

PART 2 OF 2

Preventing infection after cesarean delivery: 5 more evidence-based measures to consider

➔ Besides antibiotic prophylaxis and proper body hair and skin preparation discussed in part 1, studies offer guidance on vaginal cleansing and other measures you might have used or deliberated on

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In part 1 of our review on preventing post-cesarean infection, we critically evaluated methods of skin preparation and administration of prophylactic antibiotics. In part 2, we address preoperative cleansing of the vagina with an antiseptic solution,

preoperative bathing with an antiseptic solution, methods of placental extraction, closure of the deep subcutaneous layer of the abdomen, and closure of the skin.

CASE Should vaginal cleansing be performed prior to cesarean delivery?

An 18-year-old primigravid woman at 41 weeks' gestation has been in labor for 16 hours, and now has an arrest of descent at 0 station. An intrauterine pressure catheter and scalp electrode have been in place for the same length of time. The patient has had 9 internal examinations during the period of membrane rupture. As you are preparing to scrub the patient's abdomen, the third-year medical student asks, "When I was on the Gynecology Service, I saw the doctors wash the vagina with an antiseptic solution before they performed a vaginal hysterectomy. Should we also do that before we operate on this patient?"

Preoperative vaginal cleansing

A preoperative antiseptic vaginal scrub is often used as an additional step to help reduce postcesarean infection.



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The authors report no financial relationships relevant to this article.

Does cleansing the vagina with povidone-iodine before surgery further reduce the risk of endometritis and wound infection?

Multiple studies have sought to determine if cleansing the vagina with an antiseptic solution further reduces the incidence of postcesarean infection beyond what can be achieved with systemic antibiotic prophylaxis. These studies typically have focused on 3 specific outcomes: endometritis, wound (surgical site) infection, and febrile morbidity. The term febrile morbidity is defined as a temperature $\geq 100.4^{\circ}\text{F}$ (38°C) on any 2 postoperative days excluding the first 24 hours. However, many patients who meet the standard definition of febrile morbidity may not have a proven infection and will not require treatment with antibiotics. The more precise measures of outcome are distinctly symptomatic infections, such as endometritis and wound infection, although, as noted in the review of published studies below, some authors continue to use the term febrile morbidity as one measure of postoperative complications.

In a randomized, placebo-controlled trial (RCT) of 308 women having a nonemergent cesarean delivery, Starr and colleagues reported a decreased incidence of postoperative endometritis in women who received a 30-second vaginal scrub with povidone-iodine compared with women who received only an abdominal scrub (7.0% vs 14.5%, $P < .05$).¹ The groups did not differ in the frequency of wound infection (0.7% vs 1.2%, $P = .4$) or febrile morbidity (23.9% vs 28.3%, $P = .4$).¹

In another RCT, Haas and colleagues found that preoperative vaginal cleansing with povidone-iodine compared with an abdominal scrub alone was associated with a decreased incidence of a composite measure of postoperative morbidity (6.5% vs 11.7%; relative risk [RR], 0.55; 95% confidence interval [CI], 0.26–1.11; $P = .11$).² The postoperative composite included fever, endometritis, sepsis, readmission, and wound infection.

Subsequently, Asghania and associates conducted a double-blind, nonrandomized study of 568 women having cesarean

delivery who received an abdominal scrub plus a 30-second vaginal scrub with povidone-iodine or received an abdominal scrub alone.³ They documented a decreased incidence of postoperative endometritis in the women who received the combined scrub (1.4% vs 2.5%; $P = .03$, adjusted odds ratio [AOR], 0.03; 95% CI, 0.008–0.7). The authors observed no significant difference in febrile morbidity (4.9% vs 6.0%; $P = .73$) or wound infection (3.5% vs 3.2%; $P = .5$).³

Yildirim and colleagues conducted an RCT comparing rates of infection in 334 women who received an abdominal scrub plus vaginal cleansing with povidone-iodine and 336 patients who had only a standard abdominal scrub.⁴ They documented a decreased incidence of endometritis in women who received the vaginal scrub (6.9% vs 11.6%; $P = .04$; RR for infection in the control group, 1.69; 95% CI, 1.03–2.76.) The authors found no difference in febrile morbidity (16.5% vs 18.2%; $P = .61$) or wound infection (1.8% vs 2.7%; $P = .60$). Of note, in excluding from the analysis women who had ruptured membranes or who were in labor, the investigators found no differences in outcome, indicating that the greatest impact of vaginal cleansing was in the highest risk patients.

In 2014, Haas and associates published a Cochrane review evaluating the effectiveness of preoperative vaginal cleansing with povidone-iodine.⁵ The authors reviewed 7 studies that analyzed outcomes in 2,635 women. They concluded that vaginal preparation with povidone-iodine at the time of cesarean delivery significantly decreased postoperative endometritis when compared with the control group (4.3% vs 8.3%; RR, 0.45; 95% CI, 0.25–0.81). They also noted that the most profound impact of vaginal cleansing was in women who were in labor before delivery (7.4% vs 13.0%; RR, 0.56; 95% CI, 0.34–0.95) and in women with ruptured membranes at the time of delivery (4.3% vs 17.9%; RR, 0.24; 95% CI, 0.10–0.55). The authors did not find a significant difference in postoperative wound infection or frequency of fever in women who received the vaginal scrub.



Vaginal prep with povidone-iodine at cesarean significantly lowered the incidence of postoperative endometritis compared with a control group, according to a Cochrane review

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TABLE Effective strategies for reducing the frequency of postcesarean infection*

Level 1A Recommendations	Cleanse the vagina with povidone-iodine before the start of surgery. Remove the placenta by traction on the umbilical cord. Close the bottom half of the subcutaneous layer if it is >2 cm thick. Close the skin with a subcutaneous suture.
Level 1C Recommendation	Deferring to patient preference, allow bathing before surgery with either bar soap or chlorhexidine.

*Recommendations are based on the grading system adopted by the Society for Maternal-Fetal Medicine: 1A—strong recommendation, high-quality evidence, usually from randomized controlled trials; 1B—strong recommendation, moderate-quality evidence, usually from cohort studies; 1C—strong recommendation, low-quality evidence, usually based on expert opinion and committee guidelines. (Society for Maternal-Fetal Medicine, Chauhan SP, Blackwell SC. SMFM adopts GRADE [Grading of Recommendations Assessment, Development, and Evaluation] for clinical guidelines. *Am J Obstet Gynecol.* 2013;209(3):163–165.)

A notable exception to the beneficial outcomes reported above was the study by Reid et al.⁶ These authors randomly assigned 247 women having cesarean delivery to an abdominal scrub plus vaginal scrub with povidone-iodine and assigned 251 women to only an abdominal scrub. The authors were unable to document any significant difference between the groups with respect to frequency of fever, endometritis, and wound infection.

Other methods of vaginal preparation also have been studied. For example, Pitt and colleagues conducted a double-blind RCT of 224 women having cesarean delivery and compared preoperative metronidazole vaginal gel with placebo.⁷ Most of the patients in this trial also received systemic antibiotic prophylaxis after the umbilical cord was clamped. The authors demonstrated a decreased incidence of postcesarean endometritis in women who received the intra-vaginal antibiotic gel (7% vs 17%; RR, 0.42; 95% CI, 0.19–0.92). There was no difference in febrile morbidity (13% vs 19%; *P* = .28) or wound infection (4% vs 3%, *P* = .50).

What the evidence says

Consider vaginal preparation with povidone-iodine at the time of cesarean delivery to reduce the risk of postpartum endometritis. Do not expect this intervention to significantly reduce the frequency of wound infection. Vaginal cleansing is of most

benefit to women who have ruptured membranes or are in labor at the time of delivery (Level I Evidence, Level A Recommendation; **TABLE**). Whether vaginal preparation with chlorhexidine with 4% alcohol would have the same beneficial effect has not been studied in a systematic manner.

Placenta extraction, closure techniques

Evidence suggests that employing certain intraoperative approaches helps reduce the incidence of postcesarean infection.

What other measures help prevent infection following cesarean surgery?

One other measure known to decrease the risk of postcesarean endometritis is removing the placenta by exerting traction on the umbilical cord rather than extracting it manually. In one of the first descriptions of this intervention, Lasley and associates showed that, in high-risk patients who also received intravenous antibiotic prophylaxis after cord clamping, the rate of postoperative endometritis was 15% in the group that had spontaneous delivery of the placenta compared with 27% in women who had manual extraction (RR, 0.6; 95% CI, 0.3–0.9; *P* = .02).⁸ A recent Cochrane review that included multiple subsequent reports confirmed this observation (Level I Evidence, Level A Recommendation; **TABLE**).⁹



Povidone-iodine vaginal cleansing is most beneficial in women who have ruptured membranes or are in labor at the time of cesarean

Abdominal wall closure. Two other interventions are valuable in decreasing the frequency of deep and superficial wound infection. In patients whose subcutaneous layer is >2 cm thick, closure of the deep subcutaneous tissue significantly reduces the risk of wound seroma, hematoma, and infection.¹⁰ In addition, closure of the skin edges with a subcuticular suture, as opposed to surgical staples, significantly reduces the frequency of superficial wound complications (Level I Evidence, Level A Recommendation; **TABLE**).¹¹ Poliglecaprone 25, polyglactin 910, and polyglycolic acid suture, 3-0 or 4-0 gauge, are excellent suture choices for this closure.

CASE **Planned cesarean delivery: Is preoperative antiseptic bathing warranted?**

A 33-year-old woman (G2P1001) at 39 weeks' gestation is scheduled for a repeat low transverse cesarean delivery. In addition to planning to implement the measures discussed above, her clinician is considering whether to recommend that the patient bathe with an antiseptic solution, such as chlorhexidine, the day before the procedure.

Preoperative antiseptic bathing

The concept of bathing with an antiseptic solution before surgery to prevent surgical site infections (SSIs) has been considered for many years. Intuitively, if the body's resident and transient skin flora are decreased preoperatively with whole-body antiseptic washing, then the overall pathogen burden should be decreased and the risk of SSI also should be reduced. Historically, chlorhexidine preparations have been used as preoperative antiseptic solutions because they are so effective in reducing colony counts of skin flora, especially staphylococci.¹² Although preoperative antiseptic washing definitely reduces the concentration of skin bacteria, the data regarding reduction in SSI are inconsistent. Of particular note, there are no studies investigating the impact of preoperative antiseptic bathing in women having cesarean delivery.

Does preop bathing with an antiseptic reduce infection risk?

One of the first studies evaluating preoperative antiseptic washing was published by Cruse and Foord in 1980.¹³ In this 10-year prospective investigation, the authors demonstrated that patients who underwent preoperative washing with a hexachlorophene solution had fewer SSIs compared with those who washed with a nonmedicated soap and those who did not wash at all. Subsequent studies by Brady et al in 1990,¹⁴ Wilcox et al in 2003,¹⁵ and Colling et al in 2015¹⁶ all showed a decrease in the rate of SSIs with preoperative antiseptic washing, and the authors strongly supported this intervention. However, care must be taken when interpreting the results of these cohort investigations because in some cases antiseptic washing was not the only preoperative intervention. Thus, it is difficult to ascertain the true benefit of antiseptic washing alone.^{14,15} Moreover, in one study, preoperative antiseptic washing did not decrease the overall incidence of SSIs, just those caused by *Staphylococcus aureus* and methicillin-resistant *S aureus* (MRSA).¹⁶

Authors of 3 recent reviews have assessed the relationship between preoperative antiseptic washing and SSIs. Webster and Osborne analyzed 7 RCTs in a Cochrane review.¹⁷ All trials used 4% chlorhexidine gluconate as the antiseptic, and they included a total of 10,157 patients. The authors concluded that bathing with chlorhexidine did not significantly reduce SSIs compared with either placebo (RR, 0.91; 95% CI, 0.8–1.04) or bar soap (RR, 1.02; 95% CI, 0.57–1.84). Three additional studies in this review compared chlorhexidine bathing with no washing. One study showed a significant reduction of SSIs after the patients bathed with chlorhexidine (RR, 0.36; 95% CI, 0.17–0.79); the other 2 studies demonstrated no significant difference in outcome.

Kamel and colleagues conducted a recent systematic review that included 20 randomized and nonrandomized studies (n = 9,520); while the authors concluded that showering with an antiseptic solution




While bathing with an antiseptic solution decreases skin flora, it does not significantly reduce surgical site infections

reduced skin flora, they could not confirm that it produced a significant reduction in infection.¹⁸ Finally, in a meta-analysis that included 16 randomized and non-randomized studies with 17,932 patients, Chlebicki and associates concluded that there was no significant reduction in SSIs with whole-body bathing with chlorhexidine compared with bathing with soap or placebo or with no bathing (RR, 0.90; 95% CI, 0.77–1.05; $P = .19$).¹⁹ A recent report from the World Health Organization confirmed these observations, although the report did not specifically focus on

patients who had had a cesarean delivery.²⁰

What the evidence says

Although chlorhexidine bathing reduces skin flora, especially in the number of staphylococcal species, this effect does not necessarily translate into a reduction of SSIs. Therefore, we recommend against routine chlorhexidine bathing before cesarean delivery, although we acknowledge that there is no apparent harm associated with this practice, assuming that the patient is not allergic to the medicated soap (Level II Evidence, Level C Recommendation; **TABLE**, page 20). 

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» Preventing infection after cesarean delivery: Evidence-based guidance, Part 1

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