

The Reduction of Surgical Site Infections by Bundling Active Surveillance for Methicillin-Resistant *Staphylococcus Aureus* and Preoperative 2% Chlorhexidine Gluconate in Obstetrics and Elective Surgery

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ABSTRACT

The Reduction of Surgical Site Infections by Bundling Active Surveillance for Methicillin-Resistant *Staphylococcus Aureus* and Preoperative 2% Chlorhexidine Gluconate Preoperative in Obstetrics and Elective Surgery

Background:

Postoperative surgical site infections (SSIs) occur in up to 5% of surgical patients, making SSIs the most common healthcare-associated infection in surgical patients. *Staphylococcus aureus* is the most common cause of SSI and methicillin-resistant strains (MRSA) are becoming increasingly common causes of SSI, including community hospitals. Mortality is 3 times higher in patients with SSIs due to *S. aureus* and 12 times higher in patients with SSI due to MRSA. Median hospital costs for patients with SSI due to MRSA are estimated \$40,000 greater than patients with SSI due to non-resistant *S. aureus*.

Objective:

Annual increases in reported MRSA skin and soft-tissue infections in the emergency department of our 2 hospitals suggested MRSA was becoming a community problem. In 2005, there were no SSIs due to MRSA; however, in 2006 SSIs due to MRSA were reported.

Factors affecting the risk of SSI include adequacy of preoperative surgical skin preparation and nasal colonization with pathogens. Nasal carriage of MRSA increases the risk for SSIs, and the Institute for Healthcare Improvement (IHI) recommends identifying patient nasal carriage of MRSA as part of a multi-step effort to reduce MRSA infection. Our approach included identification of nasally colonized MRSA patients and the introduction of a new preoperative skin antiseptic protocol.

Methods:

A targeted surveillance was initiated of cesarean-sections, hip replacements, knee replacements, gastric bypass surgeries and banding, and surgeries involving bone fusions.

Screening for nasal carriage of MRSA was conducted at the 36-week prenatal exam for obstetrical patients, and 1 to 5 days preoperatively for surgical patients. Any patient with a positive MRSA screening was treated with nasal application of mupirocin.

Preoperative skin preparation was initiated by the patient on the morning of surgery with 2% chlorhexidine gluconate (CHG) no-rinse cloths and appropriate instructions provided. One cloth was used to wipe down the front of the body, starting at the neck and working down and the second cloth was used to wipe down the back of the body in a similar fashion. The patients were instructed to then allow the skin to air-dry.

Results:

Procedure	Combined SSI Rates for Both Hospitals for 2006		Combined SSI Rates for Both Hospitals for 2007 (After introduction of the SSI Prevention Protocol)	
	Total SSI	SSI due to MRSA	Total SSI	SSI due to MRSA
Cesarean-section	12	3	4	1
Total knee replacement	1	1	1	1
Total hip replacement	0	0	0	0
Gastric bypass and banding	0	0	1	0
Bone fusion	1	1	1	0

Total SSI/year was reduced from 14 to 7, representing a 50% reduction. Rates from SSI due to MRSA decreased from 5 to 2, resulting in a 60% reduction.

Conclusions:

The introduction of a program that included screening for and treatment of nasal carriage of MRSA, combined with preoperative skin antiseptics with 2% CHG cloths led to a reduction in SSI rates and SSI due to MRSA. The cost of implementing the program was estimated at \$108,000 for MRSA cultures, 2% CHG wipes, and mupirocin ointment, for an annual surgical volume of 6900 patients. Based on the quoted median excess cost of \$40,000 per SSI due to MRSA, avoiding 7 cases of SSI due to MRSA saved the hospitals \$280,000. The resultant economic savings related to MRSA SSI prevention was \$172,000.

The numbers reported in the poster for the study have been updated by the authors and therefore are somewhat different from those reported in the initial abstract.

REFERENCES

- Mangram AJ, Horan TC, Pearson ML, et al. The Hospital Infection Control Practices Advisory Committee. Guideline for prevention of surgical site infection, 1999. *Infect Contr Hosp Epidemiol.* 1999;20:247-278.
- Neumayer L, Hosokawa P, Imani K, et al. Multivariable predictors of postoperative surgical site infection after general and vascular surgery: results from the patient safety in surgery study. *J Am Coll Surg.* 2007;204:1178-1187.
- McGarry SA, Engemann JJ, Schmadler K, et al. Surgical-site infection due to *Staphylococcus aureus* among elderly patients: mortality, duration of hospitalization, and cost. *Infect Control Hosp Epidemiol.* 2004;25:461-467.
- Engemann JJ, Carmeli Y, Cosgrove SE, et al. Adverse clinical and economic outcomes attributable to methicillin resistance among patients with *Staphylococcus aureus* surgical site infection. *Clin Infect Dis.* 2003;36:592-598.
- Chadwick W G. Risk factors for surgical site infection. *Surg Infect.* 2006;7 Suppl 1:S7-11.
- Davis KA, Stewart JJ, Crouch HC, et al. Methicillin-resistant *Staphylococcus aureus* (MRSA) nares colonization at hospital admission and its effect on subsequent MRSA infection. *Clin Infect Dis.* 2004;39:776-782.
- 5 Million Lives Campaign. Getting started kit: Prevent Pressure Ulcers How-to-Guide. Cambridge, MA:Institute for Healthcare Improvement; 2008. (Available at www.ihl.org)
- Jackson MM. Topical antiseptics in healthcare. *Clin Lab Sci.* 2005;18:180.
- DeBaun B. New Alcohol-Free 2% CHG Solution Reduced Bacterial Counts of Drug-Resistant *Acinetobacter* and MRSA by 99.9%. Poster presented at the 2007 Association of periOperative Registered Nurses (AORN) Congress, Mar 2007.
- Livingston B. Challenges and experience with implementing patient preoperative skin preparation in a Veterans Administration (VA) Health System to prevent surgical site infections. Presented at Association for Professionals in Infection Control and Epidemiology (APIC), San Jose, CA; June 24, 2007.
- Rhee H, Harris B. Reducing Surgical Site Infection: 2% CHG Cloth Reduces SSI Rates by >70% Difference Resulting in a \$154,869 Cost Avoidance. Poster presented at the Virginia's Improving Patient Care and Safety (VIPCS) 7th Annual Conference, Richmond, VA; 2007, May 23.
- Washington State Health Department. Living with MRSA. Available at www.doh.wa.gov/Topics/Antibiotics/MRSA.htm. Accessed May 2, 2008.

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BACKGROUND

■ SSIs are postoperative infections that may occur as a result of a surgical procedure.

■ SSIs are the most common health care-associated infection in surgical patients.^{1,2}

■ *Staphylococcus aureus* is the most common cause of SSI.³

→ MRSA are becoming increasingly common causes of SSI.

■ SSIs increase medical costs, morbidity, and mortality. Increased costs, morbidity, and mortality are even greater if the patient is infected with MRSA.^{3,4}

→ Elderly patients with SSIs due to *S. aureus* have median hospital costs of \$85,648 compared with \$32,023 in uninfected patients.³ Median hospital costs for patients with SSI due to MRSA are estimated to be \$40,000 greater than for patients infected with non-resistant *S. aureus*.⁴

→ Mortality is 5 times higher in elderly patients with SSI compared to uninfected elderly patients.³ Compared to controls, mortality is 3 times higher in patients with methicillin-sensitive *S. aureus* and 12 times higher in patients with MRSA.⁴

■ Risk factors for SSI:⁵

- prolonged procedures
- hypothermia
- trauma
- hypoxia
- shock
- hyperglycemia
- blood transfusion

■ Other factors that affect the risk of SSIs include adequacy of preoperative surgical skin preparation¹ and nasal colonization with MRSA.⁶

■ Reduction of SSI is one of the goals of the IHI's 5-Million Lives Campaign and the Surgical Care Improvement project.⁷

■ The CDC recommends that patients shower or bathe the night before surgery and use an appropriate skin antiseptic to reduce the risk of infection.¹

■ Alcohol-free CHG in a 2% solution:

→ is a commonly used skin antiseptic¹

→ is effective against a wide variety of pathogens¹

→ persists on the skin, allowing continued antiseptic action⁸

→ has been shown to reduce bacterial counts of MRSA on the abdomen and groin areas by 99.9%⁹

■ Application of 2% CHG in a no-rinse cloth at 2 facilities as part of their protocols was recently shown to reduce their rates of SSI.^{10,11}

OBJECTIVE

Annual increases in reported MRSA skin and soft-tissue infections in the emergency department of our 2 hospitals suggested that MRSA was becoming a community problem. In 2005, no SSIs due to MRSA were reported in our surgical patients; however, in 2006, SSIs due to MRSA were reported, which suggested that MRSA was also becoming a problem in our surgical population.

To reduce the rate of SSI, we developed an approach that included the:

- identification of nasally colonized MRSA patients and
- introduction of a preoperative skin antisepsis protocol that involves the use of a 2% CHG, alcohol-free, no-rinse cloth.

METHODS

- Patients scheduled for the following surgical procedures were monitored for SSIs: cesarean delivery, hip replacement, knee replacement, gastric bypass surgery and banding, and bone fusion.

- All patients underwent screening for nasal carriage of MRSA.

→ This was conducted in obstetrical patients at the 36-week prenatal exam and in surgical patients, 1 to 5 days before surgery. Any patient positive for MRSA was treated nasally with mupirocin twice daily for 5 days.

- Preoperative skin preparation was initiated by the patient on the morning of surgery using 2% CHG no-rinse cloths; appropriate instructions were provided.

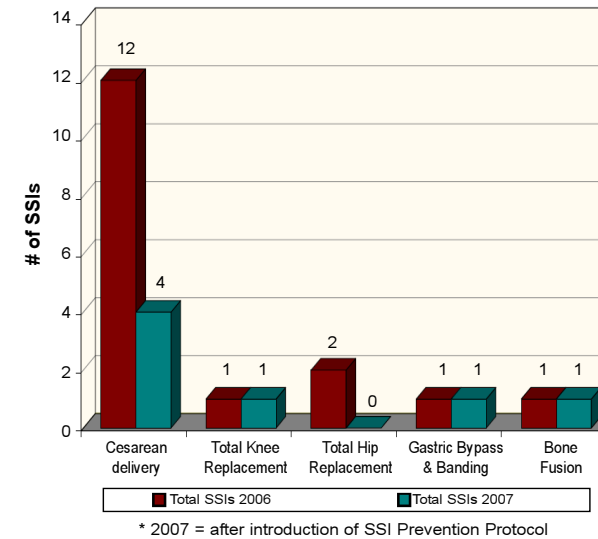
→ One cloth was used to wipe down the front of the body, starting at the neck and working down, and the second cloth was used to wipe down the back of the body in a similar fashion. The patients were instructed to then allow the skin to air-dry.

→ A patient education booklet was given to any patient colonized with MRSA: *Living with MRSA* produced by the Washington State Health Department.¹² These booklets were very well received by the patients.

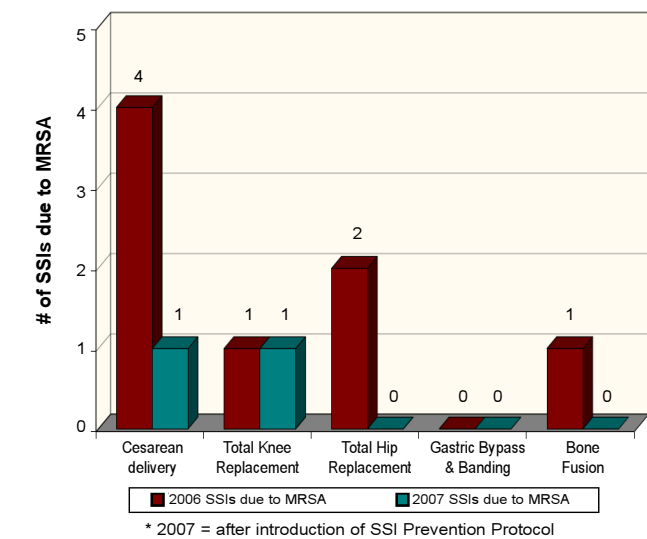


RESULTS

Combined Incidence of SSIs for Both Hospitals (by Procedure): 2006 and 2007*



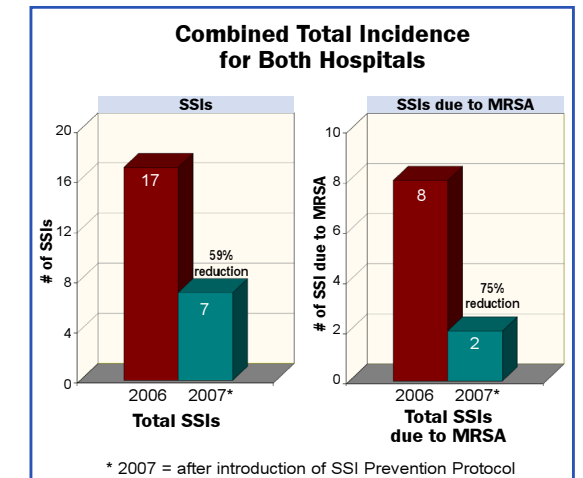
Combined Incidence of SSIs Due to MRSA for Both Hospitals (by Procedure): 2006 and 2007*



- Total annual incidence of SSIs decreased from 17 to 7 (59% reduction). The incidence of SSIs due to MRSA decreased from 8 to 2 (75% reduction).

- The cost of implementing the program was estimated at \$108,000, which included MRSA cultures, 2% CHG wipes, and mupirocin ointment for an annual surgical volume of 6900 patients. Given the median cost of \$40,000 per SSI due to MRSA, the prevention of 6 cases of SSI due to MRSA saved the hospitals \$240,000. The resultant cost savings related to MRSA SSI prevention was \$132,000.

- During the study, many patients reported that the product was easy to use and the instructions were easy to understand and follow.



CONCLUSIONS

The introduction of a program that included screening for and treatment of nasal carriage of MRSA, combined with preoperative skin antisepsis with 2% CHG cloths led to a reduction in SSI rates and in SSIs due to MRSA.

Lessons Learned:

- SSI rates can be reduced with a protocol that screens for and treats nasal MRSA and uses 2% CHG no-rinse cloths for preoperative skin antisepsis
- A reduction in the rate of SSIs may reduce medical costs to the hospital
- Patients in the program reported that the CHG no-rinse cloths were easy to use
- Patient education was provided (*Living with MRSA* from the Washington State Health Department) and was well-received