Povidone-iodine spray technique versus traditional scrub-paint technique for preoperative abdominal wall preparation

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Abstract

Objective: The study was conducted to compare povidone-iodine spray and traditional scrub-paint techniques in reducing abdominal wall bacteria during preoperative preparation.

Study design: Sixty patients scheduled to undergo vaginal surgery were recruited for study. Cultures of the abdominal skin were performed before and after preparation with two techniques: A traditional 5-minute iodophor soap scrub-paint on one half and povidone-iodine aqueous spray on the other. Multiple pairwise comparisons were performed with the Wilcoxon signed rank test. A P value of .05 was considered statistically significant in all analyses.

Results: The mean number of colonies for spray after 1 minute was 1.83 ± 3.16, for spray after 3 minutes was 0.40 ± 1.15, and after 5-minute scrub was 0.87 ± 2.97. Both techniques, the spray after 3 minutes and the 5-minute scrub, were statistically more effective at reducing bacterial counts than the spray after 1 minute. There was no statistically significant difference between the spray after 3 minutes and the scrub techniques.

Conclusion: Povidone-iodine applied as a spray and left to dry for 3 minutes appears as effective as the traditional scrub-paint technique in reducing abdominal wall bacteria before abdominal surgery. (Am J Obstet Gynecol 2002;187:1434-7.)
Wound infections occur in approximately 5% of patients undergoing major abdominal surgery. 
Several factors can contribute to the development of postoperative wound infections, some 
relating to the patient and some to the procedure itself. A key factor in preventing infection is 
the elimination of bacterial contamination of the operative site at the time of surgery.

The purpose of preoperative skin preparation is to reduce bacteria on the skin before making an 
incision. The most common method currently used to prepare the skin at the time of surgery 
involves scrubbing the operative site with an antiseptic soap solution, followed by painting the 
site with an antiseptic paint solution after the soap has been blotted dry.

The objective of this study was to compare a spray-only technique to the traditional scrub-paint 
technique in reducing abdominal wall bacteria.

**Material and methods**

Sixty women scheduled to undergo vaginal surgery were enrolled after informed consent was 
obtained. After anesthesia had been administered, a blood agar plate (trypticase soy agar with 5% 
sheep blood) was directly applied to the abdominal skin just above the umbilicus to obtain a 
control count of skin bacteria. Half of the abdomen was then prepared with a traditional 5-minute 
aqueous iodophor soap (10%) scrub and paint technique. The other half of the abdomen was 
prepared with povidone-iodine, 5% aerosol spray (Betadine, Purdue Frederick, Norwalk, Conn) 
that required 30 to 45 seconds to apply. No scrub was performed on the spray side.

Blood agar plates were applied directly to the skin after 1 and 3 minutes in two separate areas on 
the spray side. A blood agar plate was applied directly to the skin after the 5-minute preparation 
on the scrub-paint side. The plates were incubated at 37°C for 48 hours, and colony counts were 
performed. The percent reduction in bacteria was calculated by subtracting the colony count after 
preparation from the control colony count, dividing by the control colony count, and then 
multiplying by 100.

For data analysis, multiple pairwise comparisons (scrub vs 1 minute after spray, scrub vs 3 
minutes after spray, and 1 vs 3 minutes after spray) were performed with the Wilcoxon signed 
rank test. Comparisons of percent reduction in bacteria were performed using paired samples t 
test. A $P$ value of .05 was considered statistically significant in all analyses. The proportion of
cultures with zero growth with each method is reported with a 95% CI. Analyses were performed with SPSS software (release 10.0, SPSS, Chicago, Ill).

**Results**

All control plates contained bacterial growth ranging from 2 to 300 colonies. The mean number of colonies on control plates was 72.6 with 27 of 60 (45%) containing >100 colonies.

Data comparing scrub-paint, 1-minute spray, and 3-minute spray techniques is summarized in Table I. The mean number of colonies for spray after 1 minute was 1.83 ± 3.16, for spray after 3 minutes was 0.40 ± 1.15, and after a 5-minute scrub was 0.87 ± 2.97. This represented a reduction in bacteria of 96.72% for spray after 1 minute, 99.53% for spray after 3 minutes, and 98.89% for the 5-minute scrub. The proportion of cultures with zero growth was 0.57 (95% CI 0.44-0.70) for spray after 1 minute, 0.82 (95% CI 0.72-0.93) for spray after 3 minutes, and 0.83 (95% CI 0.73-0.93) for the 5-minute scrub. Both the spray after 3 minutes and the 5-minute scrub techniques were statistically more effective than the spray after 1 minute at reducing bacterial counts (3 minutes vs 1 minute, \( P < .001 \) and scrub vs 1 minute, \( P = .003 \)). There was no statistically significant difference between the spray after 3 minutes and scrub techniques in reducing abdominal wall bacteria (\( P = .5 \)).

**Table I.** Comparison of scrub-paint, 1-minute, and 3-minute techniques

<table>
<thead>
<tr>
<th>Technique</th>
<th>Number of Colonies Mean ± SD</th>
<th>Proportion of Cultures with Zero Growth 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scrub-paint</td>
<td>1.83 ± 3.16</td>
<td>0.57 (0.44-0.70)</td>
</tr>
<tr>
<td>1-minute spray</td>
<td>0.40 ± 1.15</td>
<td>0.82 (0.72-0.93)</td>
</tr>
<tr>
<td>5-minute scrub</td>
<td>0.87 ± 2.97</td>
<td>0.83 (0.73-0.93)</td>
</tr>
</tbody>
</table>

**Comment**

Wound infection is one of the most common serious complications of gynecologic surgery, occurring in approximately 5% to 10% of patients undergoing abdominal hysterectomy. 3,4 Although wound infection is a possible complication whenever an incision is made, factors that increase the risk of wound infection are well known and can be separated into patient-related factors and surgical factors. Patient factors include those related to the local wound, such as depth of adipose tissue and oxygen concentration, as well as systemic factors such as poorly
controlled diabetes, obesity, and malnutrition. Surgical factors include the type of procedure (clean, clean-contaminated, contaminated, and dirty) and duration of operation.

The most important factor in the development of a wound infection is the presence of bacterial contamination at the time of the surgical procedure. Lister is credited as the first author to suggest the use of antiseptic technique during surgery to reduce bacterial contamination and eliminate infection. Burke confirmed that wound infections can be reduced by administering prophylactic antibiotics at the time of exposure to bacterial contamination. Bacterial contamination can also be reduced by using irrigation and, possibly by the use of adhesive drapes.

The goal of preoperative skin preparation is to eliminate bacterial contamination at the surgical site. Although variation exists in techniques for skin preparation before surgery, one of the most commonly used techniques involves an initial scrub with antiseptic soap solution, followed by painting the prepared area with antiseptic paint solution. Authors advocating this technique suggest that mechanical friction on the skin is important because it removes debris and nonviable cells.

Studies comparing shaving and depilatory cream to remove hair from the operative site suggest that mechanical friction on the skin during shaving has a deleterious effect on maintaining sterility. Similarly, the use of scrub brushes by operating room personnel has been shown to result in higher bacterial counts than cleansing without brushes.

Some authors have found the use of paint-only techniques and the use of alcohol with iodophor-impregnated drapes to be as effective as the traditional scrub-paint technique in reducing bacteria and preventing wound infections. These techniques may be effective because they avoid trauma to the skin at the operative site.

The spray technique for preparation would also be expected to minimize trauma to the abdominal wall skin. Potential advantages of the spray technique include reduced time to perform preparation and reduced cost compared with current methods. Other potential advantages include ease and consistency of technique for preparation, with potentially less risk of improper technique, resulting in ineffective preparation.

Although the current data suggest that a 3-minute spray may be as effective as the traditional scrub-paint technique in reducing abdominal wall bacteria, the ability of the spray technique to prevent wound infections remains to be proven. Despite reduction in bacteria at the beginning of
a surgical case, recolonization may occur during surgery and contribute to the development of infection. The ultimate measure of the effectiveness of any preparation technique is its ability to prevent postoperative infections. Our data support the undertaking of a randomized clinical trial comparing the effectiveness of spray and scrub-paint techniques in preventing postoperative wound infections in patients undergoing abdominal surgery.

Acknowledgments

We thank Nancy Davis for her assistance in the preparation of this manuscript.

References


11. Recommended practices for skin preparation of patients. AORN J 1996;64:813-6. [Context Link]


Appendix
Discussion

DR DONALD G. GALLUP, Savannah, Ga. Dr Moen and his colleagues have devised a well-designed study that challenges our traditional techniques for preparing the abdominal skin for a surgical incision. His study uses the 60 patients as their own control. I should emphasize at the onset that this is a pilot study. All patients underwent vaginal surgery.

I will not reiterate all of his results. In summary, control plates contained bacterial growth from 2 to 300 colonies, with a mean number of 73 colonies. Evaluation of colonies after the spray for 1 minute revealed a 96.7% reduction in bacteria; after spray for 3 minutes, a 99.5% reduction in bacteria; and after scrub-paint for 5 minutes, a 98.9% reduction in bacteria. They note that no statistical significance exists in reduction of bacteria when the spray was left to dry for 3 minutes compared with the traditional scrub-paint technique.

In their Comment, Dr Moen and associates note that the spray technique may reduce time to perform skin preparation and therefore reduce cost. Any time saved in the operating room is true cost savings for the patient and the hospital. Time saved is also a “cost savings” for surgeons
who are in the trenches, where minutes lost are critical. As I tell my residents, “Seconds add up to minutes, minutes add up to hours, hours add up to days; we don't need to be here all day.” Not only are the innovations presented today a savings to others, they are a savings to us surgeons. Time saved in the operating room arena can give us more time to see office patients.

In 1978, Galle et al 1 showed, in an elegant study, that a 5-minute no-brush scrub of surgeons' hands was statistically as effective as the then traditional 10-minute 2-brush technique. Currently, most operating rooms no longer have signs at the scrub sink demanding a 10-minute surgeon hand scrub.

The authors also suggest that a spray technique minimizes trauma to the abdominal skin wall. I agree. On the basis of older studies, such as the classic article by Cruise and Foord, 2 most authors no longer shave the abdominal wall, but use a clip technique or depilatory creams to remove hair from the operative site. At our institution, we use a clip technique just before surgery to remove hair that might interfere with the wound closure.

As also noted by the author, other disciplines have successfully reported the use of a 1-minute cleansing with alcohol and the use of iodophor impregnated drapes. 3,4 One must carefully apply these drapes. If these incise drapes separate from the skin during the operation, wound infection rates have increased 6-fold. 4

Dr Moen's conclusions are on the money. The authors remind us that theirs is a preliminary study. It does show equivalent reduction in abdominal wall bacteria when the 3-minute spray was compared with the traditional scrub-paint technique. I thoroughly agree with their statement that a randomized clinical trial using these two methods of skin preparation in patients undergoing abdominal procedures for gynecologic indications should be done. The primary end point would then be the prevention of wound infections in these patient groups. This is an excellent idea for the Research Committee of Society of Gynecologic Surgeons.

I have the following questions for Dr Moen:

1. Was the consent form signed by the 60 women approved by the Institutional Review Board?
2. Who performed the colony counts?
3. Did any of the patients have preoperative “scrub” showers the evening before or morning before surgery? (Noteworthy, 1 patient in the control group had only 2 colonies on unprepared skin.)
DR MOEN (Closing). In response to Dr Gallup's specific questions: (1) An IRB-approved consent form was used for the study. (2) Colony counts were performed by four different technicians from the microbiology laboratory of the hospital. (3) None of the patients had “scrub showers” ordered as part of their preoperative preparation.

References


Key words: Skin preparation; wound infection