

Use of multiple nursing interventions (cluster nursing) in ABO hemolytic disease of neonates and evaluation of its effect

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Abstract

Objective: This study aimed to create a group of nursing intervention (cluster nursing) strategies of phototherapy for neonates and to evaluate clinical effects of intervention measures on reducing neonatal jaundice in neonates.

Methods: We performed a prospective study. A total of 141 patients with neonatal ABO hemolytic jaundice were included and randomly divided into two groups: intervention group and control group. The intervention group adopted cluster nursing measures in combination with continuous phototherapy (blue light), while the control group adopted routine nursing together with continuous phototherapy (blue light).

Results: No differences were observed in general characteristics between the groups. On the seventh day of treatment, percutaneous bilirubin levels were significantly lower in the intervention group than in the control group. On the seventh day of treatment, milk intake was significantly higher and the duration of hospitalization was significantly shorter in the intervention group than in the control group.

Conclusion: Use of cluster nursing measures in combination with phototherapy in neonatal ABO hemolysis can effectively reduce bilirubin levels, improve symptoms of jaundice, and shorten the course of the disease.

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Keywords

Cluster nursing, phototherapy treatment, neonatal ABO hemolysis, jaundice, milk, bilirubin

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Introduction

Neonatal hemolytic disease refers to homologous autoimmune hemolysis caused by blood group incompatibility of the mother and child. In this disease, ABO blood group incompatibility is the most common, and its symptoms are milder than Rh hemolysis, but there is still the possibility of nuclear jaundice. Therefore, early intervention treatment has important clinical significance.¹ Cluster nursing is defined as a group of nursing intervention measures, and each measure has been verified in clinical practice to improve the outcomes of patients. This combination can achieve a better outcome than single implementation.² Previous research has shown that massage can effectively promote intestinal peristalsis and discharge of meconium, and reduce bilirubin absorption. The simple touch method increases the appetite of neonatal milk intake, stimulates the synthesis of glycogen, fat, and protein, improves the digestive ability of food absorption, and quickly restores physiological weight loss.³ During the process of massage with music therapy, children's crying time, sleeping time, and jaundice index are improved, indicating that massage combined with music therapy for jaundice can improve the treatment effect.⁴ Additionally, a bath effectively cleanses the skin, removes dirt, and promotes skin health. In the 1980s, new concepts of phototherapy and health care were developed in countries, such as the United States, Canada, and Japan. Developmental care for premature infants has been implemented by providing

a "bird's nest" and "butterfly pillow" to provide a sense of security and to promote extension of the newborn's body. This study aimed to create cluster nursing intervention strategies of phototherapy for neonates and to evaluate clinical effects of intervention measures on reducing neonatal jaundice in neonates.

Materials and methods**General data**

Pediatric patients with neonatal ABO hemolytic jaundice who were admitted to the Affiliated Hospital of Qingdao University Neonatal Intensive Care Unit (NICU) from June 2014 to June 2015 were enrolled. The patients were randomly divided into two groups by a computer-generated randomization list. All pediatric patients were ABO blood group incompatible, and positive for serum-free antibody and erythrocyte antibody. All patients who met the following criteria^{5,6} were excluded: Rh hemolysis, severe infections, hepatic disease, hyperbilirubinemia without significant causes, and inherited metabolic diseases. General data were compared before treatment, such as sex, gestational age, birth weight, phototherapy duration, and bilirubin levels. Additionally, milk intake, percutaneous bilirubin values and the duration of hospitalization of neonates in both groups were recorded during their 7 days of hospital stay.

Methods

The two studied groups were the intervention group and control group. These two groups adopted the same therapy regimen, using a double-sided illuminated blue box (Ningbo David Medical Device Co., Ltd., Ningbo, China) for blue light treatment, and the main peak of the wavelength of the blue light was between 425 and 475 nm. The duration of phototherapy was 8 to 16 hours. The accumulated time of using the modulator tube was ≤ 1000 hours, and the distance from the modulator tube to the skin was 30 to 50 cm. Room temperature was maintained within 24°C to 26°C and humidity in the oven was 55% to 65%. The phototherapy box was preheated and maintained within 28°C to 32°C. The pediatric patients were placed into the phototherapy box.

The control group adopted routine nursing measures⁷ for skin cleaning before the patients were placed into the box. Patients were not allowed to apply powders and oils on the skin. If the body temperature of the pediatric patient was higher than 37.8°C or lower than 35°C, phototherapy was stopped. In contrast, the intervention group adopted cluster nursing therapy. Specific measures in the intervention group were as follows.

Unified operator training and guidance. The operators participated in unified training and guidance, including theoretical training and operation training. Through lectures, bedside presentations, and video demonstrations, the operators investigated various methods and application of NICU cluster nursing for neonatal phototherapy. If examination results met the standards after theoretical training and operation assessment, the intervention was performed.

Bath. Tub baths were performed by nurses who completed the training. Environmental requirements were a room temperature of 24°C to 28°C, gentle light, and water temperature of 38°C to 41°C. A bath time of 10 minutes was considered as suitable (or up to 30 minutes). Both hands were washed and warmed, fingernails were shorter than the fingertips, and a mask was worn.

Creation of a “nest”. The bath towel of the neonate was folded to the center like a roller to make an oval nest. This was performed to simulate the uterine environment for the neonates, and thus increase their sense of security. The patient was placed into the nest in the phototherapy box (preheated up to 33°C–34°C) with the neck stretched, and both hands and legs were close to the centerline of the body in a curled position. The position of the patient’s body was properly changed until the phototherapy was completed.

Music therapy. Female singing and classical music can calm the neonate and reduce adverse reactions of phototherapy.³ Gentle, natural, and regular music was repeatedly played every 3 hours. The music volume was continuously maintained at 20 to 30 dB. A cassette recorder was used and placed 30 to 40 cm near the head of the neonate when played.⁸

Touching. Within 1 hour after milk intake, touching was not performed. Operators adopted domestic modified simple meridian massage (MDST-AC (plus acupoints with collateral massages)).³ In MDST-AC, the newborn is in a half-naked condition, and the traditional touch method is combined with traditional Chinese medicine channels and collaterals in the spleen and kidney meridian. Spleen channel and kidney channel massage in traditional Chinese meridians is also included.

The primary outcome was percutaneous bilirubin values in neonates. Secondary outcomes included milk intake and the duration of hospitalization for neonates.

Statistical methods

We calculated our sample size on the basis of the sample size formula suggested for randomized, clinical trials, considering a type I error of 5% ($\alpha = 0.05$), type II error of 20% ($\beta = 0.20$; power = 80%), and the bilirubin level as the main variable. SPSS 17.0 (SPSS Inc., Chicago, IL, USA) was used for statistical processing. Quantitative data were analyzed by the *t*-test for two independent samples and values are shown as mean \pm standard deviation. Qualitative data were analyzed by the chi-squared test and described as frequency and percentage. The normality of the data was verified by the quantile-quantile graph. For comparison of observational indicators in both groups, the *t*-test of two independent samples and the Mann–Whitney test were used. $P < 0.05$ was considered statistically significant.

Ethics

The guardians were informed that the study process would not be life-threatening or damage the newborn, while protecting the privacy of the subject. This study was approved by the Qingdao University Ethics Committee. The guardians

voluntarily participated in the study and signed informed consent.

Results

A total of 141 pediatric patients were randomly divided into 72 patients in the intervention group and 69 patients in the control group. The gestational age of the patients ranged from 37 to 42 weeks and birth weight ranged from 2500 to 4000 g. There were no significant differences in sex, gestational age, birth weight, phototherapy duration, and bilirubin levels before treatment between the groups (Table 1).

Comparison of percutaneous bilirubin values of neonates in both groups is shown in Table 2. On the seventh day of treatment, percutaneous bilirubin levels were significantly lower in the intervention group than in the control group ($P = 0.01$). Comparison of milk intake of neonates in both groups is shown in Table 3. On the seventh day of treatment, milk intake was significantly higher in the intervention group than in the control group ($P = 0.02$). The duration of hospitalization was significantly less in the intervention group than in the control group (7.03 ± 1.204 versus 8.81 ± 2.241 days, $P < 0.001$).

Discussion

ABO hemolytic disease is the most common disease in the neonatal period, and excessive bilirubin levels can lead to injury of several

Table 1. General characteristics of pediatric patients with neonatal ABO hemolytic jaundice.

Groups	No. of cases		Gestational age (weeks)	Bilirubin value (mg/dL)	Maternal age (years)	Birth weight (kg)
	Male	female, n (%)				
Intervention group	72	33 (45); 39 (54)	38.15 ± 4.45	12.79 ± 3.45	29.81 ± 5.93	3.37 ± 0.52
Control group	69	37 (53); 32 (46)	39.26 ± 1.65	14.00 ± 3.89	29.40 ± 4.41	3.40 ± 0.52
T (χ^2)		0.84	1.96	1.94	0.47	0.35
P value		0.35	0.05	0.05	0.64	0.72

Values are mean \pm standard deviation or n (%).

Table 2. Comparison of percutaneous bilirubin values in neonates in both groups over 7 days.

Groups	No. of cases	Bilirubin levels on the 1st day (mg/dL)	Bilirubin levels on the 2nd day (mg/dL)	Bilirubin levels on the 3rd day (mg/dL)	Bilirubin levels on the 4th day (mg/dL)	Bilirubin levels on the 5th day (mg/dL)	Bilirubin levels on the 6th day (mg/dL)	Bilirubin levels on the 7th day (mg/dL)
Intervention group	72	10.01±3.10	10.36±2.56	10.02±2.19	9.61±2.39	9.62±2.02	8.94±1.84	8.22±1.92
Control group	69	10.22±3.34	10.06±2.89	9.95±2.50	10.18±2.87	9.50±2.57	9.41±2.40	9.19±2.37
T value		0.40	0.64	0.19	1.27	0.31	1.29	2.65
P value		0.69	0.53	0.85	0.21	0.75	0.20	0.01

Values are mean ± standard deviation.

Table 3. Comparison of milk intake for neonates in both groups over 7 days.

Groups	No. of cases	Milk intake on the 1st day (mL/day)	Milk intake on the 2nd day (mL/day)	Milk intake on the 3rd day (mL/day)	Milk intake on the 4th day (mL/day)	Milk intake on the 5th day (mL/day)	Milk intake on the 6th day (mL/day)	Milk intake on the 7th day (mL/day)
Intervention group	72	46.79 ± 12.51	52.07 ± 12.58	58.64 ± 13.35	64.07 ± 13.62	75.29 ± 13.96	75.29 ± 13.96	82.36 ± 15.57
Control group	69	47 ± 12.70	52.71 ± 11.97	61.21 ± 12.38	67.29 ± 13.15	74.71 ± 14.84	74.71 ± 14.83	75.86 ± 17.45
T value		0.10	0.31	1.18	1.42	0.97	0.24	2.34
P value		0.92	0.76	0.24	0.16	0.33	0.81	0.02

Values are mean ± standard deviation.

tissue organs, especially the central nervous system.⁹ In recent years, some scholars in China have proposed the concept of the cluster,^{10,11} which was applied early in the adult ICU and achieved good clinical effects in preventing ventilator-associated pneumonia and catheter-related blood stream infections. However, cluster intervention is not as well applied in the NICU, and no studies have been conducted on ABO hemolytic disease in neonates.

Previous studies^{12,13} have indicated that touching and bathing effectively promote intestinal peristalsis, accelerate discharge of meconium, and reduce absorption of bilirubin. Furthermore, before phototherapy, these methods can effectively clean the skin, remove dirt, promote skin metabolism, increase a comfortable sensation, and improve compliance of phototherapy.¹⁴ Smith et al.¹⁵ showed that nursing with a “nest” and music treatment improve the comfortable sensation of neonates in the phototherapy box, increase the sense of security, and reduce dysphoria and crying. An increasing amount of studies have focused on music treatment on neonates.¹⁶ Music calms breathing and heart rate in neonates, and improves sucking behavior. In combination with application of a nest, music simulates the uterine environment to enable neonates to better adapt to the extra-uterine environment, reduce anxiety, and relieve stress.

We used cluster nursing intervention for neonatal patients with ABO hemolytic disease, and measured bilirubin levels, milk intake, the duration of hospitalization, and other indicators to evaluate its effects. We found that the mean bilirubin level in the intervention group on the seventh day of treatment was significantly lower than that in the control group, and milk intake during hospitalization was higher. Additionally, the days of hospitalization were significantly shortened in the intervention group compared with the control

group. Before phototherapy, bathing in combination with touching increases defecation, increases release of bilirubin, and reduces serum bilirubin levels.⁶ As mentioned above, music improves sucking behavior and increases milk intake. Cluster nursing integrates these factors to provide a synergistic effect of each factor, and thus reduces days of hospitalization, shortens healing time, and reduces hospitalization fees.

Our results indicate that the cluster nursing intervention planned in this study was effective. However, during the first several days of intervention, milk intake and bilirubin levels did not significantly change. On the seventh day, the differences in milk intake and bilirubin levels were significant, which may be associated with the limited time, operation, and size of the sample. Further studies are required to investigate formulation of cluster nursing intervention strategies for neonatal jaundice, factors of cluster intervention, and the optimum combination of various factors according to evidence-based medicine.


Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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