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

Wei-Wei Wu, Hong-Yan Li*, Shi-Feng Wu, Jia-Ao Yu, Dan Cheng, Duo Cai, Wu-Ming Zhang, Xiao-Chuan Xu

Department of Burn Surgery, the First Hospital of Jilin University, NO.71 Xinmin Street, Changchun City, Jilin Province, PR China

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]. 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 responded nurses 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).

Evaluation on wound healing time: We reviewed the hospitalization medical records of two groups of children patients and statistically analysed the wound healing time, i.e. the number of days between the injury and achieving more than 95% epithelialization of the wounds in two groups (Table 6).

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 χ^2 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.

Basic information			
Bed No.	Name	Age	Hospitalization no.
Gender	Admission date	Body weight (kg)	Height (cm)
Admission diagnosis			
History conditions			

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 ○			Frequency: /d
	Color: yellow ○ black ○ dark green ○ none ○			
	Amount: excess ○ normal ○ inadequate ○			
Current stage nutritional assessment indicators				
Body Mass Index (BMI)	Mid-Upper Arm Muscle Circumference (MAMC)	Calf Circumference (CC)	Blood Glucose (GLu)	Total Cholesterol (TC)
Total Protein(TP)	Albumin(ALB)	Prealbumin (PA)	Transferrin (TRF)	Triglyceride (TG)
Hemoglobin(HB)	Red Blood Cell (RBC)	White Blood Cell (WBC)	Platelet (PLT)	Lymphocyte Count (LTC)
Blood Urea Nitrogen (BUN)	Creatinine (Cre)	Alanine Aminotransferase (ALT)	Aspartate Aminotransferase (AST)	Cholinesterase
Serum potassium (K^+)	Serum sodium (Na^+)	Serum calcium (Ca^{2+})	Serum Chlorine (Cl^-)	
Others				

Table 2. *Daily assessment of enteral nutrition for child patient with burn injury.*

Daily assessment contents				
Date of record (yy-mm-dd)		Days from injury (d)		
Total Burned Body Surface Area (TBSA)		Feeding methods	Oral feeding ○ Nasogastric tube feeding ○	
			Nasointestinal tube feeding ○	
			Double-lumen gastrojejunostomy tubes ○	
Catheter depth (cm)		Catheter patency	Yes ○ No ○	
Infusion rate (ml/h)		Elevation bed 30-45°	Yes ○ No ○	
Enteral nutrition content and intake from previous day				
Target amount of enteral nutrition for current day				
Actual enteral nutrition content and intake for current day				
Total intake in 24 H			Total discharge in 24 H	
Adverse reactions	Nausea ○ Vomiting ○ Bloating ○ Diarrhea ○ Others ○			
Defecation	Consistency: hard ○ soft ○ pulpy ○ mushy ○ entirely liquid ○			Frequency: /d
	Color: yellow ○ black ○ dark green ○ none ○			
	Amount: excess ○ normal ○ inadequate ○			
Gastric remnant (ml)		Abdominal circumference (cm)	Bowel sounds (Time/min)	

Latest nutritional assessment indicators				
Body Mass Index (BMI)	Mid-Upper Arm Muscle Circumference (MAMC)	Calf circumference (CC)	Blood Glucose (GLu)	Total Cholesterol (TC)
Total Protein (TP)	Albumin (ALB)	Prealbumin (PA)	Transferrin (TRF)	Triglyceride (TG)
Hemoglobin (HB)	Red Blood Cell (RBC)	White Blood Cell (WBC)	Platelet (PLT)	Lymphocyte count (LTC)
Blood Urea Nitrogen (BUN)	Creatinine (Cre)	Alanine Aminotransferase (ALT)	Aspartate Aminotransferase (AST)	Cholinesterase
Serum potassium (K^+)	Serum sodium (Na^+)	Serum calcium (Ca^{2+})	Serum chlorine (Cl^-)	
Others				

Table 3. *General patient characteristics.*

Project	Classification	Control group		Experimental group		χ2 value	P value
		n=47	%	n=50	%		
Age	1 y old	18	38.29	20	40	0.194	0.8716
	2 y old	15	31.91	17	34		
	3 y old	8	17.02	7	14		
	4-5 y old	6	12.77	6	12		
Gender	Male	29	61.7	26	52	0.9289	0.3382
	Female	18	38.29	24	48		
Burn area	20~40%	27	57.44	29	58	0.003	0.9969
	40~60%	20	42.55	21	42		
Causes	Burn	12	25.53	18	36	1.2427	0.2819
	Scald	35	74.47	32	64		

Table 4. *Comparison of two groups of children by nutritional evaluation indicators ($\bar{x} \pm s$).*

	Case number	Albumin (g/L)	Prealbumin (mg/L)	Hemoglobin (g/L)	Urea nitrogen (mmol/L)	Body mass index (kg/m^2)	Transferrin (g/L)
Control	47	31.73 ± 1.73	137.46 ± 37.46	120.44 ± 20.44	2.14 ± 1.31	13.1 ± 2.4	2.81 ± 0.96
Experimental group	50	38.51 ± 8.51	153.27 ± 53.27	149.72 ± 49.72	3.58 ± 1.23	15.6 ± 2.2	3.24 ± 0.72
t		5.47	3.37	6.35	5.58	5.35	2.99
P		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

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

	Cases number	Abdominal distension	Diarrhea	Vomiting	Blockage
Control group	47	11 (23.4)	13 (27.66)	8 (17.02)	9 (19.15)
Experiment Group	50	3 (6)	2 (8)	2 (4)	1 (2)
χ^2		5.942	10.374	4.443	7.705
P		<0.01	<0.01	<0.01	<0.01

Table 6. *Wound healing time in two groups ($\bar{x} \pm s$).*

Group	Number of cases	Wound healing (d)	t	P
Control group	47	33 ± 6.93	3.32	<0.01

Experimental group	50	28 ± 7.82

Discussion

Burns can lead to metabolic abnormalities, malnutrition, increased risk of infection and changes in cell function. Rapid removal of damaged burn tissue, combined with early nutritional support, can significantly weaken the process of this automatic destruction. Due to particular age-related characteristics, children's need for nutritional support is significantly higher compared to other populations. In the disease or traumatic stress state, they can rapidly develop protein-calorie malnutrition [6] leading to muscle atrophy, organ dysfunction, wound healing delay, and impaired immune function [17]. Early enteral nutrition is beneficial in reducing the metabolic response-related hormone levels [18], increasing the immune globulin [19], reducing the incidence of gastroparesis [20] and stress ulcer, increasing mesenteric artery blood flow [21], maintaining the intestinal mucosal barrier [22] and reducing the risk of malnutrition due to insufficient energy [23,24].

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 damage to the gastrointestinal tract. Therefore, the effective implementation of enteral nutrition is essential. Nurses tasked with implementation of enteral nutrition can take the initiative to find and solve problems and use more appropriate measures [31,32] to avoid the occurrence of adverse events through effective nursing evaluation, thus helping to enhance the efficacy of enteral nutrition.

Taking into account typical characteristics of children with severe burns, the author designed the content of the daily assessment around the relevant issues and indicators that have to be monitored during the process of enteral nutrition.

The protocol used in Doig's study repeatedly assessed whether the energy requirement reached 80% of total goal. [33] The goal was not explicitly described and might be set differently by participating centers. Furthermore, Goig's study did not assess risk of malnutrition, and PN was started if EN is contraindicated. Because the use of PN may have different consequences depending on baseline nutritional status, our study uses NRS and NUTRIC to triage patients who may benefit from PN. Heyland et al. conducted an observational study comparing effectiveness of enteral feeding protocol [34]. Participating centers were divided by the presence or absence of feeding protocol. No implementation was performed. Details of feeding protocols were not reported and might vary substantially across participating centers. The same study group proposed a feeding protocol called "The Enhanced Protein-Energy Provision *via* the Enteral Route in Critically Ill Patients" (PEP μP) protocol. The advantage of PEP μP protocol was that it allows nurses to adjust the feeding rate to compensate for procedural interruption.

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

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.

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*Correspondence to

Hong-Yan Li

Department of Burn Surgery

The First Hospital of Jilin University

PR China