

Original Article

Effects of comprehensive nursing intervention on patients with acute respiratory distress syndrome undergoing prone position ventilation

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Abstract: Objective: To explore the effect of comprehensive nursing intervention on patients with acute respiratory distress syndrome (ARDS) undergoing prone position ventilation (PPV) during treatment. Methods: ARDS patients undergoing PPV (n=130) were enrolled as research objects, and their data were retrospectively studied. The patients were assigned to an observation group nursed under the comprehensive nursing mode and a control group nursed under the routine nursing mode according to the nursing intervention mode (each n=65), and the following items of the two groups were compared: ventilation indexes, mean arterial pressure (MAP), hospitalization time in intensive care unit (ICU), total hospitalization time, complication rate, Acute Physiology and Chronic Health Evaluation II (APACHE II) score, and nursing satisfaction. Results: The observation group after comprehensive nursing intervention showed significantly higher MAP and better ventilation indexes than the control group (both $P<0.05$), and also experienced significantly shorter hospitalization time in ICU and total hospitalization time than the control group (both $P<0.05$). In addition, the complication rate and APACHE II score of the observation group were both significantly lower than those of the control group, while the nursing satisfaction of the observation group was significantly higher than that of the control group (all $P<0.05$). Conclusion: Comprehensive nursing intervention can effectively improve the efficacy of PPV in ARDS patients, shorten their hospitalization time, and improve their nursing satisfaction.

Keywords: Acute respiratory distress syndrome, prone position ventilation, comprehensive nursing, efficacy

Introduction

Acute respiratory distress syndrome (ARDS) is a common clinical respiratory disease, which is characterized by acute onset, critical condition, and high mortality, seriously threatening the life and health of patients [1, 2]. Prone position ventilation (PPV), as a common method of auxiliary ventilation used for ARDS patients in recent years, can significantly improve oxygenation and effectively alleviate refractory hypoxemia of patients [3, 4]. However, it requires patients to keep a prone position for a long time, which is prone to bring about complications and cause pain in patients during treatment, and also poses certain difficulties for later nursing on the patients, so it is not conducive to the patients' recovery [5]. Some studies have pointed out that prone position is a passive position, which is prone to cause skin inju-

ries such as pressure sores, facial edema, easy distortion or even slippage of catheters, psychological anxiety, and other nursing problems [6, 7]. Therefore, it is necessary to take targeted nursing measures for such patients to improve the quality of nursing and prognosis of them.

The effect of routine nursing currently applied on ARDS patients undergoing PPV in clinical practice is not satisfactory, which is characterized by one-sidedness, such as insufficient attention to the psychological changes of patients and the impact of environmental intervention and insufficient attention to the overall care of patients. Accompanied by routine nursing, common nursing problems include insufficient health guidance, insufficient knowledge of prone ventilation, insufficient attention to the negative emotions of patients, and insuffi-

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cient nutrition balance of patients [8]. Comprehensive nursing is an all-round nursing mode, which is mainly based on high-quality nursing and provides comprehensive and integrated nursing services for patients. Compared with the traditional nursing mode, comprehensive nursing has made appropriate adjustments in nursing time and scope, under which a scientific and reasonable nursing program is formulated to ensure that it provides high-quality nursing for ARDS patients undergoing PPV [9]. At present, relevant researches mainly focus on nursing modes in ARDS patients undergoing PPV and their effects, including evidence-based nursing and cluster nursing. The efficacy of nursing is different along with the difference of selected outcome measures [10]. However, there are rare reports on the efficacy of comprehensive nursing intervention in ARDS patients undergoing PPV. Therefore, this study adopted comprehensive nursing for patients, and evaluated its effect on the ventilation indexes, mean arterial pressure (MAP), hospitalization time, complication rate, APACHE II score, and nursing satisfaction of the patients, with the goal of providing scientific basis for clinical nursing measures.

Materials and methods

Research objects

ARDS patients admitted to The Second Affiliated Hospital of Hainan Medical University from June 2017 to December 2019 (n=130) were enrolled as research objects, and their clinical data were studied retrospectively.

The inclusion criteria of the patients: Patients meeting the 2012 diagnostic criteria of ARDS issued by the European Society of Intensive Care Medicine (ESICM) based on clinical symptoms, plain CT scan, and chest radiography [11]; patients suffering from acute onset, dyspnea, and oxygenation disorder (arterial carbon dioxide partial pressure (PaO_2)/inspired oxygen (FI_2) <200 mmHg); patients whose imaging results indicated infiltration of pulmonary interstitium or alveoli, pulmonary artery wedge pressure less than 18 mmHg, and no left ventricular dysfunction; patients older than 18 years old; patients receiving PPV; patients with detailed clinical data, and those who and whose family members signed informed consent forms and were willing to cooperate with the study.

The exclusion criteria of the patients: Patients with contraindications for PPV including facial fracture and intracranial hypertension; patients with skin diseases such as skin damage; pregnant or lactating women; patients with mental diseases, malignant tumor diseases or severe hearing impairment, and those accompanied by organic diseases such as congenital heart disease.

The patients were selected according to the inclusion and exclusion criteria, and their clinical data were collected. The enrolled patients were assigned to a control group nursed under the routine nursing mode (n=65) and an observation group nursed under the comprehensive nursing mode based on routine nursing (n=65). The study was approved by the Ethics Committee of The Second Affiliated Hospital of Hainan Medical University.

Methods

Patients in the control group were given routine nursing as follows: Nursing staff were arranged to record the vital signs of the patients, help them complete all corresponding laboratory and imaging examinations, carry out drug treatment according doctor's advice, carry out general health education, and inform patients and their family members of possible complications caused by PPV.

Patients in the observation group were given comprehensive nursing based on routine nursing as follows [12, 13]: (1) Health guidance: Nursing staff were arranged to inform the patients of relevant knowledge of ARDS and treatment scheme of PPV, relieve fears and doubts of the patients and their family members about the disease, and introduce successful cases of PPV treatment. In addition, the nursing staff were arranged to help the patients complete examinations, and monitor their abnormal indexes in real time. Furthermore, the nursing staff were arranged to actively communicate with the patients, establish a good nurse-patient relationship with them, help them correctly understand the disease, relieve their discomfort to the greatest extent, and improve their tolerance and compliance to treatment. (2) Nursing against complications: The nursing staff were arranged to regularly carry out posture nursing for the patients every 2 hours, adjust the positions of the patients' heads and limbs to prevent their joints from being exces-

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sively pressed or stretched and prevent bed-sore. The nursing staff were required to pay attention to the occurrence of pressure, discount and fall-off of catheters such as arterio-venous catheters and artificial airway catheters when helping the patients turn over. In addition, the nursing staff were arranged to strengthen respiratory tract nursing, humidify airway, keep the patients' respiratory tract unobstructed, and adjust the ventilator parameters according to the arterial blood gases and blood oxygen saturation of the patients. Furthermore, the nursing staff were also arranged to raise the head and shoulder of each patient by 15-30 degrees with a pat to prevent facial edema, and apply a horseshoe-shaped head ring to each patient to prevent patient's eyes from being pressed. The nursing staff were also required to pay attention to the changes of patients' vital signs to avoid adverse reactions such as hypotension during treatment. (3) Psychological nursing: The nursing staff were arranged to understand the changes of psychological activities of the patients in the whole process of treatment, give timely psychological counseling to them, try to alleviate their psychological discomfort, anxiety, and tension, help them establish the belief of overcoming the disease, and improve their activity in cooperating with treatment and nursing. (4) Diet nursing: The nursing staff were arranged to provide nasal feeding diet for the patients undergoing PPV to supplement their calories and enhance their resistance and immunity in the premise of avoiding aspiration and maintaining their gastric tube unobstructed and clean. (5) Environmental intervention: The nursing staff were arranged to create a quiet, healthy, warm, and comfortable ward environment, pay attention to the physical and mental state of the patients, and help them shift their attention through music or broadcasting.

Outcome measures

Primary outcome measures: The ventilation indexes including arterial partial pressure of oxygen (PaO₂), arterial carbon dioxide partial pressure (PaCO₂), PaO₂/PaCO₂, and MAP of the two groups were compared.

The Acute Physiology and Chronic Health Evaluation II (APACHE II) score was also compared between the two groups. With a total score of 71 points, the APACHE II scoring system con-

sists of the following three parts: Acute physiology score, age score, and chronic health status score, and a higher APACHE II score indicates more serious disease. APACHE II scoring of the patients was completed by 2 senior attending ICU physicians.

Secondary outcome measures: The hospitalization time in ICU and total hospitalization time of the two groups were compared.

The complications of the two groups during nursing intervention were also compared, including hypotension, unplanned extubation, pressure sore, facial edema, catheter slippage, and corneal injury. The complication rate was calculated as follows: The number of patients suffering from a complication/the total number of patients × 100%.

The nursing satisfaction of the two groups was compared: The nursing satisfaction was a score given by a patient and his/her familiars in terms of ward environment, health education, nursing staff's technology and work attitude, and nursing results, which had a full score of 100 points, and indicated high satisfaction with more than 90 points, satisfaction with 70-90 points, and dissatisfaction with less than 70 points [14]. The nursing satisfaction was calculated as follows: Nursing satisfaction = (the number of patients with high satisfaction + the number of patients with satisfaction)/total number of patients × 100%.

Statistical analysis

The experimental data were processed using SPSS22.0 (IBM Company, United States). Quantitative data were expressed as the mean ± standard deviation ($\bar{x} \pm sd$), compared between groups using the independent-samples T test, and compared within groups before and after intervention using the paired t test. Enumeration data were expressed as the number of cases/percentage (n/%), and compared between groups using the chi-square test. $P < 0.05$ indicates a significant difference.

Results

Comparison of basic data

As shown in **Table 1**, there was no significant difference between the two groups in items including sex, age, body mass index (BMI),

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Table 1. Comparison of basic data

Index	Control group (n=65)	Observation group (n=65)	χ^2/t	P
Age (years)	58.1±4.9	58.4±5.1	0.342	0.733
Male/female (case)	42/23	45/20	0.313	0.576
BMI (kg/m ²)	21.24±1.22	20.93±1.06	1.548	0.124
Cause of disease (case)			0.716	0.869
Severe pneumonia	27	25		
Aspiration pneumonia	22	25		
Sepsis	10	11		
Lung contusion	6	4		
Hypertension (case)	14	11	0.446	0.504
Diabetes (case)	10	13	0.475	0.491
Incubation (case)			0.769	0.381
Oral tracheal intubation	57	60		
Transtracheal intubation	8	5		

Note: BMI: body mass index.

Table 2. Comparison of ventilation index and MAP ($\bar{x} \pm sd$, mmHg)

Group	Control group (n=65)	Observation group (n=65)	χ^2	P
MAP	66.52±6.24	69.21±6.83	2.366	0.020
PaCO ₂	43.74±5.73	41.32±5.10	2.53	0.013
PaO ₂	67.93±4.91	71.42±5.54	2.736	0.007
PaO ₂ /FiO ₂	223.61±42.83	240.12±47.24	2.974	0.004

Note: MAP: mean arterial pressure; PaCO₂: arterial carbon dioxide partial pressure; FiO₂: inspired oxygen fraction; PaO₂: arterial partial pressure of oxygen.

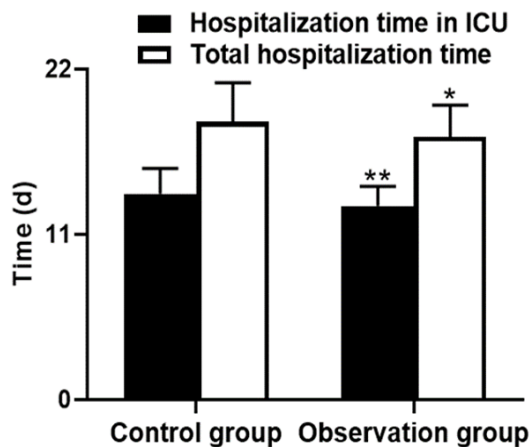


Figure 1. Comparison of hospitalization time of patients. Compared with the control group, *P<0.05, **P<0.01. ICU: intensive care unit.

cause of disease, and incubation (all P>0.05), so the two groups were comparable.

Comparison of ventilation indexes and MAP

The observation group showed significantly higher MAP than the control group (P=0.020), and in terms of ventilation indexes, the observation group showed significantly lower PaCO₂ and significantly higher PaO₂ and PaO₂/FiO₂ than the control group (both P<0.05). See **Table 2**.

Comparison of hospitalization time in ICU and total hospitalization time

Compared with patients in the control group, patients in the observation group experienced significantly shorter hospitalization time in ICU (13.7±1.7 d vs. 12.9±1.3 d, t=3.014, P=0.003) and total hospitalization time (18.5±2.6 d vs. 17.5±2.1 d, t=2.412, P=0.017). See **Figure 1**.

Comparison of complication rate

The complication rate of the observation group was significantly lower than that of the control group (12.31% (8/65) vs. 30.77% (20/65), $\chi^2=6.555$, P=0.011). See **Table 3**.

APACHE II score

The APACHE II score of the control group at admission and discharge was 27.43±5.82 points and 21.54±4.13 points, respectively, and the APACHE II score of the observation group at admission and discharge was 27.12±5.24 points and 19.70±3.32 points, respectively, so both groups got a significantly lower APACHE II score at discharge (both P<0.001), and the score of the observation group was significantly lower than that of the control group at discharge (t=2.757, P=0.007). See **Figure 2**.

Comparison of nursing satisfaction

The nursing satisfaction of the observation group was significantly higher than that of the control group (87.69% (57/65) vs. 72.31% (47/65), $\chi^2=4.808$, P=0.028). See **Table 4**.

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Table 3. Comparison of complications of patients (n (%))

Group	Control group (n=65)	Observation group (n=65)	χ^2	P
Hypotension	3	1		
Unplanned extubation	5	2		
Facial edema	3	1		
Catheter slippage	3	1		
Corneal injury	2	1		
Pressure ulcer	4	2		
Total complications	20 (30.77)	8 (12.31)	6.555	0.011

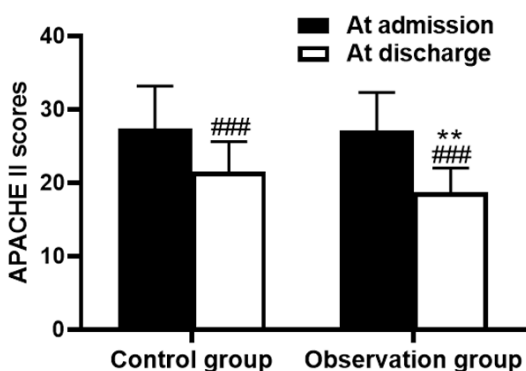


Figure 2. Comparison of APACHE II scores of patients. Compared with when admitted to the same group, ### $P < 0.001$; compared with patients in control group at discharge, ** $P < 0.01$. APACHE II: acute physiology and chronic health evaluation II.

Discussion

At present, PPV is increasingly applied to the clinical treatment of ARDS. Its mechanism is to reduce shunt, promote blood flow ventilation, and gradually restore some lung tissues. However, in clinical practice, it is difficult to nurse patients undergoing PPV. In recent years, there have been research reports that high quality of medical nursing is more and more valuable for improving the therapeutic effect on patients [15]. One study has concluded that comprehensive nursing is an all-around high-quality nursing mode, and its clinical application has captured increasing attention [16]. It is reported that comprehensive nursing can significantly improve the compliance of patients, reduce adverse emotions caused by diseases and the occurrence of complications, ameliorate the symptoms of patients, and thus enable the patients to obtain satisfactory therapeutic effects [17]. The comprehensive nursing applied in this study was a new nursing mode, under which measures including health guidance, nursing against complications, psycho-

logical nursing, diet nursing, and environmental intervention were adopted for ARDS patients undergoing PPV. The results of this study showed that the ventilation indexes and MAP of the patients in the observation group were significantly better than those in the control group, indicating that comprehensive nursing provided comprehensive and high-quality nursing for the patients, and finally achieved the goal of improving the nursing quality and continuously

improving the prognosis of the patients. In addition, compared with the control group, the observation group experienced significantly shorter hospitalization time in ICU and total hospitalization time, implying that comprehensive nursing could ameliorate symptoms of ARDS patients undergoing PPV and accelerate their recovery, which was basically consistent with the results reported by Lu et al. [18].

The prevention of complications plays a crucial role in the smooth recovery of patients. The results of this study revealed that ARDS patients undergoing PPV were prone to hypotension, unplanned extubation, pressure sore, facial edema, catheter slippage, and corneal injury, and the total incidence of complications of the observation group was significantly lower than that of the control group, which may be due to the following reasons: Diet nursing improved the physical quality of patients; environmental intervention created a favorable ward for patients to help them recover from illness; psychological nursing relieved anxiety and depression of the patients and their families, and improved the patients' treatment compliance and active cooperation, and nursing against complications enhanced patients' confidence in treatment.

The APACHE II scoring system is widely applied to evaluate the condition of severe patients, and a higher score indicates more serious condition. One study has confirmed that APACHE II score is closely related to the onset and prognosis of ARDS [19]. This study developed a targeted comprehensive nursing mode to promote the recovery of ARDS patients undergoing PPV to the maximum extent, with the goal of improving their prognosis. The results of this study revealed that the APACHE II score of the observation group was significantly lower than that of the control group, which was due to the

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Table 4. Comparison of nursing satisfaction of patients (n (%))

Group	Control group (n=65)	Observation group (n=65)	X ²	P
Very satisfied	26	35		
Satisfied	21	22		
Dissatisfied	18	8		
Satisfaction rate	47 (72.31)	57 (87.69)	4.808	0.028

fact that comprehensive nursing provided health guidance, nursing against complications, psychological nursing, and other intervention measures for the patients, playing an auxiliary role in ameliorating the patient's condition and helping them live in the best physiological and psychological state. In the aspect of nursing satisfaction, under the comprehensive nursing, nursing staff obtained improved professional level and more accurately understood the nursing contents of ARDS patients undergoing PPV, contributing to achieving the purpose of nursing patients more carefully [20]. One study has pointed out that good nursing intervention can improve patients' nursing satisfaction [21]. The results of this study revealed that patients in the observation group nursed under comprehensive nursing showed significantly higher nursing satisfaction than patients in the control group, which was basically similar to previous research reports [22].

This study also has certain limitations, such as small sample size, single-center study, lack of long-term follow-up results, and no classification comparison. In the future, a multi-center randomized controlled study with large sample size and long-term follow-up is needed for further confirmation.

To sum up, the intervention of comprehensive nursing for ARDS patients undergoing PPV patients conforms to the nursing needs of the patients, which can effectively improve the ventilation indexes and MAP of the patients, reduce complications, shorten their hospitalization time, and can also improve their APACHE II score and clinical nursing satisfaction, so it is worthy of promotion in clinical practice.

Disclosure of conflict of interest

None.

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