DOI: 10.53469/jcmp.2025.07(09).53

Application of Nurse-led Family Participatory Rehabilitation Training in Early Rehabilitation of ARDS Patients with Mechanical Ventilation

Yingjin Lu, Yanfang Lu, Hongyun Ji, Chaoyan Xu, Chunxuan Wei

Department of Critical Care Medicine, Affiliated Hospital of Youjiang Medical university for Nationalities

Abstract: ***Objective:*** *To explore the application effect of nurse-led family participatory rehabilitation training in early rehabilitation of ARDS patients.* ***Methods:*** *In this study, 62 patients with ARDS mechanical ventilation who met the criteria of admission and discharge in the intensive care unit of a tertiary hospital in Baise City from January 2024 to December 2024 were randomly divided into control group and experimental group, 31 cases in each group. The control group received ICU routine early rehabilitation, and the experimental group received nurse-led family participatory rehabilitation training. The differences in arterial blood gas analysis results, mechanical ventilation days, ICU hospitalization days, total hospitalization days, incidence of complications during hospitalization, and family satisfaction were compared between the two groups after intervention.* ***Results:*** *After intervention, PaO_2 and OI in the experimental group were higher than those in the control group, $PaCO_2$ was lower than that in the control group, and the difference was statistically significant ($P<0.05$). The mechanical ventilation days, ICU hospitalization days and total hospitalization days of the experimental group were shorter than those of the control group, and the differences were statistically significant ($P<0.05$). The incidence of complications in the experimental group was lower than that in the control group, the difference was statistically significant ($P<0.05$). The satisfaction of family members in the experimental group was higher than that in the control group, and the difference was statistically significant ($P<0.05$).* ***Conclusion:*** *Nurse-led family participatory rehabilitation training has a significant application effect in the early rehabilitation of ARDS patients with mechanical ventilation. It can improve the oxygenation and ventilation of patients, shorten the length of hospital stay, and improve the satisfaction of family members. It is worthy of promotion and application in clinical practice.*

Keywords: Family participation, Early rehabilitation, Nurse-led, ARDS.

1. Introduction

With the development of social economy and the advancement of medical technology, the success rate of treatment for critically ill patients has been continuously improved. However, the challenges faced by critically ill patients in the rehabilitation process remain severe [1-3]. Acute respiratory distress syndrome (ARDS) is a disease characterized by refractory hypoxemia and progressive respiratory distress, with a high mortality rate [4]. Mechanical ventilation is the main treatment for ARDS patients, but long-term mechanical ventilation can lead to a variety of complications and affect the prognosis of patients. Studies have shown that [5, 6] early rehabilitation activities can help patients avoid complications such as muscle atrophy and muscle weakness, promote the recovery of neuromuscular function, and reduce the number of days of hospitalization. As a patient-centered nursing model, family participatory nursing emphasizes the role of family members in the rehabilitation of patients. The nurse-led family participatory rehabilitation training not only emphasizes the leading role of nurses in rehabilitation nursing, but also encourages the family members of patients to participate in the rehabilitation training process of patients, so as to improve the rehabilitation effect of critically ill patients [7]. Previous studies have shown that family participatory nursing is mainly used in the clinical practice of newborns [8,9]. There are relatively few studies on the early rehabilitation of adult ARDS patients with mechanical ventilation, resulting in limited generalization of the research results. Therefore, the purpose of this paper is to explore the application effect of nurse-led family participatory rehabilitation training in the early rehabilitation of ARDS patients with mechanical ventilation, and to provide theoretical basis for clinical nursing practice.

2. Objects and Methods

2.1 Research Object

In this study, 62 patients with ARDS mechanical ventilation who were hospitalized in the intensive care unit of a tertiary hospital in Baise City from January 2024 to December 2024 were selected as the research objects. Inclusion criteria: 1) In accordance with the relevant diagnostic criteria of ARDS [10], mechanical ventilation treatment; 2) aged 18-70 years old; 3) ICU length of stay≥72 hours; 4) expected survival time≥6 months; 5) The doctor assessed the patient's condition to support early rehabilitation training; 6) The family members are willing to participate and cooperate with informed consent. Exclusion criteria: 1) with severe mental illness or cognitive dysfunction; 2) patients with severe heart, liver, kidney and other organ dysfunction; 3) suffering from malignant tumors; 4) Family members refused to participate. This study has been approved by the Ethics Committee of the Affiliated Hospital of Youjiang Medical university for Nationalities (Approval No.: YYFY-LL-2025-212). In this study, there were 20 males and 11 females in the control group; the age was 30-70 years old, with an average of (56.00±9.18) years old. The mean score of acute physiology and chronic health evaluation (APACHE II) was (21.00±3.00). There were 21 males and 10 females in the experimental group. The mean age was (53.90±9.06) years (range, 35-71years), and the mean APACHE II score was (21.13±3.18). There was no significant difference in gender, age and APACHE II score between the two groups ($P > 0.05$), and the baseline data were comparable.

2.2 Research Methods

The eligible ARDS patients with mechanical ventilation were

randomly divided into control group and experimental group, 31 cases in each group. Two groups of patients were given mechanical ventilation treatment, prone position ventilation 10 ~ 12h/d, anti-inflammatory and anti-infection, nutritional support, maintenance of internal environment stability and other symptomatic treatment according to the doctor's advice. In terms of rehabilitation nursing measures, the control group adopted routine early rehabilitation nursing measures, including disease observation, basic nursing, air pressure treatment, mechanical assisted expectoration, rehabilitation guidance and so on. On the basis of routine nursing, the experimental group implemented nurse-led family participatory rehabilitation training, as follows: (1) Establish a professional nursing team. A nursing team composed of professional nurses, respiratory therapists, dietitians, rehabilitation physicians and other multidisciplinary personnel was established to determine the responsibilities of team members and ensure that patients received comprehensive and continuous care. (2) Family participatory nursing training. The family members were trained in ARDS basic knowledge, mechanical ventilation operation, infection control and nutritional support. The basic nursing skills of patients' families were taught, such as turning over, patting back, airway management and so on. (3) Develop a personalized rehabilitation care plan. According to the patient's condition, family environment and family ability, a personalized nursing plan was developed. Set regular rehabilitation goals to ensure the pertinence and effectiveness of nursing measures. Provide psychological counseling for the psychological support of patients and their families, and help patients and their families cope with the psychological pressure caused by the disease. Establish a communication bridge between patients and their families, and enhance the family support system. (4) Daily nursing intervention. Guide the family members to carry out daily care, including skin care, oral care, excretion care, etc. Monitor the patient's vital signs, timely detection and treatment of complications. (5) Respiratory function exercise for patients. Guiding family members to assist patients with respiratory muscle training, deep breathing exercises, etc., to improve respiratory function. Use auxiliary tools such as respiratory trainers to promote early weaning of patients. (6) Provide adequate nutritional support for patients. According to the nutritional status of patients, formulate a reasonable diet plan, guide family members to prepare and provide suitable food for patients, and ensure balanced nutrition. (7) Carry out family participatory rehabilitation activities. Under the guidance of nurses, family members assisted patients with passive and active exercise to prevent muscle atrophy and joint stiffness. Gradually increase the amount of activity to prepare patients for getting out of bed. Nurses regularly assess the patient's rehabilitation progress and adjust the nursing plan. Through family feedback, continuous improvement of nursing measures, improve the quality of nursing.

2.3 Observation Indicators

The results of arterial partial pressure of oxygen (PaO_2), arterial partial pressure of carbon dioxide ($PaCO_2$) and oxygenation index (OI) were compared between the two groups before intervention and on the 7th day of intervention. 2 The duration of mechanical ventilation (days), ICU hospitalization days, and total hospitalization days of the two groups of patients; 3 The satisfaction of the family members of the two groups. The self-made family satisfaction questionnaire was used to investigate the total score of 100 points, of which the score ≥90 points was very satisfied, 80 ~ 89 points were satisfied, < 80 points were not satisfied. Total satisfaction = (very satisfied + satisfied) 100%; 4 The occurrence of complications during hospitalization in the two groups. Complications included delirium, ventilator - associated pneumonia, ICU-acquired muscle weakness, and the incidence of lower extremity deep vein thrombosis.

2.4 Statistical Analysis

SPSS 25.0 software was used for data processing and analysis. The measurement data were expressed as mean ± standard deviation, and t test was used for comparison between groups. The count data were expressed as cases and percentages, and the chi-square test was used for comparison between groups. $P<0.05$ was considered statistically significant.

3. Results

3.1 Comparison of PaO_2, $PaCO_2$ and OI Between the Two Groups of Patients

The results showed that there was no significant difference in PaO_2, $PaCO_2$ and OI between the two groups before intervention ($P > 0.05$). After intervention, PaO_2 and OI in the experimental group were higher than those in the control group, $PaCO_2$ was lower than that in the control group, and the differences were statistically significant ($P < 0.05$), see Table 1.

3.2 Comparison of Mechanical Ventilation Days, ICU Hospitalization Days and Total Hospitalization Days Between the Two Groups of Patients

The results showed that the mechanical ventilation days, ICU hospitalization days and total hospitalization days in the experimental group were shorter than those in the control group, and the differences were statistically significant ($P < 0.05$), as shown in Table 2.

Table 1: Comparison of PaO_2, $PaCO_2$ and OI between the two groups of patients

group	number	PaO_2		$PaCO_2$		OI	
		Before intervention	After intervention	Before intervention	After intervention	Before intervention	After intervention
control group	31	56.48±3.85	83.03±3.78	59.29±4.61	52.77±4.34	129.68±13.27	227.06±23.57
experimental group	31	55.65±4.59	88.42±2.90	58.26±3.92	48.90±3.52	124.55±13.90	246.61±34.42
t		0.780	-6.298	0.949	3.850	1.486	-2.609
P		0.438	<0.001	0.346	<0.001	0.142	0.011

Table 2: Comparison of mechanical ventilation days, ICU hospitalization days and total hospitalization days between the two groups (d)

group	number	Days of mechanical ventilation	length of icu stay	length of hospital stay
control group	31	9.48±1.57	12.39±1.82	16.23±2.00
experimental group	31	8.26±1.29	11.06±1.55	14.97±1.62
t		3.361	3.082	2.724
P		0.001	0.003	0.008

3.3 Comparison of Family Satisfaction Between the Two Groups of Patients

The results showed that the satisfaction of family members in the experimental group was higher than that in the control group, and the difference was statistically significant ($P < 0.05$), as shown in Table 3.

Table 3: Comparison of family satisfaction between the two groups (n, %)

group	number	Very satisfied	More satisfied	Not satisfied	Satisfaction
control group	31	16	10	5	26(83.9)
experimental group	31	23	7	1	30(96.8)
t					4.418
P					0.036

3.4 Comparison of the Incidence of Complications Between the Two Groups of Patients

The results showed that the incidence of complications in the experimental group was lower than that in the control group, the difference was statistically significant ($P < 0.05$), as shown in Table 4.

Table 4: Comparison of the incidence of complications between the two groups (n, %)

group	number	Deliriu m	Ventilator-associa ted pneumonia	ICU-acquired muscle weakness	Deep venous thrombosis of lower	extremity Incidence	χ^2	*P*
control group	31	3	1	4	2	10(32.3)	4.967	0.029
experimental group	31	1	0	1	1	3(9.7)		

4. Discussions

4.1 Nurse-led Family Participatory Rehabilitation Training is Beneficial to Improve Oxygenation and Ventilation in Patients with ARDS Mechanical Ventilation.

ARDS is a serious disease characterized by progressive respiratory failure, and patients usually require mechanical ventilation to maintain oxygenation and ventilation. In the process of mechanical ventilation, PaO_2, OI and $PaCO_2$ are important indicators to evaluate the respiratory function of patients. Compared with the scarcity of rehabilitation professionals, nurses, as continuous and long-term caregivers of patients, play a vital role in the functional recovery training of daily life of critically ill patients, and have obvious advantages in promoting early clinical rehabilitation of critically ill patients [11]. As a new nursing model, the role of nurse-led family participatory nursing in the early rehabilitation of critically ill patients cannot be ignored. The results of this study showed that nurse-led family participatory nursing could improve PaO_2 and OI and reduce $PaCO_2$ in ARDS patients with mechanical ventilation, which further indicated that nurse-led family participatory nursing could improve oxygenation and ventilation status of ARDS patients through early activity and respiratory therapy. The reasons for the analysis are as follows: First, nurses have professional nursing knowledge and skills, can accurately assess the patient's oxygenation and ventilation status, and provide corresponding nursing measures according to the patient's condition, such as adjusting ventilator parameters and implementing oxygen therapy. Secondly, family members participate in nursing under the guidance of nurses, which can assist patients with respiratory exercise, position change and other operations, which is conducive to patients' pulmonary rehabilitation, thus improving patients' oxygenation and ventilation. This nursing model provides strong support for the recovery of respiratory function in patients with ARDS by improving the quality of care, promoting family participation and implementing personalized respiratory rehabilitation programs. Therefore, this nursing model can be considered in the overall treatment plan of ARDS patients in clinical practice.

4.2 Nurse-led Family Participatory Rehabilitation Training is Conducive to Shortening the Number of Days of Mechanical Ventilation, ICU Hospitalization Days and Total Hospitalization Days.

The results of this study showed that the mechanical ventilation days, ICU hospitalization days and total hospitalization days of the experimental group were shorter than those of the control group ($P < 0.05$), indicating that the nurse-led family participatory nursing is an effective strategy, which can improve the rehabilitation efficiency of ARDS patients. The results of Lu [12] showed that the nurse-led early activity program could promote the rehabilitation of ICU patients with mechanical ventilation and shorten the duration of mechanical ventilation and hospitalization. Xiarong [13] also found that the implementation of nurse-led intervention strategies can significantly reduce the mechanical ventilation time, ICU hospitalization time, overall hospitalization time and mechanical ventilation time of patients with mechanical ventilation in intensive care unit. This may be due to the professional guidance of nurses and the active participation of family members. Nurses can formulate personalized respiratory training plans according to the specific conditions of patients and guide family members to participate. The participation of family members not only provides psychological support for patients, enhances the rehabilitation motivation of patients, but also enhances the cooperation of nursing team, provides more comprehensive rehabilitation nursing for patients, so as to improve the quality of nursing and promote the recovery speed of patients. Therefore, nurse-led family participatory nursing has significant advantages in shortening the days of mechanical ventilation, ICU hospitalization and total hospitalization in critically ill patients. By giving full play to the professional ability of nurses and encouraging family members to participate in the nursing process, it is helpful to improve the

quality of life of patients and promote the early recovery of patients.

4.3 Nurse-led Family Participatory Rehabilitation Training is Conducive to Improving the Satisfaction of Family Members

In this study, the satisfaction score of family members in the experimental group was significantly higher than that in the control group ($P < 0.05$), indicating that nurse-led family participatory nursing was conducive to improving the satisfaction of family members. This may be related to the family members' sense of participation in the nursing process and the positive evaluation of the nursing results. Previous studies have shown that [14], more than 90 % of ICU patients' relatives are willing to invest time to accompany patients to carry out initial activities. They are eager to master the knowledge and skills of early rehabilitation activities in order to better help patients carry out initial activities, indicating that ICU patients' relatives have a high enthusiasm for participating in patients' early rehabilitation activities. When family members feel they are part of the care team and can participate in the rehabilitation process of patients, their satisfaction with care services will be significantly improved. Participatory care at home allows family members to play an active role in nursing decision-making, which enhances the sense of control and participation of family members. The improvement of family members' satisfaction is helpful to establish a good doctor-patient relationship and promote patients' treatment compliance and rehabilitation enthusiasm.

4.4 Nurse-led Family Participatory Rehabilitation Training is Conducive to Reducing the Incidence of Patient-related Complications

A number of studies have shown that [15-17], early rehabilitation treatment for critically ill patients is conducive to reducing the occurrence of complications such as delirium, ventilator-associated pneumonia, ICU-acquired weakness, and ICU-acquired weakness. The results of this study showed that the incidence of complications during hospitalization in the experimental group was lower than that in the observation group ($P < 0.05$), indicating that nurse-led family participatory nursing was beneficial to reduce the incidence of complications in patients. The nurse-led family participatory nursing model plays an important role in the early rehabilitation of critically ill patients. In this process, nurses, as the leader, not only provide professional nursing skills, but also teach family members how to better participate in the rehabilitation process of patients, which is helpful for early detection and prevention of complications. According to Liang Yangui et al. [18], early activity intervention can significantly reduce the incidence of delirium in critically ill patients and shorten the duration of delirium in patients. Family participatory nursing improves the ability of family members to identify and prevent complications through education and support. The participation of family members is helpful to find out the changes of patients' condition in time, so as to take timely intervention measures. Nurses provide professional nursing guidance in this model to ensure the safety and effectiveness of rehabilitation activities. In addition, family participatory nursing promotes communication between patients and their families and helps patients better follow the rehabilitation plan. The implementation of this model helps to improve the psychological state of patients and reduce complications caused by emotional fluctuations.

In summary, the nurse-led family participatory rehabilitation training has shown a positive application effect in the early rehabilitation of critically ill patients, which is worthy of further promotion and application in clinical practice. However, there are some difficulties in the implementation of family participatory rehabilitation training. The first is the lack of family care knowledge and skills. In the future, family nursing training courses can be added, professional nurses can carry out systematic nursing knowledge and skills training, and provide operation manuals and video tutorials to facilitate family members to learn and review. Secondly, in the case of limited resources, how to rationally allocate nursing resources to ensure the effective implementation of family participatory rehabilitation training. At the same time, this study also has the limitations of small sample size, short observation time, and possible selection bias. Future research should expand the sample size and prolong the observation time to further verify the long-term effect of nurse-led family participatory rehabilitation training in the early rehabilitation of critically ill patients.

Fund Source

Baise Science and Technology Project in 2024 (20243433).

References

[1] Zhang Lu, Zhang Jin, Zeng Li, et al.. Current situation and research progress of early rehabilitation of neurocritical patients [J]. Contemporary Nurse (Late Edition), 2021,28 (04): 34-38.

[2] Chen Dandan, Zeng Li, Li Rongqing, et al. Research progress on blocking factors of early rehabilitation nursing practice in patients with severe neurological diseases [J]. Northwest Journal of National Defense Medicine, 2021,42 (03): 183-188.

[3] SHAO Huanzhang, YELING, QIN Bingyu. Research progress on early rehabilitation of critically ill patients [J]. Chinese Journal of Critical Care Medicine (online edition), 2020,6 (02): 206-210.

[4] KAKU S, NGUYEN C D, HTET N N, et al. Acute Respiratory Distress Syndrome: Etiology, Pathogenesis, and Summary on Management[J]. J Intensive Care Med, 2020,35(8): 723-737.

[5] Tan Chunmiao, Qiu Yuyan, Chen Miao, et al. Effect of early rehabilitation strategy on long-term prognosis of elderly critically ill patients with mechanical ventilation [J]. Chinese Geriatric Health Medicine, 2023,21 (04): 142-146.

[6] Zhang Ying, Zhang Tingting, Qiang Jie, et al. The application value of early rehabilitation in patients with ICU-acquired myasthenia [J]. Modern Journal of Integrated Traditional Chinese and Western Medicine, 2021,30 (01): 92-95.

[7] Chen, Yu, Zhang. Application status of family participatory nursing model in the prevention and treatment of delirium in ICU [J]. Nursing research, 2020,34 (19): 3453-3456.

[8] Gao Lingshan, Huang Xiaoyan. Effect of family participatory nursing in neonatal intensive care unit on the management of very low birth weight premature infants [J]. Heilongjiang Traditional Chinese Medicine, 2024,53 (02): 251-253.
[9] He Huan, He Huayun, Sun Qiuyi, et al. The application of family participatory nursing based on family ward in premature infants with bronchopulmonary dysplasia [J]. Chongqing Medical, 2024,53 (08): 1183-1188.
[10] FERGUSON N D, FAN E, CAMPOROTA L, et al. The Berlin definition of ARDS: an expanded rationale, justification, and supplementary material[J]. Intensive Care Med, 2012,38(10): 1573-1582.
[11] CAMICIA M, LUTZ B, SUMMERS D, et al. Nursing's Role in Successful Stroke Care Transitions Across the Continuum: From Acute Care into the Community[J]. Stroke, 2021,52(12): e794-e805.
[12] Lu Hong. Effect of nurse-led early activity program on rehabilitation and deep venous thrombosis of lower limbs in ICU patients with mechanical ventilation [J]. Journal of Mathematical Medicine, 2021,34 (08): 1236-1239.
[13] Xia Rong, Yu Qian. Application of nurse-led intervention strategies in the care of patients undergoing mechanical ventilation in the intensive care unit [J]. General nursing, 2022,20 (14): 1933-1935.
[14] Jia Xueping, Li Guifang, Zhang Guizhen, et al. Analysis of the willingness of family members of ICU patients to participate in early rehabilitation activities of patients and its influencing factors [J]. Contemporary Nurses, 2024,31 (04): 137-140.
[15] Peng Siqin, Yu Hehua, Jiang Zhuojuan. Application value of early rehabilitation intervention based on 4E model in ICU patients with mechanical ventilation [J]. Nursing practice and research, 2023,20 (04): 565-569.
[16] Han, Li, Zhao et al. Construction and application of early rehabilitation program for ICU patients [J]. Chinese Journal of Nursing, 2020,55 (01): 8-15.
[17] Sun Wenhui, Yan Boyun, Wang Ting. Effects of early rehabilitation training based on quantitative assessment on the prognosis of patients with mechanical ventilation in ICU [J]. Journal of Clinical Nursing, 2022,21 (01): 26-29.
[18] Liang, Chen, Zheng. Early activities in the prevention of delirium in patients with mechanical ventilation in intensive care unit [J]. China Health Standards Management, 2022,13 (04): 144-148.