



Prevalence of Modifiable Surgical Site Infection Risk Factors in Hip and Knee Joint Arthroplasty Patients at an Urban Academic Hospital

Jason S. Pruzansky, MD^a, Michael J. Bronson, MD^{a,b}, Ronald P. Grelsamer, MD^{a,b},
Elton Strauss, MD^{a,b}, Calin S. Moucha, MD^{a,b}

^a Department of Orthopaedic Surgery, Mount Sinai School of Medicine, New York, New York

^b Department of Orthopaedic Surgery, Joint Replacement Center, Mount Sinai Hospital, New York, New York

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ABSTRACT

Surgical site infections after hip and knee arthroplasty can be devastating if they lead to periprosthetic joint infection. We examined the prevalence of the modifiable risk factors for surgical site infection described by the American Academy of Orthopaedic Surgery Patient Safety Committee. Our study of 300 cases revealed that only 20% of all cases and 7% of revision cases for infection had no modifiable risk factors. The most common risk factors were obesity (46%), anemia (29%), malnutrition (26%), and diabetes (20%). Cases with obesity or diabetes were associated with all histories of remote orthopedic infection, 89% of urinary tract infections, and 72% of anemia cases. The high prevalence of several modifiable risk factors demonstrates that there are multiple opportunities for perioperative optimization of such comorbidities.

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Surgical site infections after hip and knee arthroplasty can be devastating if they lead to periprosthetic joint infection. Studies have estimated that 0.86% to 1.55% of primary total knee arthroplasties and 0.3% to 1.63% of primary total hip arthroplasties will develop deep infection [1–4]. The hospital charges of treating an infected prosthetic joint arthroplasty are approximately \$96,000 for a hip and \$110,000 for a knee [5]. Infected patients have longer hospital stays and more complications [5,6]. Minimizing the frequency of these infections is of great benefit to patients, surgeons, and hospitals alike. The American Academy of Orthopaedic Surgeons (AAOS) Patient Safety Committee has identified several core modifiable risk factors for surgical site infection based on previously published studies. These risk factors are rheumatoid arthritis, human immunodeficiency virus (HIV), diabetes, smoking, anemia, risk for methicillin-resistant *Staphylococcus aureus* (MRSA) colonization, obesity, urinary tract infection (UTI), malnutrition, a history local or remote orthopedic infection, and poor dental hygiene [7]. Little evidence exists regarding how common this specific set of modifiable risk factors is in the population undergoing joint arthroplasty surgery in the United States. Our study examines the prevalence of these risk factors in patients who underwent hip and knee arthroplasty at our institution and lays the foundation for comparisons between different populations of joint arthroplasty patients. By identifying those risk factors that are most common

attention and resources can be focused more effectively and greater attempts at risk reduction can be pursued. As government programs and private insurers focus more attention on infection rates and base payments on outcomes and best-practice guidelines, prevention of infection will be an even greater priority.

Materials and Methods

After obtaining approval from the institutional review board of our institution the medical records from the cases of 300 total hip arthroplasty (THA), total knee arthroplasty (TKA) and unicompartmental knee arthroplasty (UKA) performed from 9/28/2010 to 5/1/2011 were examined. Patients who had bilateral joint arthroplasties performed on the same day were regarded as having one set of data to examine. Patients who had staged joint arthroplasty procedures several days apart during the same admission were regarded as separate data sets in order to take into account potential changes in some of the risk factors. Each patient's preoperative medical history, anesthesia evaluation, office history, and laboratory results were utilized to record the modifiable risk factors to be studied. These sources were dated within 30 days of the date of surgery. Diabetes, HIV, rheumatoid arthritis, smoking, and a history of local or remote orthopedic infection were noted as either present or absent. These risk factors were recorded by self-reporting by patients. Anemia was defined by our institution's laboratory threshold of hemoglobin <11.7 g/dL for women and <13.9 g/dL for men. Obesity was defined as a recorded body mass index (BMI) >30 kg/m². The presence or absence of a UTI was dependent on whether the patient had a preoperative urinalysis performed. Risk for MRSA colonization was

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Reprint requests: Jason S. Pruzansky, MD, Department of Orthopaedic Surgery, Mount Sinai School of Medicine, 5 East 98th Street, 9th Floor, Box 1188, New York, NY 10029.

Table 1
Overall Prevalence of Modifiable Risk Factors.

Risk Factor	Present (%)	Absent (%)	Total
Obesity	138 (46)	162 (54)	300
Anemia	87 (29)	213 (71)	300
Malnutrition	71 (26)	201 (74)	272
DM	59 (20)	241 (80)	300
Smoking	29 (10)	271 (90)	300
UTI	9 (5)	159 (95)	168
HIV	13 (4)	287 (96)	300
MRSA risk	7 (2)	293 (98)	300
Orthopedic infection	6 (2)	294 (98)	300
RA	5 (2)	295 (98)	300

defined as having a patient self-report or have documented previous MRSA infection, documented MRSA colonization, residence in a nursing home, employment as a healthcare worker, or active duty in the military. Malnutrition was defined as albumin <3.5 g/dL or total lymphocyte count <1500 cell/μL. Poor dental hygiene was not included in this study due to the absence of this information in patients' charts. Data recorded for revision cases performed for infection were taken from the records of the second stage re-implantation surgery. Statistical work was performed using SPSS (IBM corp, Armonk, NY). Descriptive analysis of the several modifiable risk factors was performed using univariate statistics. Chi-square and Fisher's exact tests were used for comparing the frequency of modifiable risk factors between the groups of primary, aseptic revision, and infected revision arthroplasty cases. The groups were used as independent variables while the presence or absence of the modifiable risk factors was analyzed as a dependent variable.

Results

In our study population of 300 cases, 107 primary total hip arthroplasties, 110 primary total knee arthroplasties, and 22 primary unicompartmental knee arthroplasties were performed. A total of 31 revision THA were performed, including 4 for infection. Thirty revision TKA procedures were performed, including 10 for infection. Table 1 illustrates the frequency and total proportion of each risk factor. Obesity was the most prevalent modifiable risk factor for infection in the population studied, present in 46% of cases. Other large minorities of patients had the risk factors of anemia (29%), malnutrition (26%), and diabetes (20%). Tables 2 and 3 demonstrate the frequencies and proportions of risk factors for cases specifically with diabetes and obesity. Patients with either of these two risk factors were responsible for all cases of distant orthopedic infection and eight of nine UTI cases. Obese and diabetic patients also comprised 72% of cases with anemia. Fig. 1 presents the frequency distribution of the risk factors. Among all of the 300 cases studied, 113 had only one modifiable risk factor. Only 20% of cases were without

Table 2
Risk Factors for Patients with Diabetes.

Risk Factor	Present (%)	Absent (%)	Total
Obesity	31 (53)	28 (47)	59
Anemia	25 (42)	34 (58)	59
Malnutrition	14 (27)	38 (73)	52
UTI	3 (9)	29 (91)	32
Smoking	4 (7)	55 (93)	59
HIV	2 (3)	57 (97)	59
Orthopedic infection	2 (3)	57 (97)	59
MRSA risk	1 (2)	58 (98)	59
RA	1 (2)	58 (98)	59

Table 3
Risk Factors for Patients with Obesity.

Risk Factor	Present (%)	Absent (%)	Total
Anemia	38 (28)	100 (72)	138
DM	31 (22)	107 (78)	138
Malnutrition	25 (20)	97 (80)	122
Smoking	11 (8)	127 (92)	138
UTI	5 (7)	63 (93)	68
HIV	4 (3)	134 (97)	138
Orthopedic infection	4 (3)	134 (97)	138
RA	3 (2)	135 (98)	138
MRSA risk	2 (1)	136 (99)	138

any modifiable risk factors. Of the cases involving revision for infection, only 7% were without any modifiable risk factor.

The frequencies with which each risk factor was found in the groups of primary, aseptic revision, and infected revision cases are presented in Tables 4–6. Statistical comparisons of these three groups, with each risk factor frequency used as a dependent variable, yielded some significant results. The risk factors of UTI ($P < 0.0465$) and HIV ($P < 0.0016$) were significantly more common in infected revision cases compared to primary arthroplasty cases. Obesity ($P < 0.0499$) was moderately significant as well in this comparison. UTI ($P < 0.0323$) and HIV ($P < 0.0226$) were also significantly more common in infected revision cases than aseptic revision cases. HIV was significantly more common in all revision cases compared to primary arthroplasty cases ($P < 0.0270$).

Discussion

Infection remains a devastating threat to patients undergoing joint arthroplasty of the hip and knee. Decreasing the prevalence of those risk factors that can be modified prior to surgery may diminish the risk of infection. Obesity is a central health care problem across the United States. A few studies have shown how obesity increases surgical site infection in joint arthroplasty patients [3,8,9]. One particular prospective study found the rate of infection to be 6.7 times higher in obese patients undergoing TKA and 4.2 times higher for THA [10]. Our study found that nearly one-half of cases were obese and suggests that patients undergoing revision arthroplasty for infection are more likely to have this modifiable risk factor. In light of this substantial infection risk and the common occurrence of obesity in the arthroplasty population, attention by orthopedists to this health problem could advance the fight against surgical site infection. Many total joint arthroplasty patients have already

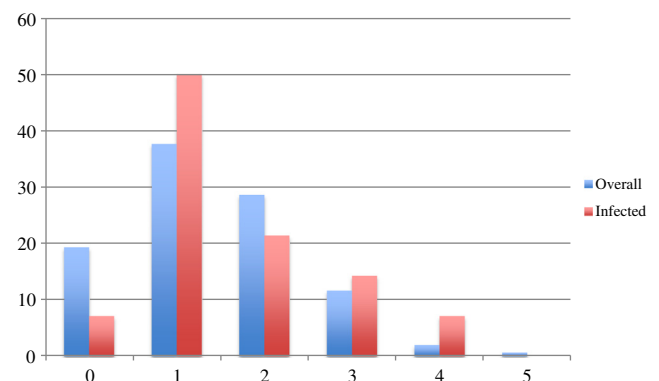


Fig. 1. Frequency of sums of risk factors (%). Most cases had one or two modifiable risk factors.

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