

Original Article

Effect of humanized care in the treatment of neonatal jaundice and its effect on oxygen saturation

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Abstract: Objective: This study aimed to investigate the effect of humanized care in the treatment of neonatal jaundice and its effect on oxygen saturation. Methods: A total of 202 infants with neonatal jaundice admitted to our hospital from January 2018 to June 2020 were divided into group A (n=102) and group B (n=100) according to their parents' choice. Group A received humanized care and group B received routine nursing. The clinical efficacy, serum aspartate aminotransferase (AST), alanine aminotransferase (ALT), total bilirubin (TBIL) levels and arterial blood oxyhemoglobin saturation (SaO₂), cerebral oxygen saturation (rSO₂), mean arterial pressure (MAP) levels were determined between the two groups. Results: Compared with group B, group A had significantly shorter time of fetal stool turning yellow, time of jaundice regression and duration of blue light irradiation ($P < 0.05$), lower serum AST, ALT and TBIL levels ($P < 0.05$), higher levels of SaO₂, rSO₂ and MAP ($P < 0.05$), higher average sleep time per day and mean daily milk consumption ($P < 0.05$). The incidence of adverse events in group A was significantly lower than that in group B ($P < 0.05$). Parental satisfaction with care in group A was significantly higher than that in group B ($P < 0.05$). Conclusion: Humanized care can significantly improve the prognosis and recovery speed and is conducive for SaO₂ to return to normal level, and can reduce the adverse reactions with high parental satisfaction.

Keywords: Neonatal jaundice, humanized care, nursing effect, oxygen saturation

Introduction

Neonatal jaundice refers to an abnormal increase in serum level of bilirubin within 28 days after birth due to metabolism disorders, resulting in a yellowish discoloration of the white part of the eyes and skin [1]. Two types of jaundice may occur in newborns, including physiological and pathological jaundice. Pathological jaundice is mainly caused by excessive secretion of bilirubin, hepatic metabolism dysfunction and bile acid synthesis disorders [2, 3]. Factors that lead to disorders of bilirubin metabolism in children include hypoxia and infection, and neonates with jaundice are often accompanied by low level of oxyhemoglobin saturation (SaO₂) [4]. Physiological jaundice usually subsides spontaneously, whereas pathologic jaundice often requires clinical intervention [5]. The treatment options for pathological jaundice include phototherapy, immunoglobulin, albumin, phenobarbital, blood exchange transfusion, surgical therapy and traditional Chinese medicine,

which can effectively reduce the level of bilirubin [6, 7]. The physiological functions of the neonates are not fully developed and they typically have low immunity, so appropriate nursing measures should be taken to improve the clinical efficacy [8]. Humanized care is a comprehensive plan catering to the feeding, therapeutic, psychological, and hygienic aspects of infant nursing. Some clinical studies have been conducted on neonatal jaundice nursing, but there are some differences in the direction of research and the conclusions drawn by different scholars. The present study was conducted on 202 infants with neonatal jaundice in our hospital to observe the clinical value of humane care in neonates with jaundice and the effect on their SaO₂ levels.

Materials and methods

Clinical data

A total of 202 cases of neonatal jaundice admitted to our hospital from January 2018 to June

2020 were enrolled, including 105 male infants and 97 female infants, aged 2 to 9 (d), and were divided into group A (n=102) and group B (n=100) based on choices of their parents.

Inclusion and exclusion criteria

Inclusion criteria: (1) infants were clinically diagnosed with neonatal jaundice [9] within 10 days of birth; (2) the clinical data of infants were complete; (3) infants whose families were cooperative; (4) the study was approved by the ethics committee of the First Affiliated Hospital, Baotou Medical College, Inner Mongolia University of Science; and (5) the family members of the infants had signed the informed consent form.

Exclusion criteria: (1) infants with congenital immunodeficiency, malignant tumors, and severe infectious disease; (2) infants with severe cardiac, hepatic, and renal insufficiency; and (3) infants with expected survival time ≤ 3 months.

Methods of care

Group B received routine nursing measures according to the doctor's instructions and their vital signs were monitored, while group A was additionally cared with humanized care on the basis of the nursing measures in group B. (1) Feeding strategies. Feeding should not only provide proper supply of nutrients essentials, but also promote the recovery of the gastrointestinal function of jaundiced newborns and normal frequency of defecation. The baby should be fed every 2~3 h and the amount of milk was decided by the digestive capacity of the fetus. After breastfeeding, infants' back was patted to prevent vomiting. Nasogastric tube feedings are used for infants who are not able to take in enough calories orally; (2) Gent stroking. Stroking improves infant mood, promotes vagus nerve stimulation and secretion of gastrin, so that baby's ability to absorb nutrients is enhanced, and ultimately accelerate the passage of stools. After disinfecting their hands, the nursing staffs stroked the whole body of the infant from top to bottom once in the morning, midnight and evening. (3) Hydrotherapy: On the one hand, hydrotherapy affords the highest degree of hygiene. It can promote the expansion of neonatal capillaries, speed up blood circulation, promote metabolism, increase appe-

tite, and ultimately accelerate defecation. During the hydrotherapy, the room temperature should be controlled at 27°C, the water temperature 37-39°C, the belly button should be affixed with a waterproof patch, and the caregiver can help the infants stretch his/her limbs; (4) Bird's nest care. The infant sense of security was enhanced by simulating the environment in the womb. The bath towel wrapped around the newborn was rolled and folded into an oval shape, in which the infant was placed to reduce fidgeting.

Outcome measurement

(1) Clinical efficacy: Time of fetal stool turning yellow, time of jaundice regression and duration of blue light irradiation of the two groups of infants were recorded. The shorter time indicates the better prognosis. (2) Liver function: 3 mL of fasting venous blood was collected from the two groups at 1 day before and 7 days after nursing intervention, respectively. The serum levels of aspartate aminotransferase (AST), alanine aminotransferase (ALT) and total bilirubin (TBIL) were detected using AU400 chemical analyzer (Olympus, Japan). Low levels indicate good prognosis and recovery of liver function. (3) Blood oxygen function: Rad-57 palm-type pulse oximetry analyzer (MASIMO, USA) was used to detect arterial blood SaO_2 at 1 day before and 7 days after nursing intervention; cerebral oxygen saturation (rSO_2) was detected using vPad-A1 brain blood oxygen saturation monitor (Olico, Sweden); PM-9000A ECG monitor was used to detect its average arterial pressure (Hunan Ruibo), and the above operations were carried out in strict accordance with the instrument instructions. The higher level of SaO_2 , rSO_2 and mean arterial pressure (MAP) indicates the higher oxygen content and the better prognosis. (4) Sleep time and milk intake: The average daily sleep time and daily milk intake was compared between the two groups after 2 weeks of nursing. The higher average daily sleep time and milk intake indicates the better prognosis and quality of life. (5) Adverse reactions: The incidence of adverse reactions in the two groups was recorded during the treatment period. (6) Parental satisfaction with nursing care during the treatment period: On the day of discharge, the satisfaction with nursing care during the treatment period was scored by parents of the infants, with ≥ 80 as satis-

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Table 1. Comparison of baseline data

Grouping		Group A (n=102)	Group B (n=100)	Statistical value	P
Average daily age (d)		5.09±0.71	5.48±0.95	0.637	0.406
Gender	Male	57	58	0.542	0.513
	Female	45	42		
Body mass (kg)		3.52±0.64	3.31±0.62	0.584	0.524
Mode of delivery	Vaginal delivery	63	60	0.531	0.572
	Cesarean section	39	40		
Disease classification	Mild	25	21	0.649	0.435
	Moderate	50	49		
	Severe	27	30		

Table 2. Comparison of clinical outcomes ($\bar{x} \pm s$, d)

Parameters	Group A (n=102)	Group B (n=100)	t-value	P
Time of the fetal stool turning yellow	1.74±0.48	2.63±0.72	6.041	0.001
Time of jaundice regression	3.16±0.82	5.43±1.37	6.793	0.001
Duration of blue light irradiation	2.31±0.57	3.65±0.84	6.462	0.001

were comparable (**Table 1**).

Clinical efficacy

Infants in group A had significantly shorter time of fetal stool turning to yellow (1.74±0.48 d), time of

jaundice regression (3.16±0.82 d), and duration of blue light irradiation (2.31±0.57 d) than those in group B [(2.63±0.72 d), (5.43±1.37 d), and (3.65±0.84 d), respectively] ($P < 0.05$, **Table 2**), and the difference between the two groups was statistically significant, indicating that humanized care significantly improved the outcome of neonates with jaundice.

Liver function

The pre-care AST, ALT, and TBIL levels showed no significant difference between the two groups ($P > 0.05$). After care, the above indicators were decreased to a certain extent in both groups compared with those before care, showing significant difference ($P < 0.05$). After care, the levels in group A were significantly lower than those in group B (**Figure 1**). The humanized care significantly improved the liver function and prognosis of neonates with jaundice.

Blood oxygen level

The two groups showed no significant differences in SaO_2 , rSO_2 , and MAP before care ($P > 0.05$), and after care, compared with group B, group A had significantly higher SaO_2 , rSO_2 and MAP ($P < 0.05$, **Figure 2**). Humanized care significantly improved blood oxygen level of the neonates with jaundice and improved their organismal hypoxia.

factory, 80-60 as basic satisfactory, and < 60 as unsatisfactory. Higher scores indicate higher parental satisfaction.

Statistical analysis

Statistical analysis was performed using SPSS 25.0, in which the measurement data were expressed as mean \pm standard deviation ($\bar{x} \pm s$), and the two independent samples non-parametric test was used for intergroup analysis. Count data expressed as (%) were analyzed using the *Chi-square* test. $P < 0.05$ indicates that the difference is statistically significant. The Gradpad Prism 7.0 package was used for graphing.

Results

Baseline data

A total of 202 neonates with jaundice, including 115 males and 87 females, were enrolled and randomly divided into two groups: group A (n=102) and group B (n=100) based on choices of the parents. The differences between the two groups were compared on the baseline data, such as age, gender, body weight, mode of delivery and disease grading. The results showed that there was no significant difference in baseline data such as gender, mean age, body mass, mode of delivery, and disease grading between the two groups ($P < 0.05$), which

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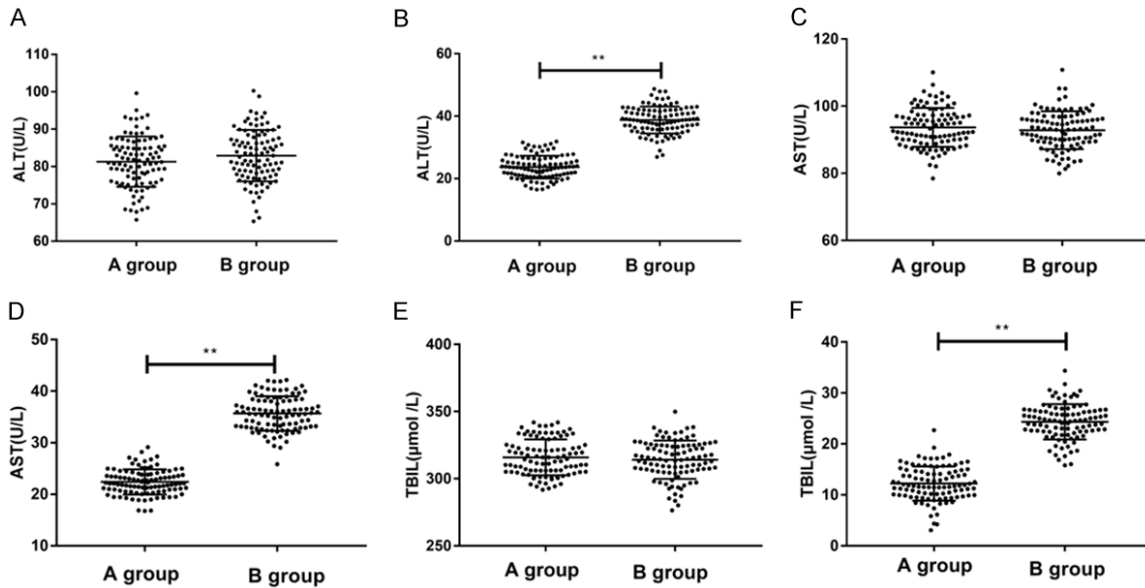


Figure 1. Comparison of liver function between the two groups. A: ALT before care, B: ALT after care; C: AST before care, D: AST after care; E: TBIL before care, F: TBIL after care. Before care, there was no significant difference in serum ALT, AST and TBIL levels between the two groups ($P > 0.05$). After care, serum ALT, AST and TBIL levels in group A were significantly lower than those in group B ($P < 0.05$). ***indicates $P < 0.001$.

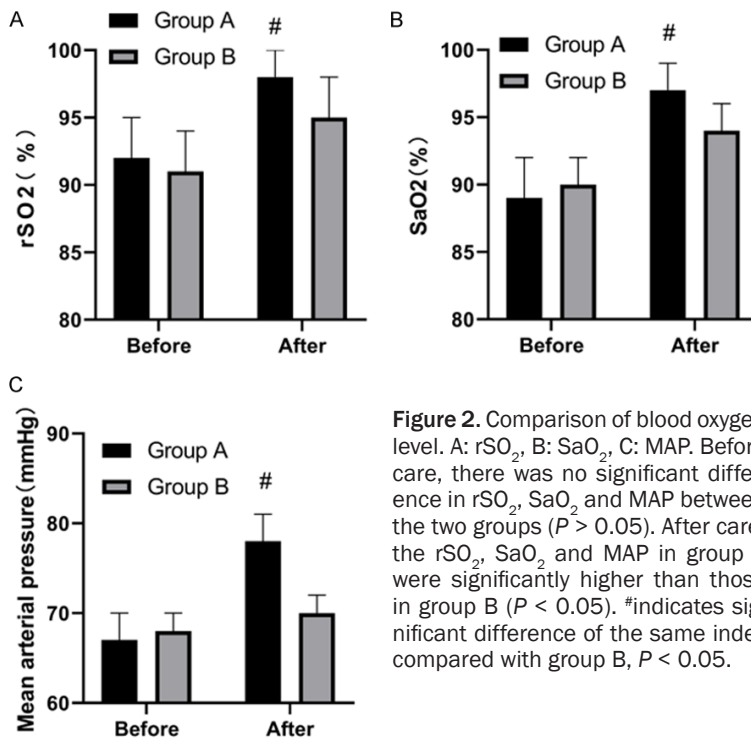


Figure 2. Comparison of blood oxygen level. A: rSO₂, B: SaO₂, C: MAP. Before care, there was no significant difference in rSO₂, SaO₂ and MAP between the two groups ($P > 0.05$). After care, the rSO₂, SaO₂ and MAP in group A were significantly higher than those in group B ($P < 0.05$). #indicates significant difference of the same index compared with group B, $P < 0.05$.

The humanized care effectively improved the quality of life of neonates with jaundice, and was beneficial to their nutritional status and growth and development during the recovery period.

Adverse reactions

Group B had 6 cases of abnormal temperature, 4 cases of diarrhea and 3 cases of rash, and group A had 1 case of abnormal temperature and 1 case of rash. The incidence of adverse reaction in group B was 13%, which was significantly higher than 1.97% in group A ($P < 0.05$, Table 3). Humanized care significantly reduced the incidence of adverse events during the treatment.

Sleep time and volume of milk intake

Compared with group B, the average daily sleep time and average daily milk intake of group A were significantly higher ($P < 0.05$, Figure 3).

Parental satisfaction with care

The 98.04% parents of infants in group A were satisfied with the care during the treatment, higher than 87% in group B ($P < 0.05$, Figure 4).

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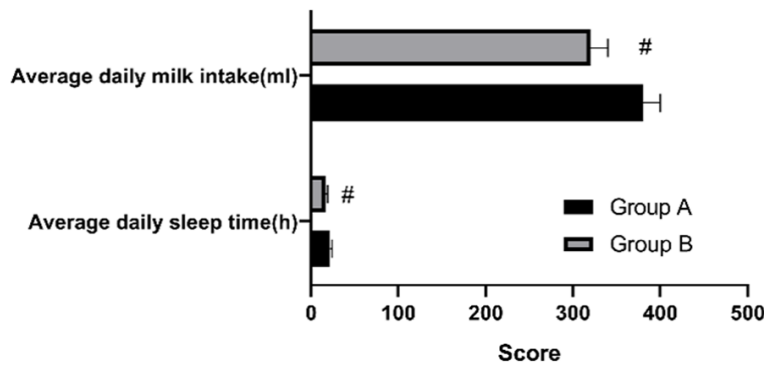


Figure 3. Comparison of average daily sleep time and average daily milk intake. After nursing, the average daily sleep time and the average daily milk intake in group A were significantly higher than those in group B ($P < 0.05$). #indicates significant difference of the same index compared with group B, $P < 0.05$.

Table 3. Comparison of the occurrence of adverse reactions [n (%)]

Group	Abnormal temperature	Diarrhea	Rash	Incidence
Group A (n = 102)	1 (0.98)	0 (0.00)	1 (0.98)	2 (1.96)
Group B (n = 100)	6 (6.00)	4 (4.00)	3 (3.00)	13 (13.00)
χ^2	-	-	-	8.951
P	-	-	-	0.003

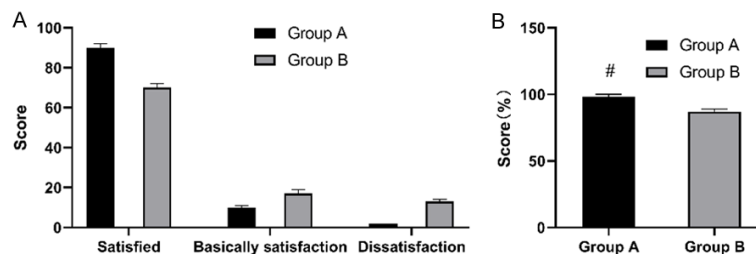


Figure 4. Comparison of the satisfaction of the parents of the two groups. A: Number of patients with satisfaction, B: Percentage of satisfaction. The number of patients with satisfaction and percentage of satisfaction in group A were higher than those in group B ($P < 0.05$). #indicates significant difference of the same index compared with group B, $P < 0.05$.

Discussion

Pathological jaundice is one of the common disorders in the neonatal period, which is caused by the abnormal accumulation of bilirubin [6]. Neonatal jaundice, if not treated in time, may develop cerebral bilirubinemia and other serious complications, which has a negative impact on the growth and development of infants [10]. The treatment options for neonatal jaundice have been clearly defined, mainly including phototherapy and drug therapy [7]. It has been clinically shown that the prognosis of

neonates with jaundice and the recovery of physical fitness cannot be achieved without high quality of nursing [11]. In this study, 202 cases of neonatal jaundice received routine care measures and humane care, respectively, so as to compare the nursing effects.

This study first compared the nursing effects by comparing the time to disappearance of clinical symptoms of neonates with jaundice. The stool of neonates with jaundice usually contains a large amount of bilirubin, which will be reabsorbed into the blood via the hepatic circulation if not eliminated in time, and the color of fetal stool turning from black to yellow indicates that bilirubin has been excreted [12, 13]. In present study, the time of the fetal stool turning yellow in group A was significantly shorter than that in group B. In addition, the time of jaundice regression and the duration of blue light irradiation in group A were also significantly shorter than those in group B. Humanized care has accelerated the recovery of neonates with jaundice by improving their nutritional status, circulatory status, mood, and vagal excitability, which facilitates the elimination of bilirubin from their urine and feces.

Liver function indicators were used to assess the prognosis of neonates with jaundice [14]. Among them, TBIL is the most direct indicator of the change in the condition of jaundiced infants, while ALT is one of the most sensitive indicators of liver function in neonates with jaundice [15, 16]. Johnson et al. [17] showed that the serum TBIL level of neonates with jaundice were closely related to their prognosis, and the clinical treatment plan should be adjusted according to the serum TBIL level. Wu et al. [18] adopted different therapies for neonates with jaundice, and the results showed that the

serum ALT, AST and other liver function indices of the group with good prognosis were significantly better than those of the group with poor prognosis. Disorders of bilirubin metabolism could lead to the development of pathological jaundice, impairing the liver to take up and bind bilirubin. Therefore, liver function is commonly used to assess the prognosis of neonates with jaundice [19]. In the present study, TBIL, ALT, and AST levels in group A were significantly lower than those in group B following nursing. This indicates that, on the one hand, a significant reduction in serum levels of bilirubin, and, on the other hand, an effective recovery of liver function. Humanized care promoted the elimination of bilirubin by improving the gastrointestinal function of jaundiced neonates and the liver function of the newborns.

It has been shown that hypoxia could contribute to the development of neonatal jaundice [20]. Hypoxia causes damage to erythrocytes, and hypoxia is involved in the development of neonatal jaundice by affecting hepatic metabolism of bilirubin and gastrointestinal excretion of bilirubin [9]. Therefore, the present study also observed the oxygen concentration in the blood of the two groups. SaO_2 , the concentration of oxygen in the blood, is one indicator to assess the present and severity of hypoxia [21]. Nitzan et al. [22] showed that the SaO_2 level of neonates with jaundice was significantly lower than that of healthy newborns, which was closely related to the prognosis, and the SaO_2 level of newborns with good prognosis was significantly higher than that of newborns with poor prognosis. In this study, the SaO_2 level of group A was significantly higher than that of group B, indicating that their body hypoxia could be improved more effectively. In addition, the study also compared the cerebral hypoxia of the two groups. rSO_2 is one of the clinical indicators of oxygen supply to the brain. $\text{rSO}_2 < 95\%$ indicates that the brain is hypoxic and may lead to insufficient blood supply to the brain [23]. The MAP also reflects the oxygen supply of the brain and hemodynamics. In this study, the rSO_2 and MAP levels in group A were significantly higher than those in group B. The humanized care improved the clinical efficacy of neonates with jaundice by improving their circulatory status and significantly promoted the recovery of their hypoxic condition. The study also compared the average daily sleep time and average

daily milk intake of the two groups. Adequate sleep and milk intake are fundamental to the nutritional status and growth of newborns, both of which can be significantly affected in infants with jaundice. After nursing, compared with group B, the average daily sleep time and average daily milk intake of group A were significantly higher, which will benefit to the normal growth and development of infants, and also improve the prognosis of the disease.

High quality nursing care can reduce the occurrence of adverse reactions, and in this study, humanized nursing care can significantly reduce the occurrence of adverse reactions, indicating that humanized nursing care can promote the jaundice regression. In addition, the parents of group A had higher nursing satisfaction.

In summary, humanized care can significantly improve the prognosis, adjust the SaO_2 level, reduce the incidence of adverse reactions and improve parental care satisfaction. However, this study still has some limitations, such as the study only explored the short-term outcomes of the two groups after nursing, and did not compare the recurrence rate of jaundice in the mid- and long-term period after nursing, which will be improved in future studies.

Disclosure of conflict of interest

None.

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