ONLINE FIRST

Chlorhexidine Gluconate–Impregnated Central Access Catheter Dressings as a Cause of Erosive Contact Dermatitis

A Report of 7 Cases

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Background: Chlorhexidine gluconate–impregnated dressings have become widely adopted as a means to reduce the risk for catheter-associated bloodstream infections. These dressings release antiseptic under occlusion onto the skin surrounding catheter insertion sites. Although chlorhexidine gluconate is a known cause of contact dermatitis, the phenotypic range of this adverse effect of chlorhexidine gluconate–impregnated dressings in critically ill patients has not been described.

Observations: We report 7 cases of erosive irritant contact dermatitis due to chlorhexidine gluconate–impregnated transparent dressings. Six of these patients were children (age range, 4 months to 2 years); the adult was a critically ill 62-year-old man. Four patients were immunosuppressed after solid organ transplant and all were receiving blood pressure support at the time of this reaction. The insertion sites of femoral catheters were involved in all but 1 case; 3 catheter sites were involved in the adult patient. Results of extensive infectious work-ups were negative. All lesions resolved with discontinuation of the chlorhexidine gluconate–containing dressings, local wound care, and alternative antimicrobial dressings.

Conclusions: Erosive contact dermatitis is an underrecognized complication of chlorhexidine gluconate–impregnated dressings. Health care providers should be aware of this risk, particularly in young children and immunosuppressed and/or critically ill patients, who may be more susceptible to the irritant effects of these dressings. When the dressings are used, patients should be monitored closely for skin breakdown.

The dermatologist was consulted 12 days after left femoral CAC placement to evaluate skin irritation surrounding the insertion site. On examination, a rectangular erythematous patch was present in the left groin extending to his anterior left thigh with multiple large erosions covered by fibrinous debris (Figure 2A). The site had been dressed with a chlorhexidine gluconate–impregnated gel pad and changed approximately once every 4 days from the time of insertion. The CAC was removed owing to malfunction, and the patient was treated empirically with systemic broad-spectrum antibacterial, antiviral, and antifungal therapy while awaiting culture results. Gram stain, bacterial culture, direct fluorescent antibody testing, viral culture, potassium hydroxide preparation, and fungal culture from the erosions yielded negative findings. The area was treated with topical antibiotics and non-adherent dressings, with reepithelialization of the erosions during the following week.

CASES 2 TO 7

We evaluated 6 additional cases of geometric erosive dermatitis surrounding CAC insertion sites dressed with chlorhexidine gluconate–impregnated transparent gel pads. The similar clinical findings are described in the Table and Figure 2B-D.

Chlorhexidine gluconate is a rare but known cause of allergic contact dermatitis (ACD) and irritant contact dermatitis (ICD). Several reports have described ACD due to chlorhexidine gluconate, some complicated by anaphylactic shock after its application to intact skin. The prevalence of sensitization to chlorhexidine gluconate in positive skin patch test results ranges from 0.47% to 2.7%, with the highest rates in children with atopic dermatitis. However, the local ICD that is the most frequent adverse reaction to chlorhexidine gluconate exposure in children has not been as thoroughly examined in the literature. Previous reports of ICD after chlorhexidine gluconate exposure in children describe a range of clinical presentations from mild erythema to severe exudative reactions.

We reviewed 7 cases of erosive dermatitis occurring at the sites of CACs dressed with chlorhexidine gluconate–impregnated gel pads changed at approximately weekly intervals (Table). Six of the patients were infants and children ranging in age from 4 months to 2 years. The final patient in our series (case 7), a critically ill 62-year-old immunosuppressed man, presented with cutaneous eruptions similar to those of our 6 pediatric cases at the sites of his 3 CACs. All the patients were severely ill, necessitating care in the ICU and requiring blood pressure support. Four of the 7 patients, including the adult, had received solid organ transplants and were immunosuppressed. Five of the 7 patients died of their underlying illnesses, unrelated to the erosions at their catheter sites, during the same hospital admission.

Our findings are consistent with demographics of earlier reports suggesting that infants are most susceptible to the irritant effects of dressings containing chlorhexidine gluconate. In a randomized study evaluating the efficacy and safety of chlorhexidine gluconate–impregnated dressings in children, local redness developed in 4 subjects, compared with only 1 control subject; removal of the CAC or dressing was not needed, and the erythema resolved with catheter removal. All 4 subjects were neonates. In another study comparing povidone-iodine– with chlorhexidine gluconate–containing dressings, 19 of 335 infants who received chlorhexidine gluconate–containing dressings developed severe exudative reactions with erythematous patches extending to the edges of the antimicrobial dressings, which were partially or completely covered by mucopurulent drainage. Most episodes (79%) occurred in neonates with gestational age less than 28 weeks and birth weight less than 1000 g and who were younger than 1 week at the time of CAC insertion. No patient in the povidone-iodine group developed contact dermatitis, and all patients with ICD after the use of chlorhexidine gluconate–containing dressings were switched to povidone-iodine dressings with resolution of the symptoms. Although lower rates of positive findings in catheter tip cultures were seen in the chlorhexidine gluconate group, no difference in the incidence of catheter-related bloodstream infections or bloodstream infections without an identified source was found. These reports suggest that the skin of infants and young children may be more susceptible to irritation by chlorhexidine gluconate than that of older children. Severe ICD in reaction to chlorhexidine gluconate–containing dressings has been reported in adults at a lower rate than in children (3.3 per 1000 catheter insertions), predominantly affecting critically ill patients with multiple-organ failure and skin fragility, as in case 7.

As a manifestation of the innate immune response, ICD results from the irritant’s perturbation of the skin barrier and cytotoxic effects on keratinocytes, inducing a cytokine cascade. The susceptibility to ICD depends on endogenous and exogenous factors that culminate in damage to the integrity of the skin barrier and in release of in-
Inflammatory cytokines. The patient population described in this report is at greater risk for cutaneous complications given the compromised nature of the skin barrier in pediatric and chronically ill patients and the relative immunodeficiency from the immature nature of the immune systems of young children, iatrogenic immunosuppression, or the combination of the two. The relative hypoperfusion of the skin in these patients requiring blood pressure support also may have compounded their susceptibility to ICD.

Among known exogenous risk factors for ICD are the concentration and potency of the irritant, duration and site of skin exposure, occlusion over the application site, and ambient temperature and humidity. The reported erosive dermatoses can be attributed to the occlusive nature of the dressings, the continual skin exposure, and the local concentrations of chlorhexidine above the reference range achieved on the skin surface. Such a reaction has never been described in infants receiving full-body chlorhexidine gluconate skin cleansing without occlusive dressings.

In most of the cases reported herein, the insertion sites of femoral catheters were involved, affecting the groin and proximal thigh. The susceptibility to ICD varies with the region of skin exposed, with the thigh being the most vulnerable. In case 5, the patient had an identical dressing on the arm without any evidence of irritation, underscoring the importance of the body site as a factor for...
the development of ICD. The site of skin exposure is only one factor contributing to the risk for ICD, and 2 patients had erosive lesions at other sites. Case 4 had an erosive lesion on the neck, another intertriginous site. Her young age and immunosuppression after a heart transplant also may have contributed to a lower threshold for this reaction. Case 7 developed erosions at other sites, including sites of other adhesives, and wrist. This patient may have been particularly susceptible to the irritant effects of CHG because he also developed these lesions after the shortest interval after catheter placement among the other patients described (8 days).

Because the patients most likely to be exposed to chlorhexidine gluconate–containing dressings are severely ill and often immunocompromised, they are most vulnerable not only to the irritant sequelae of this exposure but also to infectious processes that could mimic ICD. All cultures and other microbiological evaluations from the sites in our patients yielded negative results. How-ever, these crucial investigations should not be overlooked when managing erosive or ulcerative lesions at the site of a CAC. Many of our patients received systemic broad-spectrum antimicrobial coverage at the time of presentation; for those who did not, however, such coverage was added while awaiting culture results.

The management of erosive ICD hinges on the recognition and removal of the chemical or the physical irritant and wound care. In all the patients described, dis-continuation of chlorhexidine gluconate treatment under occlusion was recommended. Alternative antimicrobial dressings were used with clinical improvement in the lesions in 5 of 7 patients. In 2 cases, the CACs were removed owing to malfunction of the catheters involved. In all cases, the erosions and ulcerations resolved during the following 1 to 2 weeks with appropriate wound care.

We infer that these cases represent ICD rather than ACD because of the erosive nature of the lesions, the occlusive nature of the dressings, and the occurrence of these reactions in infants, in whom ACD is rare. In addition, this reaction occurred at some but not all sites of application in patients with multiple chlorhexidine gluconate–containing dressings. No patient demonstrated evidence of pruritus, including the adult, although the severity of these patients’ conditions likely prevented them from manifesting this symptom. None of the cases involved the use of tinted chlorhexidine, with which prior cases of ACD have been reported.19,20 No patient developed erosions at other sites, including sites of other adhesives, and cases 6 and 7 improved while using the clear acrylic dressings without chlorhexidine gluconate, supporting our suspicion that chlorhexidine gluconate may be the component causing this reaction. Given the critical conditions of these patients and the erosive nature of the expected reactions, certain confirmatory tests, such as repeated open-application testing or patch testing, were not performed.

Given the known variability in the presentation of ICD, the cases presented herein probably represent more severe irritant reactions to chlorhexidine gluconate–impregnated dressings. We cannot determine whether these presentations represent the severe end of the same

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Table. Summary of Clinical Features in the Present Case Series

<table>
<thead>
<tr>
<th>Case No./Sex/Age</th>
<th>Site</th>
<th>Duration of CAC Discovery, d</th>
<th>Comorbidities</th>
<th>Immunosuppression</th>
<th>BP Support</th>
<th>Wound Care</th>
<th>Wound Outcome/Time, d</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/M/6 mo</td>
<td>L groin</td>
<td>12</td>
<td>CHD repair</td>
<td>No</td>
<td>Yes</td>
<td>Topical antibiotics, nonadherent dressings</td>
<td>Lesions resolved/7</td>
</tr>
<tr>
<td>2/M/2 y</td>
<td>L groin</td>
<td>30</td>
<td>CHD repair, pulmonary HTN</td>
<td>No</td>
<td>Yes</td>
<td>Topical antibiotics, nonadherent and silver-impregnated dressings</td>
<td>Lesions resolved/10</td>
</tr>
<tr>
<td>3/M/4 mo</td>
<td>L groin</td>
<td>22</td>
<td>CHD, heart Tx, sepsis</td>
<td>Yes</td>
<td>Yes</td>
<td>CAC removed, topical antibiotics, petroleum jelly, nonadherent dressings</td>
<td>Lesions resolved/4</td>
</tr>
<tr>
<td>4/F/2 y</td>
<td>R aspect of neck</td>
<td>17</td>
<td>CHD, heart Tx, Tx rejection</td>
<td>Yes</td>
<td>Yes</td>
<td>Topical antibiotics, nonadherent dressings</td>
<td>Lesions resolved/6</td>
</tr>
<tr>
<td>5/F/1 y</td>
<td>R groin</td>
<td>13</td>
<td>CHD, heart Tx, graft failure, stroke, osteomyelitis</td>
<td>Yes</td>
<td>Yes</td>
<td>Topical antibiotics, silicone- and silver-impregnated dressings</td>
<td>Lesions resolved/NS</td>
</tr>
<tr>
<td>6/M/5 mo</td>
<td>L groin</td>
<td>16</td>
<td>CHD, sepsis, DIC</td>
<td>No</td>
<td>Yes</td>
<td>Alcohol and povidone-iodine cleansing, silver-impregnated dressings, transparent dressing</td>
<td>Lesions resolved/NS</td>
</tr>
<tr>
<td>7/M/62 y</td>
<td>L groin, L aspect of neck, R wrist</td>
<td>8</td>
<td>Dermatomyositis and pulmonary HTN, renal failure</td>
<td>Yes</td>
<td>Yes</td>
<td>L femoral CAC removed, topical antibiotics, nonadherent dressings, paper tape</td>
<td>Lesions resolved/NS</td>
</tr>
</tbody>
</table>

Abbreviations: BP, blood pressure; CAC, central access catheter; CHD, congenital heart disease; DIC, disseminated intravascular coagulation; HTN, hypertension; L, left; NS, not specified; PF, pulmonary fibrosis; PNA, pneumonia; R, right; Tx, transplant; y, years.

a All patients had negative microbiology results for fungal culture, potassium hydroxide test, bacterial Gram stain and culture, herpes simplex virus/varicella zoster virus direct fluorescent antibody test, and viral culture.
Erosive contact dermatitis at the site of CACs can pose a significant danger to patients because it has the potential to provide a larger portal for entry to infection than the catheter alone. One should consider whether central access is crucial for life-sustaining measures and, if so, what lengths are appropriate to maintain a clean, well-protected CAC insertion site. Intensive care units must tailor goals in each patient with care, particularly in infants or young children and immunosuppressed patients, who may be most susceptible to the irritant effects of occlusive CHG dressings. When these dressings are used to prevent CAC infections, providers should monitor skin closely for the development of erosive contact reactions.

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REFERENCES