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Risk Factors for Surgical Site Infection Following Total Joint Arthroplasty

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Risk Factors for Surgical Site Infection Following Total Joint Arthroplasty

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INTRODUCTION

Surgical Site Infection (SSI) after total joint arthroplasty (TJA) is a rare but devastating complication[1]. In spite of improvement in the prevention of SSI, these infections are still a significant cause of morbidity in surgical patients[2]. Management of Hospital Acquired infections (HAI) including SSI poses a huge economic burden on healthcare[3]. As part of the mission to reduce the burden of HAI, the Centers for Disease Control and Prevention (CDC) has issued guidelines for the prevention of SSI that are currently being updated[4]. In addition, CDC requires all hospitals to report HAI through the National Healthcare Safety Network (NHSN) surveillance program.

It is believed that identification of patient-related risk factors and their reversal in some cases can lead to a reduction in SSI[5]. Although several studies have been performed to determine the risk factors of SSI following TJA[1,6], risk factors for SSI as defined by the CDC and required to be reported has not been fully evaluated. The objective of this case-control study was to determine the patient-related risk factors for SSI following primary and revision TJA using our institutional database on TJA and the data generated by the NHSN surveillance.

MATERIALS AND METHODS

Upon approval of the Institutional Review Board, 6111 primary and revision TJAs performed between April 2010 and June 2012 were identified. SSI cases based on the CDC definition were captured by infection control nurses in one of the 4 following ways: 1) An alert is sent to surveillance center from microbiology whenever a culture from a patient isolates an organism, 2) An alert is issued when a patient within one year of their index arthroplasty is readmitted to the main or affiliated hospitals, 3) an automatic check is in place to scan the operating room schedules and detect the names of patients who had arthroplasty within the preceding year, and 4) our institution is informed of patients readmitted to other facilities, as the Joint Commission and Act 52 requires institutions to share this information with each other. SSI cases with index surgery performed at another institution were excluded and all cases were followed up for one year regarding development of SSI.

Logistic regression and bootstrap resampling were used respectively to create and validate the model for predictors of SSI. The predictive power of the model was estimated by the area under the curve (AUC) in receiver operating characteristic plots.

RESULTS

During the study interval 6,111 TJA were performed in 3,414 women and 2,697 men with a mean age of 63.0 ± 11.4 (standard deviation) years. SSI developed in 80 cases [1.31%; 95% Confidence Interval (CI): 1.02% - 1.59%]. The highest rate of SSI was observed following revision total knee arthroplasty (TKA) at 4.57% (95% CI: 2.31% - 6.83%) followed by revision total hip arthroplasty (THA) at 1.94% (95% CI: 0.75% - 3.13%).

FIGURES 1 & 2, TABLE 1

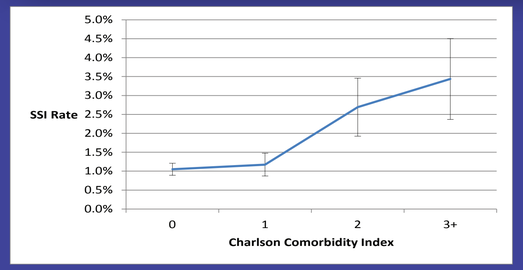

Figure 1. Relationship between the CCI and the rate of SSI.

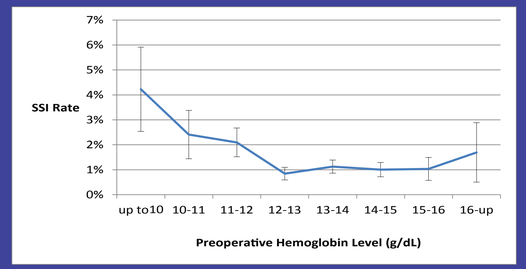

Figure 2. Relationship between the preoperative Hemoglobin level and the rate of SSI. g=Grams; dL=Deciliter.

Variable		Odds Ratio	95% Confidence Interval	p-value
Gender	Female	1 (Reference)	-	0.01
	Male	1.79	1.11-2.89	
Charlson Comorbidity Index	0	1 (Reference)	-	0.01
	≥ 2	2.29	1.32-3.94	
Preoperative Hemoglobin Level	≤ 10 g/dL	1 (Reference)	-	0.03
	12-13 g/dL	0.85	0.73-0.98	
Type of Surgery	Primary Total Joint Arthroplasty	1 (Reference)	-	0.48
	Revision Total Joint Arthroplasty	1.30	0.62-2.75	
Type of Primary Total Joint Arthroplasty	Total Hip Arthroplasty	1 (Reference)	-	0.29
	Total Knee Arthroplasty	0.75	0.44-1.29	
Interaction of joint and type of Surgery	Primary Surgery + Hip	1 (Reference)	-	0.02
	Revision Surgery + Knee	3.13	1.17-8.34	

Table 1. Predictive factor associated with the development of SSI. g=Grams; dL=Deciliter.

RESULTS

As Figure 1 demonstrates, the rate of SSI increased in patients with a higher Charlson Comorbidity Index (CCI). The highest rate of SSI at 4.23% (95% CI: 0.92% - 7.53%) was found in patients with a preoperative hemoglobin level of ≤ 10 g/dL (Figure 2).

Multivariate logistic regression indicated that higher CCI, male gender, revision TKA, and lower preoperative hemoglobin level are independent predictors of SSI (Table 1). The AUC of the model was found to be 0.709 without correction and 0.678 after bootstrap correction for model optimism (200 bootstrap samples). These values indicate that the model has fair predictive power.

DISCUSSION

The study has some limitations. Despite the availability of a comprehensive database, this retrospective study may suffer from the shortcomings of the design such as non-uniformity of data collection and bias. Despite all efforts to capture data on every SSI that occurred following TJA in this cohort, it is possible that some cases of SSI that were seen and treated on an outpatient basis may have been missed. However, we feel the latter is unlikely, as ordering of any cultures would have led to the notification of the infection surveillance center. We included only variables with the highest probability of affecting SSI in the model to avoid the potential negative effect that entering too many variables in the presence of a small number of events could have on the model. This might be considered as one of the limitations of this study. However, we used various statistical testes to make sure that output is accurate.

In conclusion, this study, comprising of a relatively large cohort of patients receiving TJA at a single institution, has identified various risk factors of SSI. Low preoperative hemoglobin level is one of the modifiable risk factors for SSI and preoperative correction of hemoglobin may reduce likelihood of postoperative SSI. A study comparing impact of preoperative optimization of hemoglobin with not correcting the preoperative hemoglobin level is recommended.

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