A comparison between occlusive and exposure dressing in the management of burn wound

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ABSTRACT

Background and aim: Two types of dressing, occlusive and exposure dressing, are commonly used in burn units. A dressing is said to be occlusive if a moist wound surface is maintained when the dressing is in place. This study was designed to compare the effectiveness of occlusive and exposure dressing in controlling burn infections.

Patients and methods: Two hundred patients with second-degree burns admitted to Mottahari Hospital, Tehran, Iran, over a period of 12 months from May 2012 to May 2013 were studied. They were divided into two groups of 100 each, to receive either occlusive or exposure dressing. During the first week of treatment, wound specimens were obtained by sterile swab and cultured in selective media. Demographics (age and gender), burn areas, cause of burn, length of hospital stay (LOS), type of infections and time to total healing were compared between the two groups.

Results: Occlusive dressing was more susceptible to microbial contamination and infections than exposure dressing. The mean duration of treatment based on epithelialization and healing in occlusive dressing was longer than for exposure dressing. The most common isolate was Pseudomonas spp., followed by Enterobacter, Escherichia coli, Staphylococcus aureus, Acinetobacter, and Klebsiella spp.

Conclusions: Exposure dressing was more suitable than occlusive dressing for treating partial-thickness at our center. Pseudomonas aeruginosa was the most common organism encountered in burn infection.

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1. Introduction

The International Society for Burn Injuries defines a burn as an injury to the skin or other organic tissue caused by thermal trauma [1]. Skin injuries due to ultraviolet radiation, radioactivity, electricity, or chemicals, as well as respiratory damage resulting from smoke inhalation, are also considered burns [2,3]. When the skin as a physical barrier is damaged, pathogens have a direct route to infiltrate the body, possibly resulting in infection [4,5]. In addition to the nature and extent of injury influencing infections, the type and quantity of microorganisms that colonize the burn wound appear to influence the future risk of invasive wound infection. The pathogens that infect the wound are primarily gram-positive bacteria such as methicillin-resistant Staphylococcus aureus (MRSA) and gram-negative bacteria such as Acinetobacter baumannii-calcoaceticus complex, Pseudomonas aeruginosa, and Klebsiella species [6–10]. A burn is denoted as first degree when it affects the epidermis, superficial second degree when the damage penetrates into the papillary dermis, and deep second degree when the damage extends beyond the reticular dermis. However, burns destroying all layers of the skin down to the subcutaneous fat are designated as third-degree burns [11]. In first- and second-degree burns, healing is by primary intention and is almost scarless. However, in deep second-degree and third-degree burns, the healing process usually leads to contracture and formation of hypertrophic scars, with patients often requiring reconstructive surgery [12,13]. Before selecting a dressing for a particular wound, a practitioner must assess the needs of the wound carefully to understand which dressing would provide maximal benefit. It must be noted that occlusive dressings might potentiate wound infection [7]. However, although heavy colonization by skin and wound flora is often seen under certain types of occlusion, clinical infection is not a frequent occurrence. Infections are considered to be one of the most important and potentially serious complications in people with burns [14]. The National Burn Repository of the United States reported 19,655 cases of complications in people with burns over a 10-year period; of these, 31% were pulmonary complications, 17% were related to wound infection and cellulitis, and 15% were due to septicemia and other infectious complications [15]. Certain aspects of wound healing may, in fact, be promoted by bacterial colonization, although clinical infection can lead to wound breakdown and systemic infection [16]. Occlusive dressings may help prevent infection by presenting a barrier to potential pathogens, and hydrocolloid occlusive dressings have been shown to prevent the dissemination of MRSA [17,18]. This study was designed to compare the effectiveness of occlusive and exposure dressing in controlling burn infections.

2. Patients and methods

Two hundred subjects with second-degree burns over 2–5% of the total body surface area (TBSA) were examined after being admitted to the Mottahari hospital burn unit over a period of 12 months from May 2012 to May 2013.

The inclusion criteria applied was outpatients who sustained second-degree burns not exceeding 2–5% of TBSA and who received systemic cephalaxin (first-generation cephalosporin). The burn sites included the wrist, forearm, palm, backs of the hands, ankles, buttock, and back of the leg. These patients were randomized into two equal groups to receive either occlusive or exposure dressing for treatment. A structured questionnaire was prepared to record the history (age, gender, occupation, cause, location, and percentage and degree of burn), examination details, and investigation reports. In open dressing, the wound was cleared of dead tissue and debris gently, cleaned with warm water and baby shampoo, then washed with sterile normal saline, and dried with a sterile gauze. Next, the wound was covered with an approximately 16-mm-thick layer of silver sulfadiazine cream.

The above procedure was repeated the following day in the hospital emergency room. During the first week of treatment, swabs were collected from the burn wounds after cleaning the site with sterile normal saline. To obtain a culture of the burn surface, topical agents (if any) were first removed with gauze soaked in sterile saline. An area measuring 4 cm² was swabbed using two sterile swab sticks. For dry wounds, the swab was moistened with sterile saline before swabbing. These specimens were immediately transported to the laboratory for further processing. The burns were treated up to the level of the epithelium, and wound healing and the results of microbial culture for each patient were recorded. The occlusion dressing was performed using the same technique as that for exposure dressing, except that the wound was wrapped with a sterile bandage at the end. The following definition was taken as a sign of infection:

- Change in color in the area with burns or the surrounding skin
- Purplish discoloration, particularly if swelling is also present
- Change in thickness of the burn (the burn suddenly extends deep into the skin)
- Greenish discharge or pus
- Fever

For data analysis, an independent t-test was used in SPSS package version 11.5.
3. Results

The participants were 72% men and 28% female. The incidence of burns due to hot liquid (55, 27.5%) was higher than those due to other causes such as liquid and explosive gases (20, 10%), flame (seven, 3.5%), electricity (six, 3%), and chemicals (six, 3%) (Table 1). The mean difference in healing time based on the cause of burn between the occlusive and exposure dressing methods was significant \( p < 0.001 \), and was shorter in the exposure dressing (Tables 1 and 2). The reduction in healing time based on the anatomic site of the burn was 33.3% and 35% for the occlusive and exposure dressing methods, respectively (Table 2). The distribution of microbial contamination is shown in Table 3. Out of 56 burn wounds with contamination, the most common isolate was Pseudomonas spp. (21, 10.5%), followed by Enterobacter (nine, 4.5%), Escherichia coli (eight, 4%), S. aureus (eight, 4%), Acinetobacter (six, 3%), and Klebsiella spp. (four, 2%). The overall infection rates in the case of occlusive dressings were 23% in 56 wounds, whereas the rates were much lower (5%) in the case of exposure dressings.

<table>
<thead>
<tr>
<th>Etiology of burns</th>
<th>Total sample</th>
<th>No. of treated burns in each method</th>
<th>Healing time (days) by occlusive dressing method</th>
<th>Healing time (days) by exposure dressing method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot liquid</td>
<td>114</td>
<td>57 (28.5%)</td>
<td>21</td>
<td>12</td>
</tr>
<tr>
<td>Fluid and explosive gases</td>
<td>42</td>
<td>21 (10.5%)</td>
<td>20</td>
<td>12</td>
</tr>
<tr>
<td>Flame</td>
<td>14</td>
<td>7 (3.5%)</td>
<td>19</td>
<td>11</td>
</tr>
<tr>
<td>Electrical</td>
<td>12</td>
<td>6 (3%)</td>
<td>14</td>
<td>11</td>
</tr>
<tr>
<td>Chemical</td>
<td>12</td>
<td>6 (3%)</td>
<td>22</td>
<td>14</td>
</tr>
<tr>
<td>Surface burn</td>
<td>4</td>
<td>2 (1%)</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>Other forms</td>
<td>2</td>
<td>1 (0.5%)</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
<td>100</td>
<td>101</td>
<td>69</td>
</tr>
</tbody>
</table>
4. Discussion

Infectious complications are an important contributor to morbidity and mortality in patients with burns [19–24]. This study was conducted to study the differences in healing rates with two types of local burn treatment in the control of burn infection. The rate of epithelialization of wounds treated with the exposure method was significantly (p < 0.001) more rapid (p < 0.05) than those treated with occlusive dressings. This finding is in agreement with other reports [25,26]. A higher incidence of burn was noted in men; our findings correlated with another study in which the highest percentage of burns occurred in men [27,28]. With respect to the burn etiology, we observed that hot liquid was the main cause of burns (110 patients, 55%). This may be explained by the fact that hot liquids are commonly used in households, most frequently by women in many aspects of daily life. This finding correlates with other studies [29,30]. The results of this study showed that the rate of clinical infection was lower with exposure than occlusive dressings; this is likely a result of the normal activity of the host defenses when exposure dressings are used. Based on the results of this study, exposure dressing appears to be more suitable than occlusive dressing for the treatment of burn wounds, but more research is required to confirm its suitability. According to data from numerous publications in different countries, the most commonly isolated pathogens from burn patients and their environments are P. aeruginosa, S. aureus, E. coli, Klebsiella spp., Enterococcus spp., coagulase-negative staphylococci, Enterobacter spp., Acinetobacter spp., and Candida spp. [31,32]. P. aeruginosa was found to be the most commonly isolated bacteria (21 cases, 10.5%). Other bacterial species isolated included Enterobacter (nine cases, 4.5%), E. coli (eight cases, 4%), S. aureus (eight cases, 4%), Acinetobacter (six cases, 3%), and Klebsiella (four cases, 2%). Our results were in agreement with the findings of many studies around the world, demonstrating Pseudomonas to be the most commonly isolated bacteria [33,34]. The prevalence of P. aeruginosa is remarkably high possibly because this organism thrives in a moist environment and is resistant to most antibiotics. In contrast to our study, studies conducted by others showed that S. aureus was the most common isolate in patients with burn wound infections [30,35]. This might be due to the type and quantity of microorganisms that colonize these wounds. In the last 8 years, the incidence of multidrug-resistant gram-negative bacilli A. baumannii is also increasing [36]. In this study, Acinetobacter spp. was found in six samples (3%). A number of factors may contribute to this increase in the incidence of Acinetobacter spp., such as its presence as a normal skin commensal and its ease of spreading.

5. Conclusion

Oclusive dressing was more susceptible to microbial contamination and infections than exposure dressing was. Thus, we suggest the use of exposure dressing in the outpatient treatment of minor burns.

Conflict of interest

The authors have no conflicts of interest to declare with regard to the manuscript or its contents.

Limitation

We did not have adequate equipment to assess the extent of wound infection; therefore, we used swab wound culture for determination of the wound infection.

Ethical approval

This research was registered in Iranian Registry of Clinical Trails (IRTC) with register number (IRCT2012007110245N1).
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