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Surgical Site Infections in Outpatient Surgeries: Less Invasive Procedures Contribute Substantially to the Overall Burden

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Abstract

Over 50% of outpatient surgeries predicted to have an increased likelihood of an adverse event were excluded from SSI surveillance based on VASQIP eligibility criteria, defined by clinician determination of invasiveness. Burden of SSI for eligible versus ineligible surgeries was similar, necessitating re-evaluation of surveillance activities in the outpatient setting.

Keywords

Surgical Site Infection; Ambulatory Surgery; Infection Prevention

Introduction

Surgical site infections (SSI) are among the most common and costly reported healthcare-associated infections.^{1,2} However, SSI surveillance systems were designed for, and are primarily focused on, inpatient invasive surgical procedures.³ These systems, often heavily reliant on microbiology results, may fail to capture the full range of infectious complications following minor surgical procedures occurring in an ambulatory setting.⁴

The Veterans Affairs Surgical Quality Improvement Program (VASQIP) is used by the VA nationally to assess surgical outcomes and improve the quality of surgical care. A similar surveillance system developed in the private sector, the National Surgical Quality Improvement Process (NSQIP), is now used by over 700 hospitals.⁵ However, these programs are limited in scope; procedures deemed to be minor and at low risk of adverse events, including many urologic and skin and soft-tissue procedures, are systematically excluded from review.^{6,7,8} Thus, the true SSI burden attributable to these perceived low-risk procedures is unknown. In this study, we sought to evaluate the relative burden of SSI in

VASQIP-eligible cases versus those cases deemed too minor for systematic review (VASQIP-ineligible) in the ambulatory setting.

Methods

This retrospective study examined outpatient surgeries performed between October 1, 2011 and September 30, 2015 across 11 VA inpatient facilities and 20 VA freestanding ambulatory surgery centers; data for these surgeries were derived from the VA Corporate Data Warehouse. Outpatient surgeries included in the analysis were identified based on Current Procedure Terminology (CPT) codes and the Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Program's 2014 Surgery Flag Software. A VASQIP eligible procedure is defined as an invasive procedure, identified by CPT code, which is associated with a measurable morbidity or mortality outcome; eligible procedures are determined by the VA National Surgery Office.⁹

A surveillance model was developed based on postoperative healthcare utilization flags (admission, ED visit, multiple visits to any surgical clinic) adjusted for patient co-morbidities, demographic, and procedural factors to identify surgeries with a high likelihood of an adverse event within 30 days after the procedure.⁷ The development dataset included manually reviewed cases with and without healthcare utilization flag. This model was then validated using a subset of charts selected based on the estimated probability an adverse event occurred. For all manual reviews, a trained nurse identified postoperative adverse events, including SSIs based on VASQIP definitions of superficial, deep or organ system infections, and surgeons on the project provided oversight.⁶

We compared SSI rates among VASQIP eligible and ineligible cases in our chart reviewed cases using SAS version 9.4 chi-square tests.

Results

There were 1,001,938 surgeries in the outpatient setting during the study period, 30% of which were VASQIP eligible. The healthcare utilization flags used in the surveillance model flagged 6.4% of VASQIP eligible cases, and 8.7% of VASQIP ineligible cases. To develop and validate the surveillance model, 2,256 outpatient surgeries underwent manual review;¹⁰ 1,018 (45.1%) procedures were eligible for VASQIP review (Table).

Nearly all skin and soft tissue procedures (325/345, 95%) and nearly half of urologic procedures reviewed were not eligible for VASQIP surveillance. In total, 90 SSIs (4%) were identified among the manually reviewed cases; 47 SSIs (3.8%) were identified in the VASQIP-ineligible cases compared to 43 SSIs (4.5%) in the VASQIP-eligible cases. The chi-square test was insignificant ($p=0.61$). In line with the rate of AE-flagging, the distribution of SSI was 4.6% in skin and soft tissue, 3.7% in urology, versus 6.0% in general surgery cases, which would generally be included in standard VASQIP review.

Discussion

This is the first study to evaluate the contribution of minor, outpatient procedures to the overall burden of SSI and to evaluate how alternative surveillance strategies- based on healthcare utilization rather than more standard microbiology-based surveillance- could be used to enhance detection. Using data from the Veterans Health Administration, the largest integrated health care system in the US, greater than 50% of outpatient surgeries reviewed in a prior study of adverse events would not have been considered for SSI review based on current VASQIP policies for clinician-determined operative complexity. Yet, despite the perception of low potential for post-operative adverse events, the contribution of total SSI burden was similar in invasive versus less invasive procedures. This suggests that policies around how surveillance is completed in the outpatient environment may need to be re-evaluated.

While the overall rate of SSI following outpatient surgical procedures is low, the volume and the complexity of these surgeries are rising in parallel. In 2010, there were 28.6 million ambulatory surgery visits to hospital and ambulatory surgical centers (ASC)³¹¹; however, despite this increasingly large number of surgical procedures at risk for an adverse event³, compliance with current infection prevention standards in outpatient settings is documented as low as 33%.⁴ The Centers for Medicare and Medicaid Services currently has a voluntary pay-for-reporting program for ASCs to report specific adverse events and has begun to track all postoperative ED visits and admissions following surgery in an ASC. However, their current surveillance definition may only account for a small subset of patients undergoing ambulatory procedures within an ASC and not in hospitals and, like VASQIP/NSQIP, this system may not be sufficiently comprehensive to identify and address the full scope of safety concerns. Further study and tracking of postoperative outcomes that includes a broader set of procedures from every specialty performing invasive procedures and all locations of care might allow for targeted infection prevention projects and improvement in overall patient safety for patients receiving care in outpatient settings.

Limitations of this study include use of data from a larger study developing an AE surveillance model for outpatient surgery⁷; as such cases were not sampled to represent surgical specialties. In addition, VA outpatient surgeries include a high prevalence of genitourinary procedures, thus these results may not be generalizable to non-VA facilities. However, strengths of this study include evaluation of a large dataset inclusive of all outpatient surgeries over a four-year period with manually adjudicated outcomes to provide meaningful information about the scope of SSI in this population.

In conclusion, routine SSI surveillance is limited in the outpatient setting; this gap in care may cause patient safety events to be missed for clinical procedures regarded by clinicians as “safe.” Expanding surveillance and applying utilization triggers to identify adverse events may provide a clearer and more objective picture of the distribution of SSI following outpatient procedures.

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Table:

Characteristics of Procedures With and Without Surgical Site Infections in Sample of FY12–15 VA Outpatient Surgeries

Procedure Type	VASQIP-Eligible		VASQIP-Ineligible		All FY12–15 Surgeries
	Total, n=1,108	SSI N=43 (4.2%)	Total, n=1,238	SSI n=47 (3.8%)	Total, n=1,001,045
General Surgery	395	23 (5.82%)	18	2 (11.11%)	94,684 (9.46%)
Genitourinary	244	10 (4.10%)	210	7 (3.33%)	160,840 (16.07%)
Orthopedics	182	1 (0.55%)	79	2 (2.53%)	155,430 (15.53%)
Ear/Nose/Throat	60	6 (10.00%)	102	1 (0.98%)	68,574 (6.85%)
Hand	26	2 (7.69%)	120	4 (3.33%)	68,589 (6.85%)
Vascular	24		6		22,150 (2.21%)
Skin/Soft Tissue	20	1 (5.00%)	325	15 (4.62%)	255,281 (25.50%)
Gynecological	18		9	1 (11.11%)	7,771 (0.78%)
Spine	18		1		12,733 (1.27%)
Colorectal	8		65	4 (6.15%)	23,025 (2.30%)
Breast	8				4,672 (0.47%)
Facial	6		26	1 (3.85%)	23,576 (2.36%)
Plastic/Reconstructive	4		6		5,913 (0.59%)
Neurosurgery	3		21	1 (4.76%)	14,540 (1.45%)
Foot	1		100	3 (3.00%)	33,129 (3.31%)
Vascular Access	1		65	5 (7.69%)	16,914 (1.69%)
Cardiac			80	1 (1.25%)	29,325 (2.93%)
Hemic			5		3,062 (0.31%)

NOTE: Data are from development and validation samples for a larger study on an adverse events surveillance model for outpatient surgery.^{7,12} Chart review cases were not sampled to represent surgical specialties.