Multi-Institution Analysis of Infection Control Practices Identifies the Subset Associated with Best Surgical Site Infection Performance: A Texas Alliance for Surgical Quality Collaborative Project

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BACKGROUND: In an effort to reduce surgical site infection (SSI) rates, a large number of infection control practices (ICPs), including operating room attire policies, have been recommended. However, few have proven benefits and many are costly, time-consuming, and detrimental to provider morale. The goal of this multi-institution study was to determine which ICPs are associated with lower postoperative SSI rates.

STUDY DESIGN: Twenty American College of Surgeons NSQIP and Texas Alliance for Surgical Quality-affiliated hospitals completed this Quality Improvement Assessment Board-approved study. Surgeon champions at each hospital ranked current surgery, anesthesia, and nursing adherence to 38 separate ICPs in 6 categories (attire, preoperative, intraoperative, preoperative, intraoperative, antibiotics, postoperative, and reporting) on 4-point scales for general surgery cases. These data were compared with the risk-adjusted general surgery SSI odds ratios contained in the July 2016 American College of Surgeons NSQIP hospital-level, risk-adjusted reports. Compliance rates were compared between the 7 best (median SSI odds ratio, 0.64; range, 0.56 to 0.70) and 7 worst (median SSI odds ratio, 1.16; range, 0.94 to 1.65) performers using ANOVA.

RESULTS: Nearly all hospitals reported maximal adherence to hair removal with clippers (Surgical Care Improvement Project measure Inf-6) and to best-practice prophylactic antibiotic metrics (Surgical Care Improvement Project measure Inf-1-3). Variable adherence was identified across many ICPs and more frequent compliance with 8 ICPs correlated with lower SSI odds ratios, including preoperative shower; skin preparation technique; using clean instruments, gowns, and gloves for wound closure and dressing changes; and transparent internal reporting of SSI data. Operating room attire ICPs, including coverage of nonscrubbed provider head and arm hair, did not correlate with SSI rates.

CONCLUSIONS: This analysis suggests that the subset of ICPs that focus on perioperative patient skin and wound hygiene and transparent display of SSI data, not operating room attire policies, correlated with SSI rates. Implementation of this subset of evidence-based ICPs may improve SSI rates at lower-performing hospitals. (J Am Coll Surg 2017;225:455–464. © 2017 by the American College of Surgeons. Published by Elsevier Inc. All rights reserved.)

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Abbreviations and Acronyms
CHG = chlorhexidine
ICP = infection control practice
OR = operating room
SCIP = Surgical Care Improvement Project
SSI = surgical site infection

Surgical site infections (SSIs) are defined as infections at any level between the skin and the organ space presenting within 30 days of a surgical procedure, in the absence of a surgical implant. A recent study found that SSIs develop rapidly in 1% of all surgical patients during their index admission, and patients undergoing gastrointestinal surgery have an inpatient SSI rate of 1.3%.[1] Expanding capture of SSI occurrences to 30 postoperative days, a large study of noncardiac operations at 121 Veterans Affairs hospitals documented an SSI rate of 4.6%.[2] Overall, SSIs are responsible for 14% to 16% of nosocomial infections, causing considerable patient morbidity, need for intensive care, prolonged length of stay, hernia, readmission, and even mortality.[3]

Surgical site infections not only impact patient outcomes and patient experience, they also incur a considerable cost burden to the healthcare system. Studies have estimated that SSIs are associated with a mean increase in cost of care of 115%, mostly attributed to increased length of stay.[4] Even superficial SSIs can result in average inpatient charge increases of up to $8,900.[5] Gastrointestinal surgery patients with any SSI were found to have their length of stay increased by a mean of 10 days and a $20,829 higher mean cost of hospital stay. When extrapolated to national data, this results in almost 1 million extra hospital days and $1.6 billion additional hospital costs, even without accounting for additional outpatient treatment.[1] True SSI rates and associated morbidities and costs are likely even higher than those reported in the literature, as a substantial proportion of SSIs present post-hospital discharge and might not be captured in administrative data secondary to outpatient management, poor post-discharge surveillance, or presentation of the patient to another institution.[6]

There are several proven risk factors and contributors to SSI, including obesity, smoking, immune-compromised state, nutrition status, and diabetes. Hospital-system infection control practices (ICPs), including skin preparation technique and antibiotic delivery, have proven to lower SSI rates; however, blanket implementation of Surgical Care Improvement Project (SCIP) guidelines has had variable impacts on outcomes.[7,8]

More recently, an ever-expanding number of perioperative ICPs have been proposed, recommended, and even mandated. Many of these practices fall into the category of operating room (OR) attire. The Association of Perioperative Registered Nurses, in particular, has recommended compliance with multiple OR attire practices that impact personnel in the field of surgery and distant from the field of surgery.[9-12] These policies include location and other specifics of scrub laundering; type of surgical cap; restrictions on jewelry and nail polish; undershirts; OR shoes and shoe covers; forearm coverage; head, facial hair, and sideburn coverage; personal bags; stethoscopes; and masks. Although many of these have face validity, most are unproven.[9-19] In addition, review of these policies has found that many are costly, time-consuming, and detrimental to provider morale.[17-24]

In the vacuum of consistent and reliable approaches to wound infection quality improvement, other groups have recommended implementation of an ever-increasing number of unproven ICPs. This has confused the situation and lowered confidence that any intervention will reliably improve outcomes. Many systems have implemented an externally recommended set of practices or "bundle." Unfortunately, this approach does not guarantee success, as many of these recommended practices are unproven and even those that are proven (ie SCIP metrics) do not improve outcomes consistently.[25]

It is incumbent on all guideline-producing bodies to recognize the contribution of surgical personnel comfort to performance and patient safety, preferably balancing local factors and evidence of benefit. Given that compliance with process metrics, such as SCIP, have not been consistently proven to impact wound infection rates, studies that assess a broader set of ICPs and hospital culture are needed to determine which specific set of practices best correlate with optimal outcomes. To address this knowledge gap, the Texas Alliance for Surgical Quality American College of Surgeons NSQIP collaborative designed a multi-institution survey instrument to assess a range of ICPs and associated them with risk-adjusted SSI data.

METHODS

After approval of the University of Texas MD Anderson Cancer Center Quality Improvement Assessment Board, surgeon champions, surgical clinical reviewers, and OR managers from 29 American College of Surgeons NSQIP and Texas Alliance for Surgical Quality-affiliated hospitals were sent surveys inquiring about adherence to and compliance with 38 ICPs in 6 areas of care that are proven or proposed to influence SSI rates, including attire, preoperative, intraoperative,