Clinical Experience with MEBT in Treating Burn Patients in Groups

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[Abstract] This paper recorded 12 patients burned by bus turnover and fire on May 28th 1994. Five patients had over 50% TBSA and over 35% 3rd degree wounds. Five patients had 20~30% TBSA and two patients had below 10% TBSA. Among them, one patient had complicated forehead and facial wounds. The patients received MEBT/MEBO all along together with early resuscitation and anti-infection treatments and finally they were all cured.

Our hospital received a group of 12 burned patients in May 1994 with 5 extensive burned cases. All the 12 patients were cured since our early salvage was prompt and the following treatments were proper. Lots of valuable experiences in treating burned patients in groups had been accumulated from this case, which were summarized as follows.

1.Clinical Data

At 3P.M. on May 28th 1994, the turnover of a bus caused gas fire and 72 passengers were wounded. Among them, 12 passengers were severely burned and they were sent to our hospital one hour later. Ten patients were males and the other two were females. There were 2 cases over 50 years old, 4 cases in the age range 30~40, 5 cases in the age range 20~29 and one case of 19 years old. There were 5 patients with over 50% TBSA and over 35% 3rd degree wounds, 5 patients with 20~30% TBSA and 2 patients with below 10% TBSA. One of them also had forehead and facial wounds.

Table 1 The general conditions of 12 burned patients.

<table>
<thead>
<tr>
<th>Case</th>
<th>Sex</th>
<th>Age</th>
<th>Burn area %</th>
<th>Inhalation Injury</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>TBSA 2nd wounds area</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>male</td>
<td>54</td>
<td>55 37</td>
<td>/</td>
</tr>
<tr>
<td>2</td>
<td>male</td>
<td>26</td>
<td>56 38</td>
<td>/</td>
</tr>
<tr>
<td>3</td>
<td>male</td>
<td>51</td>
<td>63 45</td>
<td>moderate</td>
</tr>
<tr>
<td>4</td>
<td>male</td>
<td>30</td>
<td>85 42</td>
<td>moderate</td>
</tr>
<tr>
<td>5</td>
<td>male</td>
<td>30</td>
<td>85 60</td>
<td>moderate</td>
</tr>
<tr>
<td>6</td>
<td>male</td>
<td>32</td>
<td>30 18</td>
<td>/</td>
</tr>
<tr>
<td>7</td>
<td>male</td>
<td>29</td>
<td>24 5</td>
<td>/</td>
</tr>
<tr>
<td>8</td>
<td>male</td>
<td>22</td>
<td>22 1</td>
<td>/</td>
</tr>
<tr>
<td>9</td>
<td>male</td>
<td>25</td>
<td>8 3</td>
<td>/</td>
</tr>
<tr>
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<td>female</td>
<td>19</td>
<td>26 2</td>
<td>/</td>
</tr>
<tr>
<td>11</td>
<td>female</td>
<td>24</td>
<td>19 1</td>
<td>/</td>
</tr>
</tbody>
</table>
2. Early Resuscitation Treatment

1) The basic requirements of early resuscitation treatment: The early resuscitation treatment should follow the following scheme. A. Maintain the respiratory function. B. Maintain the cardiovascular function. C. Maintain the renal function and establish intravenous channels promptly. The formula of fluid replenishment was based on the variables of weight, TBSA and burned depth. The principle of fluid replenishment was as follows: except the case 2, 3, 4 and 5 adopted the colloid and crystalloid formula (Table 2), the others adopted the crystalloid formula.

<table>
<thead>
<tr>
<th>Case</th>
<th>Total volume</th>
<th>Urine volume</th>
<th>Input:Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10840</td>
<td>1110</td>
<td>9.8:1</td>
</tr>
<tr>
<td>2</td>
<td>11130</td>
<td>1265</td>
<td>8.8:1</td>
</tr>
<tr>
<td>3</td>
<td>11300</td>
<td>1520</td>
<td>7.3:1</td>
</tr>
<tr>
<td>4</td>
<td>14150</td>
<td>1545</td>
<td>9.3:1</td>
</tr>
<tr>
<td>5</td>
<td>18600</td>
<td>2070</td>
<td>9.0:1</td>
</tr>
</tbody>
</table>

2) Ensure the smooth condition of the respiratory tract: Among the 12 patients, 3 of them had breathlessness, scorch vibrissa and light hoarse voice. They also had serious head and facial wounds. As a result, together with anti-shock treatment, tracheotomy was carried out immediately before debridement.

3) Maintain the heart function: Three patients had rapid heart rate of above 140 times per minute in the early normative anti-shock treatment and 5 patients even had 150~160 times per minute. At the same time, blood pressure range decreased with contract pressure 9 to 12 kpa. As enlarging the volume, cedilanidum and dopamine were used to support the heart function and the heart rate decreased below 120 times per minute gradually.
3. Treatment of The Wounds

Early debridement was carried out after the conditions had stabilized. After debridement, MEBT occlusive dressing could be applied in treating small-area and medium-area wounds. In extensive burned patients, occlusive dressing could be applied in the four limbs while exposed therapy could be applied in the trunk. After 24 hours, exposed therapy could also be applied in four limbs. Red and white granulations overlapped after the early treatments of the combination of medicine and blade in the first 12 days in these 12 patients. The wounds almost healed after one month and a half and 2~3 months later, they were cured completely.

4. Anti-infection Treatment

All 12 patients received penicillin treatments in the first 2 days after burns, and then the choice should change in the fluid reabsorbing stage. The patients with small-area and medium-area burns were given broad-spectrum penicillin while extensive burned patients should be given polymyxin, the first and second generation cephalosporin. Pseudomonas aeruginosa infection did not occur in these patients in the first three weeks. In the whole treating process, five patients had positive blood culture (with no clinical symptom) result one time. However, all the other 125 blood culture tests showed negative results. Three patients who received tracheotomy all had negative results.

5. Discussion

Although the accident of group of burns was rare, it did occur occasionally. There were already many reports about it in China but most of them were about the organizing work involved in the early salvage while few reports summarized clinical experiences. The characters of group of burns were lots of patients, serious conditions, urgent missions, limited time and inadequate medical equipments. How to solve these problems in treatments of group of burns? The salvage experiences accumulated would have great value in guiding treatments of group of burns, especially in treatments of group of chemical burns in the wartime. Our clinical experiences of treating 12 burned patients at one time were summarized as follows.

1) Treatment of Group of Burns.

Group of burns indicated that there were about 10 patients or 5 severe burned patients in one accident. Group of burns had the characters of lots of patients, serious conditions, limited time, urgent organization, high technical requirements, heavy nursing work and inadequate medical equipments. Urgent measures should be taken to ensure the smooth salvage.

1. Powerful command group: Ensure organizing and transferring human and material resources quickly and rationally to make the salvage work go in an orderly way. Mobilize all medical staffs and assistants to join in the salvage work. Establish different groups such as sorting group, salvage group, accommodating
group and logistics group. Establish different salvage spots and assign special personnel to direct. Twelve patients were sent to the emergency room in our hospital in succession in one hour after the burns. After the first arrival of some patients, the command group in charge and the dean of burns center went there immediately and assigned medical staffs to do different jobs.

2. Sorting group

① The sorting group composed of burns specialists, who made rapid judgments about the wounds and assigned the corresponding salvage missions. They were also responsible for registering and directing the patients to correct spots to receive treatments. As a result, each patient could be attended by a burns specialist and a doctor, who had both professional burns training and practical experiences. ② The patients were classified according to their burned area, burned depth, the occurrence of shock, inhalation injury and complications. The anti-shock treatment was carried out by 2～3 burns specialists. At the same time, every staff was assigned definite tasks and everything was prepared to support the treatment. ③ The principles of treatments were as follows: severe burned patients were sent to the salvage room in our hospital in priority. Those who were already in shock or with severe inhalation injury were treated in the emergency room immediately. In the first 2 hours after their arrival, effective and safe intravenous channels were established. Venesection and tracheotomy could also be carried out while urinary drainage tube could be applied in patients with light coma, thus paved the way for the following treatments. Moderate burns patients were sent to the hospital wards directly after the related procedures had been done. Early treatments should adopt MEBT. Light burns patients received their early treatments in the emergency room and later they could conduct hospitalization procedures.

3. Salvage group. The medical staffs were divided into different salvage groups according to the numbers and conditions of patients. At the same time, all related departments were informed to organized human and material resources to support the salvage group.

4. Accommodating group. The patients were sent to the isolation ward or ordinary ward (ordinary isolation ward) after anti-shock, early wounds treatment and other treatments. A special treatment panel was established in each ward.

5. Logistics group. Logistics group was established immediately, which composed of pharmacy, supply room, blood bank and nutrition room. Logistics group was responsible for equipments, dressing and blood supply as well as disinfection and nutrition preparation. It was under the leadership of command group.

2) The proper and prompt resuscitation measures were the base of successful treatments. The rapid establishment of intravenous channels and fluid supply were powerful measures in burns resuscitation. Keeping the respiratory tract smooth and supplying enough oxygen were also indispensable steps. Severe burns together with severe wounds in head, facial and neck areas were always accompanied with
different degrees of inhalation injuries. In this case, even without obvious dyspneic respiration, early tracheotomy should be applied to ensure adequate oxygen supply, thus conducing to successful resuscitation. Although the patients might not have obvious dyspneic respiration in the early stage, even asphyxia would occur 24~48 hours after plenty of transfusion. By that time cutting the trachea might be too late and cause negative influence for resuscitation treatment and even cause lung complications. As a result, tracheotomy should be carried out as soon as possible, especially for those patients who need to be transferred. Otherwise breath obstruction might occur and this might deprive the chance of salvage. Tracheotomy not only benefited for the early resuscitation treatment, it also ensured the following turnover treatment and the combination of medicine and blade treatment. Three patients received tracheotomy before debridement, which paved the way for the successful resuscitation and operation, and got rid of the trachea cannula 15 days after burns. None of them had complications.

Among 5 extensive burned cases, except one patient who received fluid replenishment according to crystalloid type formula, all other patients adopted the crystalloid and colloid type formula, which was recommended by the National Burns Conference in 1970. In the first 24 hours, 1.5ml colloid and electrolyte solution should be given per 1 percent of 2nd or 3rd burned area per kilogram of body weight. Children should be given 1.8ml while infants should be given 2ml. The water volume in this solution was 2000ml. (60~80ml per kilogram body weight for children while 100ml for infants). The proportion of colloid and crystalloid should refer to the patients’ conditions. Normally it was 0.5:1.0 (1:2), in severe patients it was 0.75:0.75 (1:1).

In the second 24 hours, the electrolyte and colloid volume decreased to half of the volume in the first 24 hours. The water volume was still 2000ml. The colloid included plasma, whole blood and dextran. The proportion of the electrolyte solution (1.25%SB or 1/6 gram molecular weight sodium lactate) was usually 2:1 and this could change to 1:1 in case of severe haemoglobinuria or acid poisoning. Water content could choose 5%~10% glucose solution.

Transfusion speed: In the first 8 hours of the first 24 hours, half the total daily amount could be transfused. The other half could be transfused in the remaining 16 hours. In the first 4 hours after burns, 2/3 total amount which should be transfused in the first 8 hours should be injected. The remaining 1/3 amount could be transfused in the next 4 hours.

Double zero formula: This formula could be applied in wartime or in case of treating group of patients since its calculation was convenient. The total input volume in the first 24 hours (ml) = burns area (2nd and 3rd degree) × 100. The water volume was 2000ml. The remaining was 1/3 colloid solution and 2/3 electrolyte solution. The colloid and electrolyte solution in the second 24 hours decreased to half the actual input of the first 24 hours. The water volume was still 2000ml.

In fact, the crystalloid volume far exceeded the amount in the calculation. The actual proportion of crystalloid and colloid solution was 2.4:1~3.9:1 (Table 2). Thus the
input of colloid decreased and the total input in the first 24 hours was below the
calculation from the formula\(^1\). The result was high urine output thus relieved tissue
edema and avoided the disadvantages of pure crystalloid solution input. This was a
feasible experience for treatments of group of burns or burns in wartime.

Maintaining the heart function of extensive burned patients was an important factor
influencing early resuscitation. Recently more and more scholars had noticed the
changes of hemodynamics in the early stage of burns. These changes included
increased heart-beat, decreased heart-output and increased vascular resistance.
Decreased heart-output, which could decreased to 30~50% the normal volume,
predceded the occurrence of decreased blood and plasma volume. It was considered
that the existence of cardiac muscle inhibition factor in the blood circulation caused
heart-output to decrease. As a result, maintaining the heart functions was very
important in early resuscitation period. Three patients had the heart beat rate of 140
times per min after transfusion of more than 1000ml per hour for 8 hours. Another 5
patients had the heart rate of 150~160 times per min after the same transfusion.
Their blood pressures were relatively low with the contractive pressure 9-12kpa.
Electrocardiogram showed the result was sinus tachycardia. Since the input amount
was adequate, the incident of rapid heart rate and low blood pressure indicated that
the heart function was poor and the heart-output had decreased. Later dopamine
and cedilannidum were applied and the heart rate decreased to below 120 times per
min.

3) The prompt treatment of deep wounds was an important step in a successful
salvage. The treatment of extensive 3\(^{rd}\) degree wounds was crucial. It was difficult
to carry out early 3\(^{rd}\) degree wounds treatment since human resources were limited.
As a result, it was very important to apply the combination of medicine and blade in
succession according to the patients' conditions. Among the 12 patients, nine of
them should be carried out the combination of medicine and blade method while one
patient should be carried out in different times. On the following day after burns,
moderate and light burned patients received MEBT while deep burned patients
received the combination of medicine and blade treatment. In extensive burned
patients, treatments were carried out 5 days later after the burns when the patients
had went through the shock period. The result of combination of medicine and blade
treatment was satisfactory and the treatment would not be delayed. Nine patients
received this treatment and MEBT was finished several days later. Besides, in order
to decrease the frequency and shorten the time of the combination of medicine and
blade treatment, MEBT was applied first in moderate burned patients. Not only the
necrotic tissues were discharged, the occurrence of wounds aggravation was also
avoided. Early functional treatment could also be applied and this would solve the
relationships between the application of medicine and blade. In case of limited
human resources, this method could be applied clinically thus avoided severe
infection and wound sepsis incurred by the existence of necrotic tissues.

4) The proper application of MEBT and antibiotics as well as strengthening
disinfection and isolation systems were important measures of a successful salvage.
Burns infection was still the main complication in burns treatment. The following
principles should be mastered firmly: ① pass shock stage ② avoid infection ③
treat respiratory tract burns ④ early tracheotomy ⑤ avoid acute anoxia ⑥ avoid
sputum block ⑦ early oxygen supply ⑧ early sedation ⑨ early correcting of
congestive heart failure ⑩ Prompt application of MEBT ⑪ Prompt wounds treatment.
Otherwise, it would be an important reason causing death[2]. At the same time of
wounds treatment, the proper application of MEBT and antibiotics were an important
step in applying MEBO in the wounds. In case of group of burns, the causes of
injury and accident locus were the same, thus MEBT could be applied together with
antibiotics treatment. MEBO could relieve the pain in the wounds. Try to make
unionization and avoid complication, which could favor the change of conditions.
During the period of wounds inspection, the problem of inadequate medical
equipments could be solved. This group of 12 patients all received penicillin
treatments in the first two days. During the fluid reabsorbing stage and after the
combination of medicine and blade treatment, the choice of antibiotics should change.
In moderate and light burned patients, broad-spectrum antibiotics should be applied.
In extensive burned patients, polymyxin and the first and second generation
cephalosporin should be applied. The application of antibiotics could stop when the
conditions stabilized. Strengthening disinfection and isolation systems were also
important. In treatment of group of burns, many extraneous doctors and nurses
joined our salvage. Since they were not familiar with MEBT and the related
regulations in the hospital ward, proper training to them were necessary. This was a
practical problem in our clinical salvage. Each burns specialist was assigned to lead
a medical group and after some time, all the doctors and nurses became familiar with
the disinfection and isolation system and our working procedure. Pseudomonas
aeruginosa infection and even cross contamination did not occur in all these 12
patients in the first 3 weeks. Five patients received blood culture tests for 126 times
and except positive result for one time, all other tests showed negative results.
Three patients who received tracheotomy did not have lung complications and the
wounds almost healed in one month and a half and they were all cured after two
months.

References

[1] Wang G. et all., The Systemic Treatments of Burns by Chinese and Western
[2] Han Q. et all., 451 Cases of Pediatric Burn Treated with MEBO, The Chinese