

Original Article

Effects of comprehensive care on complications, oxygenation indexes and guardian's psychological mood of children with neonatal respiratory distress syndrome

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Abstract: Objective: To observe the effects of comprehensive care on complications, oxygenation indexes of children with neonatal respiratory distress syndrome (NRDS), as well as their guardian's psychological mood. Methods: Totally 205 cases of children with NRDS admitted to our hospital from February 2018 to December 2019 were recruited and divided into two groups according to different nursing interventions. Cases receiving comprehensive care were included in the research group (RG, n=108), and cases receiving routine care were included in the control group (CG, n=97). The curative effect, improvement of clinical symptoms, complications during nursing process, improvement of oxygenation indexes, degree of lung injury, improvement of physiological health were observed and compared, as well as the improvement of parents' psychological mood and their satisfaction with this nursing intervention. Results: After care, RG had significantly better improvement of clinical indexes than that in CG, with notably lower PaCO₂ and higher PaO₂ and SaO₂. Besides, children in RG showed remarkably lower Murray score and APACHE-II score, and the patients of children in RG also had lower SAS and SDS scores. The overall response rate (ORR) of children in RG was evidently higher than that in CG, the incidence of total complications in RG was evidently lower than that in CG, and the nursing satisfaction of parents in RG was evidently higher than that in CG. Conclusion: Comprehensive care is effective for children with NRDS, which can improve oxygenation indexes and lung injury, reduce the incidence of complications, and improve the psychological mood of parents.

Keywords: Comprehensive care, neonatal respiratory distress syndrome, complications, oxygenation index, guardian's psychological mood

Introduction

Neonatal respiratory distress syndrome (NRDS), also known as hyaline membrane disease, is one of the most common causes of neonatal morbidity and death [1]. Oxygen diffusion efficiency through alveolar-capillary exchange barrier is affected by many factors, which constitutes the major pathophysiology of NRDS [2]. The clinical manifestations of the disease include apnea, nasal incontinence, cyanosis, etc., which seriously threaten the life and health of children [3]. In recent years, with the continuous development of medical technology, the level of diagnosis of NRDS has been constantly improved, and its therapeutic effect has also been notably improved [4]. Clinical research shows that effective nursing intervention is critical in improving the treatment effect and prognosis of children [5].

Mechanical ventilation intervention is often used in the treatment of NRDS to alleviate the clinical symptoms of children, but the therapeutic interventions are associated with many complications [6]. Particularly in children, the combination of effective nursing intervention is necessary for children to recover as early as possible [7]. Previous studies have shown that children who receive routine care often have poor outcomes due to lack of systematic and predictable nursing interventions, which also affects the treatment effect and quality of life of children [8, 9]. Nowadays, with the continuous reform and development of medical service mode, comprehensive care has been used in many diseases [10, 11]. Comprehensive care is a patient-centered nursing mode, which requires deep understanding and cognition of nurses on the meaning of accuracy and details, in other words, nurses should master various

nursing skills and operations in the nursing process for children to ensure the smooth progress of treatment and rehabilitation of children [12]. For example, one research shows that [13] effective nursing education intervention can achieve better effects in nursing knowledge and practice related to NRDS, thus reducing the mortality and morbidity of children. In addition, due to the acute onset, severe and complicated condition of NRDS, parents of ill children will face unbearable psychological pressure due to lack of psychological preparation and sudden changes. Eventually, it will lead to depression, anxiety and panic, which may seriously affect their physical and mental health [14, 15]. Long-term psychological stress may also lead to parents' loss of confidence in the treatment of the child, which will have a certain impact on the subsequent treatment of the child [16]. It is suggested that effective communication skills can reduce fear and anxiety and increase self-confidence of family members who are committed to the neonatal intensive care unit [17].

This study explores the application value of comprehensive care in children with NRDS by implementing this nursing model for patients and their families, aiming at providing a feasible nursing intervention measure for the treatment of children with NRDS.

Materials and methods

General data

Totally 205 cases of children with NRDS admitted to Changzhou Second People's Hospital from February 2018 to December 2019 were recruited and divided into two groups according to different nursing interventions. Cases receiving comprehensive care were included in the research group (RG, n=108), and cases receiving routine care were included in the control group (CG, n=97). Inclusion criteria: Both groups of children met the diagnostic criteria of respiratory dysfunction syndrome [18], and were diagnosed and confirmed by chest X-ray and lung auscultation. Both groups of children were newly diagnosed cases, with complete case data, and received follow-up treatment in our hospital after diagnosis. This study was conducted with the approval of the ethics committee of our hospital, and all the subjects' guardians were informed and signed a fully informed consent form. Exclusion criteria: Chil-

dren had respiratory diseases, heart disease, or damaged vital organ function, parents who could not correctly understand the contents of the scale or were unable to read and write, children or family who quit the experiment or lost to follow-up. Inclusion criteria were applicable to all subjects.

Nursing methods

Children in CG were given routine care: (1) The parents of the children were given routine health education, which mainly included the basic knowledge of NRDS, the disease progress of the children, procedures of care, visiting time and matters needing attention during visiting. (2) Nursing staff closely observed the changes of children's condition and clinical manifestations, strictly monitored the skin color, consciousness, bleeding and other indicators of children, as well as the respiratory changes of children. At the same time, they would take measures to prevent children from infection.

The children in RG were given comprehensive care: (1) A dedicated team was established to develop a dedicated care plan and nursing interventions based on each child's condition, and professional training was provided for team members, including the use of breathing machine and treatment measures. (2) For children adopted mechanical ventilation, nursing staff fixed the intubation, scrubbed the mouth of children with compound chlorhexidine gargle every day, and changed the ventilator pipeline every week. Besides, they disinfected the ward air dynamically and monitored the ward air quality. They raised the bedside and changed the position of the child regularly every day. For children in recovery period, nursing staff helped them to carry out proper rehabilitation exercise. Sputum suction was performed strictly and aseptically, so as to reduce the risk of lung collapse. The sputum suction effect was also evaluated. (3) Detailed health education was conducted for parents of each child. Parents were informed about the disease of NRDS, the child's condition, and the visiting hours and knowledge about sterility required for the visit. Children often had critical clinical symptoms after NRDS, which put their lives in danger at any time and any place, and often caused anxiety, fear and worry among their families. Therefore, professional psychological counselors should communicate with the parents of the children, understand their understanding

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and views on NRDS, and ask whether they had emotional depression when communicating with medical staff and others, so as to help them analyze the main factors leading to anxiety and depression.

Outcome measures

1. The improvement of clinical indexes (respiratory rate, heart rate, length of hospital stay) of the two groups of children during treatment were observed and recorded.

2. Oxygenation indexes: The arterial blood of children was taken before treatment and 24 hours after treatment. Five ml of it was extracted and injected into heparin cap, and the blood was put in a cooling package at a temperature lower than 8°C. Carbon dioxide partial pressure (PaCO₂), oxygen arterial partial pressure (PaO₂) and blood oxygen saturation (SaO₂) were measured by blood gas analyzer (Yuyan Instrument Co., Ltd., Shanghai, China, 57984).

3. Lung injury: Murray score was used to evaluate lung injury [19]. The scale includes 4 items, each item scores 4 points, and the scoring standard is (0-4). The higher the score, the more serious the lung injury.

4. Acute Physiology and Chronic Health Score (APACHE-II) [20] was adopted, which includes three indexes, with a total score of 71. The higher the score, the more serious the condition of the child.

5. Psychological mood of patients' parents: Self-rating anxiety scale (SAS) and self-rating depression scale (SDS) were applied to evaluate the anxiety and depression of patients' parents before and after nursing intervention [21]. The total score of SAS scale is 100 points, with scores of 50-70 indicating mild anxiety, scores of 71-90 indicating moderate anxiety, scores of higher than 90 indicating severe anxiety, and higher scores indicating more serious anxiety. The total score of SDS scale is 100 points, with scores of 50-70 indicating mild depression, scores of 71-90 indicating moderate depression, scores of higher than 90 indicating severe depression, and higher scores indicating more serious anxiety.

6. Response rate after care: Marked response: all the clinical symptoms disappeared after care, the breathing was smooth, and Murray score and APACHE-II score improved signifi-

cantly. Effective response: the clinical symptoms of children basically disappeared after care, and the breathing was relatively smooth and better than before. No response: the children's clinical symptoms and respiratory condition did not improve after care intervention. Overall response rate (ORR) = (marked response + effective response)/total cases * 100%.

7. Complications that occurred during care were observed and recorded.

8. Family satisfaction: the self-made "patient satisfaction questionnaire" of our hospital was used, and family members of the children were invited to score the nursing, with a total of 20 questions, 100 points in total. A score less than 70 points was considered as unsatisfactory, 70-89 points was considered as moderate satisfaction, and ≥ 90 points was considered as satisfactory. Satisfaction = (Satisfactory + moderate satisfactory)/total cases × 100%.

Statistical methods

SPSS22.0 (Beijing EasyBio Co., Ltd., China) was adopted for statistical analysis, and GraphPad Prism 7 for image rendering. The counting data was expressed by [n (%)], and its comparison adopted chi-square test. When the theoretical frequency in chi-square test was less than 5, continuity correction Chi-square test was adopted. The measurement data was expressed by mean ± standard deviation (mean ± SD), and its comparison adopted independent sample t-test. Paired t-test was utilized for intra-group comparison before and after nursing. When P < 0.05, the difference was statistically significant.

Results

General data

There was no significant difference between RG and CG in general data such as gender, average gestational age, average weight, onset time, clinical symptoms, mode of production, parental smoking history and parental alcohol abuse history (P > 0.05) (**Table 1**).

Comparison of clinical indexes improvement after care between the two groups

By observing the clinical indicators of the two groups, it was found that the improvement of

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Table 1. Comparison of clinical data of children in the two groups [n (%)] (mean ± SD)

Classification	RG (n=108)	CG (n=97)	t/ χ^2 value	P value
Gender			0.086	0.768
Male	59 (54.63)	51 (52.58)		
Female	49 (45.37)	46 (47.42)		
Average gestational age (w)	33.26±3.26	32.73±3.29	1.157	0.248
Average body weight (g)	1612±417	1578±452	0.560	0.576
Onset time (h)	7.64±1.03	7.58±1.06	0.411	0.681
Clinical symptoms			0.728	0.866
Dyspnea	31 (28.70)	27 (27.84)		
Cyanosis	26 (24.07)	25 (25.77)		
Nasal incontinence	28 (25.93)	21 (21.65)		
Cyanopathy	23 (21.30)	24 (24.74)		
Mode of production			0.147	0.701
Eutocia	55 (50.93)	52 (53.61)		
Cesarean	53 (49.07)	45 (46.39)		
Parental smoking history			0.038	0.844
Present	62 (57.41)	57 (58.76)		
Absent	46 (42.59)	40 (41.24)		
Parental alcohol abuse history			0.643	0.422
Present	65 (60.19)	53 (54.64)		
Absent	43 (39.81)	44 (45.36)		

Table 2. Comparison of clinical index improvement after care between the two groups (mean ± SD)

Group	n	Respiratory rate (time/min)	Heart rate (time/min)	Length of hospital stay (d)
RG	108	39.79±3.68	128.57±9.73	3.36±0.28
CG	97	54.37±5.36	143.04±10.65	5.37±0.46
t	-	22.890	10.170	38.210
P	-	< 0.001	< 0.001	< 0.001

respiratory rate and heart rate in RG was evidently better than that in CG, and the length of hospital stay was evidently shorter than that in CG, with statistical significance ($P < 0.05$) (**Table 2**).

Comparison of oxygenation indexes between the two groups before and after care

Observation of the oxygenation indexes showed no difference between the two groups before care ($P > 0.05$). After care, the improvement degree of indexes were better than those before care in both groups ($P < 0.05$), and PaCO_2 of RG was notably lower than that in CG, while PaO_2 and SaO_2 of RG were remarkably higher than those of CG, with statistical significance ($P < 0.05$) (**Table 3**).

Comparison of Murray score between the two groups before and after care

Observation of Murray score showed no difference between the two groups before care ($P > 0.05$). After care, the improvement of the score was better than that before care in both groups ($P < 0.05$), and was notably lower in RG than CG, with statistical significance ($P < 0.05$) (**Table 4**).

Comparison of APACHE-II score between the two groups before and after care

Observation of APACHE-II score showed no difference between the two groups before care ($P > 0.05$). After care, the improvement of the score was better than that before care in both groups ($P < 0.05$), and was notably lower in RG than CG, with statistical significance ($P < 0.05$) (**Figure 1**).

Comparison of SAS and SDS scores of parents of

two groups of children

The SAS and SDS scores of parents before and after nursing were observed ($P > 0.05$). There was no significant difference between the two groups before care, but the two scores after care were remarkably better than those before care ($P < 0.05$), and were lower in the RG than CG, with statistical difference ($P < 0.05$) (**Figure 2**).

Comparison of treatment ORR between the two groups after care

We observed that the ORR was 97.22% in RG and 87.63% in CG, which was remarkably higher in RG, and the difference was statistically significant ($P < 0.05$) (**Table 5**).

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Table 3. Comparison of oxygenation indexes between the two groups before and after care (mean \pm SD)

Group	n	PaCO ₂ (mmHg)		PaO ₂ (mmHg)		SaO ₂ (%)	
		Before care	After care	Before care	After care	Before care	After care
RG	108	61.68 \pm 6.32	40.79 \pm 3.73	49.78 \pm 4.57	82.79 \pm 8.18	80.57 \pm 7.46	96.74 \pm 8.84
CG	97	62.05 \pm 6.37	48.55 \pm 3.82	50.35 \pm 4.69	73.68 \pm 7.15	79.74 \pm 7.23	89.64 \pm 8.36
t	-	0.416	14.700	0.880	8.447	0.807	5.891
P	-	0.677	< 0.001	0.379	< 0.001	0.420	< 0.001

Table 4. Comparison of Murray score between the two groups before and after care (mean \pm SD)

Group	n	Murray score	
		Before care	After care
RG	108	2.74 \pm 0.37	1.41 \pm 0.16
CG	97	2.79 \pm 0.35	1.83 \pm 0.21
t	-	0.991	16.200
P	-	0.322	< 0.001

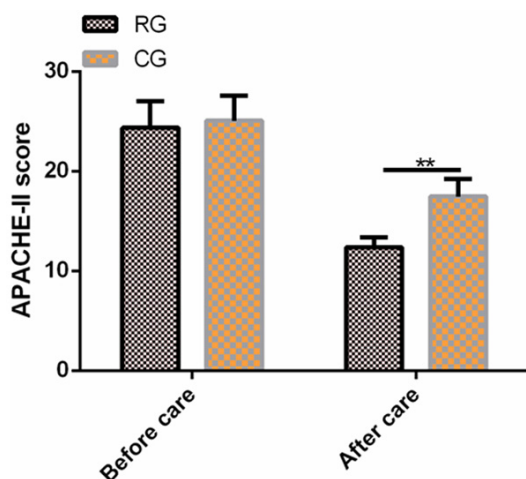


Figure 1. Comparison of APACHE-II score between the two groups before and after care. There was no difference in APACHE-II score between the two groups before care, but the score was notably lower in RG than CG after care ($P < 0.05$). Notes: * < 0.05 vs before care, ** < 0.01 vs two groups.

Complications during care in the two groups

Complications occurred during the nursing process in both groups, with the incidence of 1.85% in RG and 16.49% in CG, which was notably lower in RG than that in CG, and the difference was statistically significant ($P < 0.05$) (Table 6).

Comparison of nursing satisfaction between parents of the two groups of children

The nursing satisfaction of parents of children in RG was 98.15%, which was notably higher than that of CG (78.35%), with statistical difference ($P < 0.05$) (Table 7).

Discussion

The main cause of NRDS is the collapse of alveoli due to the lack of pulmonary surfactant [22]. Generally, children will suffer from progressive dyspnea and three depressions sign after birth, and in severe cases, death due to respiratory failure [23]. Therefore, early and effective diagnosis and treatment are necessary prerequisites. Nursing care, however, is also a kind of treatment intervention that has a great influence on the disease and is more extensive in scope, which significantly improves and promotes the therapeutic effect of children [24].

In this study, we applied comprehensive care in the treatment of children with NRDS and carried out effective psychological counseling for their families, and found that the condition of children and the psychological state of their families improved obviously after care. By analyzing the improvement of clinical indexes of children in the two groups, it was found that the improvement of respiratory rate and heart rate in RG was notably better than that in CG, and the length of hospital stay in RG was significantly shorter than that in CG, which indicated that comprehensive care could effectively keep children's respiratory tract smooth and improve their comfort, thus keeping children's vital signs stable and reducing treatment time. For children undergoing lung protective ventilation due to acute lung injury and acute respiratory distress syndrome, respiratory nursing intervention can effectively improve the deterio-

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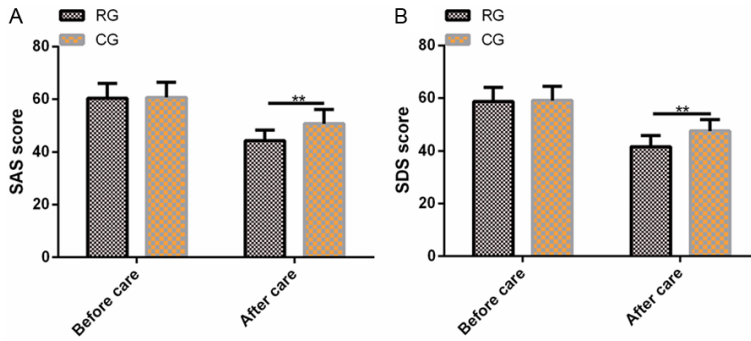


Figure 2. Comparison of SAS and SDS scores of parents of two groups of children. A: There was no difference in SAS score between parents of the two groups of children before care, but the score was notably lower in RG than CG after care ($P < 0.05$). B: There was no difference in SDS score between parents of the two groups of children before care, but the score was notably lower in RG than CG after care ($P < 0.05$). Notes: * < 0.05 vs before care, ** < 0.01 vs two groups.

Table 5. Comparison of ORR between the two groups after care [n (%)]

Group	n	Marked response	Effective response	No response	ORR (%)
RG	108	74 (68.52)	31 (28.70)	3 (2.78)	105 (97.22)
CG	97	39 (40.21)	46 (47.42)	12 (12.37)	85 (87.63)
χ^2	-	-	-	-	6.935
P	-	-	-	-	0.008

ration of oxygenation, reduce variability and potentially harmful ventilator settings [25]. By observing the oxygenation indexes of the children, we found that PaCO_2 in RG was notably lower than that in CG after care, while PaO_2 and SaO_2 were notably higher than those in CG, indicating that comprehensive care can better maintain the ventilation function of children and improve their oxygenation indexes. Our results conformed with previous study that effective intervention can improve oxygenation indexes and respiratory system function of children after operation [26]. It has been reported that alveolar collapse and atelectasis are prone to occur during the treatment of respiratory distress syndrome [27]. In this study, the Murray scores of children were observed in both groups before and after care, which was evidently lower in RG than CG, suggesting that comprehensive care can alleviate the reduction of lung volume caused by treatment, maintain the stability of airway pressure and reduce the incidence of lung injury. Clinically, APACHE-II score is often used to evaluate the prognosis of

patients after treatment [28, 29]. We observed APACHE-II scores of children in the two groups before and after care, and found that it was significantly lower in RG than CG after care, indicating that comprehensive care can effectively promote the treatment effect of children, reduce the occurrence of adverse events and improve the prognosis of children.

In the treatment of neonatal diseases, the recovery of children's diseases is largely determined by their parents' attitude towards disease treatment [30]. Most parents of children will have a series of negative emotions in the face of sudden changes, which affects their physical and mental health [31]. However, the team of Ozalp [32] indicated that effective care guidance for parents, including communication about illness and treatment, is effective in reducing

anxiety and negative emotions. In this study, SAS and SDS scores of parents before and after care were observed. The results showed that the two scores in RG were significantly lower than those in CG, suggesting that comprehensive care is beneficial to relieve parents' anxiety and depression, promote their ability to cope with diseases and improve their confidence in treatment. Comparison of the curative effects of the two groups after care showed that ORR of RG was remarkably higher than that of CG, indicating that comprehensive care has formulated and implemented effective full-time nursing intervention according to the condition of children, thus improving the response rate of treatment for children. The results of this study also showed that the total incidence of complications during the nursing process of children in RG was significantly lower than that in CG, which indicates that comprehensive care can significantly reduce the incidence of complications in the treatment and nursing period of children with NRDS, and also improve the rehabilitation foundation of children. We also

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Table 6. Complications during care in the two groups [n (%)]

Group	n	Nasal cavity slipping	Nasal obstruction	Malnutrition	Air leak	Total incidence rate (%)
RG	108	1 (0.93)	1 (0.93)	0 (0.00)	0 (0.00)	2 (1.85)
CG	97	6 (6.19)	3 (3.09)	4 (4.12)	3 (3.09)	16 (16.49)
χ^2	-	4.286	1.254	1.254	3.390	13.681
P	-	0.038	0.262	0.262	0.065	0.001

Table 7. Comparison of nursing satisfaction between parents of the two groups of children [n (%)]

Group	n	Satisfied	Moderate satisfied	Dissatisfied	Satisfaction (%)
RG	108	73 (67.59)	33 (30.56)	2 (1.85)	106 (98.15)
CG	97	35 (36.08)	41 (42.27)	21 (21.65)	76 (78.35)
χ^2	-	-	-	-	20.111
P	-	-	-	-	< 0.001

invited the children's families to score the nursing intervention. There is one study suggesting that patient satisfaction and family satisfaction are important and indispensable parts in the measurement of quality of health care, which will improve medical services [33]. In this study, the extent of satisfaction of the patients or the children in RG was notably higher than that in CG, indicating that comprehensive care enables the nurses and the families of the children to form a good nurse-patient relationship, so as to meet the nursing needs of the families of the children as far as possible, thus improving the nursing satisfaction.

Although this study confirms that comprehensive care provides better benefits for children NRDS and their families, there is room for improvement in this study. For example, we can analyze the risk factors that influence the poor prognosis of children with NRDS, which will help nursing staff to identify risk factors that need additional attention. Supplementary studies will be conducted gradually from the above perspectives in the future.

To sum up, comprehensive care is effective for children with NRDS, which can improve the oxygenation index, lung injury, reduce the incidence of complications, and improve the psychological mood of parents.

Disclosure of conflict of interest

None.

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