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Observation on the Intervention Effect of Time-sensitive Incentive Model Combined with Specialized Rehabilitation Nursing in Patients with Severe Pneumonia and Respiratory Failure

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Abstract: *Objective*: To explore the effect of implementing a time-sensitive incentive model combined with specialized rehabilitation nursing in patients with severe pneumonia and respiratory failure. *Methods*: Seventy-eight patients with severe pneumonia and respiratory failure admitted from January 2024 to February 2025 were selected and randomly divided into two groups using a computer-based random drawing method. The control group (39 patients) received routine nursing, while the observation group (39 patients) received a time-sensitive incentive model combined with specialized rehabilitation nursing. Lung function and adverse emotional states were compared between the two groups. *Results*: After 2 weeks of nursing, the lung function of the observation group was higher than that of the control group ($P < 0.05$), and the adverse emotional states of the observation group were lower than those of the control group ($P < 0.05$). *Conclusion*: Implementing a time-sensitive incentive model combined with specialized rehabilitation nursing in patients with severe pneumonia and respiratory failure can improve lung function and emotional state.

Keywords: Severe pneumonia with respiratory failure; Time-sensitive incentive model; Specialized rehabilitation nursing

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1. Introduction

Severe pneumonia is a critical illness that progresses rapidly [1]. Some patients are prone to severe complications such as respiratory failure. Respiratory failure can lead to impaired lung ventilation and gas exchange, resulting in dysfunction of other organs and tissues [2]. Patients with severe pneumonia and respiratory failure often have a severe physical and mental burden due to the need for long-term bed rest, leading to poor physical and mental states [3]. To improve rehabilitation outcomes and prognostic conditions, proper nursing care is essential. The time-sensitive incentive model emphasizes patient-centered care, requiring appropriate encouragement at suitable

times to stimulate rehabilitation potential and actively engage patients in various nursing activities. Specialized rehabilitation nursing involves developing rehabilitation plans based on disease type and severity, focusing on promoting patient recovery. In this study, 78 patients with severe pneumonia and respiratory failure were investigated to analyze the implementation effect of the time-sensitive incentive model combined with specialized rehabilitation nursing.

2. Materials and methods

2.1. General information

From January 2024 to February 2025, 78 patients with severe pneumonia and respiratory failure participated in the study. They are randomly divided into two groups using a computer-based random drawing method, with 39 patients in each group. Control group: 22 males and 17 females, aged 35–75 years (mean age: 55.43 ± 4.39 years), with a disease duration of 1–7 days (mean duration: 4.38 ± 1.07 days). Observation group: 21 males and 18 females, aged 37–74 years (mean age: 55.96 ± 4.65 years), with a disease duration of 1–8 days (mean duration: 4.85 ± 1.20 days). There are no significant differences in baseline characteristics between the two groups ($P > 0.05$).

2.2. Inclusion criteria

(1) Diagnosis of severe pneumonia with respiratory failure according to the "Clinical Practice Guidelines for Emergency Adult Community-Acquired Pneumonia (2024 Edition)" [4]

(2) Body temperature > 39°C, with obvious symptoms such as shortness of breath, cough with expectoration, dyspnea, and changes in sputum color and properties. Chest imaging shows multi-lobar involvement, lung infiltration, and detection of respiratory failure

(3) Mechanical ventilation treatment

(4) Informed consent for the study

2.3. Exclusion criteria

(1) Other severe respiratory tract diseases

(2) Abnormalities of the blood system

(3) Communication, reading, or cognitive impairments

(4) Psychiatric or psychological disorders.

2.4. Methods

The control group received routine nursing care, including preparing and administering medications as prescribed, monitoring medication responses and effects, providing mechanical ventilation therapy with ventilators, closely monitoring ventilation status, implementing ventilator care, regularly helping patients change positions, scientifically adjusting the angle of the bed head to promote sputum excretion and drainage, closely monitoring heart rate, blood pressure, and other indicators, promptly detecting malignant changes in the patient's condition, reporting to the physician in a timely manner, and following medical advice. Disease knowledge and treatment plans are introduced through manuals and videos, and patients are urged to follow medical advice.

The observation group implemented a time-sensitive incentive model combined with specialized rehabilitation nursing, including:

(1) Emotional incentives: One-on-one communication with patients within 1–2 days of admission to evaluate their psychological state and rehabilitation cognition, and analyze the causes of adverse psychological and non-compliance with rehabilitation training. Based on full respect and understanding for the patient, the responsible nurse introduced the impact of adverse psychology on rehabilitation training in simple and understandable language, flexibly used positive guidance, psychological suggestion, meditation decompression, mindfulness training, etc., to implement psychological counseling, helped patients establish confidence in rehabilitation, communicated with patients' families, urged them to participate in emotional support and psychological care, so that patients could obtain adequate emotional support and family warmth to improve their psychological state.

(2) Goal incentives: Design rehabilitation training programs based on patients' lung function, exercise endurance, and blood gas analysis, set rehabilitation training goals for each stage, scientifically arrange daily rehabilitation training content. Nurses introduced the reasons, content, processes, precautions, and advantages of rehabilitation training to patients, supervised patients to complete daily training, evaluated training conditions, evaluated the compliance and effectiveness of rehabilitation training based on weekly rehabilitation training assessment results, and created a graph of training results to affirm patients' excellent performance at various times, continuously motivate patients, and promote them to successfully complete each stage of rehabilitation training results, improving rehabilitation compliance.

(3) Role model incentives: Based on monitoring and evaluation results, a group of patients who strictly complete rehabilitation training, have good compliance, and show significant improvement in lung function and other indicators are selected weekly. Their superior performance is recognized, and they are actively arranged to share their rehabilitation training experiences and feelings at patient support group meetings, allowing other patients to obtain reference and learn from their experiences, adjust their compliance with rehabilitation training, improve their accurate cognition of rehabilitation training, and enhance their subjective initiative and active participation in training.

(4) Benefit incentives: Detailed statistics of patients' rehabilitation effects at various time points are collected, and longitudinal comparisons (evaluation of patients' condition indicators at different time points) and horizontal comparisons (comparison of rehabilitation effects at the same stage with patients admitted at the same time with similar conditions) are implemented. The positive impact of rehabilitation training on patients' diseases is comprehensively analyzed to demonstrate the value of training and improve cooperation.

(5) Rehabilitation nursing:

(a) Sputum drainage training: Patients are guided to perform sputum drainage training by adjusting their respiratory frequency. They are instructed to take a deep breath, hold their breath for 3–5 seconds, and then cough out the sputum from their bronchi. If patients are unable to cough effectively, a sputum suction machine is used to clear their sputum regularly, with suctioning performed every 2 hours. If patients have phlegm sounds, cough symptoms, or if medical equipment alarms, sputum suction is performed immediately. The daily water intake is appropriately increased to fully dilute the sputum and prevent the impact of viscous sputum on sputum drainage.

(b) Ventilation nursing: Patients are positioned in a sitting or semi-reclining position, with the head, neck, and shoulders aligned and the head tilted back slightly to ensure the airway remains open. An appropriate face mask is selected, and the ventilator pressure is adjusted, gradually increasing based on

blood gas indicators and changes in the patient's condition. Respiratory rate, heart rate, blood pressure, and other indicators are closely monitored. Patients are assisted in sputum drainage, with turning and back percussion performed every 2 hours to prevent large accumulations of sputum. The patient's ventilation status is closely monitored, and if symptoms such as aspiration, gastrointestinal discomfort, or dryness of the mouth and nose occur, the doctor is immediately informed for prompt symptomatic treatment. During ventilation, all indicators are closely monitored, and the alarm system is regularly reviewed to prevent system malfunctions.

(c) Rehabilitation training: Pulmonary rehabilitation training is initiated after successful weaning from the ventilator to reduce dependence on the device. The training focuses on respiratory exercises and physical training. Respiratory exercises include breathing exercises, blowing balloons, pursed-lip breathing, and abdominal breathing. Physical training is tailored to the patient's exercise tolerance, function, and current status. Initially, it focuses on passive bed exercises and limb massage. As the patient recovers some motor function, they are encouraged to engage in active movements and attempt to get out of bed, including standing with support, walking independently, climbing stairs, practicing Tai Chi, Wu Qin Xi, walking, and brisk walking. The patient's motor function and lung function are evaluated twice a week, and the rehabilitation training content is adjusted based on the latest assessment results to ensure its scientific effectiveness.

(d) Active communication: Patients are actively informed about their disease and nursing mode, emphasizing the positive role of rehabilitation training in their early recovery. They are encouraged to participate in training to improve their lung function.

Both groups received continuous nursing care for 2 weeks.

2.5. Observation indicators

2.5.1. Lung function

Lung function tester is used to measure forced vital capacity (FVC), forced expiratory volume in the first second (FEV1), and peak expiratory flow (PEF).

2.5.2. Negative emotions

Self-rating Anxiety Scale and Self-rating Depression Scale are adopted for evaluation. Both scales consist of 20 items with a total score of 80. The critical values are set at 50 and 53, respectively [5, 6]. The lower the score, the better.

2.6. Statistical method

SPSS 26.0 software is used to process data. Enumeration data is expressed as a percentage (%) and tested by χ^2 test. Measurement data conforming to normal distribution is represented by mean ± standard deviation, and tested by t-test (or F-test). $P < 0.05$ indicates that the difference in data is statistically significant.

3. Results

3.1. Comparison of lung function between the two groups

After 2 weeks of nursing, the lung function indicators of the observation group were higher than those of the control group ($P < 0.05$), as shown in **Table 1**.

Table 1. Lung function in two groups (n=39 cases, $\bar{x} \pm s$)

Group	FVC (L)		FEV1 (L)		PEF (L/s)	
	Pre-care	After 2-week care	Pre-care	After 2-week care	Pre-care	After 2-week care
Observation group	1.51 ± 0.13	2.27 ± 0.27[a]	0.65 ± 0.11	1.78 ± 0.29[a]	2.71 ± 0.30	4.79 ± 0.49[a]
Control group	1.56 ± 0.15	2.00 ± 0.23[a]	0.69 ± 0.13	1.40 ± 0.23[a]	2.77 ± 0.34	4.31 ± 0.42[a]
t-value	1.573	4.754	1.467	6.411	0.826	4.645
p-value	0.120	< 0.001	0.147	< 0.001	0.411	< 0.001

Note: Compared with before nursing in the same group, $^{a}P < 0.05$.

3.2. Comparison of negative emotions between the two groups

After 2 weeks of nursing, the negative emotions of the observation group were lower than those of the control group ($P < 0.05$), as shown in **Table 2**.

Table 2. Negative emotions in two groups (n=39 cases, scores)

Group	*n*	Anxiety (Pre-care)	Anxiety (After 2-week care)	Depression (Pre-care)	Depression (After 2-week care)
Observation	41	55.98 ± 3.76	35.21 ± 3.16	57.98 ± 3.96	38.67 ± 3.22
Control	41	55.32 ± 3.58	43.25 ± 3.31	57.42 ± 3.80	45.79 ± 3.46
t-value		0.794	10.972	0.637	9.407
p-value		0.430	< 0.001	0.526	< 0.001

Note: Compared with before nursing in the same group, $^{a}P < 0.05$.

4. Discussion

Severe pneumonia complicated with respiratory failure is a clinical syndrome induced by uncontrolled pneumonia, dysfunction of pulmonary ventilation, inability to perform normal and effective gas exchange, resulting in hypoxia and/or carbon dioxide retention [7]. The disease is severe and progresses rapidly, especially for elderly patients with poor physiological and immune functions. Untimely treatment can induce multiple organ damage, affecting prognosis and threatening life safety [8]. Routine nursing care is often implemented in the treatment of this disease, focusing on enhancing cognition, monitoring the disease, timely mechanical ventilation, adjusting body position, and other interventions to improve patients' quality of life and disease control effects [9]. However, routine nursing care has not formed a unified standard, and some nursing operations are not standardized, resulting in general nursing effects. Both time-limited incentive model and specialized rehabilitation nursing are modern nursing methods that emphasize patient-centered care. They were often used singly in the past, but now they are tried to be implemented together.

After 2 weeks of nursing, the lung function of the observation group was higher than that of the control group ($P < 0.05$), and the negative emotions of the observation group were lower than those of the control group ($P < 0.05$). Time-limited incentives can be based on human needs and instincts, using reasonable exogenous stimulation to promote individual endogenous positive health behaviors. It can strictly grasp the best opportunity, apply the best incentive method at different time points based on actual needs, implement personalized services, stimulate subjective initiative, adjust patients' psychology and attitude, and encourage patients to actively participate in treatment [10]. Specialized rehabilitation nursing can analyze patients' requirements for rehabilitation from a specialized perspective

based on their current physical function and disease rehabilitation needs, timely develop and implement effective nursing plans, urge patients to carry out rehabilitation training step by step, and effectively improve lung function.

5. Conclusion

In summary, the implementation of a time-limited incentive model and specialized rehabilitation nursing for patients with severe pneumonia complicated with respiratory failure can exert a synergistic effect, improve nursing effects, and enhance patients' lung function while reducing negative emotions.

Disclosure statement

The authors declare no conflict of interest.

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