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The Economic Impact of Periprosthetic Infections After Total Hip Arthroplasty at a Specialized Tertiary-Care Center

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ABSTRACT

Background: Periprosthetic infections after total hip arthroplasty represent an increased risk for patient morbidity and mortality, and an increased economic burden. The purpose of this study was to compare a group of patients who had periprosthetic infections after total hip arthroplasty to a matched group of patients who underwent primary total hip arthroplasty in terms of the associated costs, length of hospitalization, and number of readmissions (within 1 year).
Methods: Between 2007 and 2011, 16 consecutive infected patients were matched to 32 noninfected patients (1:2 ratio).
Results: The mean episode cost, length of hospitalization, and median readmissions was significantly higher in the infected group when compared to the matched cohort: $88,623 vs $25,659, 7.6 vs 3.29 days, and 2 vs 0, respectively.
Conclusion: Periprosthetic infections after THA resulted in an increased episode cost by approximately 3-fold, mean hospitalization period 2-fold, and led to a higher median number of readmissions.

Surgical site infections after total hip arthroplasty are a potentially devastating postoperative complication. These infections represent excess expenditures and costs to patients and health care institutions, as well as an increased risk of morbidity and mortality for the patient [1]. It is estimated that the incidence of surgical site infections after total hip arthroplasty ranges from 0.9% to 2.5%, which often requires multiple reoperations [2-4]. Currently, it is estimated that the annual cost of a revision procedure per periprosthetic joint infection in the United States exceeds $566 million and is expected to exceed $1.6 billion by the year 2020 [2]. With projections that the number of total hip arthroplasty procedures will increase 372% by the year 2030, it is estimated that the cost of managing these infections will represent an increasing tremendous burden for patients and health care institutions [5,6].

It has been postulated that most of the costs incurred for periprosthetic infections are due to multiple reoperations, prolonged hospitalizations, frequent readmissions, and prolonged uses of antibiotics and analgesics [7,8]. Various studies have estimated that the episode cost for managing each individual periprosthetic infection is approximately $100,000 [9,10]; however, there are limited data which specifically evaluates total hip arthroplasty infections.

Recently published studies on the topic are limited because the reported costs are either extrapolated estimates, offer no comparison group (such as primary noninfected total hip arthroplasty patients) or report on costs for all arthroplasty procedures, rather than stratifying by specific types (primary or revision), and joint involved [3,11-14]. In addition, many of these studies do not specifically evaluate the individual services, which account for the costs of treating these infections [3,12,13]. The purpose of this study was therefore to determine the costs for specific services, such as pharmaceutical services (inpatient and outpatient), medical and surgical supplies, anesthesia services, diagnostic and radiographic evaluations, operating room services, laboratory costs, blood products, consult services, and physical therapy visits. In addition, we compared the (1) associated costs, (2) length of hospital stay, and (3) number of readmissions (within 1 year).

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Methods

This study was conducted at a single specialized tertiary care center in the United States. Between January 1, 2007, and December 31, 2011, patient medical records and an infection-tracking database were reviewed for 2458 patients undergoing total hip arthroplasty to identify those patients who had surgical site infections. The infections included in this study were only deep infections extending to the joint space or deep fascial layers, which was based on the definition set forth by the Musculoskeletal Infection Society [12]. By this definition, a joint is considered positive for an infection: if there is a sinus tract in communication with the prosthesis, if 2 separate tissue or fluid cultures from the joint, or if 4 of the following 6 criteria are met: (1) an increased percentage of synovial polymorphonucleocytes, (2) an elevated erythrocyte sedimentation rate or C-reactive protein, (3) an elevated synovial leukocyte count, (4) one fluid or tissue culture that grows a pathogen, (5) gross purulence, or (6) frozen tissue sections over 5 polymorphonucleocytes per high-powered field. A superficial infection was defined as one that occurred within 30 days after the procedure and only involved the skin or subcutaneous tissue of the incision. For the purposes of this study, superficial wound infections were not considered periprosthetic infections. These do not differ markedly from any recent changes in guidelines and would not have changed the classification of the infections in either group. Superficial infections, involving only the skin or subcutaneous tissue of the incision, were not considered periprosthetic infections in this study. Patients were monitored, by reviewing medical records and an infection-tracking database, for 1 year from the initial operative date, based on the Centers for Disease Control and Prevention definition [15]. Once we identified patients with infections, we selected only those who required a 2-stage revision after their primary procedure. Patients who had 2-stage revisions were chosen, as this is considered the gold-standard treatment for periprosthetic joint infections. Institutional review board approval was obtained to analyze patient records and the data for the current study.

Postoperative care for all patients involves dressing change once in hospital 48 hours after the procedure using tegaderm and plain dressing (no aquacel). No oxygen is used for our patients postoperatively.

The following parameters were used for selecting these matched patients: type of surgical procedure, date of surgery, surgeon, age, gender, and the National Healthcare Safety Network risk category [4]. Study patients were excluded from our analysis if they did not have a minimum of one-year follow-up data to ensure that none of these patients became infected. After the selection of prospective patients, individuals were chosen randomly using a computer-generated algorithm. To verify compliance, patients were instructed to remove adhesive stickers from the cloth packages at the time of disinfection and to affix them to the instruction sheet, which was presented on the day of surgery. Patients were also questioned on the day of surgery about proper cloth use as an added level of compliance verification.

Data on infection and mortality were collected from patient medical records, including office notes, inpatient and outpatient charts, and an infection tracking database maintained by our senior infection preventionist. Data were collected for each patient regarding the length of hospitalization for each procedure, the need for readmissions and medical care, complications, and mortality during the 1-year follow-up period defined. There were no deaths in our study for either cohort.

Actual costs were obtained by reviewing hospital financial records for each individual case. The cost reports used in this study were those generated by the hospital financial system for services ordered during the patient's hospitalization. These charges were based on rates approved by the Health Services Cost Review Commission [16], but represent only those that were billed to the patient's insurance carrier (if insured) or to the patient (if uninsured). The total cost for each patient was based on the summation of each individual visit report generated. Each patient visit was verified by reviewing patient medical records, and the corresponding charges were subsequently verified by consulting patient billing and accounting services.

These costs included fixed-direct costs (the costs consumed by all patients during hospitalization) and included admitting and hospital bed per day charges. Variable-direct costs (the costs of services specific to patient consumption) included, but is not limited to, pharmaceutical services (inpatient and outpatient), medical and surgical supplies, anesthesia services, diagnostic and radiographic evaluations, operating room services, laboratory costs, blood products, consult services, and physical therapy visits. Operating room service costs included, but are not limited to, charges for implants, intravenous solutions, surgical supplies, and postoperative recovery costs. Laboratory services included, but are not limited to, charges for chemistry, hematology, urology, immunology, microbiology, and the processing of histologic samples. Radiology services included, but are not limited to, costs for X-rays, ultrasound, computed tomography, and magnetic resonance imaging scans. Physical therapy costs included charges, but are not limited to, for physical and occupational therapy services. Consult service charges obtained in this study included, but is not limited to, pulmonary, cardiology, and emergency services obtained in both an inpatient and outpatient setting.

Excel spreadsheet software (version 2007; Microsoft Corporation, Redmond, WA) was used for data collection, comparison, and calculations. GraphPad Prism software (version 6.0 for Windows, GraphPad Software, San Diego, CA) was used for statistical analysis. A chi-squared test was used to compare the length of hospitalization, number of readmissions, and total cost differentials between the 2 groups of patients. The power of our study was calculated to be 0.79 using an alpha of 0.05. A P value of less than .05 was used to determine statistical significance.

Results

We reviewed a total of 2458 patients who underwent total hip arthroplasty to identify those patients who had surgical site infections. There were a total of 35 periprosthetic infections identified, of which 3 patients used the chlorhexidine protocol and 32 patients did not. Of these patients, 19 were excluded because some were eradicated with either 1-stage revision or were revision procedures which became infected. We were able to select 16 patients to be included in the periprosthetic infection cohort. The goal of this study was to use only primary total hip arthroplasty cases, which became infected.

The study group was matched to 32 patients who had a primary total hip arthroplasty and who did not have an infection at a 1:2 ratio. The following parameters were used for selecting these matched patients: type of surgical procedure, date of surgery, surgeon, age, gender, and the National Healthcare Safety Network risk category. Study patients were excluded from our analysis if they did not have a minimum of 1-year follow-up data to ensure that none of these patients became infected. After the selection of prospective patients, individuals were chosen randomly using a computer-generated algorithm.

All patients were offered the same preoperative and perioperative antiseptic regimens. They were all given 2 sets of 2% chlorhexidine-impregnated cloths (Sage Products, Cary, IL) to use the night before and the morning of surgery as previously described [17,18]. Of note in this study, 15 patients (94%) who were infected