Design of assessment tables for enteral nutrition care giving during nursing research in children with severe burns.

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Abstract

Objective: To investigate the effect of evaluation tables used in nursing work for control of enteral nutrition in children with severe burns.

Methods: The enteral nutrition nursing assessment tables were designed for children who suffered from severe burns. The tables included a cover page and a daily assessment record consisting of two parts. Daily assessment record content covered the date of injury, residual burned area, feeding methods, placement of tube, enteral nutrition content, intake and output, adverse reactions, previous/current nutritional evaluation indicators, etc. During the period between November 2009 and May 2015, fifty infants with burning injuries were monitored with the use of assessment tables for enteral nutrition (experimental group), while other forty-seven infants with burning injuries were monitored and treated without the use of tables (control group). The levels of total protein, pre albumin, hemoglobin, blood urea nitrogen and body mass index in enteral nutrition treatment were compared between the two groups through consulting the records of hospitalized patients and the nursing records of critically ill patients. The incidence rates of abdominal distention, diarrhea, vomiting and tube obstruction adverse reactions during the period of enteral nutrition in the two groups were analysed. The numbers of wound healing days in two groups were compared.

Results: Five nutrition indicators were significantly different (P<0.01) between two groups. The frequency of abdominal distension, diarrhea, vomiting and occlusion in the experimental group was lower than in the experimental group. The duration of wound healing in the two groups showed significant difference as well (P<0.01).

Conclusion: The use of enteral nutrition nursing evaluation tables during the treatment of children with burns can ensure the efficiency of enteral nutrition, reduce the incidence rate of gastrointestinal complications and tube obstructions, and promote the wounds healing.

Keywords: Burn, Enteral nutrition, Nursing evaluation table.

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Introduction

Severe burns are connected to important health problems, which are worthy of global attention [1]. Children below the age of 10 with a total burn area of over 20% are considered to have a severe burn injury [2]. Infants and children, especially those who are critically ill, are predisposed to disease-related malnutrition which can be much more harmful in comparison with similar situations in adults. An early access to nutritional support for critically ill children is needed to improve their prognosis [3,4]. Providing an appropriate enteral nutrition to burn patient within 12 h after injury should be considered a priority and is recommended by the Nutritional Support Guidelines published by ESPEN, The European Society for Clinical Nutrition and Metabolism [1].

Children, due to their imperfect digestive system, not fully developed central nervous system and unstable gastrointestinal regulation, are prone to suffer from gastrointestinal disorders after severe burn injuries [5]. In addition, inappropriate feeding methods can cause displacement of intestinal bacteria and introduction of toxins, thus increasing the risk of infection [6]. Therefore, the enteral nutrition for children with severe burn injuries has been a thorny problem faced by nurses. The more comprehensively and objectively the nurses grasp the situations of the patient, the more accurately and specifically they can perform their tasks [7]. The comprehensive and accurate nursing assessment is the basis of the entire nursing process [8].

A multidisciplinary approach to burn management is essential for optimal functional and cosmetic outcome. Serious long-term physical and psychological morbidity may be associated
with a burn injury. All members of the burn management team interact throughout the recovery period from admission to scar maturation and beyond to minimise the impact of the trauma long-term.

The dietician, in consultation with the burn surgeon and other team members, contributes to patient care by providing early nutritional assessment, clinical intervention during all phases of management, and on-going educative support to the patient, family and staff. Dieticians working outside a specialist burn unit are encouraged to liaise closely with their colleagues within the specialist units for advice and support in burn patient nutritional management.

Despite the importance of early initiation of EN, it is reported that energy requirements of critically ill patients are far from being reached, mainly due to delayed initiation of EN [9,10]. Underfeeding is associated with detrimental clinical outcomes including prolonged length of stay, infection, financial cost, impaired wound healing, and increased morbidity and mortality [9,10].

Factors associated inadequate enteral feeding include delayed initiation of EN, slow advancement of infusion rate, gastrointestinal dysfunction, under prescription, incomplete delivery of prescribed nutrition, and frequent interruption of EN [9-11]. Some of these factors can be improved with enteral feeding protocols, therefore preventing underfeeding of critically ill patients. There was evidence that implementation of enteral feeding protocol was associated with more EN intake alone, and early initiation of EN [9-11].

Although enteral feeding is recommended by international guidelines as the first choice of nutritional therapy for critically ill patients [12-14], studies have shown that the energy requirement achieved by EN is far from being reached. In mechanically ventilated patients, about 66% of patients achieved 80% of caloric requirements within 3 d [15].

The figure varies depending on different settings and study populations. Also, there is large body of evidence showing that underfeeding is associated with significantly increase risk of death. Although some investigators propose the implementation of permissive underfeeding in critically ill patients, the guideline still recommend early initiation of EN feeding and the goal of 25-30 kcal/kg/d should be achieved [16].

In order to ensure the implementation of effective enteral nutrition care program for children with severe burn injuries, our Department, since September 2012, has developed and used the enteral nutrition care assessment tables to design the enteral nutrition for children with severe burn injuries. We achieved positive results, and our findings are discussed below.

Aim and Objective
To investigate the effect of evaluation tables used in nursing work for control of enteral nutrition in children with severe burns.

Material and Methodology

Design and application of enteral nutrition nursing assessment table to child patients with burn injury

Design of enteral nutrition nursing evaluation table for child patients with burn injury: The nursing assessment table of enteral nutrition in children with burn injuries includes two parts: the cover page and the daily assessment records.

The cover page contained three major sections: 1) a patient's basic information, including bed number, name, age, hospitalization number, gender, admission date, body weight, height, and admission diagnosis; 2) a patient's medical history: feeding methods history, diet types, diet characteristics, food allergy history, history of digestive disorders and defecation; and 3) indicators of current nutritional assessment: indicators of the relevant nutritional assessment of a patient before implementation of enteral nutrition, body mass index, blood sugar, total cholesterol, total protein, albumin, prealbumin, triglyceride, hemoglobin, red blood cell, white blood cell, platelet, lymphocyte count, creatinine, urea nitrogen, alanine aminotransferase, aspartate aminotransferase, cholinesterase, serum potassium, serum sodium, serum calcium, serum chloride (Table 1).

Daily nursing assessment records included record date, days from child patient injury, the remaining burned area, feeding methods, catheter depth, catheter patency, infusion rate, bed elevation, enteral nutrition contents and intake from previous day, a target amount of enteral nutrition for current day, enteral nutrition contents and intake, intake and discharge in 24 h, adverse reactions of child patient, defecation, stomach residual volume, abdominal circumference and bowel sounds, the latest nutritional evaluation indicators of patients after enteral nutritional treatment (the indicators are the same as the current stage nutritional evaluation indicators) (Table 2).

The use of enteral nutrition nursing assessment table for severe burn injury children: The nurses were asked to use the nutrition assessment tables for child patients with severe burn injuries who were allocated to experimental group immediately after the admission to the hospital. The nurses were requested to fill the basic information, the history of medical conditions, and the current nutritional evaluation indicators on the “cover page”, in order to assess the enteral nutrition-related parameters of the patients. Once the administration of the enteral nutrition started, the respondents were requested to fill out "daily assessment content" every day. The nutritional assessment indicators such as body mass index, arm muscle circumference, calf circumference in the first 2 w were measured every 3 d, and afterward they were evaluated once a week. Blood glucose, hemoglobin, red blood cells, white blood cells, platelets, lymphocyte count, serum potassium, serum sodium, serum calcium, serum chlorine were evaluated daily in the first 2 w and at least once in every 3 d afterward. Total cholesterol, total protein, albumin, prealbumin, triglyceride, creatinine, blood urea nitrogen, alanine aminotransferase, aspartate aminotransferase,
cholinesterase were assessed at least once every 5 d. The assessments would be stopped only after the enteral nutrition treatment was finished. The circle "○" in the table indicates the selections, and a nurse should check "√" in the corresponding circle according to a patient's condition.

Clinical application

General Information: There were 97 cases of severe burn injury patients who received the enteral nutrition during the period between November 2009 and May 2015 in our Department, including 55 males and 42 females aged between 1 y and 5 y old. The average age of patients was 3.3 ± 1.8 y. The total burned body area was 20%~60% TBSA, the average was 25.4% ± 8.5%. The burn severity was II degree to III degree. The causes of injury included 67 cases of scald and 30 cases of burn. The exclusion criteria were as follows: 1. important organ disorders such as cardio- pulmonary diseases; 2. vertebral fractures, abdominal organ ruptures and other serious combination injuries; 3. congenital intestinal diseases; 4. death of patient during hospitalization. In September 2012, our Department has developed and began to apply the enteral nutrition nursing assessment tables to child patients with burn injuries. This was approved by the Medical Ethics Committee of the First Hospital of Jilin University. We set 47 cases as a control group who were treated without the enteral nutrition nursing assessment tables during the period between November 2009 and August 2012, and we set further 50 cases as an experimental group/observation group that was treated using the enteral nutrition nursing assessment tables during the period between September 2012 and May 2015. There were non-significant difference in the age, gender, burn area, and burn causes between two groups (P>0.05), as shown in Table 3.

Evaluation indicators and methods: Evaluation indicators of nutritional status: We checked the hospital medical records of patients from both groups to receive the values and means for blood total protein, prealbumin, hemoglobin, urea nitrogen and body mass index during the implementation of enteral nutrition treatment (Table 4).

Evaluation of adverse reactions: We reviewed the nursing records of two groups of children patients and statistically analysed the number of incidence of abdominal distension, diarrhea, vomiting, and catheter obstructions in two groups during the implementation of enteral nutrition treatment (Table 5).

Results

All the data were analysed using SPSS20.0 software. The differences in measurement data were analysed by t test. The differences in counting data were analysed by χ² test. P values smaller than 0.05 were considered statistically significant; P values smaller than 0.01 were considered statistically significant.

The age and gender ratio between the control and observational group showed non- significant p value of 0.87 and 0.33 respectively. The burn area between both the groups was also at non-significant p value range.

The values of albumin, prealbumin, hemoglobin, urea nitrogen and body mass index in control group were 31.73 ± 1.73, 137.46 ± 37.46, 120.44 ± 20.44, 2.14 ± 1.31, 13.1 ± 2.4, 2.81 ± 0.96 respectively.

The values of albumin, prealbumin, hemoglobin, urea nitrogen and body mass index in experimental group were 38.51 ± 8.51, 153.27 ± 53.27, 149.72 ± 49.72, 3.58 ± 1.23, 15.6 ± 2.2, 3.24 ± 0.72 respectively.

When the comparison had been done between the control group and experimental group, the results showed significantly difference between the two groups (P<0.05) in context to values of albumin, prealbumin, hemoglobin, urea nitrogen and body mass, and the difference was significant (P<0.01). The frequency of abdominal distension, diarrhea, vomiting and obstruction in the experimental group was lower than in the control group, and there was significant difference between the two groups (P<0.01).

The number of healing days in the control group was 33 ± 6.93 in comparison to experimental group which revealed to be 28 ± 7.82. The results revealed that the wound healing time was significantly different between two groups with significant p value of less than 0.01 (Table 6).

Table 1. Enteral nutritional nursing assessment table for child patient with burn injury.

<table>
<thead>
<tr>
<th>Bed No.</th>
<th>Name</th>
<th>Age</th>
<th>Hospitalization no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Admission date</td>
<td>Body weight (kg)</td>
<td>Height (cm)</td>
</tr>
</tbody>
</table>

Admission diagnosis

| History conditions |

Table 1. Enteral nutritional nursing assessment table for child patient with burn injury.

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Feeding methods
- Breast feeding
- Formula feeding
- Mix feeding
- Regular diet

Past diet types
- Rice
- Noodle
- Congee
- Others

Past diet characteristics
- Full Liquid Diet
- Semi-liquid Diet
- Regular Diet
- Others

Food allergy history

Medical history of digestion system

Past defecation
- Consistency: hard ○ soft ○ pulpy ○ mushy ○ entirely liquid ○
- Color: yellow ○ black ○ dark green ○ none ○
- Amount: excess ○ normal ○ inadequate ○

Current stage nutritional assessment indicators

Table 2. Daily assessment of enteral nutrition for child patient with burn injury.
Design of assessment tables for enteral nutrition care giving during nursing research in children with severe burns

<table>
<thead>
<tr>
<th>Latest nutritional assessment indicators</th>
<th>Body Mass Index (BMI)</th>
<th>Mid-Upper Arm Muscle Circumference (MAMC)</th>
<th>Calf circumference (CC)</th>
<th>Blood Glucose (GLu)</th>
<th>Total Cholesterol (TC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Protein (TP)</td>
<td>Albumin (ALB)</td>
<td>Prealbumin (PA)</td>
<td>Transferrin (TRF)</td>
<td>Triglyceride (TG)</td>
<td></td>
</tr>
<tr>
<td>Blood Urea Nitrogen (BUN)</td>
<td>Creatinine (Cre)</td>
<td>Aspartate Aminotransferase (AST)</td>
<td>Cholinesterase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum potassium (K⁺)</td>
<td>Serum sodium (Na⁺)</td>
<td>Serum calcium (Ca²⁺)</td>
<td>Serum chlorine (Cl⁻)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3. General patient characteristics.

<table>
<thead>
<tr>
<th>Project</th>
<th>Classification</th>
<th>Control group</th>
<th>Experimental group</th>
<th>χ² value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=47</td>
<td>%</td>
<td>n=50</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>1 y old</td>
<td>18</td>
<td>20</td>
<td>0.194</td>
<td>0.8716</td>
</tr>
<tr>
<td></td>
<td>2 y old</td>
<td>15</td>
<td>17</td>
<td>0.9289</td>
<td>0.3382</td>
</tr>
<tr>
<td></td>
<td>3 y old</td>
<td>8</td>
<td>7</td>
<td>0.003</td>
<td>0.9969</td>
</tr>
<tr>
<td></td>
<td>4-5 y old</td>
<td>6</td>
<td>6</td>
<td>1.2427</td>
<td>0.2819</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>29</td>
<td>26</td>
<td>0.9289</td>
<td>0.3382</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>18</td>
<td>24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burn area</td>
<td>20~40%</td>
<td>27</td>
<td>29</td>
<td>0.003</td>
<td>0.9969</td>
</tr>
<tr>
<td></td>
<td>40~60%</td>
<td>20</td>
<td>21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Causes</td>
<td>Burn</td>
<td>12</td>
<td>18</td>
<td>1.2427</td>
<td>0.2819</td>
</tr>
<tr>
<td></td>
<td>Scald</td>
<td>35</td>
<td>32</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Comparison of two groups of children by nutritional evaluation indicators (x̄ ± s).

<table>
<thead>
<tr>
<th>Case number</th>
<th>Albumin (g/L)</th>
<th>Prealbumin (mg/L)</th>
<th>Hemoglobin (g/L)</th>
<th>Urea nitrogen (mmol/L)</th>
<th>Body mass index (kg/m²)</th>
<th>Transferrin (g/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>47</td>
<td>31.73 ± 1.73</td>
<td>137.46 ± 37.46</td>
<td>120.44 ± 20.44</td>
<td>13.1 ± 2.4</td>
<td>2.81 ± 0.96</td>
</tr>
<tr>
<td>Experimental group</td>
<td>50</td>
<td>38.51 ± 8.51</td>
<td>153.27 ± 53.27</td>
<td>149.72 ± 49.72</td>
<td>15.6 ± 2.2</td>
<td>3.24 ± 0.72</td>
</tr>
<tr>
<td>t</td>
<td>5.47</td>
<td>3.37</td>
<td>6.35</td>
<td>5.58</td>
<td>5.35</td>
<td>2.99</td>
</tr>
<tr>
<td>P</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

Table 5. Comparison of patient outcomes after implementation of enteral nutrition (number of cases and incidence, (%)).

<table>
<thead>
<tr>
<th>Cases number</th>
<th>Abdominal distension</th>
<th>Diarrhea</th>
<th>Vomiting</th>
<th>Blockage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group</td>
<td>47</td>
<td>11 (23.4)</td>
<td>13 (27.66)</td>
<td>8 (17.02)</td>
</tr>
<tr>
<td>Experiment Group</td>
<td>50</td>
<td>3 (6)</td>
<td>2 (8)</td>
<td>2 (4)</td>
</tr>
<tr>
<td>χ²</td>
<td>5.94</td>
<td>10.374</td>
<td>4.443</td>
<td>7.705</td>
</tr>
<tr>
<td>P</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

Table 6. Wound healing time in two groups (x̄ ± s).

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of cases</th>
<th>Wound healing (d)</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group</td>
<td>47</td>
<td>33 ± 6.93</td>
<td>3.32</td>
<td>&lt;0.01</td>
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A large body of literature and experimental data show that enteral nutrition in young children with burns can reduce hospital stay and mortality [25,26]. Therefore, as long as there is a severe gastrointestinal dysfunction in children with severe burns, enteral nutrition should be considered as the first option [27]. But because of severe gastrointestinal motility disorder patients often [28], combined with immature digestive system in children, intestinal peristalsis and secretory function is relatively poor, gastrointestinal regulation is low, especially in children with post-burn gastrointestinal ischemia Hypoxia resulting in impaired gastrointestinal mucosal barrier, prone to abdominal distension, diarrhea, vomiting, gastrointestinal bleeding and other symptoms [29,30], destruction of intestinal mucosal barrier, causing flora. Due to this reason, the incorrect choice of food during the implementation of enteral nutrition or improper feeding methods may lead to gastrointestinal discomfort, or even increase the risk of malnutrition due to insufficient energy [23,24].

Child's weight and height are the basic parameters for pediatric nutrition screening [35], while the patient's burn area and the number of days after injury are important parts in calculating the nutrients intake. Therefore, the design of the patient assessment table included weight, height, admission diagnosis, the number of days after injury, and the remaining burn area in order to easily assess the energy needs of the child. The Chinese guidelines for pediatric enteral parenteral nutrition support and clinical application clearly state that the risk of each child should be evaluated based on prior medical history, diet and other aspects of the assessment, and the choice of nutritional preparations should be based on the child's intestinal function, current eating situation, comprehensive history of food allergies and other factors [36]. Therefore, this assessment form contains the assessment of the prior history in the design of the feeding patterns for the children and includes current diet, food allergy, digestive system history and defecation assessment to facilitate the implementation of enteral nutrition. The habit of children and the digestive system have a preliminary understanding and understanding of the characteristics of children in accordance with the characteristics of personalized selection of appropriate enteral nutrition food, preparation and take appropriate feeding methods. In addition, the assessment contains daily monitoring of parameters related to the gastrointestinal tract, including adverse reactions, defecation, stomach residual volume, abdominal circumference and bowel sounds assessment. Before and after the content of each other, to facilitate the nurses before and after feeding the gastrointestinal tract and bowel movements for an objective comparison of the situation, as well as early detection of intolerance in the feeding process of symptoms, timely adjustment of feeding programs. The management program and formal monitoring can minimize the incidence of enteral nutrition complications [37]. The incidence of abdominal distention, diarrhea, and vomiting was significantly lower in the experimental group than in the control group, and the incidence of adverse reactions during feeding was significantly reduced. Tzm vzo ensure that the patient's caloric requirements were met, the nutritional intake was continuously monitored during the implementation period, with regular monitoring of body weight, blood glucose, triglycerides, albumin and other indicators [38,39]. Therefore, the table was designed for evaluation of nutritional indicators before and after the implementation of enteral nutrition, and

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required regular assessment of the nutritional indicators, their testing and recording, as well as recording the content of enteral nutrition, target volume and intake. The amount of records, to facilitate the dynamic understanding of medical staff in daily practice of infant enteral nutrition formulations and feeding volume, combined with nutritional evaluation indicators for more intuitive reference and contrast. The average levels of albumin, prealbumin, hemoglobin, urea nitrogen and body mass index were higher in the experimental groups compared to the control group, and the wound healing time in the experimental group was shorter than that in the control group. It can be seen that the use of this assessment table can ensure the effective implementation of nutrition. The effective nutritional support can reduce the body's high metabolic response, reduce infection and promote wound healing. In addition, daily assessment of transfer tube, catheter depth, infusion rate, and bed elevation by nurses can be more targeted for children to adopt the appropriate feeding, avoid the pipeline prolapse and blocking, and reduce the risk of aspiration.

Conclusion

Nutritional support for patients during the implementation should be frequently assessed and monitored to ensure the achievement of nutritional goals, early detection of complications, and timely adjustments of the nutritional support program [40,41]. This study clearly demonstrated that the use of the enteral nutrition care assessment tables in providing the nursing care for children with burns can reduce the incidence of adverse reactions during feeding and ensure the efficient implementation of nutritional program.

Acknowledgement

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