Apoyo nutricional enteral postoperatorio y cuidados de enfermería para niños con cardiopatías congénitas

Postoperative Enteral Nutrition Support and Nursing Care for Children with Congenital Heart Disease

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Resumen
La cardiopatía congénita a menudo es complicada o crítica debido a la afección. A menudo hay diferentes grados de desnutrición antes de la cirugía, y la corrección es más difícil. Este artículo desarrolla un programa de atención en grupo para el apoyo nutricional enteral postoperatorio en niños con cardiopatía congénita compleja (CHD). Los niños con CHD compleja que se sometieron a cirugía se dividieron aleatoriamente en un grupo de observación y un grupo de control. Ambos grupos recibieron apoyo nutricional enteral postoperatorio. En base a los resultados basados en la evidencia, se desarrollaron las medidas de manejo del grupo e implementado, y se compararon los efectos de soporte nutricional de los dos grupos. Los resultados mostraron que la duración de la alimentación nasal, el tiempo de cateterización del ventilador y la estancia hospitalaria postoperatoria fueron significativamente más cortos en el grupo de observación que en el grupo control. La incidencia de intolerancia alimentaria fue significativamente menor que la del grupo control. Los niveles séricos totales de proteína, albúmina y prealbúmina en el grupo fueron mayores que los del grupo control (P <0.05). La aplicación de la terapia de agrupamiento puede mejorar apoyo nutricional enteral postoperatorio en niños con CHD de bajo peso corporal.

Palabras clave: cardiopatía congénita; nutrición enteral; terapia grupal; atención pediátrica

Abstract
Congenital heart disease is often complicated or critical due to the condition. There are often different degrees of malnutrition before surgery, and correction is more difficult. This article builds a clustered care program for postoperative enteral nutrition support in children with complex congenital heart disease (CHD). Children with complex CHD who underwent surgery were randomly divided into observation group and control group. Both groups received postoperative enteral nutrition support. The observation group established an enteral nutrition group. Based on the evidence-based results, the cluster management measures were developed and implemented, and the nutritional support effects of the two groups were compared. The results showed that the duration of nasal feeding, ventilator catheterization time, and postoperative hospital stay were significantly shorter in the observation group than in the control group. The daily heat supply was significantly higher than that in the control group. The incidence of feeding intolerance was significantly lower than that of the control group. The serum total protein, albumin and prealbumin levels in the group were higher than those in the control group (P<0.05). Application of clustering therapy can improve postoperative enteral nutrition support in children with low body weight CHD.

Key words: Congenital heart disease; Enteral nutrition; Cluster therapy; Pediatric care

1. Introduction
Vascular and cardiac functional and structural abnormalities associated with birth, such as ventricular septal defect, atrial septal defect, etc., can be defined as congenital heart disease[1]. The main clinical symptoms of the disease are dizziness, fatigue, shortness of breath, palpitations, etc., which have a serious impact on their development and health. Congenital heart disease (congenital heart disease) is complicated or critical due to various conditions. There are often different degrees of malnutrition before surgery. Correction is more difficult. Although postoperative cardiac hemodynamics tends to be normal, surgical trauma, fever, and deficiency Oxygen, infection, etc[2-3]. can increase the metabolism of children, postoperative rehabilitation of protein,
sugar, fat, vitamins also increased, and some postoperative children with ventilator affecting eating, gastrointestinal dysfunction caused by insufficient nutrient intake, etc[4]. Will affect the recovery of children. Therefore, early postoperative enteral nutrition support is particularly important.

In recent years, enteral nutrition has begun to receive attention from heart centers around the world, and enteral nutrition (EN) has been started through the nasogastric tube within 48 hours after surgery[5]. However, related studies have shown that more than half of children with congenital heart disease (congenital heart disease) receiving early enteral nutrition support are still suffering from feeding intolerance (FI) and malnutrition. One of the important reasons for prolonged hospitalization and increased mortality. Nurses play a key role in the nutritional management of children[6-7]. Reasonable assessment and preventive measures are of great significance in improving the adverse clinical outcomes of children and improving the quality of life of children[8]. However, due to unstable vital signs, insufficient intrauterine nutritional reserve, and immature gastrointestinal development, there are still more children with symptoms of feeding intolerance after receiving enteral nutrition support, which may aggravate the burden on the heart and affect the surgical outcome[9-10]. Clustered care can be combined with a series of evidence-based care programs for postoperative enteral nutrition support in children with low-weight CHD, which helps to improve efficacy, but still needs clinical research. This study included 118 patients with CHD who underwent a prospective randomized controlled trial focusing on the intervention effect of clustered care model on postoperative enteral nutrition support in children with low-weight CHD. The results are reported below.

2. Materials and methods

2.1 General Information

A total of 118 children with CHD who underwent surgery in our hospital from June 2017 to October 2018 were enrolled in this study. A prospective randomized controlled trial was conducted. This study has been approved by the Ethics Committee of our hospital. The children were divided into observation group and control group by random number table method.

Observation group: 23 males and 36 females; age 5-12 (7.71±0.74) months; birth weight 1278~2482 (2174.58±182.75) g; 14 cases of atrial septal defect, 21 cases of ventricular septal defect, pulmonary stenosis 13. For example, there were 11 cases of patent ductus arteriosus.

Control group: 25 males and 34 females; age 5-12 (7.95±0.68) months; birth weight 1318~2417 (2107.68±188.74) g; 12 cases of atrial septal defect, 22 cases of ventricular septal defect, pulmonary stenosis 12. For example, 13 cases of patent ductus arteriosus. There was no significant difference in the general data between the two groups (P>0.05), which was comparable.

Inclusion criteria: age ≤ 12 years old; CHD alone; spontaneous treatment, family members signed informed consent, and admitted to the neonatal intensive care unit of our hospital; positive isotropic drug score [dopamine (×1) + dopaque Butylamine (×1) + amrinone (×1) + milrinone (×10) + adrenaline (×100)] <20 points; postoperative enteral nutrition support procedure was initiated with reference to doctor's advice.

Exclusion criteria: history of gastrointestinal disease or children with chylothorax; children with multiple intracardiac malformations and extracardiac malformations; peritoneal dialysis treatment; children requiring reoperation; those who wished to withdraw from the ventilator within 24 hours after surgery.

Shedding criteria: postoperative death; reoperation; family members asked to withdraw.

2.2 Method

2.2.1 Intervention method

All patients were admitted to neonatal intensive care unit after operation, and actively carried out enteral nutrition support according to doctor's instructions. The nutrient solution was prepared by Nestle Health Science Chengershu formula powder, with 1 mL calorie of 3.34 kcal. Specific support programs and nursing measures are as follows.

2.2.1.1 Control group

According to the recovery of gastrointestinal function, feeding began after the start of intestinal peristalsis, and the nasogastric tube was used for feeding. The intermittent gastric tube was mainly instilled, and 50~100 mL of clear rice soup was given for the first time. If there was no abnormality, the nasal feeding nutrient solution was 10 mL/kg every 3 hours. If the child has feeding intolerance, the feeding is suspended. Continuous an intolerance, active anal canal exhaust, follow the doctor's advice to reduce the feeding amount, reduce the feeding concentration or apply morphine, simethicone and so on. The child was suspended during the evacuation of the ventilator. After the tracheal intubation was removed for 6 hours, the patient was still unable to eat by mouth. He continued to feed the nose and was able to tolerate oral feeding. Feasibility judgment by oral feeding: 50~100mL of warm boiled water, if there is no cough, then 50~100mL of clear rice soup after 1~2h, if there is no retention in the stomach, then formulation milk 50~100mL after 3~4h, no Abnormalities are completely adjusted for oral feeding.
2.2.1.2 Observation Group

Ten nurses in the department set up an enteral nutrition support group to formulate and strictly implement the cluster management measures to conduct nursing intervention for the children in the observation group. Specific improvement measures: 1) Carry out incremental incremental nutritional support, firstly give 50~100mL of clear rice soup, first use 1mL/(kg· h) intestine application of nutrient solution, and continue to observe the tolerance of children for 3h. After that, pause for 1h to observe the occurrence of feeding intolerance. If there is no abnormality, increase the application dose by 1mL/(kg· h) every 4h, and finally reach the maximum tolerance of body fluid [not more than 6mL/(kg· h)], such as In the case of feeding intolerance, the previous dose is halved and continued to be fed at this dose. Until the child has not received feeding intolerance after withdrawing from the ventilator, the feeding is not suspended. 2) promote abdominal motility by abdominal massage. Abdominal massage should be performed at least once every 4 hours for 15 minutes. During the feeding period, the bowel sounds should be auscultated in time. If the bowel sounds are not heard, the gastrointestinal motility should be strengthened immediately by massage.

2.2.2 Observation indicators

(1) Child recovery effect after surgery. Including enteral nutrition start-up time, nasal feeding duration, ventilator catheterization time, postoperative hospital stay.

(2) Daily heat supply from 1 to 4 days after surgery.

(3) Feeding intolerance and other complications. Among them, the evaluation criteria for feeding intolerance: one or more of symptoms such as vomiting, bloating, and gastric retention during enteral nutrition support, wherein vomiting refers to vomiting more than 3 times per day; gastric retention refers to the control group before each feeding In the observation group, the amount of gastric residual fluid was more than 2 mL/kg or bile-like content before each dose adjustment; abdominal distension refers to abdominal muscle tension or 24 h abdominal circumference increases 1.5 cm. Other complications include ventilator-associated pneumonia and gastrointestinal bleeding.

(4) Children with nutritional status. Serum total protein, albumin and prealbumin levels were measured before surgery, 1 day after surgery, and 7 days after surgery.

2.2.3 Statistical methods

The data were processed by SPSS19.0. The measurement data were expressed by mean ± standard deviation (). The variance analysis, independent sample t test, and paired sample t test were used. The count data was expressed by the composition ratio, and the χ2 test was used. The difference was statistically significant at P < 0.05.

3. Results

3.1 Comparison of the general situation between the two groups

One patient died in the observation group and one patient withdrew from the family. A total of 57 patients completed the whole study period. In the control group, 2 patients died and 1 patient underwent reoperation. A total of 56 patients completed the whole study period.

3.2 Comparison of postoperative recovery effects in two groups of children

There was no significant difference in the start time of enteral nutrition between the two groups (P>0.05). The duration of nasal feeding, ventilator catheterization time and postoperative hospital stay were significantly shorter in the observation group than in the control group. The difference was statistically significant (P <0.05). See Table 1.

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of cases</th>
<th>Enteral nutrition start-up time</th>
<th>Nasal feeding duration</th>
<th>Ventilator catheterization time</th>
<th>Postoperative hospital stay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation group</td>
<td>57</td>
<td>18.71±2.13</td>
<td>17.53±13.17</td>
<td>42.77±12.71</td>
<td>228.58±21.72</td>
</tr>
<tr>
<td>Control group</td>
<td>56</td>
<td>18.13±2.62</td>
<td>53.32±12.82</td>
<td>48.42±14.43</td>
<td>251.63±20.28</td>
</tr>
<tr>
<td>t value</td>
<td></td>
<td>1.220</td>
<td>-2.368</td>
<td>-2.210</td>
<td>-3.300</td>
</tr>
<tr>
<td>P value</td>
<td></td>
<td>0.225</td>
<td>0.020</td>
<td>0.029</td>
<td>0.001</td>
</tr>
</tbody>
</table>

3.3 Postoperative heat supply in the two groups

The Mauchly spherical test showed that the sample distribution did not satisfy the spherical distribution hypothesis (W=0.821, P=0.001), and the subsequent test statistic used the Greenhouse-Geisser method to correct the test value. Time-effect analysis showed that the daily calorie supply showed a significant upward trend from 1 to 4 days after operation, and the trend was statistically significant (P<0.05). The group effect analysis showed
that the daily heat supply of the observation group was significantly higher. In the control group, the difference was statistically significant (P<0.05); there was a significant interaction between time effect and group effect (P<0.05). See Table 2.

### Table 2. Daily caloric supply 1 to 4 days after operation in both groups kJ/(kg·d)

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of cases</th>
<th>1d after surgery</th>
<th>2d after surgery</th>
<th>3d after surgery</th>
<th>4d after surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation</td>
<td>57</td>
<td>158.13±35.99</td>
<td>208.20±30.91</td>
<td>230.31±45.24</td>
<td>251.80±33.39</td>
</tr>
<tr>
<td>Control</td>
<td>56</td>
<td>71.39±17.91</td>
<td>134.19±41.20</td>
<td>155.49±39.54</td>
<td>201.02±60.98</td>
</tr>
</tbody>
</table>

### 3.4 Comparison of complications during feeding between the two groups (see Table 3)

### Table 3. Comparison of complications during feeding between the two groups (%)

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of cases</th>
<th>Feeding intolerance</th>
<th>Ventilator-associated pneumonia</th>
<th>Gastrointestinal bleeding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation</td>
<td>57</td>
<td>4(7.02)</td>
<td>3(5.26)</td>
<td>0 (0.00)</td>
</tr>
<tr>
<td>Control</td>
<td>56</td>
<td>15(26.79)</td>
<td>4(7.14)</td>
<td>2(3.57)</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>0.005</td>
<td>0.716</td>
<td>0.243</td>
</tr>
</tbody>
</table>

### 3.5 Changes in nutritional status of the two groups of children

The distribution of serum total protein, albumin and prealbumin at any time was consistent with the spherical distribution hypothesis (P>0.05), and the test volume was not corrected. Time-effect analysis showed that the total protein decreased significantly at 1 day after operation, and the total protein increased at 7 days after operation. Albumin and prealbumin decreased significantly at 1 day after operation, and remained stable at 7 days after operation. Albumin and prealbumin levels in the observation group were significantly higher than those in the control group. The difference was statistically significant (P<0.05); there was a significant interaction between time effect and group effect (P<0.05). See Table 4 to Table 6.

### Table 4. Comparison of total protein changes between the two groups of g/L

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of cases</th>
<th>Preoperative</th>
<th>1d after surgery</th>
<th>7d after surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation</td>
<td>57</td>
<td>61.37±5.28</td>
<td>52.18±3.17</td>
<td>58.17±3.04</td>
</tr>
<tr>
<td>Control</td>
<td>56</td>
<td>60.88±4.17</td>
<td>52.31±3.15</td>
<td>55.82±3.37</td>
</tr>
</tbody>
</table>
Note: F time point = 37.158, P = 0.000; F group = 12.887, P = 0.000; F time point × group = 17.75, P = 0.000

### Table 5. Comparison of albumin changes in two groups of children g/L

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of cases</th>
<th>Preoperative</th>
<th>1d after surgery</th>
<th>7d after surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation</td>
<td>57</td>
<td>39.83±4.71</td>
<td>34.47±4.15</td>
<td>40.18±3.15</td>
</tr>
<tr>
<td>Control</td>
<td>56</td>
<td>39.1±3.82</td>
<td>32.72±5.03</td>
<td>33.08±3.53</td>
</tr>
</tbody>
</table>
Note: F time point = 42.758, P = 0.000; F group = 17.518, P = 0.000; F time point × group = 21.118, P = 0.000

### Table 6. Pre-albumin changes in the two groups were compared mg/L

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of cases</th>
<th>Preoperative</th>
<th>1d after surgery</th>
<th>7d after surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation</td>
<td>57</td>
<td>108.41±13.15</td>
<td>92.24±13.15</td>
<td>107.53±13.58</td>
</tr>
<tr>
<td>Control</td>
<td>56</td>
<td>107.68±15.58</td>
<td>89.54±12.47</td>
<td>90.38±13.52</td>
</tr>
</tbody>
</table>
Note: F time point = 34.182, P = 0.000; F group = 14.57, P = 0.000; F time point × group = 18.38, P = 0.000

### 4. Discussion

About 10 to 150,000 babies with congenital heart disease are born each year in China, and the surgical treatment of congenital heart disease is becoming more and more low-age and low-weight. However, infants with congenital heart disease have malnutrition mostly due to hemodynamic abnormalities, inadequate feeding, digestive tract malabsorption and repeated infections[11]. The extracorporeal circulation during surgery often induces stress response. Delayed-type immune response, various cardiotonic drugs used to pass the low cardiac output after surgery, fluid restrictions, and the input of a large number of blood products also limit the intake of nutrients, so various preoperative and postoperative factors lead to congenital heart disease. The high incidence
of malnutrition in children. Some scholars surveyed the nutritional status of hospitalized children with congenital heart disease in three children’s medical centers in Shanghai in 2007. The results showed that the prevalence of malnutrition was as high as 34.7%[12-14].

As early as 2005, the American Journal of Enteral Parenteral Nutrition introduced guidelines for nutritional support for critically ill children, including the promotion of enteral nutrition rather than parenteral nutrition. The parenteral route can provide the body’s calories and essential nutrients, but there are many unavoidable shortcomings, such as atrophy of the gastrointestinal mucosa, increased permeability, intestinal immune dysfunction and intestinal bacterial translocation. Early enteral nutrition can improve the morphological changes of intestinal mucosa, promote the secretion of digestive tract hormones and help the recovery of physiological functions of intestinal mucosa, promote the absorption of digestive nutrients, restore gastrointestinal function as soon as possible, and maintain the machinery and biology of mucous membranes. A barrier that helps to improve the patient’s tolerance to disease treatment. Therefore, early nutritional support for gastro-intestinal nutrition is the first choice[15].

The incidence of malnutrition in hospitalized children is high, and CHD surgery itself can lead to strong stress response. Therefore, it is necessary to carry out enteral nutrition support in children with low body weight CHD, but such children have enteral nutrition. Support tolerance is often poor, mainly because: gastrointestinal development is relatively immature; intraoperative cardiopulmonary bypass, the body is in a controlled shock state, in order to ensure the supply of important organs, blood supply to the digestive system is reduced; postoperative cardiac output Unstable, may lead to digestive system hypoxia, acidosis, ischemia and reperfusion injury; anesthesia, sedation and other drugs may also cause gastrointestinal tract damage[16]. Therefore, reliable nursing measures should be taken to avoid feeding intolerance and ensure the smooth intake of nutrition.

All the children included in this study received mechanical ventilation intervention for more than 24 hours after surgery. Therefore, only the nasogastric tube can be fed early in the postoperative period. The results showed that the observation group recovered faster after surgery, the duration of nasal feeding, and the time of ventilator catheterization. The hospitalization time is shorter, indicating that the clustered nursing management mode can effectively guarantee the postoperative recovery effect of the child. At the same time, the observation group had more daily caloric supply from 1 to 4 days after operation, suggesting that it is more tolerant to enteral nutrition and can receive more nutrients and energy supply, which helps to promote postoperative recovery. The incidence of postoperative feeding intolerance in the observation group was only 7.02%, which was significantly lower than that in the control group (26.79%). It can directly confirm that the nursing model can reduce the risk of feeding intolerance[17-18]. Consistent with this, the postoperative serum protein in the observation group The level is significantly higher than the control group, indicating that its nutritional status is better, which also helps to improve its prognosis.

The main improvement in the observation group was to adjust the rate of nutritional support, applying continuous nutritional support rather than intermittent nutritional support. Previous reports have confirmed that intermittent feeding can shorten the time of total enteral nutrition in very low birth and low quality children, but it may increase the risk of complications such as gastric retention, gastroesophageal reflux, apnea, etc. due to vagus nerve excitation; It is helpful for nutrient absorption and has a certain value for maintaining the body's hormone levels, which may help to improve the prognosis of children. Gradually increasing the calorie supply is in line with the postoperative recovery needs of the child, and the nutrient supply from the low dose helps to strengthen the gastrointestinal tolerance. The observation team also asked the nurse to participate in judging whether the child had feeding intolerance and actively intervened through abdominal massage. Because the nurse did not passively perform medical advice, the participation and initiative were higher, which helped to mobilize their enthusiasm. . Ye Lihua et al reported that the touch can reduce the incidence of neonatal feeding intolerance, which may be: promoting vagal activity, enhancing gastrointestinal activity; promoting gastrointestinal hormone release and accelerating gastrointestinal emptying.

Foreign nursing experts are committed to developing their own enteral nutrition processes in their heart centers for nutritional management of children with congenital heart disease, and have been shown to improve calorie intake and reduce feeding intolerance in a short period of time. The nurse-led enteral feeding process developed by the Wave Children's Hospital significantly reduced the incidence of feeding intolerance in children with left ventricular dysplasia syndrome and no necrotizing enteritis. It can reduce the incidence of bloating, vomiting, diarrhea and gastrointestinal bleeding in children with congenital heart disease.

Intestinal nutrition begins after congenital heart disease, and should follow the principle of increasing dosage, acceleration, and concentration. The increase rate depends on age, body weight, heart function, gastrointestinal tolerance, formula, feeding method, and need to be strict. Monitor related complications. For children with congenital heart disease, the bowel sound should be auscultated in time to judge the gastrointestinal motility, and the damage caused by surgical trauma or reperfusion of special diseases can be ruled out. Massage can be strengthened to strengthen gastrointestinal motility. Each massage was performed 30 minutes after feeding, 3 to 4 times / d, 5 minutes / time. For children with hemodynamic instability, sedation or analgesia is necessary in order to ensure the effective implementation of enteral nutrition, the minimum dose should be used.
within the effective range; the cardiac medicine and sedation should be reduced as soon as possible under the condition of stable hemodynamics. The use of muscle relaxants helps to reduce feeding tolerance during postoperative enteral nutrition support for congenital heart disease, thus effectively ensuring postoperative energy supply.

5. Conclusion

The clustered care model requires continuous improvement of care programs that help improve the postoperative enteral nutrition support in children with CHD through evidence-based care, so it has the advantage of continuous improvement. Although the improvement schemes summarized in this study are effective, they still need to be further improved and supplemented by the clustering model.

References