Drop a Bundle and Save: Reducing Surgical Site Infections Across Surgical Populations

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Introduction

Each year, approximately 26 million inpatient surgical procedures are performed in the United States, and data analysis from the National Center for Health Statistics and the National Healthcare Safety Network (NHSN) indicates 250,000 to 1 million surgical site infections (SSIs) develop each year. Patients who develop SSIs have a 46% greater risk of being admitted to an intensive care unit, and are 3.5 times more likely to experience mortality within 30 days of discharge. SSIs are known to increase patient morbidity, mortality,1 costs for an excess of $1.6 billion economic impact2 on the U.S. healthcare system.

Studies have shown that a patient's own microbial flora is the primary etiologic factor in cardiac-related SSIs,3 with greater than 50% of infections attributed to Staphylococcus aureus or coagulase-negative Staphylococcus epidermidis.4,5 It is well documented that patients undergoing cardiac and vascular surgery are at an increased risk for development of SSIs,6-8 and studies have shown mortality rates in this patient population are significantly increased (17.9% versus 3.9%, P=0.0001).9

Prevention of SSIs has come to the forefront of infection prevention initiatives, and preventive measures have been recommended by best practice guidelines10-16 and other infection prevention initiatives. The Surgical Care Improvement Project (SCIP) was initiated to ensure the adherence to basic principles of infection prevention, antimicrobial prophylaxis, and surgical care. SCIP recommends the following interventions:

- Appropriate use of antibiotics
- Appropriate hair removal
- Controlled 6 am postoperative serum glucose in major cardiac surgery patients

Despite participation in SCIP and documented adherence with SCIP initiatives, surgical site infections (SSI) rates for cardiac surgeries exceeded national benchmarks at our 273-bed community hospital in 2006. A quality improvement intervention was undertaken to ensure all prevention practices were up to date based on evidence-based guidance.

Methods

A multidisciplinary team was selected to carry out the quality improvement initiative. The team consisted of a Cardiothoracic surgeon, cardiologist, anesthesiologist, infection control practitioners, pharmacists, clinical nurse specialists, and a staff nurse from the Clinical Action Team.

Initially, a literature review was performed,17,18 which assisted the team in updating all SSI prevention efforts. The results of the literature review revealed a need for an enhanced bundle of care incorporating the following interventions:

- Tight glucose control
- Additional skin antisepsis
- Additional antibiotic prophylaxis and empiric treatment (systemic and oral)
- Consistent adherence to a SSI bundle approach

A longitudinal project timeline is presented in Figure 1 and shows the different SSI prevention efforts which were implemented.

Figure 1. Bundle Implementation Timeline*

March 2006: Tight glucose control protocol tested for non-diabetic patients admitted during the surgical procedure through the last day of post op day 5. Modified glucose parameters from 100-110 mg/dL to 80-120 mg/dL for diabetic and non-diabetic patients. SCIP-defined success at 2006 was our tight control was defined our blood glucose 80-120 mg/dL both diabetic and non-diabetic patients.

April 2006: Tight glucose control implemented on open heart surgery patients.

October 2006: 2% Chlorhexidine Gluconate (CHG) cots added PM and AM of surgery by nurse.

December 2006: All patients treated empirically with aminopenicillin or beta-lactam/alpha-lactamase inhibitor combinations for 1 to 3 days for positive nasal cultures of Staph and MSSA carriers.

January 2007: CLABSS and central line sites assessed by a CLABSS specialist.

May 2007: 2% Chlorhexidine Gluconate (CHG) cots added PM and AM of surgery – received instructions and product from HeartLink and Antimicrobial PM and AM Cots – confirmed to participate Oct 2006.


September 2006: Antimicrobial technology added inside 2006 on limited basis.

Outcomes

A review of the cumulative cardiac surgery SSI data from 2006 to 2009 revealed a 57.2% relative reduction.

This multivariate quality improvement project decreased the incidence of SSIs in the cardiac and vascular surgery population in this community hospital. We attribute these positive outcomes to the following key factors:

- A multidisciplinary approach and clinical action team champions were key for our successful implementation of the PSB.
- Hardwiring the PSB through integration across the continuum of care by automation into the electronic medical record through order sets, smart links, and "best practice" alerts.
- The Cardiac Care Improvement Committee identified strategies to implement the PSB for either at risk populations based on the successful implementation in our cardiac surgery population.
- Data analysis comparing our experience to the national benchmarks helped to establish priorities for our Infection Control Plan and the Cardiac Care Improvement Committee.

Clinical Implications

- Despite high reliability compliance with the CMS SCIP indicators, our SSI rates were higher than our historic baseline.
- There are limited randomized controlled clinical trials demonstrating the impact of our PSB elements for the reduction of SSI.
- Our PSB appears to have impacted the SSI rates for both cardiac and peripheral vascular surgery.
- Our risk-adjusted cardiac surgery SSI rates were statistically significantly higher in 2006 compared to the NHSN published rates before implementation of the PSB and continue to suggest statistically significant reductions over three years.
- Our lower extremity vascular surgery SSI rate reductions were statistically significant following the implementation of the PSB.

References

4. Prevention and control of surgical site infection: a report of the health care infection control practices advisory committee (HICPAC) and the healthcare infection control practices advisory committee (HICPAC). American Society for Microbiology. 2003.