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Brief Report

Infection prevention and enhanced recovery after surgery: A partnership for implementation of an evidence-based bundle to reduce colorectal surgical site infections

Heather Albert BSN, RN, CIC [a,*], Will Bataller MS [b], Nadia Masroor MPH [a], Michelle Doll MD, MPH [a,b], Kaila Cooper MSN, RN, CIC [a], Paula Spencer MSHA, PMP, CPHIMS [a], Donna Winborne BSN, RN, MSHA [a], Elaine M. Zierden BSN, RN, CNOR [a], Michael P. Stevens MD, MPH, FACP, FIDSA, FSHEA [a,b], Michael Scott MB, ChB, FRCP, FRCA, FFICM [a,b,c], Gonzalo Bearman MD, MPH, FACP, FSHEA, FIDSA [a,b]

[a] *Virginia Commonwealth University Hospital, Richmond, VA*
[b] *Virginia Commonwealth University School of Medicine, Richmond, VA*
[c] *Department of Anesthesia, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA*

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To reduce surgical site infections (SSIs) in colorectal surgeries we introduced a bundle of care elements in partnership with the Enhanced Recovery after Surgery (ERAS) multidisciplinary team. We measured the incidence of National Healthcare Safety Network-defined SSIs, along with adherence to bundle care elements. Despite opportunities for improvement in adherence to some key components, implementation of the ERAS protocol may have facilitated a reduction in the rate of colorectal SSIs at our institution.

Colorectal surgeries present a high risk of surgical site infection (SSI), with an incidence of 16.9%[1] compared with an incidence of 2% during other surgical procedures.[2] SSIs increase morbidity and health care costs.[3-5] After several singular attempts by the Healthcare Infection Prevention Program to reduce SSIs were unsuccessful, we collaborated to introduce a multifaceted evidence-based bundle of care to reduce SSI as part of a larger quality improvement initiative. We incorporated approaches to reduce SSI in partnership with the Enhanced Recovery After Surgery (ERAS) project, a program that institutes standardized pre-, intra-, and postoperative protocols to minimize patient physiologic stress and improve the metabolic response to surgery.[6] Prior studies reported improved outcomes—such as reductions in length of stay, complications, and hospital readmissions—following implementation.[6] In addition to standard ERAS elements, such as patient warming, correctly timed antibiotics, and fluid management, we added several other evidence-based items, such as wound irrigation and separate closing trays.[6] In doing so, we developed a standard protocol for all colorectal surgeries.

METHODS

Our study was based in the Virginia Commonwealth University Medical Center, an 865-bed, tertiary academic hospital. A protocol for colorectal procedures was developed with input from representatives of ERAS, colorectal surgery, surgical oncology, anesthesia, pharmacy, infection prevention, and nursing from perisurgical services during discussions in weekly meetings. In October 2016, the intraoperative protocol was implemented on all surgical procedures involving the colon and rectum, including all procedures under surveillance for National Healthcare Safety Network (NHSN) reporting. The bundle elements included (1) patient hair removal in the perisurgical unit (a preoperative step), (2) maintaining normothermia (body temperature >35.5°C), (3) antibiotic prophylaxis (2,000 mg cefoxitin *OR* a combination of 500 mg metronidazole and 2,000 mg cefazolin for patient weight ≤120 kg, 3,000 mg cefazolin for weight >120 kg), (4) use of surgical wound protectors, (5) wound irrigation with antibiotic solution, and (6) skin closure protocol (closure tray with surgeon gown and glove change).

The colorectal surgery division expanded in January 2017 with the hire of 2 additional surgeons. Compliance with key components of the

* Address correspondence to Heather Albert, BSN, RN, CIC, Virginia Commonwealth University Hospital, 1300 E Marshall St, RM 2-100, Richmond, VA 23298.
E-mail address: heather.albert@vcuhealth.org (H. Albert).
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Table 1
Mean SSI rates and SIRs pre- and postintervention

	SSI rate*	SIR	*P* value†
Prebundle implementation (12/2015-9/2016)	12.26	1.67	.004
Postbundle implementation (10/2016-7/2017)	5.04	0.62	

SIR, standardized infection ratio; *SSI*, surgical site infection.
*Per 100 procedures.
†Two-proportion *z* test comparing SSI rate means.

bundle was obtained by review of the electronic medical record starting in February 2017 (upon completion of the documentation fields); results were reported monthly to the ERAS project team as process of care measures. Monthly colorectal SSI rates by NHSN criteria and NHSN standardized infection ratios were calculated for the 10 months pre- (December 2015 to September 2016) and 10 months postbundle (October 2016 to July 2017) implementation. A 2-proportion *z* test was conducted to compare the mean SSI rates pre- and postintervention (SAS 9.4; SAS Institute, Cary, NC).

RESULTS

In the 10 months prior to implementation, there were 26 infections and 212 colorectal procedures (12.26 infections per 100 procedures) (Table 1). After intervention, there were 13 infections and 258 procedures (5.04 infections per 100 procedures).

Table 2 summarizes compliance with protocol methods from February-July 2017. Case adherence to intraoperative protocol, in order of most to least compliant, is as follows: 77% normothermia maintenance, 69% antibiotic prophylaxis, 50% wound irrigation, 48% skin closure protocol, 40% wound protector, 32% hair removal in perisurgical unit (Table 2).

DISCUSSION

We addressed colorectal SSI risk reduction through ERAS, a multifaceted protocol with interventions spanning the surgical continuum of care. The project team developed and applied a standardized, stepwise protocol and observed the effects on outcome using quality improvement methodology.

Initially after implementation, we noted a lack of protocol integration in many procedures. Hair removal practices were adherent to protocol in a minority of cases and use of wound protectors was limited. The role of these 2 factors in SSI prevention is not well understood; current expert guidelines are limited by insufficient data to recommend for or against many of the interventions employed by surgical teams in efforts to decrease SSI.[7,8] Furthermore, some strong recommendations are based on theoretical rather than clinical evidence.[9] Although each individual item in the ERAS bundle may not by itself drive SSI reduction, the end result of keeping the patient as close to a physiologically normal state as possible has been shown to improve a variety of outcomes.[6] We speculate that higher adherence to protocol elements may further reduce SSIs; greater adherence has been associated with improvement in surgical outcomes at other centers.[6,10]

Table 2
Adherence to bundle implementation (February-July 2017)

Protocol change (no. of procedures/total procedures)	Compliance (%)
Hair removal (15/47)*	32
Normothermia (85/110)	77
Antibiotics (76/110)	69
Wound protector (44/110)	40
Wound irrigation (55/110)	50
Closure protocol (53/110)	48

*Sixty-three procedures did not require any hair removal.

The implementation of an evidence-based colorectal SSI prevention bundle resulted in a significantly lower SSI rate compared with the 10 months prior to intervention. These encouraging early outcomes may spur other centers to investigate partnerships with ERAS in their own programs.

Study limitations include a limited surgical sample size, a relatively short 10-month pre and post quasi-experimental analysis, and a single institution design; results may not be generalizable. Adherence monitoring was based on retrospective review of documentation; results may be affected by incomplete documentation. Traditional SSI risk reduction interventions were bundled into ERAS, and thus the relative impact of individual components is not known. For example, perioperative hair removal compliance was low, suggesting that this may have played a minor role in overall SSI risk reduction when part of an ERAS bundle. Study strengths include the continual data collection process and the engagement of key stakeholders in developing, implementing, and refining the protocol. The collaborative ERAS-SSI prevention bundle remains ongoing at our institution, suggesting that the intervention is sustainable.

CONCLUSIONS

This study adds to the body of literature on colorectal SSI risk reduction strategy implementation. As far as we know, we are the first to report a partnership between a hospital infection prevention program and a fully implemented ERAS pathway. Our results suggest that hospital infection prevention programs should consider partnering with quality improvement initiatives, such as ERAS, to develop and collaboratively implement a multidisciplinary standardized prevention bundle for surgical risk reduction. The clinical benefits of ERAS—specifically minimizing patient physiologic stress and improving the metabolic stress response to surgery—may further benefit traditional SSI prevention strategies, such as perioperative antibiotic use, hair removal, and normothermia. Further studies with both process and clinical outcomes are needed to best define optimal infection prevention bundle elements within ERAS.

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