ASCRS
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Special Edition from the Quality Assessment and Safety Committee
Reducing Surgical Site Infection – Where do I look?

Introduction
The clinical and economic burden of surgical site infections (SSI) to the United States (US) population is significant. An estimated 158,000 surgical patients are afflicted with an SSI each year, with an average cost of over $20K (total = $3.1B).[1] The ability of hospitals and surgeons to minimize this burden is an ongoing focus of quality improvement efforts undertaken by hospitals, payers, and regulatory agencies.

What is a Surgical Site Infection?
Surgical site infections are classified into three categories based upon the location and depth of infection. These include superficial, deep and organ surgical site infections. The classification system most commonly used is based upon that published by Horan et al in 1992[2], and this system is the basis for that used by the Centers for Disease Control (CDC), the National Healthcare Safety Network, and the National Surgical Quality Improvement Program (NSQIP).

Superficial surgical site infections (SSSI) involve the skin or subcutaneous tissue around the incision. SSSI meet one or more of the following additional criteria: purulent drainage from the incision, organisms isolated from an aseptically obtained culture, fluid or tissue from the incision, or signs/symptoms of infection (pain/tenderness, localized swelling, redness/heat) in an incision that is deliberately opened by a surgeon.

Deep surgical site infections (DSSI) involve the deep soft tissues, generally fascia and/or muscle. In order to be considered a DSSI, one of the following must be present: a deep incision spontaneously dehisces or is deliberately opened by a surgeon when the patient has at least one of the following signs or symptoms fever (>38 C), localized pain or tenderness, or documentation of an abscess.

Organ space surgical site infections (OSSI) occur deep to the muscle and fascia, involving organs and/or organ spaces. OSSIs also have at least one of the following: purulent drainage from a drain that is placed into the organ/space, organisms are isolated from fluid or tissue in the organ/space by a culture which is performed for diagnostic or treatment purposes, or documentation of an abscess.

Who Monitors Surgical Site Infections?
Several different agencies have a mandate to measure, analyze, and report rates of SSI. The methods used by each of these agencies vary, and therefore it may not be surprising to obtain different reports from different data sources.

Administrative/Billing Data
In each hospital, coders pore over clinical documentation and apply ICD-10 codes (the ICD-9 scheme was retired in 2015) according to the diagnoses applied by clinicians within the medical record. These data are then reported to payers, most notably the Centers for Medicare and Medicaid Services (CMS). CMS data (aka "Medicare data") are freely available to third parties, and

several groups (including CMS) now publicly report hospital and surgeon-specific outcomes that reflect infectious complications. Hospitals and surgeons can use their own institutional administrative data to analyze SSI rates, and track changes over time. These data are easily available, but often criticized as being inaccurate.

National Healthcare Safety Network

In addition to billing data, the CMS also receives SSI data through the National Healthcare Safety Network (NHSN). These data are ascertained by trained staff within each hospital in the US, and are intended to facilitate the tracking of a range of different Hospital-Acquired Infections (HAIs). Analyses of these data are reported back to hospitals, and also form the basis for a portion of CMS's Value-Based Purchasing (VBP) evaluation. Of note, these reports are only based on occurrences of deep and organ space SSI.

NSQIP

The American College of Surgeon's National Surgical Quality Improvement Program (NSQIP) is one of the most important means by which hospitals can track SSI outcomes. Reports from the NSQIP have the highest level of risk-adjustment and quality control, but are limited in that the program only analyzes a sample of patients (usually 20%). Also, the NSQIP program is associated with a significant cost in terms of personnel and associated fees and is available at a minority of hospitals within the US. Despite these limitations, reports from the NSQIP are a robust platform for monitoring SSI.

"Home-Grown"

The availability of existing mechanisms to monitor SSIs does not mean that providers should not design their own approach.

Which data source should I use to guide my efforts?

Each of the data sources listed above has specific strengths and weaknesses as a platform for quality improvement. The choice as to which should be used depends on a set of considerations that is specific to each institution. In choosing a data source, one should be aware of the costs/burdens of accessing the data, accuracy of the data, available sample size, and institutional beliefs/culture.

State of the Evidence Regarding SSI

The Surgical Care Improvement Project (SCIP) sought to coalesce recommendations regarding specific peri-operative processes of care into a single checklist, and CMS used payment as a lever to encourage uptake of guideline-driven care. Elements of care related to SSI prevention included antibiotic selection, antibiotic discontinuation, appropriate hair removal, re-dosing of antibiotics, and postoperative normothermia. The SCIP measures are no longer a part of CMS's approach to hospital value-based purchasing, leaving a void in the guidance that is available to providers who interested in targeting elements of care that are associated with SSI reduction.

In the table below is a list of the elements that are commonly considered in developing a comprehensive approach to reducing rates of SSI. A review of the evidence underlying each of these factors is beyond the scope of this short communication.

Preoperative	**Perioperative**	**Postoperative**
Appropriate Hair Removal	Antibiotic Selection	Antibiotic Discontinuation
Bowel Prep (Mechanical, Oral Abx)	Antibiotic Re-Dosing	Supplemental Oxygen Therapy

Preoperative Skin Cleansing	Patient Warming	Dressing Care/Removal
Smoking Cessation	Minimizing Incision Size/Length	Negative Pressure Devices
DM Optimization	Supplemental Oxygen Therapy	Early Triage of Wound Problems
Patient Warming	OR Skin Preparation	IVF Reduction
Patient Education	Gown/Glove Changes	Glycemic Control
	New Closing Trays	Shower
	Wound Irrigation ± Antibiotics	
	IVF Reduction	
	Wound Protectors	
	Restricted OR Traffic	
	Wound Drains	
	Glycemic Control	

Choosing an Approach

Providers seeking to implement programmatic improvements in SSI reduction need to exercise judgment regarding which elements are most appropriate. One of the most effective ways to deal with potential uncertainty in choosing a single process of as a target for quality improvement is to use a "bundle" approach, whereby a range of interventions are used. The bundle approach has documented effectiveness in multiple studies.[3-6]

Conclusion

Lowering rates of postoperative SSIs is challenging work. Many of the most straightforward/effective interventions (e.g. prophylactic preoperative antibiotics) are already part of standard practice. Additional work to further reduce rates of postoperative SSIs requires a thoughtful approach that combines an understanding of existing literature with attention to the metrics/mechanisms that can be used to monitor progress.

Selected Literature

1. Zimlichman, E., et al., *Health care-associated infections: a meta-analysis of costs and financial impact on the US health care system.* JAMA Intern Med, 2013. **173**(22): p. 2039-46.
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4. Weiser, M.R., et al., *Effectiveness of a multidisciplinary patient care bundle for reducing surgical-site infections.* British Journal of Surgery, 2018. **105**(12): p. 1680-1687.
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6. Waits, S.A., et al., *Developing an argument for bundled interventions to reduce surgical site infection in colorectal surgery.* Surgery, 2014. **155**(4): p. 602-6.