SSI Prevention:
Crossing Environments of Care, Standardizing Incision Management

Healthcare-acquired infection (HAI) ranks within the 10 leading causes of death in the United States. More than 20 percent of all hospital-acquired infection can be attributed to the infection of a surgical site (SSI). Although SSI occurs in approximately 2 percent of surgical procedures, infection rates vary widely, according to the type of procedure. At any given time, about 1 in every 20 inpatients has an infection related to hospital care. These infections cost the U.S. healthcare system billions of dollars each year and lead to the loss of tens of thousands of lives. In addition, HAIs can have devastating emotional, financial and medical consequences.

The most recent correction update of the CDC recommendations in Surgical Site Infection prevention noted that in 2010, an estimated 16 million operative procedures were performed in the United States. A recent prevalence study found that SSIs, which occur within 30 days of surgery, were the most common healthcare-associated infection, accounting for 31 percent of all hospital-acquired infections among hospitalized patients. National Healthcare Safety Network data for 2006-2008 (16,147 SSIs following 849,659 operative procedures) showed an overall SSI rate of 1.9 percent.

The authors state that while advances have been made in infection control practices, including improved operating room ventilation, sterilization methods, barriers, surgical technique, and availability of antimicrobial prophylaxis, SSIs remain a substantial cause of morbidity and an associated mortality rate of 3 percent has been attributed to them. Of this, 75 percent of the mortality rate has been directly related to the SSI.

Three categories of variables have proven to be reliable predictors of SSI risk:
1. Those that estimate the intrinsic degree of microbial contamination of the surgical site.
2. Those that measure the duration of an operation.
3. Those that serve as markers for host susceptibility.

As obesity rates continue to rise across the United States, increased incidence of surgical site infection can be expected: in a 2011 paper, colectomy patients’ SSI rate was 14.5 percent if they were obese (BMI>30kg/m2) versus 9.5 percent if they were not. The authors found an overall rate of SSI of 10.3 percent for colorectal surgery patients. Those patients with obesity, which is the most commonly encountered SSI risk factor, faced $17,324 of additional costs when an SSI complicated their recovery, as well as a longer hospital stay and nearly four times the risk for readmission.

Perhaps considering infection prevention as a phenomenon that reaches beyond the healthcare system is a way to begin to proactively plan for its reduction. Susceptibility to infection occurs well before the patient enters the operating room; addressing risk factors such as obesity and controlling impact of co-morbidities such as diabetes and sedentary activity levels may need to be joined by the infection preventionist as well as the community health nurse and primary care physician.
Cost of Surgical Site Infection

Cardiovascular surgical SSI had the greatest absolute impact in terms of total additional cost and length of stay. Costs were increased by $37,513, and length of stay by 13.7 days, based on 2005 data, as noted in a 2009 study. Second in impact were neurosurgical site infections, with colorectal surgical site infections ranking third in length of stay and cost, as well. Gastrointestinal SSI, orthopedic, obstetrical and gynecologic, and skin/tissue/breast SSI ranked in that order in both costs and length of stay.¹

Conservatively calculated, SSI increased the length of stay by 9.7 days and mean cost of treatment by $20,842 when all sources of infection were considered. In the pediatric population, surgical site infection lengthened hospital stays by 10.6 days and added $27,288 to the cost of care.¹

It may be that extending the service of the infection preventionist into relationship with discharge planning and home care, although possibly incurring more initial cost to the acute care facility, could influence procedures that would reduce SSI incidence arising after discharge.

Managing the Surgical Wound — a Problem With Procedure

The incision care recommendations from the Centers for Disease Control for prevention of surgical site infections are very brief: “when a surgical incision is closed primarily, as most are, the incision is usually covered with a sterile dressing for 24 to 48 hours. Beyond 48 hours, it is unclear whether an incision must be covered by a dressing or whether showering or bathing is detrimental to healing.” This recommendation is Category IB: strongly recommended for implementation and supported by some experimental, clinical, or epidemiological studies and strong theoretical rationale. These statements are familiar to all those charged with reduction of infection incidence.⁵

The dressing for surgical wounds is usually left in place for 24 to 48 hours unless significant drainage or bleeding from the site occurs. The overall goal of surgical incision management is to provide a bacterial barrier until re-epithelialization has taken place and the wound is physiologically closed. The decision to remove the dressing using clean or aseptic technique varies according to the condition of the wound and the patient’s health condition. Regardless of the technique employed, care must be taken to prevent infected materials from contacting the wound. Closed wounds can be sufficiently cleaned with normal saline before being re-dressed.⁶ However, in many acute care and ambulatory surgical settings the standard of care for surgical incisions is still gauze and tape, known to allow incursion of bacteria, external moisture, and debris to contaminate the incision, as well as to supply very few elements of moist wound healing, the standard for evidence based wound care across all healthcare settings.⁴⁻⁷⁻¹¹

It may prove that collaboration between the infection preventionist and the wound, ostomy and continence nurse, as well as the surgeon, in standardizing processes of incision care and advanced wound care products is essential in driving down incision site infection, which comprises 67 percent of all surgical site infections. Bacteria on the skin surrounding the incision can be a serious threat, as most SSIs show skin flora as the infectious agent.⁸ Choosing a surgical site dressing with ideal characteristics for barrier protection, as well as support of moist wound healing, that is applied across care environments until the wound is re-epithelialized is emerging as an efficient intervention for supporting rapid healing.¹²

Infection Reduction and Environment of Care

Infection prevention policies and procedures, designed with collaboration of other healthcare professionals invested in preventing hospital-acquired infections, should cross environment of care boundaries when the best interest of the patient indicates doing so.⁶

As the CDC authors state, discussing post-operative discharge planning, many patients are discharged very soon after their operation before surgical incisions have fully healed. The lack of optimum standardized protocols for home incision care dictates that much of what is done at home by the patient, family or home care agency practitioners must be individualized, and is therefore subject to anecdotal or traditional intervention vs. evidence based practice. The intent of discharge planning is to maintain integrity of the healing incision, educate the patient about the signs and symptoms of infection, and advise the patient about whom to contact to report any problems.³

Between 12 percent and 84 percent of SSIs are detected after patients are discharged from the hospital. At least two studies have shown that most SSIs become evident within 21 days after operation.² Since the length of postoperative hospitalization continues to decrease, many SSIs may not be detected for several weeks after discharge and may not require readmission to the operating hospital. Dependence
solely on inpatient case-finding will result in underestimates of SSI rates for some operations (for example, coronary artery bypass graft). In an industry white paper, a comprehensive, multimodal system of infection reduction strategies is discussed, stating that aggressively driving down healthcare-acquired infection is simply the right thing to do for patients. Moving research interest and development of infection prevention practice well in front of the operative event, into collaborative education and intervention in concert with other healthcare providers, also seems like the proper way to address conditions known to raise risk for SSI. Extending infection prevention practice beyond the acute care setting and into the home care nursing environment through multidisciplinary standardization of processes and products also may prove to be the right thing to do to protect patients from surgical site infection.

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Factors Affecting the Incidence of Surgical Wound Infections

**Patient Related Characteristics**
- Age: very young and very old patients
- Poor nutrition
- Diabetes (>200 mg/dl glucose)
- Cigarette smoking and alcoholism
- Obesity
- Concurrent distant infections
- Presence of necrotic tissue
- Bacterial colonization
- Immunosuppression
- Length of preoperative hospitalization, length of stay in ICU
- Steroid use
- Chronic renal insufficiency
- Previous cardiovascular interventions
- Previous radiotherapy and chemotherapy
- Allogenic blood product transfusion including leukocytes
- Deterioration in physical condition
- Inadequate tissue perfusion
- Normovolemia/hypovolemia, preoperative body temperature
- Respiratory oxygen concentration
- Presence of nasal colonization

**Characteristics Related to Surgical Team and Intervention**
- Emergency or elective procedure
- Time of day when surgery is done
- Inadequate surgical hand scrub, skin preparation, and mechanical intestinal cleaning
- Surgical area, length, and complexity
- Presence of foreign matter or suture, surgical procedure and suturing, quality of procedure
- Presence of local or systemic infection
- Surgical classification, hematoma, seroma, fistula
- Drains
- Mechanical stress on wound
- Inappropriate use of cautery
- Inadequacy in education of surgical team
- Inappropriate dressing technique
- Prophylactic antibiotics

**Characteristics Related to the Operating Room and ICU Environment**
- Inadequate refrigeration
- Having open basins for solutions used during surgery
- Inadequate air conditioning in the operating room
- Inadequate architecture of the ICU
- Noncompliance of healthcare workers with principles of asepsis
- Inadequate patient care (drain care, dressing change, position change, etc.)
- Inadequate sterilization/disinfection of instruments
- Heavy traffic flow in the area
- Inadequate cleaning of objects used by the patient (sheet, blanket, etc.)
- Contamination of feeding solutions with bacteria during patient feeding
References
2. April 2013 CDC/NHSN Protocol Corrections, Clarification, and Additions

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