Chlorhexidine gluconate preoperative skin preparation initiated a 100% reduction of incisional Cesarean section infections while other risk factors were evaluated and corrected

Phillip Rauk, MD, Susan Khan, MD, MPH, Christine Hendrickson, RN, BSHA, CIC, CWOCN; Deb Cahoon RN, MS - Vice President Pediatric & Maternal Nursing Services; Paula Ann Lutz, MSN, RN, CNOR, BC, Perioperative Clinical Learning Specialist; Darlene Gillespie, RN, MSN; Lauren Johnson, MS, RN, APN-BC; Elizabeth Nowakoski, RN, ICP; Amy Gangler, MA, BSN, RN, NE-BC • University of MN Medical Center, Fairview, Minneapolis, MN

Abstract

Chlorhexidine gluconate preoperative skin preparation in obstetrical cesarean section patients results in 100% prevention of surgical site infections

Authors: Phillip Rauk, MD, Christine Hendrickson

Issue: Cesarean section (C-section) is the greatest risk factor for postpartum maternal infections. Infectious complications occur 30 times more frequently following C-sections compared to vaginal deliveries, with mortality rates related to infections sevenfold higher. Incidence of C-section SSI has been reported to reach insured risks, with a mean attributable total cost of $25,546.40, accounting for as much as $10 billion annually in direct SSIs. Although we were unable to identify formal cost studies specifically for SSI, cesarean section infection studies associated with SSI activities following other surgical procedures suggest that the attributable cost of these infections is high. Of the estimated 4,140,419 births in the United States in 2005, 30.2% (approximately 1,250,400) were by cesarean delivery (C-section).1

C-sections are associated with a higher morbidity than vaginal deliveries.

- Women are 5 times as likely to develop a postpartum infection after undergoing a C-section than if they undergo a vaginal delivery.
- These infections include surgical site infections (SSIs) and endometritis; the rate of SSI after C-section is estimated to range from 8.2% to 11.2%.2

In a review of the literature on SSI, Stone et al5 determined a mean attributable total cost of $25,546.40 per SSI, which may include readmission and outpatient costs along with the hospital stay associated with the C-section. Although we were unable to identify formal cost studies specifically for SSIs after C-section, studies of the cost associated with SSI following other surgical procedures suggest that the attributable cost of these infections is high.

A multi-pronged approach to process improvement resulted in zero incisional SSI. C-section infections were greater than the benchmarks set by the National Nosocomial Infections Surveillance System Index (NNIS) from January 2006 through August of 2008. A detailed C-section infection prevention action plan was developed and implemented to improve critical process and results in improved and additional patient outcomes. A reduction in SSI is one of the goals of the 5-Million Lives campaign of the Institute for Healthcare Improvement (IHI). The 5-Million Lives Campaign seeks to improve the quality of health care by protecting patients from harm, and one of the ways identified to reach this goal is to reduce the rate of SSI.3

Results

- The University of Minnesota Medical Center, Fairview (UMMC) reported a median direct cost of $5,005/case with a $125,000 increase during the first 6 months of 2005 in incremental costs just for the inpatient stay associated with the C-section.
- A reduction in SSI is one of the goals of the 5-Million Lives campaign of the Institute for Healthcare Improvement (IHI). The 5-Million Lives Campaign seeks to improve the quality of health care by protecting patients from harm, and one of the ways identified to reach this goal is to reduce the rate of SSI.3

The Centers for Disease Control and Prevention (CDC) recommends that patients shower or bathe with an antiseptic the night before surgery and that an antiseptic be applied to the skin at the incision site.4

The CDC notes that chlorhexidine gluconate (CHG) is a commonly used skin antiseptic with a broad range of antimicrobial activity and is not harmful.4 CHG is bactericidal agent effective against Gram-positive and Gram-negative bacteria, is able to bond the skin and remain active for up to 5 hours, and is not necrotic in the presence of blood and other organic material.4

The use of CHG in the form of a no-rinse cloth has been shown to reduce microbial counts on the skin, and the no-rinse cloth appears to be as or more effective than a wash-rinse preparation containing 4% CHG at reducing skin bacterial counts.5

UMMC found that ensuring compliance with pre-C-section showering and bathing with an effective antiseptic is not always feasible given the frequency of home bedrest and unanticipated C-section cases.

Between January of 2006 and August 2006, UMMC noted that our SSI rates after C-section were greater than the benchmarks set by the National Nosocomial Infections Surveillance System Index (NNIS). Therefore, UMMC initiated a team approach to identify and address the problems that might contribute to the high rate of SSI. Due to the benefits associated with the use of CHG-containing skin preparations, UMMC explored the use of such products as part of the initiative to reduce SSI in C-section patients.

Figure 1: C-Section Surgical Site Infections

Figure 2: C-Section Infection Rates Compared to NNIS Index

Conclusions

- Ongoing collaboration and communication with physicians and nurses to identify all potential causal elements, including ongoing feedback.
- Evaluation and correction of surgical instrument management, including par levels, flash sterilization and competency audits.
- Standardization of a CHG preoperative skin preparation contributed to rapid reduction of surgical infections while other action elements were implemented.
- Ongoing collaboration and communication with physicians and nurses to identify all potential causal elements, including ongoing feedback.
- The Centers for Disease Control and Prevention (CDC) recommends that patients shower or bathe with an antiseptic the night before surgery and that an antiseptic be applied to the skin at the incision site.4

The CDC notes that chlorhexidine gluconate (CHG) is a commonly used skin antiseptic with a broad range of antimicrobial activity and is not harmful.4 CHG is bactericidal agent effective against Gram-positive and Gram-negative bacteria, is able to bond the skin and remain active for up to 5 hours, and is not necrotic in the presence of blood and other organic material.4

The use of CHG in the form of a no-rinse cloth has been shown to reduce microbial counts on the skin, and the no-rinse cloth appears to be as or more effective than a wash-rinse preparation containing 4% CHG at reducing skin bacterial counts.5

UMMC found that ensuring compliance with pre-C-section showering and bathing with an effective antiseptic is not always feasible given the frequency of home bedrest and unanticipated C-section cases.

Between January of 2006 and August 2006, UMMC noted that our SSI rates after C-section were greater than the benchmarks set by the National Nosocomial Infections Surveillance System Index (NNIS). Therefore, UMMC initiated a team approach to identify and address the problems that might contribute to the high rate of SSI. Due to the benefits associated with the use of CHG-containing skin preparations, UMMC explored the use of such products as part of the initiative to reduce SSI in C-section patients.

Lessons Learned

- Women are 5 times as likely to develop a postpartum infection after undergoing a C-section than if they undergo a vaginal delivery.
- These infections include surgical site infections (SSIs) and endometritis; the rate of SSI after C-section is estimated to range from 8.2% to 11.2%.2

In a review of the literature on SSI, Stone et al5 determined a mean attributable total cost of $25,546.40 per SSI, which may include readmission and outpatient costs along with the hospital stay associated with the C-section.

Although we were unable to identify formal cost studies specifically for SSI after C-section, studies of the cost associated with SSI following other surgical procedures suggest that the attributable cost of these infections is high.

A reduction in SSI is one of the goals of the 5-Million Lives campaign of the Institute for Healthcare Improvement (IHI). The 5-Million Lives Campaign seeks to improve the quality of health care by protecting patients from harm, and one of the ways identified to reach this goal is to reduce the rate of SSI.3

The Centers for Disease Control and Prevention (CDC) recommends that patients shower or bathe with an antiseptic the night before surgery and that an antiseptic be applied to the skin at the incision site.4

UMMC found that ensuring compliance with pre-C-section showering and bathing with an effective antiseptic is not always feasible given the frequency of home bedrest and unanticipated C-section cases.

Between January of 2006 and August 2006, UMMC noted that our SSI rates after C-section were greater than the benchmarks set by the National Nosocomial Infections Surveillance System Index (NNIS). Therefore, UMMC initiated a team approach to identify and address the problems that might contribute to the high rate of SSI. Due to the benefits associated with the use of CHG-containing skin preparations, UMMC explored the use of such products as part of the initiative to reduce SSI in C-section patients.

Reprints provided compliments of Sage Products, Inc.

800-329-2220 • www.sageproducts.com

Presented at the 2008 APIC Annual Conference: June 15-19, 2008

21103
Objective

UMMC had a pre-intervention rate of SSIs after C-sections of between 1.2% and 8%. Between January of 2006 and August 2006, the SSI rates were greater than the NNIS benchmarks. UMMC used a team approach to develop interventions to reduce the SSI rates in C-section patients.

Methods

The UMMC infection control team first identified problems that might contribute to SSIs and then developed a core team of administrators, staff, physicians, and infection control personnel to address these problems. The team collaborated periodically to discuss methodology and outcomes. The first action and the action with the greatest positive impact was the development of a preoperative skin preparation protocol that involved the use of CHG-containing no-rinse cloths. We instituted the following interventions:

- Introduced (in August 2006) a new product – 2% CHG-containing cloths – required for use on the skin of all C-section patients before entering the operating room (scheduled cases) and on the skin of all patients at risk of having a C-section (e.g., those with prolonged labor and premature rupture of the membranes – unscheduled cases).
- Developed a quick reference sheet to educate staff on the use of the CHG-containing cloths.
- Implemented ongoing communication with direct-care staff in the form of meetings, posters/fliers including monthly graphs, and updates to the action plan.
- Educated obstetrical scrub technicians and nurse assistants on the principles of sterilization, processes, and documentation requirements; increased the availability of surgical instruments; and shifted the responsibility for sterilization of surgical instruments back to central processing.
- Developed a knowledge base assessment tool and an educational video to train staff about appropriate antiseptic practices in the operating room; topics included hand scrubbing techniques, room set up, proper attire, and surgical preparation techniques.
- Appointed a light duty nurse from the Post-Anesthesia Care Unit to assist in review of economic analyses of health care-associated infections.
- Introduced (in August 2006) a new product – 2% CHG-containing no-rinse cloths. We instituted the following interventions:
  - Initiated the use of a solution containing 2% CHG gluconate and 70% alcohol instead of alcohol alone for intraoperative skin preparation after obtaining agreement from the surgeons.
- Development of a knowledge base assessment tool and an educational video to train staff about appropriate antiseptic practices in the operating room; topics included hand scrubbing techniques, room set up, proper attire, and surgical preparation techniques.
- Appointed a light duty nurse from the Post-Anesthesia Care Unit to assist in review

Results

These interventions led to a reduction in the rate of SSIs after August 2006, when the use of the 2% CHG-containing no-rinse cloth was initiated. The incisional SSI rate decreased to 0% for a full year (September 2006 to September 2007). The rates dropped to zero immediately in response to initiation of the CHG-containing no-rinse cloth; allowing the team the additional time necessary to complete the action plan while continuing to deliver safe and effective care. For the remainder of 2007, there was 1 incisional SSI in October, 1 in November, and none in December.

Conclusions

Implementation of interventions led to a reduction in SSI rates in patients undergoing C-section. Of note, the incisional SSI rate decreased to 0% soon after the 2% CHG-containing no-rinse cloth for skin preparation was initiated in August 2006. UMMC also experienced a rapid reduction in rates of endometritis after August 2006. On the basis of the 36 SSIs that occurred at our institution from January to August 2006, the interventions may have prevented an estimated average of 4.5 infections per month. An additional savings of $54,000 in case-related incremental costs was projected for 2007 following the return to infection levels below historical and NNIS rates.

Lessons Learned

- Reduction of SSI rates was accomplished through the collaboration of staff and physicians and the implementation of procedural changes.
- Standardization of preoperative skin preparation techniques to include the use of CHG-containing products contributed to a reduction in SSIs.
- Education of the surgical scrub technicians and scrub nurses about operating room antisepsis, accomplished through the use of videos and hands-on training, contributed to a reduction in SSIs.
- Confirmation of an action plan to maintain the reduction in SSI rates was a necessary part of the process.

References

4. Pottinger JM, Starks SE, Steelman VM. Skin sterilization, processes, and documentation requirements; increased the availability of surgical instruments; and shifted the responsibility for sterilization of surgical instruments back to central processing.
6. Institute for Healthcare Improvement. Getting It Right First Time: C-Section SSI Rates Compared to NNIS Average.始了性22006 2007