

Original Article

The clinical value of comprehensive nursing intervention in preventing ventilator-associated pneumonia

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Received December 27, 2020; Accepted February 2, 2021; Epub April 15, 2021; Published April 30, 2021

Abstract: Objective: The aim of the present study was to evaluate the clinical value of comprehensive nursing intervention in preventing ventilator-associated pneumonia (VAP). Methods: Eligible 116 patients who received mechanical ventilation in our hospital from June 2018 to December 2019 were equally randomized into a control group and an observation group. The observation group adopted comprehensive nursing while conventional nursing was adopted in the control group accordingly. The mechanical ventilation time, hospitalization time, VAP incidence, psychological status, quality of life and nursing satisfaction were compared. Results: The mechanical ventilation and hospitalization time in the observation group was shorter compared to that in the control group ($P < 0.05$). For the VAP incidence, the observation group exhibited a significantly lower level than the control group (3.44% vs 13.79%) ($P < 0.05$). SAS and SDS scores before intervention were not different between the groups ($P > 0.05$); after intervention, the scores in both groups decreased, and the scores of the former group were significantly lower than those of the latter group ($P < 0.05$). The quality of life scores before intervention did not show any significant difference ($P > 0.05$); after intervention, a significant increase of quality of life in the observation group was observed compared to the control group ($P < 0.05$). The nursing satisfaction rate in the observation group was found to be higher when compared with that in the control group (94.87% vs 81.03%, $P < 0.05$). After intervention, the oxygenation index, the ratio of alveolar arterial oxygen partial pressure difference to arterial oxygen partial pressure ($P(A-a)DO_2/PaO_2$), and oxygen partial pressure in both groups of patients were improved compared with those before intervention. After intervention, a significant increase in the oxygen partial pressure and oxygenation index was identified in the observation group compared with the control group, while the $P(A-a)DO_2/PaO_2$ was found to be in a lower level ($P < 0.05$). Conclusion: Comprehensive nursing intervention can shorten the mechanical ventilation and hospitalization time, prevent the occurrence of VAP, ease the negative emotions of patients, and improve their quality of life as well as nursing satisfaction.

Keywords: Comprehensive care, prevention, ventilator-associated pneumonia, clinical value

Introduction

Mechanical ventilation is one of the main rescue techniques for respiratory failure, whereas some patients often have some complications, particularly ventilator-associated pneumonia (VAP) [1, 2]. VAP is defined as pneumonia that occurs 48 h after receiving mechanical ventilation treatment or within 48 h after withdrawal of mechanical ventilation [3]. VAP patients may have difficulty in weaning, prolonged hospital stay, which poses threat to their life quality [4, 5]. In this regard, it is vital to find an effective nursing method to prevent VAP during mechanical ventilation. The core of the comprehensive nursing intervention model is patient-centered, focusing on patients' lives and health, rights

and needs, personality and dignity. The comprehensive nursing intervention model includes not only the intervention of traditional clinical nursing techniques, various examination measures, and drug intervention, but also interventions against patient's cognition, psychological state and behavior. Thus, the present study was conducted to assess the clinical value of comprehensive nursing intervention in preventing VAP and to provide reference for its prevention.

Material and methods

Study population

116 patients presenting to our hospital from June 2018 to December 2019 for mechanical

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ventilation participated in the current study after obtaining written informed consent and approval from the hospital's ethics committee. Patients requiring mechanical ventilation were included. Patients with lung infection, less than 48 h of mechanical ventilation and who were expected to die within 48 h from the primary disease were excluded from the study. Patients were divided into a control group (n=58) and an observation group (n=58) randomly. Patients in observation group were 42.0~60.0 years old, and the patients in control group were 41.0~60 years old.

Methods

Control group: The control group was given conventional nursing intervention, including conventional sputum suction nursing, posture nursing, psychological care, and environmental nursing.

Observation group: The observation group was given comprehensive nursing intervention based on the treatment adopted in the control group. (1) Cognitive and psychological nursing. Patients on mechanical ventilation tend to have negative emotions such as anxiety and insecurity because of insufficient knowledge about mechanical ventilation. Nursing staff were required to carry out detailed disease education for patients, explain the purpose of the treatment and possible adverse reactions and make adequate psychological preparation for patients [6]. Patients were encouraged to actively face the disease and to establish the confidence toward treatment. (2) Environment and posture nursing. Indoor environment was kept ventilated, clean, and quiet with regular bacterial disinfection, while the temperature and humidity of the ward were controlled appropriately. According to patients' condition, they were assisted to be in a comfortable position with the head, neck and shoulders at the same level. To ensure the comfort of patients, they were allowed to tilt the head back and turn over regularly with help [7]. (3) Enhanced airway nursing. To ensure the airway patency of patients, the airway temperature and humidity of the patients were kept at an appropriate level, and the ventilator parameters were then adjusted according to their specific conditions. The correct way of spitting was explained to the patients, and the patients were assisted to turn over their bodies [8]. (4) Ventilator duct nursing.

The ventilator pipes were replaced, and the ventilators were cleaned in time to avoid cross-infection; the threaded pipe of the ventilator was changed every week, the condensed water in the respiratory pipe was cleaned in time, and antibiotics were used rationally; intermittent weaning and early withdrawal of sedatives were encouraged to reduce the incidence of VAP [9]. (5) Nutritional support. According to the patients' situation, reasonable diet plans were made; for patients who could not eat on their own, nasal feeding was adopted.

Observation indexes

Primary observation indexes: (1) Mechanical ventilation time and hospitalization time. (2) Incidence of VAP. (3) The main indicators of blood gas (oxygenation index, $P(A-a)DO_2/PaO_2$ and oxygen partial pressure).

Secondary observation indexes: (1) Psychological condition. Self-rating anxiety scale (SAS) [10] was used for evaluation, among which above > 69 points was interpreted as severe anxiety, 60-69 as moderate anxiety, 50-59 as mild anxiety, and < 50 as normal. (2) Self-rating depression scale (SDS) [11] was used for assessing depression, among which > 72 points was interpreted as severe depression, 63-72 points as moderate depression, 53-62 points as mild depression, and < 53 points as normal. (3) Quality of life. The SF-36 scale [12] was used for evaluation, including dimensions of psychology, emotion, body and society. The total score for each item was 100 points. The mean value of the four items indicated the quality of life. (4) Nursing satisfaction. Nursing satisfaction was evaluated according to the questionnaire designed by the nursing personnel. There were 8 items in total with five ranks from "very satisfied" to "very dissatisfied". The satisfaction rate = (very satisfied + satisfied + generally satisfied)/number of cases × 100%.

Statistical analysis

Statistical analysis was done using SPSS23.0 software. The quantitative data that were consistent with normal distribution were expressed as $\bar{x} \pm sd$, and the differences between the groups were examined using t-test, while a variance analysis was adopted for repeated measurement data. The qualita-

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Table 1. Comparison of general material

Group	n	Gender		Average age (years old)
		Male	Female	
Observation group	58	32	26	50.89±8.41
Control group	58	31	27	50.32±8.66
χ^2/t		0.035		0.360
P		0.853		0.720

Table 2. Comparison of mechanical ventilation and hospitalization time ($\bar{x} \pm sd, d$)

Group	n	Mechanical ventilation time	Hospitalization time
Observation group	58	15.34±4.15	17.46±5.69
Control group	58	23.65±5.71	25.34±6.77
t		8.966	6.876
P		< 0.001	< 0.001

Table 3. Comparison of VAP incidence (n)

Group	n	With VAP	Without VAP	VAP incidence
Observation group	58	2	56	3.44
Control group	58	8	50	13.79
χ^2				3.940
P				0.047

tive data were presented as n (%); a rank-sum test was performed for ordered qualitative data while a χ^2 test was used to examine the disordered data. A P-value of < 0.05 was declared as statistically significant difference.

Results

Baseline information in the two groups

The differences in baseline information of the two groups regarding age and gender did not reach statistical significance ($P > 0.05$). See **Table 1**.

Mechanical ventilation and hospitalization time

The observation group had shorter mechanical ventilation and hospitalization time as compared with the control group ($P < 0.05$). See **Table 2**.

VAP incidence

VAP incidence in the observation group was found to be lower compared to that in the con-

trol group (3.44% vs 13.79%) ($P < 0.05$). See **Table 3**.

Main indicators of blood gas analysis

After intervention, the oxygenation index, $P(A-a)DO_2/PaO_2$, and oxygen partial pressure of the two groups of patients were improved compared to those before intervention; after intervention, the oxygen partial pressure and oxygenation index of the observation group patients were higher than those of the control group; in contrast, the $P(A-a)DO_2/PaO_2$ was lower ($P < 0.05$). See **Table 4**.

Secondary outcomes

Psychological status: SAS and SDS scores did not statistically differ prior to intervention in the two groups ($P > 0.05$); after intervention, the scores decreased in both groups, while a greater decrease was observed in the observation group when compared with the control group, and the difference was statistically significant ($P < 0.05$, **Table 5**).

Quality of life: The quality of life scores prior to intervention in the two groups were homogeneous ($P > 0.05$); after intervention, the observation group had significantly higher scores compared to the control group ($P < 0.05$). See **Table 6** for details.

Nursing satisfaction: A significant higher nursing satisfaction in the observation group was observed as compared to the control group (94.83% vs 75.86%) ($P < 0.05$). See **Table 7**.

Discussion

VAP is a common nosocomial infection, which is not only related to patients' own disease [13] but also associated with factors of antibiotic use, artificial airway, mistaken aspiration and mechanical ventilation time [9, 14]. Among them, mechanical ventilation is a leading cause for the occurrence of VAP, and the incidence increases with time, consequently having a negative impact on the prognosis of patients [15]. Due to the high mortality rate resulting from VAP, appropriate prevention measures are urgently needed.

Comprehensive nursing intervention is a new patient-centered nursing model, which can effectively improve patients' nursing services

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Table 4. Comparison of main indicators of blood gas analysis between the two groups ($\bar{x} \pm \text{sd}$)

Index	Time	Observation group (n=58)	Control group (n=58)
oxygen partial pressure(mmHg)	before intervention	52.4±16.7	53.2±17.1
	after intervention	87.4±23.4*,#	81.3±21.1*
oxygenation index(mmHg)	before intervention	117.9±28.1	118.0±27.9
	after intervention	246.7±39.2*,#	199.9±31.2*
P(A-a)DO ₂ /PaO ₂	before intervention	0.97±0.14	0.96±0.11
	after intervention	0.52±0.06*,#	0.68±0.08*

Note: *compared with before intervention, $P < 0.05$; #compared with control group after intervention, $P < 0.05$.

Table 5. Comparison of SAS and SDS scores ($\bar{x} \pm \text{sd}$, score)

Group	n	SAS		SDS	
		Before intervention	After intervention	Before intervention	After intervention
Observation group	58	61.52±6.32	44.15±4.81*	55.41±5.38	46.21±4.26*
Control group	58	61.37±6.15	57.41±5.17*	55.93±5.13	50.14±4.72*
t		0.130	14.301	0.533	4.707
P		0.897	< 0.001	0.595	< 0.001

Note: *comparison with the data before intervention, $P < 0.05$.

Table 6. Comparison of quality of life ($\bar{x} \pm \text{sd}$, score)

Group	n	Before intervention	After intervention
Observation group	58	65.78±12.14	87.64±15.98*
Control group	58	66.88±12.32	73.65±15.72*
t		0.484	4.753
P		0.629	< 0.001

Note: *comparison with the data before intervention, $P < 0.05$.

by utilizing various resources [16]. Its strengths can be interpreted as follows. Cross-infection caused by foreign bacteria can be effectively avoided through environmental nursing in the wards [17]; After airway nursing, respiratory tract mucosal damage can be extensively avoided; Psychological nursing intervention can enhance patients' confidence in treatment, improve patients' nursing and treatment compliance, and is thus more conducive to the development of nursing work [18]; After ventilator tube nursing, the bacteria invasion can be greatly avoided in case of VAP; After comprehensive nursing, VAP can be prevented, mechanical ventilation and hospitalization time can be shortened, and patients' nursing satisfaction as well as quality of life can be improved [19].

We implemented comprehensive nursing interventions for patients in the observation group, including measures such as strengthen-

ing environmental management, respiratory management, postural care, and oral care. The findings of the current study showed that the observation group was superior to the control group in mechanical ventilation and hospitalization time. And VAP incidence was found to be lower in the observation group. What is more, after intervention, the scores decreased in both groups, while a

greater decrease was observed in the observation group when compared with the control group. Additionally, after intervention, the quality of life in the observation group was better than the control group. Notably, a significant higher nursing satisfaction in the observation group was observed as compared to the control group after intervention. Importantly, after intervention, the oxygen partial pressure and oxygenation index of the observation group patients were found to be higher than those of the control group, while the respiratory index was lower. Taken together, all these results highlight that comprehensive nursing intervention performs well in shortening ventilation time and lowering lung damage and improving prognosis.

In conclusion, given the observed results, we recommend comprehensive nursing intervention as a preferred method for VAP nursing.

Table 7. Comparison of nursing satisfaction between the two groups

Group	n	Very satisfied	Satisfied	Generally satisfied	Dissatisfied	Very dissatisfied	The satisfaction rate (%)
Observation group	58	32	18	5	3	0	94.83
Control group	58	21	13	10	8	6	75.86%
Z/X				5.236			7.71
P				< 0.01			< 0.01

Disclosure of conflict of interest

None.

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