Experience in the Treatment of Patients with Burns Covering More Than 90% TBSA and Full-Thickness Burns Exceeding 70% TBSA

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OBJECTIVE: The objective of this study was to explore our experience in the treatment of serious burn patients (total burn surface area [TBSA] > 90% and full thickness burns > 70% TBSA).

METHODS: Thirty patients who were admitted to our unit over a period of 12 years were analyzed retrospectively; 23 cases (76.7%) were successfully treated.

RESULTS: There were seven out of 12 cases (58.3%) in the first 5 years and 16 out of 18 cases (88.9%) in the latter 7 years of the study period.

CONCLUSIONS: It is concluded that: 1) giving electrolyte-free fluids (around 3700 ml) and the maintenance of hourly urine output at 70 ml or more appear to be beneficial in resuscitation therapy; 2) the first operative procedure should be undertaken early, at about the third day after injury; 3) a higher percentage area of eschar to be excised in the first operation is encouraged and eschar excision of up to 40% or more is preferable; 4) controlling the area of exposed wound under 5% in the entire therapeutic course is essential in the prevention of burn infection; 5) emphasis should be placed on the vital role of a dehumidifier in reducing the incidence of fungal infection; and 6) early enteral nutrition with the use of growth hormone in correcting the nutritional state of the patient is also emphasized. (Asian J Surg 2002;25(2):154–6)

INTRODUCTION

It is extremely difficult to treat patients inflicted with burns covering more than 90% of total body surface area (TBSA) and full-thickness burns exceeding 70% of TBSA concomitantly. Although survival of such patients has been reported, no statistical data about the survival rate have been published. A total of 30 burn patients were admitted to our unit over a period from 1988 to 2000. Of these, 23 patients survived (76.7%) and seven died.

PATIENTS AND TREATMENTS

The patients comprised 26 males and four females. The mean age was 25.7 ± 6.01 years old. The average burn size was 93.6 ± 3.04% of TBSA. All but one case were associated with inhalation injury to some extent (six mild, 14 moderate, nine severe).

Fluid therapy in the shock stage

Complete data about shock fluid therapy were collected in 18 out of 28 cured cases. The amount of fluid administered is shown in Table 1.

Timing of the first operative procedure

The efficacy of early eschar excision and skin grafting in deep burns has been accepted worldwide. Our patients underwent the first operation at an average of 2.93 ± 1.18 days after injury. There was no statistical difference between the survivors and those who died.

Table 1. Fluid Administered during shock (n = 18)

<table>
<thead>
<tr>
<th></th>
<th>1st 24 h</th>
<th>2nd 24 h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colloid (ml)</td>
<td>2,975.9 ± 806</td>
<td>1,959.4 ± 542.8</td>
</tr>
<tr>
<td>Electrolyte sol’n (ml)</td>
<td>3,938.6 ± 1,389.5</td>
<td>2,324.2 ± 894.4</td>
</tr>
<tr>
<td>(0.9 NS, 1.5% NaHCO3)</td>
<td></td>
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<tr>
<td>Electrolyte-free fluid (ml)</td>
<td>3,696.9 ± 1068.9</td>
<td>3,752.1 ± 946.9</td>
</tr>
<tr>
<td>(5% GS sol’n)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (ml)</td>
<td>10,368.9 ± 1650</td>
<td>8,080 ± 1,478.6</td>
</tr>
<tr>
<td>Urine output (ml/h)</td>
<td>72.4 ± 24.1</td>
<td>75.8 ± 21.6</td>
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NS = normal saline; GS = glucose and saline; sol’n = solution.

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Patients respond well to early fluid therapy. The amount of physiological electrolyte-free fluid given reached as much as 3,700 ml/24 h with an hourly urine output maintained at around 70 ml.

**Early debridement and skin grafting**

Since seriously burned patients are liable to have invasive infections, patients should undergo the first surgical intervention early. In our group of patients, operations were performed at an average of $3.93 \pm 1.18$ days post-injury. Aggressive surgical excision of part of the eschar, especially the infected region, was beneficial for the control of invasive infection and alleviation of toxaemia. Fourteen patients had serious toxaemia or wound sepsis before surgery, but with the use of antibiotics and early extensive excision of the eschar and skin grafting, the infection was soon brought under control.

**The area of eschar excision**

A considerable area of eschar should be excised in the first operative procedure. In our study, the percentage of area removed in the first operation was $44.1 \pm 3.49\%$. The maximum area excised in a single operation was 48%. Twenty-seven patients underwent the operation uneventfully; three developed mild shock intraoperatively. This might have been attributable to inadequate transfusion, as the patients’ conditions improved after aggressive blood transfusion.

**Results**

The overall cure rate was 76.7% (23/30). The mortality rate was 23.3% (7/30). The patient cure rate was divided into two phases depending on the effectiveness of the treatment. The first phase (1988–1993) and the second phase (1994–2000). The cure rate was 58.3% (7/12) in the first phase and higher in the second phase at 88.9% (16/18) (Table 2). The cure rate between the two phases was statistically significant ($\chi^2 = 5.66$, $\chi^2_{0.05} < \chi^2 < \chi^2_{0.01}$).

Seven victims died of various complications: sepsis in five, adult respiratory distress syndrome (ARDS) in one and multiple organ dysfunction syndrome (MODS) in one. Thus, infection was the main cause of death. The main complications are listed in Table 3.

**Discussion**

**Fluid resuscitation**

Whether the patient can overcome the “shock stage” uneventfully (i.e., without signs of hypotension or oliguria) is of prime importance to the subsequent treatment as well as in the prevention of early burn infection and MODS.

Table 2. Cure rates for the two phases

<table>
<thead>
<tr>
<th></th>
<th>Number of cures</th>
<th>Number of deaths</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988–1993</td>
<td>7 (58.3%)</td>
<td>5 (41.7%)</td>
<td>12</td>
</tr>
<tr>
<td>1994–2000</td>
<td>16 (88.9%)</td>
<td>2 (11.1%)</td>
<td>18</td>
</tr>
<tr>
<td>Total</td>
<td>23 (76.7%)</td>
<td>7 (23.3%)</td>
<td>30</td>
</tr>
</tbody>
</table>

Percentage burn area excised in the first operative procedure

The mean percentage of area removed in the first operation was $44.1 \pm 3.49\%$. The maximum area excised in a single operation was 48%. Twenty-seven patients underwent the operation uneventfully; three developed mild shock intraoperatively. This might have been attributable to inadequate transfusion, as the patients’ conditions improved after aggressive blood transfusion.

**Table 3. Main complications (Number of case-episodes)**

<table>
<thead>
<tr>
<th>Burn shock</th>
<th>ARDS</th>
<th>Sepsis</th>
<th>Digestive tract haemorrhage</th>
<th>Pulmonary infection</th>
<th>Pulmonary oedema</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>4</td>
<td>16</td>
<td>3</td>
<td>8</td>
<td>5</td>
</tr>
</tbody>
</table>

ARDS = adult respiratory distress syndrome.
within 1 year was used in all our patients. The transplantation of frozen homoskin intermingled with microautoskin (Chinese method) yielded a satisfactory clinical effect. The wound healing rate after excision of eschar reached 95% or more. Small residual wounds exist in some patients. These were eliminated with supplementary autografts. External dressings were opened at 8–10 days postoperatively, exposing the wound. This is important in controlling infections caused by the local focus of homoskin or rejected homoskin. The dermis of homoskin may dehydrate to form a dry scar. It provides a protective layer for the wound until the underlying autoskin has healed completely. This is similar to the subscar healing in second-degree burns after exposure.

Management of wound infection

Systemic infection is one of the major causes of death among burn patients. Infection mainly arises from the wound (exogenous infection). Therefore, treating the wound well is important. Aside from the early extensive excision of eschar and skin grafting, Providon iodine or SD-Ag was routinely applied topically after hospital admission. Every effort was made to assist spontaneous healing of second-degree burns. The non-operative eschar was kept intact for 3 weeks, then an aggressive eschar removal procedure was performed. The wound was covered tightly with small pieces of homo and autoskin. The area of exposed wound was kept to less than 5% of TBSA for the entire therapeutic course, as far as possible.

We found that patients' toxic syndromes became apparent when the exposed wound area reached 5%–10%. Furthermore, the incidence of systemic infection and MODS increases in parallel to the incidence of infected wound, resulting in higher risk of morbidity and mortality. The administration of systemic broad-spectrum antibiotics is still an effective measure in the prevention of burn infection. Empirical therapy with broad-spectrum third generation antibiotics such as Tienam (imipenem and cilastatin) and Fortum (cefazidime) were given on admission. Antibiotics are strongly indicated:

1) within 10 days after injury: the tissue edematous fluid will be reabsorbed in the late shock stage, resulting in a high incidence of invasive infections;
2) in the perioperative period for major operations;
3) in wound infection caused by the extensive lysis of eschar or serious toxic syndromes;
4) when wound sepsis is suspected;
5) the presence of serious complications: antifungal agents (usually amphotericin or Diflucan) should be prescribed in cases where antibiotics have been prescribed for more than 2 weeks.

Nutritional Supplementation

Long-term hypermetabolic response and low oral intake places the patient in a negative nitrogen balance until wound healing has occurred. Malnutrition is one of the factors resulting in low body resistance, thus, rendering the patient more susceptible to infection. We found that patients with less extensive wounds had better appetite. Aside from the early oral intake of food and parenteral nutrition, nutrition support was implemented through the use of an elementary diet (Nutrient) orally or by continuous nasal gastric tube feeding with daily injection of growth hormone (GH) 12–16 units per day for two weeks. Early correction of negative nitrogen equilibrium was obtained by the use of the above nutritional regime.

Prevention of fungal infection

Our unit is situated in Guangzhou, which is in the subtropical zone, characterized by humidity and high temperature. From March to May, the relative humidity may reach as high as 95% or more. The climate, therefore, is favourable to the growth of fungus.

In reviewing our previous cases, we found that a few cases were associated with fungal wound infections or fungal sepsis. The persistent use of hot air fans directed at the wound has proved to be effective in the prevention of fungal wound infection. However, the use of fans may cause the wound to deepen. Therefore, we used a dehumidifier to lower the relative humidity of the ward to less than 60%, with good results.

REFERENCES

4. Zhou YP. Successful recovery of 14 patients inflicted with fullthickness burn for more than 70% TBSA. Burns 1998;24:162–5.