American College of Surgeons and Surgical Infection Society: Surgical Site Infection Guidelines, 2016 Update

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Guidelines for the prevention, detection, and management of surgical site infections (SSI) have been published previously.[1-3] This document is intended to update earlier guidelines based on the current literature and to provide a concise summary of relevant topics.

Surgical site infections are both common and morbid. Surgical site infections are now the most common and costly of all hospital-acquired infections, accounting for 20% of all hospital-acquired infections. Surgical site infections are associated with increased length of stay and a 2- to 11-fold increase in the risk of mortality. Although most patients recover from an SSI without long-term adverse sequelae, 77% of mortality in patients with an SSI can be attributed to the infection itself.[1,4]

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The incidence of SSI is 2% to 5% in patients undergoing inpatient surgery.[1] Estimated annual incidence varies widely, ranging from 160,000 to 300,000 in the US.[1,4] These estimates are likely understated, given the surveillance challenges after discharge.

The financial burden of SSI is considerable; it ranks as the most costly of the hospital-acquired infections.[1] The annual cost of SSI in the US is estimated at $3.5 to $10 billion.[1] Increased costs from SSIs are driven by increased length of stay, emergency department visits, and readmissions. On average, SSI extends hospital length of stay by 9.7 days, and increases the cost of hospitalization by more than $20,000 per admission. More than 90,000 readmissions annually are attributed to SSIs, costing an additional $700 million per year. Because up to 60% of SSIs were estimated to be preventable with the use of evidence-based measures,[1] SSI has become a pay-for-performance metric and a target of quality-improvement efforts.

The most widely used definition of SSI has been provided by CDC.[5] This definition is used for research, quality improvement, public reporting, and pay-for-performance comparisons. According to this definition, SSIs are classified by depth and tissue spaces involved. A superficial incisional SSI involves only the skin or subcutaneous tissue, a deep incisional SSI involves the fascia or muscular layers, and an organ space SSI involves any part of the body opened or manipulated during a procedure, excluding the previously mentioned layers.

Numerous risk factors have been identified for the development of an SSI after surgery. These risk factors can be broadly separated into intrinsic (patient) factors that are modifiable or nonmodifiable, as well as extrinsic (eg procedure, facility, preoperative, and operative) factors (Table 1). Potentially modifiable patient risk factors include glycemic control and diabetic status, dyspnea, alcohol and smoking status, preoperative albumin <3.5 mg/dL, total bilirubin >1.0 mg/dL, obesity, and immunosuppression. Nonmodifiable patient factors include increasing age, recent radiotherapy, and history

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Abbreviations and Acronyms

ACS = American College of Surgeons
DPC = delayed primary closure
OR = operating room
SCIP = Surgical Care Improvement Project
SSI = surgical site infection

of skin or soft tissue infection.[1,6] Procedure-related factors include emergency and more complex surgery and wound classification.[6] Facility risk factors include inadequate ventilation, increased operating room (OR) traffic, and appropriate sterilization of equipment.[1] Preoperative risk factors include presence of a pre-existing infection; inadequate skin preparation; hair removal; and antibiotic choice, administration, and duration.[1] Intraoperative risk factors include duration of surgery, blood transfusion, maintenance of asepsis, poor-quality surgical hand scrubbing and gloving, hypothermia, and poor glycemic control.[1,6,7]

The human and financial consequences of SSI are substantial. Surgical site infection is a complex problem influenced by numerous factors, only some of which are under the surgeon's control. Strategies to decrease SSI are multimodal and occur across a range of settings under the supervision of numerous providers. Ensuring high compliance with these risk-reduction strategies is crucial to the success of SSI reduction efforts.

METHODS

Earlier guidelines represent the cornerstone of this SSI guideline update. Within the framework of existing guidelines, specific topics were researched in PubMed, with a focus on more recent literature. Specifically, literature was sought out addressing knowledge gaps in previously published guidelines. This literature was summarized by one author and sent to an internal expert panel, as well as external context experts for review. Additional studies were added according to feedback from these experts. Guidelines were drafted according to the evidence provided by this literature. These were again reviewed by both an internal expert panel and by outside content experts to reach consensus agreement on the final guidelines presented here.

RESULTS

Tables 2–4 summarize all consensus statements and guidelines. Table 2 covers the prehospital setting, Table 3 covers the hospital setting, and Table 4 covers the post-discharge setting. Here, we provide a summary of the literature informing these guidelines.

Table 1. Surgical Site Infection Risk Factors

Risk Factor
Intrinsic (patient-related)
Non-modifiable
Increased age
Recent radiotherapy
History of skin or soft tissue infection
Modifiable
Diabetes
Obesity
Alcoholism
Current smoker
Preoperative albumin <3.5 mg/dL
Total bilirubin >1.0 mg/dL
Immunosuppression
Extrinsic (procedure-related)
Procedure
Emergency
Increasing complexity
Higher wound classification
Facility
Inadequate ventilation
Increased operating room traffic
Contaminated environmental surfaces
Non-sterile equipment
Preoperative
Pre-existing infection
Inadequate skin preparation
Inappropriate antibiotic choice, timing, and weight-based dosing
Hair removal method
Poor glycemic control
Intraoperative
Longer procedure duration
Blood transfusion
Breach in asepsis
Inappropriate antibiotic re-dosing
Inadequate gloving
Inappropriate surgical scrub
Poor glycemic control

Prehospital interventions

Preoperative patient optimization topics include bathing and showering techniques, smoking cessation, whether long-term glucose control affects SSI risk, MRSA screening and decolonization, and bowel preparation for elective colorectal surgery.

Preoperative bathing and showering

Chlorhexidine reduces the bacterial colonization of the skin,[8] however, a recent Cochrane database systematic