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Original Article

Effect of comprehensive nursing intervention in children with respiratory failure

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Abstract: Objective: To investigate the effect of comprehensive nursing intervention in the management of pediatric patients with respiratory failure. Methods: A total of 60 pediatric patients were selected as research subjects, and the clinical data were collected and retrospectively investigated. The patients were divided either into a control group (n=30) or an observation group (n=30) according to the nursing care methods. Pediatric patients from the observation group underwent comprehensive nursing intervention, while those in the control group received conventional nursing care intervention. The clinical effects, negative emotions, SF-36 scores, hospital stays, clinical symptom indicators, blood gas indices, lung function indicators and the nursing satisfaction rates were compared between the two groups. Results: The clinical effect in the observation group was significantly better than that in the control group. Compared with those in the control group, significantly lower scores of the Self-Rating Anxiety Scale and the Self-Rating Depression Scale were observed in the observation group. The indicators associated with blood gas and lung function in the observation group were significantly improved in contrast to those in the control group. Moreover, the disappearance time of pulmonary rales, disappearance time of cyanochroia, alleviation time of dyspnea and hospital stays in the observation group were significantly shorter than those in the control group, while the SF-36 scores and the nursing satisfaction rate in the observation group were significantly higher than those in the control group (all $P<0.05$). Conclusion: Comprehensive nursing intervention significantly improved clinical treatment effects and patient satisfaction, alleviated the clinical symptoms, increased life quality and shortened hospital stay. So, it is worth being promoted in clinical practice.

Keywords: Comprehensive nursing, respiratory failure, pediatric patient, efficacy

Introduction

Respiratory failure is characterized by the dysfunction of ventilation and/or expiration caused by various factors, without autonomous respiration, so the body's cannoth sustain itself. Many Studies showed that respiratory failure can easily lead to CO_2 retention, resulting in a series of physiological and metabolic disorders or even death if not treated in time [1, 2]. Due to the incomplete development of the respiratory system and poor defensive ability, respiratory failure can be easily induced in children with severe pneumonia, trachea obstruction, sepsis and so on [3]. Another study reported that compared with adult respiratory failure, the progression of pediatric respiratory failure was much faster, and it was more likely to cause cardiac arrest, respiratory arrest and damage vital organs such as the brain, resulting in serious adverse outcomes [3]. At present, the therapy for pediatric respiratory failure is mainly based on symptomatic and supportive treatment. However, due to the lack of optimal nursing methods in the course of medical treatment for pediatric patients, the prognosis of these patients is poor, and it is difficult to achieve the expected therapeutic effect. Therefore, it is necessary to perform targeted nursing intervention for pediatric patients with respiratory failure to improve the quality of nursing care and the prognosis of the patient.

The effect of conventional nursing currently applied for pediatric patients with respiratory failure in clinical practice is not satisfactory,

which includes some limitations such as insufficient attention to psychological nursing and the influence of environmental intervention. Accompanied by conventional nursing, common nursing problems are inadequate health guidance, insufficient knowledge about respiratory failure, neglecting nutritional balance of pediatric patients [4, 5]. Comprehensive nursing is a holistic nursing mode, which can provide high-quality, comprehensive and integrated nursing services for patients. Some studies revealed that comprehensive nursing performed appropriate adjustments in the terms of nursing quality and scope [6, 7]. Under this nursing mode, scientific, high-quality and comprehensive nursing measures are developed to ensure the recovery of patients. So far, relevant research mainly focuses on nursing modes for pediatric patients with respiratory failure and their effects, including cluster nursing and evidence-based nursing. The efficacy of nursing care is different along with a difference in selected outcome measures [8, 9]. However, there are few studies on the efficacy of comprehensive nursing care on pediatric patients with respiratory failure. Thus, this study performed comprehensive nursing for pediatric patients with respiratory failure, and assessed its effect on clinical effects, negative emotions, SF-36 scores, hospital stays, clinical symptom indicators, blood gas indices, lung function indicators and nursing satisfaction, with the goal of providing scientific basis for clinical nursing care in pediatric patients with respiratory failure.

Materials and methods

Subjects

This is a retrospective study. Pediatric patients admitted in Sichuan Provincial Maternity and Child Health Care Hospital from January 2017 to May 2020 were enrolled in this research. This study was approved by the Ethics Committee of hospital (Approval No. 2016-325). Inclusion criteria: (1) Pediatric patients who met the diagnostic criteria for respiratory failure [10]. (2) Pediatric patients who were diagnosed with respiratory failure for the first time did and not received any treatments. (3) Pediatric patients with PaO_2<8 kPa, and/or $PaCO_2$>6.65 kPa. (4) Pediatric patients who actively cooperated with this study. (5) Pediatric patients with complete clinical data. Exclusion criteria: (1) Patients who were accompanied with other system failures. (2) Patients whose respiratory failure was caused by congenital respiratory system dysplasia. (3) Patients with asthma, cognitive impairment, neurological disease, gastrointestinal dysfunction or severe electrolyte disturbance. (4) Patients with serious dysfunction of important organs such as the heart, liver or kidney.

According to the inclusion criteria and exclusion criteria, 60 pediatric patients with respiratory failure were recruited in this research, and the collected data were retrospectively analyzed. According to the nursing care methods, these patients were assigned into a control group (n=30) and an observation group (n=30). Patients in the control group were treated with conventional nursing care, while those in the observation group were treated with comprehensive nursing care.

Methods of nursing care

Pediatric patients in the control group underwent conventional nursing care. The conventional care intervention included recording their vital signs, conducting laboratory and imaging tests, maintaining an unobstructed airway, providing medical treatment following the doctor's orders, improving respiratory function, keeping normal body temperature, closely observing the patient's conditions and giving general health education.

Those in the observation group underwent comprehensive nursing care in addition to the conventional care intervention [11]. The comprehensive nursing care included the following items. (1) Health education: Upon admission, nurses informed the families or guardians of pediatric patients about knowledge associated with respiratory failure and treatment regimens, so as to relieve their fears and doubts. (2) Medication nursing: Oxygen was given through the appropriate methods according to the conditions of pediatric patients. The methods included a nasal oxygen cannula, mask oxygen inhalation and so on. Continuous oxygen-supply with low flow (1-2 L/min) and low concentration (25%-30%) was performed. Noninvasive positive pressure ventilation was immediately conducted for pediatric patients with abnormal breathing, aggravated cyanosis

symptoms and obvious symptoms of respiratory failure. The pediatric patients were assisted to sit up, and their back was patted for sputum excretion to prevent the occurrence of hypostatic pneumonia. If necessary, suction catheter combined with aerosol inhalation therapy was used. The vital signs and state of consciousness of the pediatric patients were closely observed, and the abnormalities were treated in a timely manner. (3) Psychological care: Nurses adequately understood the psychological changes of pediatric patients and their families during hospitalization periods, minimized their psychological discomforts, and helped them to establish beliefs in overcoming the disease. They were encouraged to enhance confidence in rehabilitation. The families were guided to provide patients with scientific accompaniment and care. (4) Diet care: Diets easy to digest, high-quality protein, high calorie and rich vitamins were provided to improve the resistibility and immunity of the pediatric patients, and any hot, spicy or stimulating food was avoided. The dieting principle was more meals per day but less food per meal. If patients had too serious conditions to eat, administration of intravenous fluids was required. (5) Ward environment: Nurses tried to create a quiet, healthy, warm and comfortable environment for the patients. The indoor air was kept fresh, and windows were open regularly. The room was maintained at a temperature of 18-22°C and a humidity of 60%. The ward was clean, hygienic and sterilized regularly. The isolation procedures with respiratory precautions were developed to protect pediatric patients from infectious contact, and the number of accompany the personnel was decreased.

Observed outcomes

The clinical efficacy was compared between the two groups. The criteria of efficacy were as follows [12]: significantly effective: the symptoms of dyspnea and cyanosis disappeared, and the blood gas indications and other detection indexes returned to normal levels; effective: the clinical symptoms of the children were significantly improved, and the blood gas indications and other detection indexes were close to normal levels; ineffective: clinical symptoms, blood gas indications, other indexes were improved or became even worse. The total response rate of comprehensive nursing was obtained according to the following formula: total response rate = [1 - (number of ineffective patients/total number of patients)] × 100%.

The anxiety and depression were compared between the two groups. The Self-Rating Anxiety Scale (SAS) and the Self-Rating Depression Scale (SDS) were exploited to assess the negative emotions of children before and after intervention [13]. SAS or SDS was composed of 20 items and scaled by a 4-point scoring method. Higher SAS scores indicated worse anxiety. Higher SDS scores indicated severe depression.

SF-36 scores and hospital stays were compared between the two groups. SF-36 questionnaire was used to assess the quality of life in children between the two groups. It was composed of 36 questions, including physical functioning, general health, role physical, bodily pain, social functioning, vitality, as well as emotional and mental health. The score ranged from 0 point to 100 points. Higher score suggested better health.

Clinical symptom indicators, blood gas index and lung function indicators were compared between the two groups. Clinical symptom indicators consisted of the disappearance time of pulmonary rales, disappearance time of cyanochroia and alleviation time of dyspnea. Blood gas index were composed of pH, $PaCO_2$, PaO_2 and SaO_2. Lung function indicators included the vital capacity, forced vital capacity, inspiratory capacity, maximal voluntary ventilation and ventilation flow rate.

The nursing satisfaction rate was compared between the two groups: The scores of nursing satisfaction were provided by the patient and his/her family in terms of ward environment, health education, work attitude, nurse skills and nursing outcomes. The total score was 100 points. A score over 90 points indicated great satisfaction. Scores between 70 and 90 points indicated satisfaction. A score less than 70 points indicated dissatisfaction. The nursing satisfaction rate in each group was obtained according to the following formula: Nursing satisfaction rate = (the number of cases with great satisfaction + the number of cases with satisfaction)/total number of cases × 100%.

Table 1. Comparison of basic information between the two groups

Group	Control group (n=30)	Observation group (n=30)	t/χ^2 value	*P* value
Male/Female (n)	14/16	15/15	0.067	0.796
Age (years)	7.5±1.2	7.7±1.1	0.672	0.506
Course of disease (years)	3.8±0.9	4.0±1.0	1.213	0.230
BMI (kg/m^2)	16.6±0.8	16.8±0.9	1.195	0.246
Respiratory failure classification (n)			0.480	0.488
I type	24	26		
II type	6	4		

Note: BMI: Body mass index.

Table 2. Comparison of clinical efficacy between the two groups

Group	Ineffective (cases)	Effective (cases)	Significantly effective (cases)	Total response rate (%)
Control group (n=30)	8	9	13	73.3
Observation group (n=30)	2	12	16	93.3
χ^2 value				4.320
P value				0.038

Statistical analysis

Data analyses were conducted by the SPSS 23.0 software package. The measurement data were presented as mean ± standard deviation (SD). Independent t-test was used for comparison between the two groups. Chi-square test (χ^2 test) was used for comparison of enumeration data between the two groups, and the enumeration data was expressed as percentage or case (n). P<0.05 suggested statistical differences.

Results

Comparison of basic information

As shown in **Table 1**, there was no significant difference between the two groups in the term of sex, age, course of disease, cause of disease and respiratory failure classification (all *P*>0.05), so the two groups were comparable.

Comparison of clinical efficacy

In the control group, as far as treatment efficacy; there were 8 cases of ineffective, 9 cases of effective and 13 cases of significantly effective, while in the observation group there were 2 patients with ineffective, 12 patients with effective and 16 patients with significantly effective. As shown in **Table 2**, the total response rate in the observation group was significantly higher than that in the control group.

Comparison of the degree of negative emotions

There was no obviously statistical difference in the SDS score and SAS score between the two groups before intervention (all P>0.05). The SDS and SAS scores after intervention were remarkably lower than those before intervention in both groups (all P<0.001). After intervention, the SDS score and SAS score in the observation group were obviously lower than those in the control group, as seen in **Figure 1**.

Comparison of clinical symptom indicators

As shown in **Table 3**, the disappearance time of pulmonary rales, disappearance time of cyanochroia and alleviation time of dyspnea in the control group were 5.5±1.1 d, 1.7±0.4 d and 1.9±0.4 d, respectively, while these in observation group were 4.2±1.2 d, 1.0±0.3 d and 1.3±0.6 d, respectively. Significant differences were observed in terms of disappearance time of pulmonary rales, disappearance time of cyanochroia and alleviation time of dyspnea between the two groups.

Comparison of SF-36 scores and hospital stays

As shown in **Figure 2**, the hospital stay in the observation group was significantly shorter

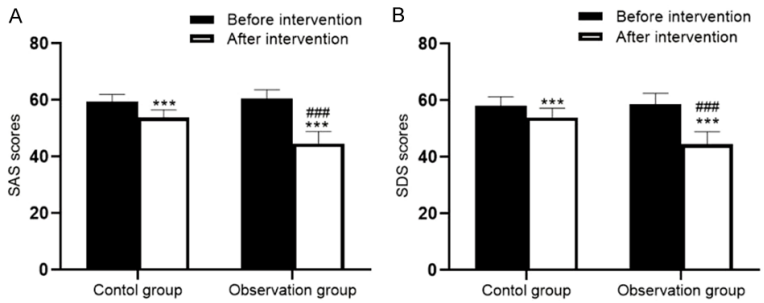

Figure 1. Comparison of SAS and SDS scores between the control group and the observation group. SAS: Self-rating anxiety scale; SDS: Self-rating depression scale. Compared with the same group before intervention, ***P<0.001; compared with control group after intervention, ###P<0.001.

Table 3. Comparison of disappearance time of pulmonary rales, disappearance time of cyanochroia and alleviation time of dyspnea between the two groups

Groups	Disappearance time of pulmonary rales (d)	Disappearance time of cyanochroia (d)	Alleviation time of dyspnea (d)
Control group	5.5±1.1	1.7±0.4	1.9±0.4
Observation group	4.2±1.2	1.0±0.3	1.3±0.6
t value	4.319	6.830	5.313
P value	<0.001	<0.001	<0.001

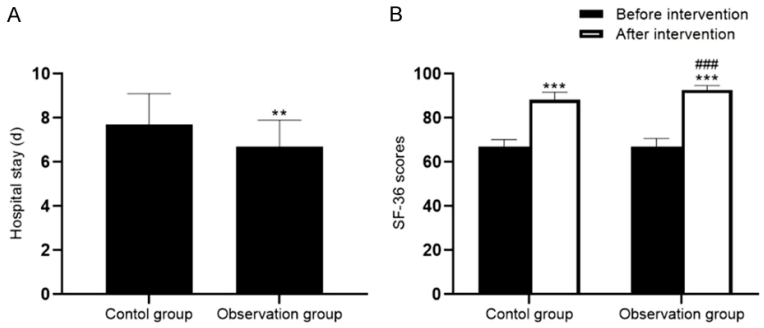

Figure 2. Comparison of hospital stay and SF-36 scores between the control group and the observation group. Compared with the same group before intervention, ***P<0.001; compared with control group after intervention, ###P<0.001, **P<0.01.

Table 4. Comparison of blood gas index between the two groups

Groups	$PaCO_2$ (mmHg)	PaO_2 (%)	PH	SaO_2 (%)
Control group	41.1±4.3	80.8±3.8	7.29±0.04	87.2±7.6
Observation group	36.7±3.5	92.8±2.2	7.30±0.03	93.2±3.5
t value	4.316	14.990	1.890	8.550
P value	<0.001	<0.001	0.064	<0.001

than that in the control group. No significant differences were observed before intervention in the term of SF-36 scores between the two groups. The SF-36 scores after intervention in both groups were significantly higher than those before intervention (all P< 0.001). Moreover, the SF-36 score in the observation group after intervention was obviously higher than that in the control group (P<0.001).

Comparison of blood gas index

As shown in **Table 4**, the values of $PaCO_2$, PaO_2 and SaO_2 in the control group were 41.1±4.3 mmHg, 80.8±3.8 mmHg and 87.2±7.6, respectively. The values of $PaCO_2$, PaO_2 and SaO_2 in the observation group were 36.7±3.5 mmHg, 92.8±2.2 mmHg and 93.2±3.5, respectively. $PaCO_2$ in the control group was significantly higher than that in the observation group, while PaO_2 and SaO_2 in the observation group were significantly higher than those in the control group (all P<0.001). No statistical difference in the value of pH was found between two groups.

Comparison of lung function indicators

As shown in **Table 5**, the vital capacity, forced vital capacity, inspiratory capacity, maximal voluntary ventilation, ventilation flow rate in the control group were 1.8±0.3 L, 1.9± 0.2 L, 1.3±0.2 L, 56.5±3.8 L/min, and 3.1±0.4 L/s, respectively, while those in the observation group were 2.1± 0.4 L, 2.3±0.3 L, 1.6±0.6 L, 59.3±3.0 L/min and 3.7±0.3 L/s, respectively. The lung function indicators in the control group were obviously lowerthan those in the observation group (all P<0.01).

Table 5. Comparison of lung function indicators between the two groups

Groups	Vital capacity (L)	Forced vital capacity (L)	Inspiratory capacity (L)	Maximal voluntary ventilation (L/min)	Ventilation flow rate (L/s)
Control group	1.8±0.3	1.9±0.2	1.3±0.2	56.5±3.8	3.1±0.4
Observation group	2.1±0.4	2.3±0.3	1.6±0.6	59.3±3.0	3.7±0.3
t value	3.620	6.710	3.693	3.196	6.131
P value	<0.001	<0.001	<0.001	0.002	<0.001

Table 6. Comparison of nursing satisfaction rate between the two groups [n (%)]

Degree of satisfaction	Control group (n=30)	Observation group (n=30)	X^2 value	*P* value
Great satisfaction	12	16		
Satisfaction	9	12		
Dissatisfaction	9	2		
Satisfaction rate	21 (70.0)	28 (93.3)	5.455	0.020

Comparison of satisfaction

In the control group, there were 12 patients with great satisfaction, 9 patients were satisfied and 9 patients were dissatisfied, while in the observation group, there were 16 cases with great satisfaction, 12 cases were satisfied and 2 cases were dissatisfied. The nursing satisfaction rate in the observation group was significantly higher than that in control group [70.0% (21/30) *vs.* 86.7% (28/30), χ^2=5.455, P=0.020], as seen in **Table 6**.

Discussion

Respiratory failure is a relatively common acute disease seen in pediatric clinics, and it is a critical clinical syndrome caused by the various pathologies. Because children are young and the immune system is not fully developed, and effective measures need to be conducted to improve the immunity in pediatric patients, the nursing also needs to be strengthened. In recent years, there have been some studies reporting that high-quality medical nursing measures are valuable for improving the treatment effect on pediatric patients [14]. Another study has shown that comprehensive nursing is holistic and high quality, and its clinical application has acquired more and more attention [15]. Other studies revealed that comprehensive nursing can significantly improve negative emotions caused by diseases, enhance the compliance of patients, decrease the incidence of complications, and alleviate clinical symptoms, thereby obtaining satisfactory treatment effects [16]. The comprehensive nursing care given to pediatric patients with respiratory failure in this study was composed of health guidance, medication nursing, diet care and ward environment intervention. The results of this study showed that the clinical efficacy of patients in the observation group was obviously better than that in the control group, indicating that comprehensive nursing provided high-quality and comprehensive nursing for pediatric patients with respiratory failure, and achieved the aim of enhancing the nursing quality and improving the prognosis. In addition, compared with the control group, the observation group experienced significantly shorter hospital stays, suggesting that comprehensive nursing can alleviate symptoms of pediatric patients with respiratory failure and accelerate their recovery, which is similar to the results reported by Mammas et al. [17].

The treatment targeted for symptoms plays an important role in the quick recovery of patients. The results of this study showed that the disappearance time of pulmonary rales, disappearance time of cyanochroia and alleviation time of dyspnea in the observation group were significantly shorter than those in the control group. The reasons are considered to be as follows: environmental intervention created a favorable ward for pediatric patients to promote their recovery from illness; diet nursing was conductive to improving the physical quality in pediatric patients; psychological nursing was helpful to alleviate the anxiety and depression in the pediatric patients and their families and to increase their self-confidence, as well as treatment compliance and active cooperation.

Depression and anxiety that occur during the course of treatment exert a severe influence on the outcomes of pediatric patients. Currently,

SAS and SDS are considered as the authoritative tools for objective and quantitative assessment of psychological conditions of patients [18]. This study revealed that SAS and SDS scores in the observation group were remarkably reduced after intervention, suggesting that pediatric patients and their families had obvious anxiety and depression, which is generally consisted with the finding reported by Gong et al. [19]. Comprehensive nursing care can play an auxiliary role in improving the mental conditions of patients and help them to be in a better psychological state.

The detection of blood gas and lung function results is widely used for evaluating the conditions of severe pediatric patients with respiratory failure. Another study demonstrated that blood gas and lung function results were closely associated with the prognosis of pediatric patients with respiratory failure [20]. This study established targeted comprehensive nursing care to promote the recovery of pediatric patients with respiratory failure, with the goal of improving their prognosis. Our results showed that the blood gas and lung function in the observation group were significantly better than those in the control group, which was due to the fact that comprehensive nursing provided health guidance, medical nursing, psychological nursing and other intervention measures for pediatric patients, playing an auxiliary role in ameliorating the patient's condition and helping them to be in a better physiological and psychological state.

SF-36 score is the most common indicator for assessing the life quality. Usually, the quality of life is significantly decreased in pediatric patients with respiratory failure since their lives are severely affected [21]. Moreover, the reduced life quality can further undermine the self-esteem and self-confidence of pediatric patients. Maximizing the recovery of life quality has become one of the important rehabilitation goals. The results of this study showed that SF-36 score in the observation group was much higher than that in control group, indicating that comprehensive nursing care can significantly improve the life quality in pediatric patients with respiratory failure. This is consistent with the results reported by Fan et al. [22].

As for patients' satisfaction with nursing care, comprehensive nursing can improve the professional abilities of nurses, allowing them to more accurately understand the nursing required for pediatric patients with respiratory failure and to acheive more meticulous nursing [23]. A study reported that good nursing care could improve patients' satisfaction with nursing [24]. The current study suggested that the satisfaction rate of nursing in the observation group was significantly better than that in the control group, which is in accordance with a previous study [25].

This study has some limitations; including being a single-center design, having small sample size, with no long-term follow-up results and no classification comparison. In the future, a randomized, double blind, multi-center, controlled clinical study with large sample size and long-term follow-up is needed to confirm the conclusions.

In summary, comprehensive nursing intervention for pediatric patients with respiratory failure conforms to nursing needs. This care method can effectively enhance the clinical treatment efficacy, improve the clinical symptoms, blood gas results and lung function of patients, decrease the hospital stay, and increase the life quality and clinical nursing satisfaction. So, it is worthy of promotion in clinical practice.

Disclosure of conflict of interest

None.

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