Use of a 1-Piece Chlorhexidine Gluconate Transparent Dressing on Critically Ill Patients

Barbara Pfaff, RN, MSN, CCRN, ACNP-BC
Teresa Heithaus, RN-BC, MSN
Madeline Emanuelsen, BS, MS

BACKGROUND  New transparent dressings with chlorhexidine gluconate in the dressing are available.

OBJECTIVES To compare the effectiveness of a new 1-piece occlusive dressing that incorporates chlorhexidine gluconate with that of a dressing plus a chlorhexidine gluconate patch in maintaining the low rate of catheter-related bloodstream infections in the intensive care unit and to evaluate nurses’ satisfaction with and cost of the new dressing.

METHODS A quality improvement observational study was done in an adult medical-surgical intensive care unit. All patients with a central venous catheter had initial and/or subsequent dressing changes done with the new dressing. The central catheter bundle elements of the Institute for Healthcare Improvement were followed. Patients were monitored for catheter-related bloodstream infections, and the rate of infection was calculated.

RESULTS During the study period of 1881 device days, the infection rate was 0.051 per 1000 device days, compared with a rate of 0.052 in 2008. Nurses preferred the new dressing. Cost savings were $3807.

CONCLUSION A low rate of catheter-related bloodstream infections can be maintained, nurses’ satisfaction achieved, and cost savings realized with the new dressing.

(Critical Care Nurse. 2012;32[4]:35-40)
nurse, a registered nurse, because the hospital did not employ a dedicated intravenous therapy team. All nurses received simulated initial and ongoing training in the care of CVCs by the staff development department.

Researchers have postulated that one cause of catheter-related BSIs is the colonization of skin organisms at the catheter site. After colonization, the organisms migrate and contaminate the tip of the catheter (extraluminal migration). As a topical antiseptic, chlorhexidine gluconate provides broad-spectrum antimicrobial protection and can reduce skin flora most commonly associated with catheter-related BSIs. The hospital adopted the use of a separate fenestrated antimicrobial chlorhexidine gluconate absorptive foam patch, the Biopatch (Ethicon, Inc). The patch was used to surround the CVC before placement of the transparent dressing (Figure 1).

In 2007, after implementation of the Biopatch, the rate of infections associated with CVCs in the adult intensive care unit (ICU) decreased dramatically to 0.3 cases per 1000 device days, much less than the US mean rate of 2.0 cases per 1000 device days, as reported by the National Healthcare Safety Network. This low rate remained consistent in the ICU throughout 2008. In the first half (January 1–June 30) of 2009, the rate decreased to zero cases per 1000 device days.

The purpose of the quality improvement project reported here was to test a new occlusive dressing that incorporates the chlorhexidine gluconate into a 1-piece application, the Tegaderm CHG Chlorhexidine Gluconate IV Securement Dressing (TSD; 3M; Figure 2). The project was prompted by the need to be in compliance with hospital policy that requires visual inspection of the insertion site minimally every shift. The major disadvantages of the 2-piece dressing (Biopatch plus transparent dressing) were the inability to see the insertion site (the chlorhexidine gluconate patch is a solid blue) and the added step in application. The advantage of the 2-piece dressing was the decrease in infection rate. Major advantages of the 1-piece system were the ability to visualize directly the insertion site (the chlorhexidine gluconate gel

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Key elements of the care bundle to prevent catheter-related infections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand hygiene</td>
<td>Maximal barrier precautions upon insertion of the catheter</td>
</tr>
<tr>
<td>Chlorhexidine skin antisepsis</td>
<td>Optimal selection of the catheter site, with avoidance of the femoral vein for central venous access in adult patients</td>
</tr>
<tr>
<td>Daily review of catheter necessity and prompt removal of unnecessary catheters</td>
<td></td>
</tr>
</tbody>
</table>

a Based on information from the Institute for Healthcare Improvement.
is clear) and the reduced step in application. A disadvantage of the 1-piece system was the difficulty in removing the gel pad from around the catheter insertion site. A comparison of each of the products is summarized in Table 2.

The adult ICU of the hospital, a 20-bed unit that admits critically ill medical, surgical, neurosurgical, obstetrical, and trauma patients, was chosen for the project. In lieu of the zero catheter-related BSI rate in the ICU in the first half of 2009, the main purpose of the project was to determine if the 1-piece dressing would be as effective as the current 2-piece system. The Biopatch used in the adult ICU is 2.5 cm in diameter and is available with 3 different center-hole sizes for different sizes of catheters. The chlorhexidine gluconate gel part of the TSD used in the project is 3 × 4 cm and surrounds and covers the catheter at the insertion site.

The goals of the project were 3-fold: to maintain the low rate of catheter-related BSIs, evaluate nurses’ satisfaction with the new product, and reduce the cost of dressing changes (the cost of the 1-piece dressing, $8.65 per dressing change, was considerably less than that of the 2-piece system, $12.07 per dressing change).

**Methods**

After approval by the institutional review board of the hospital and beginning on July 1, 2009, all patients admitted to the adult ICU in whom a central catheter was placed in the ICU had the TSD applied. The dressing was routinely changed according to current hospital policy (once a week and as needed). Patients transferred into the unit with a preexisting CVC had the dressing changed to the TSD. Physicians placed all central catheters. A multimed CVC, 22 cm, 7F (model 3720HKIC, Edwards Lifesciences LLC) without an antimicrobial coating was used with both the

<table>
<thead>
<tr>
<th>Table 2 Comparison of Biopatch and Tegaderm dressings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biopatch</strong></td>
</tr>
<tr>
<td>2 different sizes of foam patches, 3 different sizes of catheter openings</td>
</tr>
<tr>
<td>Varied concentration of chlorhexidine (varied by size)</td>
</tr>
<tr>
<td>2-piece application</td>
</tr>
<tr>
<td>Manipulation of central venous catheter and/or sutures to apply foam patch around the catheter</td>
</tr>
<tr>
<td>Varied absorption of chlorhexidine gluconate from foam patch related to size of dressing</td>
</tr>
<tr>
<td>Solid color (blue over white)</td>
</tr>
<tr>
<td>Obstructed view of catheter site</td>
</tr>
<tr>
<td>Manipulation needed to remove foam patch</td>
</tr>
</tbody>
</table>
Biopatch and the TSD on all patients. All nurses and physicians received information about the elements of the care bundle to prevent catheter-related infections. After determination of critical elements for application of the new dressing material, training in application of the TSD was conducted by clinical representatives of 3M, staff development instructors, and the clinical nurse specialist for critical care. Competency was verified by demonstration–return demonstration. The number of days the catheter was in place and the percentage of nursing care administered by registered nurses was tracked on a quarterly basis. All other elements of the care bundle were continued and documented on the critical care patient flow sheet.

Infection surveillance was conducted by the infection control practitioner. In order to ensure that all catheter-related BSIs were detected in a timely manner, a daily surveillance of the ICU was performed. The surveillance included a chart review of all patients with CVCs, an evaluation of microbiological results (blood cultures), and determination of patients’ signs and symptoms, including fever, chills, and hypotension. A BSI was considered confirmed if the laboratory results met 1 of the 2 adult criteria of the Centers for Disease Control and Prevention:

1. The patient has a recognized pathogen cultured from 1 or more blood samples and the organism cultured from blood is not related to an infection at another site.
2. The patient has at least 1 of the following symptoms: fever (temperature >38°C), chills, or hypotension and signs and symptoms and positive laboratory results are not related to an infection at another site, and a common skin contaminant was cultured from 2 or more blood samples obtained on separate occasions.

Infection rates were calculated by the infection control department by using the standard method of the National Healthcare Safety Network (number of infections divided by the number of device days, multiplied by 1000 = rate per 1000 device days) and reported to the National Database of Nursing Quality Indicators. The infection rate for the second quarter (April, May, June 2009) was compared with the infection rate for the third quarter (July, August, September 2009). The rate for the third quarter was also compared with the rate for the same quarter of the previous year (2008), and the rate for the fourth quarter (October, November, December) of 2009 was compared with the rate for the fourth quarter of 2008.

In order to evaluate nurses’ satisfaction with the TSD, a survey was distributed to 62 full- and part-time nurses working in the ICU in staff positions. Nurses were also asked to communicate any ongoing concerns to their manager or the project’s investigators.

The 3M Company provided the TSDs, assistance with training and education in the use of the product in accordance with the identified critical elements and competency standard, and visual training aids, including posters and product information. In order to analyze cost-effectiveness, the cost of both the 1-piece application and the 2-piece application was calculated. The number of dressing changes for the periods was also evaluated to determine if a cost savings had occurred.

### Results

With few exceptions, CVCs were placed in the internal jugular vein. If a catheter was placed in the femoral vein, the site was changed at the earliest opportunity to the internal jugular or subclavian vein. Table 3 gives the number of device days, number of infections, and the rates for catheter-related BSIs.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of device days</td>
<td>1032</td>
<td>930</td>
<td>935</td>
<td>951</td>
<td>973</td>
<td>4021</td>
<td>3943</td>
</tr>
<tr>
<td>No. of infections</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Rate</td>
<td>0</td>
<td>1.08</td>
<td>1.07</td>
<td>0</td>
<td>0</td>
<td>0.2</td>
<td>0.5</td>
</tr>
</tbody>
</table>

*aCalculated as the number of infections per 1000 device days.*
Of the 62 nurses who participated in the project, 30 (48%) responded to the nurses’ satisfaction survey. Outcomes are summarized in Figure 4. According to estimates, incorporating the TSD into the CVC dressing tray and eliminating the Biopatch resulted in a savings of $3.42 per dressing change. A total of 428 dressing changes were done during the trial period. Estimated savings in the ICU for a similar 6-month period would be $1463.76 (Table 4). Savings during the trial were $3807.20 because the 1-piece TSD was supplied by 3M.

**Discussion**

Prevention of catheter-related BSIs remains an important goal in the care of critically ill patients at risk for these infections. Prevention requires a multifaceted approach and the cooperation of all members of the health care team. In addition to cost, morbidity and mortality can be reduced when hospital-acquired infections are prevented. Therefore, interventions that reduce or eliminate catheter-related BSIs markedly benefit patients and patients’ families. In an era of competition, cost containment, and health care reform, hospitals cannot afford to overlook these measures.

**Limitations**

The variable in the project was the change in dressing material. According to the 2008/2009 ICU census, the patient population remained consistent as did the percentage of care delivered by registered nurses, and the number of device days. The effect of nursing hours and the severity of patients’
illnesses requires further evaluation. Although competency with CVC dressing changes was assessed, compliance is unknown. The number of patients transferred into the ICU with a preexisting CVC without the chlorhexidine gluconate patch is also unknown. We did not evaluate the use of a transparent dressing alone versus a transparent dressing in conjunction with chlorhexidine gluconate. Only 48% of the nurses who used the product responded to the satisfaction survey. The product was evaluated solely in the adult ICU. Finally, cost analysis was based on current product costs that are subject to change, depending on vendors and volume. No vendor will be supplying dressings free of charge in the future.

Conclusion

We conclude that the TSD used in conjunction with the elements of the care bundle to prevent catheter-related BSIs and appropriate staff education may be a cost-effective method to reduce or eliminate the incidence of catheter-related BSIs in a mixed population of adult ICU patients. Nurses who used the product and responded to the survey appeared to be satisfied with the dressing and indicated a preference for the 1-piece system.

References


Table 4 Savings estimate for intensive care unit and hospital-wide

<table>
<thead>
<tr>
<th>Location</th>
<th>No. of dressing changes, July 1-December 31, 2009</th>
<th>Cost of 2-piece application @ $12.07</th>
<th>Projected cost of 1-piece application @ $8.65</th>
<th>Projected savings, July 1-December 31, 2009 @ $3.42</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensive care unit</td>
<td>428</td>
<td>$15,659.96</td>
<td>$37,022.00</td>
<td>$1,463.76</td>
</tr>
<tr>
<td>Hospital-wide</td>
<td>5707</td>
<td>$68,877.46</td>
<td>$49,365.55</td>
<td>$19,511.91</td>
</tr>
</tbody>
</table>

Projected annual savings hospital-wide: $39,023.82
Actual savings during trial in intensive care unit:
- Nonuse of chlorhexidine patch @ $7/patch: $2,996.00
- Reduced number of dressing kits for same quarter of 2008 (160 fewer): $811.20
Total projected savings: $3,807.20.

Financial Disclosures

None reported.

Now that you’ve read the article, create or contribute to an online discussion about this topic using eLetters. Just visit www.ccnonline.org and click “Submit a response” in either the full-text or PDF view of the article.
