation. Furthermore, these small cohorts have limited any analysis of how a patient's overall medical comorbidity profile might influence the reimplantation rate, nonreimplantation outcomes, and additional surgeries in the interstage period.

The purpose of the present study was to investigate the clinical course and outcomes of patients who underwent explantation and antibiotic spacer placement for PJI following primary THA on a national scale, and then further this analysis by evaluating risk factors for outcomes other than reimplantation during the same time period.

Materials and Methods

The PearlDiver Patient Records Database (www.pearldiverinc.com, Fort Wayne, IN), a for-fee insurance-based patient records database, was used for the present study. The database consists of several separate private insurers and a Medicare database with procedural volumes and patient demographics for patients with International Classification of Diseases, 9th Revision (ICD-9), diagnoses and procedures or Current Procedural Terminology (CPT) codes. The data obtained are anonymous, and thus the authors' Institutional Review Board deemed this study exempt. The data for the present study were derived from the Medicare database within PearlDiver, which contains over 100 million individual patient records from 2005 to 2012. The Medicare data contained within the database is the complete 100% Medicare Standard Analytical File, indexed and reorganized to allow for patient tracking over time among other advantages.

The goal study population were patients who underwent removal of a total hip prosthesis and placement of an antibiotic cement spacer for a diagnosis of infection (stage I procedure). The database was first queried for all patients who fit this criteria using CPT code 27091 (removal of a total hip prosthesis) with the ICD-9 procedure code 80.05 (arthrotomy for removal of prosthesis without replacement, hip) coupled with ICD-9 procedure code 84.56 (insertion of cement spacer) during the same procedure. Only patients who had an associated infection ICD-9 diagnostic code, including codes for periprosthetic infection, septic THA, or postoperative infection, were then included in the study cohort. Patients without a study end point within 1 year postoperatively or without at least 1 year of follow-up in the database were excluded.

Five major study end points were evaluated within 1 year postoperatively to create 5 mutually exclusive groups: (1) mortality documented to have occurred in a hospital setting, (2) repeat debridement without reimplantation within 1 year, (3) resection arthroplasty, (4) reimplantation of a hip arthroplasty, and (5) remaining patients who were considered to have a retained spacer. Replantation was defined as a subsequent THA following the stage I procedure. A repeat stage I procedure was characterized by a removal and replantation of a cement spacer (ICD-9 procedure codes 84.57 and 84.56 in the same operation) following the index stage I procedure. Any patients who underwent a repeat stage I procedure and was subsequently reimplanted within 1 year were counted in the reimplantation group. A girdlestone-type procedure was identified as removal of a cement spacer without replacement of a second spacer, or without placement of a total hip prosthesis using ICD-9 procedure code 84.57 (removal of cement spacer) without an associated spacer insertion code (ICD-9 84.56), or CPT 27091 without an associated arthroplasty or spacer code. All remaining patients who were not coded as dead during the minimum 1-year of follow-up were considered to have retained cement spacers.

A logistic regression analysis was then performed to evaluate independent risk factors for each of 3 study end points: (1) death within 1 year postoperatively, (2) repeat stage I arthroplasty without reimplantation within 1 year postoperatively, and (3) no replantation (spacer retention) within 1 year postoperatively. The same risk factor variables were entered into the regression model for each end point of interest: gender, age, obesity, morbid obesity, tobacco use, alcohol abuse, inflammatory arthritis, depression, hypercoagulable state, diabetes mellitus, hyperlipidemia, hypertension, peripheral vascular disease, congestive heart failure, coronary artery disease, chronic kidney disease, need for hemodialysis, lung disease, and liver disease. Finally, the average elapsed time between the initial stage 1 procedure and reimplantation for patients who were reimplanted within 1 year was calculated with a standard deviation. For all significant variables, odds ratios (OR) and 95% confidence intervals were calculated. For all regression analyses, $P < .05$ was considered statistically significant. SPSS version 23 for Macintosh (IBM, Armonk, NY) was used for all statistical calculations.

Results

A total of 7146 patients who underwent hip arthroplasty prosthesis removal and cement spacer placement for infection met all inclusion and exclusion criteria. Within 1 year postoperatively, 464 patients (6.5%) died, 775 patients (10.8%) had a repeat debridement procedure and were not reimplanted within 1 year, 404 patients (5.7%) had a resection arthroplasty, 1202 patients (16.8%) retained their spacers, and the remaining 4301 patients (60.2%) were reimplanted at an average of 124.4 ± 39.3 days (Fig. 1).

Independent risk factors for death within 1 year included male gender (OR, 1.17; $P = .018$), age older than 85 years (OR, 2.78; $P < .0001$), diabetes (OR, 1.18; $P = .016$), congestive heart failure (OR

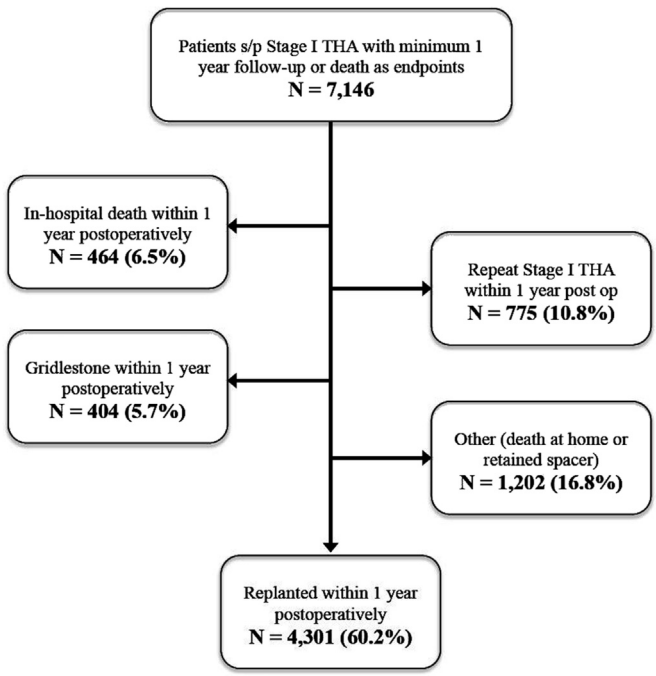

Fig. 1. Flowchart depicting the fate of patients who underwent hip arthroplasty prosthesis removal and cement spacer placement for infection.