Effect of Comprehensive Intervention Strategies Based on ESCAPE Protocol in Prevention of Post-ICU Syndrome

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Abstract [**Objectives**] To explore the effect of a comprehensive intervention strategy based on the ESCAPE program in the prevention of post-ICU syndrome. [**Methods**] A total of 286 patients treated in the ICU of Taihe Hospital from June 2021 to October 2022 were selected as study subjects. 138 patients from June 2021 to January 2022 served as the control group, while 130 patients from February 2022 to October 2022 served as the intervention group. The control group received routine nursing care, while the intervention group received a comprehensive intervention strategy based on the ESCAPE protocol. The mental state, sleep quality, fatigue, mechanical ventilation time, ICU hospitalization time, and total hospitalization time were compared between the two groups. [**Results**] The intervention group showed better sleep quality and lower fatigue at discharge compared to the control group ($P<0.05$), but no significant difference was observed in mental state ($P=0.142$). Additionally, the intervention group had shorter mechanical ventilation time, ICU hospitalization time, and total hospitalization time ($P<0.05$). [**Conclusions**] The comprehensive intervention strategy based on the ESCAPE protocol effectively improves sleep quality and reduces fatigue, and also shortens the mechanical ventilation time, ICU stay, and total hospitalization duration.

Key words Post-ICU syndrome, Nursing, Intervention

1 Introduction

With the rapid development of critical care medicine, the mortality rate of hospitalized patients in the Intensive Care Unit (ICU) has gradually decreased[1]. The focus of ICU treatment is shifting from reducing mortality to improving long-term outcomes and quality of life (QOL) for ICU survivors[2]. However, some critically ill patients may still experience anxiety, depression, and sleep disorders after successfully transitioning out of the ICU, a condition known as post-intensive care syndrome (PICS)[3]. Studies indicate that over 75% of ICU survivors may exhibit PICS symptoms due to declines in memory, executive function, language, attention, and spatial abilities, significantly impacting their daily functioning and health-related quality of life (HRQOL)[4]. PICS can hinder recovery and lead to recurrent health issues, posing major challenges during the recovery phase.

While several strategies have been proposed to prevent PICS, such as writing ICU diaries[5] and early mobilization[6], these measures do not fully address the issue. Thus, enhancing post-critical care management for ICU patients and facilitating their transition to general wards for further rehabilitation has become a primary focus for ICU healthcare providers. The updated ESCAPE protocol has been recognized as an effective strategy for post-critical care management and is recommended for widespread implementation[7]. In this study, we developed a series of comprehensive intervention strategies based on the updated ESCAPE protocol aimed at reducing the incidence of PICS and promoting recovery for critically ill patients receiving treatment in the ICU.

2 Materials and methods

2.1 Study subjects A total of 286 patients treated in the ICU of Taihe Hospital from June 2021 to October 2022 were selected. Among them, 138 patients from June 2021 to January 2022 were assigned to the control group, and 130 patients from February 2022 to October 2022 were assigned to the intervention group. Inclusion criteria included: (i) age >18 years; (ii) ICU treatment duration ≥72 h; (iii) conscious and stable vital signs upon transfer from the ICU; (iv) sufficient literacy to provide informed consent and voluntarily participate in the study. Exclusion criteria included: inability to complete the study due to changes in medical condition after ICU transfer. The primary conditions among patients included sepsis, pancreatitis, post-valve replacement, severe pneumonia, gastrointestinal bleeding, and heart failure. In the control group, there were 82 male and 56 female patients, with an average age of (56.48 ± 6.67) years and an Acute Physiology and Chronic Health Evaluation II (APACHE II) score of (17.62 ± 4.38) points. In the intervention group, there were 76 male and 55 female patients, with an average age of (57.26 ± 6.59) years and an APACHE II score of (17.38 ± 4.41) points. No statistically significant differences were found between the two groups regarding gender, age, APACHE II scores, or primary conditions. This study was approved by the hospital's ethics committee (Approval No.: 2022KS004).

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2.2 Methods

2.2.1 Control group. Patients received routine nursing care based on the standards of the Department of Critical Care Medicine, including nutritional support, rehabilitation therapy, visitation management, sedation and analgesia, and basic care.

2.2.2 Intervention group. The intervention group received a series of comprehensive intervention strategies based on the updated ESCAPE protocol, in addition to routine care. These strategies included:

(i) Early nutrition: Patients' nutritional status was thoroughly assessed, and if there were no contraindications, they were encouraged to start self-feeding or receive enteral nutrition support within 48 h of ICU admission[8]. (ii) Early targeted functional rehabilitation: Collaborating with rehabilitation therapists and primary physicians, a personalized exercise plan was developed for each patient based on their physical and psychological tolerance, progressively advancing from passive to active exercises[7]. (iii) Establishing sleep-wake rhythm: Measures were implemented to control the number of visiting healthcare staff and adjust alarm volumes to create a quieter environment for recovery. (iv) Pain management: Pain assessment was conducted upon ICU admission, and appropriate interventions were employed based on pain severity. (v) Family involvement: Family members were invited and trained to participate in basic care and early functional exercises, fostering a supportive rehabilitation environment.

2.2.3 Evaluation indicators. (i) Patient's mental state: The Chinese version of the Brief Cognitive Rating Scale, developed by Danish scholar Kasper JØrgensen and translated by Chinese scholars, is used for detection. The scale is divided into two parts: the patient section and the informant section, including patient-direct questioning (3 items), supermarket fluency (1 item), category cued memory test-recall (4 items), and informant-direct questioning (4 items). The total score of the scale ranges from 0 to 25, with higher scores indicating better cognitive function in patients. The overall Cronbach's α coefficient of the scale is 0.821, and it has been reviewed by experts and found to have good content validity with good item discrimination[8].

(ii) Patient's sleep quality: The Chinese version of the Pittsburgh Sleep Quality Index (PSQI), developed by Buysse *et al.* and translated by Liu Xiaichen *et al.*, is used to assess the sleep quality of patients over the past month. The scale includes 7 dimensions with 24 questions, and the overall Cronbach's α coefficient of the scale is 0.842. The scale uses a Likert 4-point scoring method, ranging from "very good" to "very poor" with scores from 0 to 3 points, and a total score of 21 points. Higher scores indicate poorer sleep quality[9].

(iii) Patient's fatigue condition: The Chinese version of the Fatigue Assessment Instrument (FAI), developed by Chinese scholar Xiudong, is used to comprehensively assess the fatigue condition of patients. The scale includes 4 dimensions with 29 items. The scale uses a Likert 7-point scoring method, ranging from "completely disagree" to "completely agree" with scores from 1 to 7. The overall Cronbach's α coefficient of the scale is 0.937, and the Cronbach's α coefficients for each dimension range from 0.787 to 0.926, indicating good reliability[10].

(iv) Others: Indicators such as the duration of mechanical ventilation (from intubation to extubation), the length of ICU stay (from admission to discharge from the ICU), and the total length of hospital stay (from admission to discharge) are also considered.

2.2.4 Data collection method. On the day before the patient's discharge, the evaluation of the patient's mental state, sleep quality, and health condition is completed face-to-face by project team members who have undergone uniform training, using standard guiding language. General patient information and the duration of mechanical ventilation, ICU stay, and total hospital stay are obtained from the patient's medical records.

2.2.5 Statistical methods. All data are processed using the SPSS 23.0 statistical software. Quantitative data that conform to a normal distribution are represented by mean and standard deviation, and group comparisons are made using *t*-tests; quantitative data that do not conform to a normal distribution are represented by median and interquartile range, and group comparisons are made using rank sum tests. A difference is considered statistically significant at $P<0.05$.

3 Results and analysis

3.1 Mental State, sleep quality, and fatigue between groups

The intervention group exhibited significantly better sleep quality and lower fatigue at discharge compared to the control group ($P<0.05$), but no significant difference was found in mental state ($P=0.142$) (Table 1).

Table 1 Comparison of mental state, sleep quality, and fatigue between groups

Group	Sample size	Mental state	Sleep quality	Fatigue status
Intervention	130	25.78 (23.16, 29.67)	6.38 (3.97, 10.28)	101.52 (84.62, 116.58)
Control	138	26.82 (22.97, 29.82)	7.69 (4.34, 10.85)	123.87 (88.37, 128.72)
Z-value		−1.178	−2.083	−2.214
P-value		0.142	0.027	0.021

3.2 Mechanical ventilation time, ICU length of stay, and total hospitalization time

The intervention group had significantly shorter mechanical ventilation time, ICU length of stay, and total hospitalization duration compared to the control group ($P<0.05$) (Table 2).

Table 2 Comparison of mechanical ventilation time, ICU length of stay, and total hospitalization time between groups

Group	Sample size	Mechanical ventilation time	ICU length of stay	Total hospitalization time
Intervention	130		74.83 (52.26, 89.38)	288.65 (215.47, 318.56)
Control	138	19.47 (16.17, 22.39)	82.27 (69.19, 97.36)	328.34 (283.00, 342.67)
Z-value		−6.467	−2.915	−3.201
P-value		<0.001	<0.001	0.001

4 Discussion

4.1 Comprehensive intervention strategy based on the ESCAPE protocol effectively improves sleep quality and fatigue levels The results of this study indicate that the comprehensive intervention strategy based on the ESCAPE protocol effectively improves sleep quality and reduces fatigue among patients. This finding is consistent with previous studies[11]. The reasons for this improvement include a reduction in environmental disturbances through measures such as lowering noise levels in the ward and optimizing lighting conditions. Additionally, the involvement of family members in the care process alleviates patients' anxiety and tension during treatment, which contributes to better sleep quality[12]. For patients with significant insomnia symptoms, the ESCAPE protocol also provides pharmacological assistance for sleep, thereby greatly enhancing overall sleep quality. Furthermore, the protocol includes a series of rehabilitation exercises; regular physical training and physiotherapy effectively improve patients' physical condition and alleviate feelings of fatigue[13-14]. Through the ESCAPE protocol, patients receive increased social support. Visits and companionship from family, friends, and colleagues offer patients additional care and assistance, creating a supportive environment that fosters warmth in their daily lives. Establishing a social support system can help patients better adapt to their surroundings, enhance their sense of self-worth, and consequently reduce feelings of depression and fatigue[15].

4.2 Comprehensive intervention strategy based on the ESCAPE protocol effectively reduces mechanical ventilation time, ICU length of stay, and total hospitalization time The findings of this study reveal that the intervention group experienced significantly shorter mechanical ventilation time, ICU length of stay, and total hospitalization duration compared to the control group. This suggests that the comprehensive intervention strategy based on the ESCAPE protocol facilitates early recovery for patients, which aligns with previous research[16-17]. Nutritional support is essential for sustaining life. Studies have shown that early initiation of enteral nutrition benefits both physical recovery and psychological well-being. Adequate nutrition is also critical for engaging in early mobilization and rehabilitation exercises[18]. Thus, the successful implementation of early enteral nutrition lays a foundation for patient recovery. Early and targeted functional rehabilitation, involving accurate assessments of patients' recovery and physical and psychological tolerances, allows for the development of progressive exercise plans. These plans progress from passive to active exercises and from assisted training to resistance training, ultimately transitioning from quantitative to qualitative improvements[19-20]. This approach not only consolidates therapeutic effects but also helps reduce ICU stay and associated healthcare costs, optimizing resource allocation in the ICU[21]. Sleep management, which centers on reconstructing sleep-wake rhythms, plays a crucial role in the recovery of critically ill patients, significantly impacting rehabilitation and early recovery efforts[22]. Pain management is vital, as severe pain can lead to adverse outcomes, including systemic inflammatory responses and immune suppression. Appropriate analgesic treatment can lower sensitivity to harmful stimuli, mitigating a range of negative pathophysiological responses[23], thereby enhancing patient comfort and promoting recovery. Family involvement further alleviates stress for both patients and their families, boosting patients' confidence and motivation during treatment and rehabilitation.

5 Conclusions

Critically ill patients often face physical, cognitive, and psychological impairments that may persist for months to years following recovery. Despite advancements in understanding the risk factors for post-intensive care syndrome (PICS), knowledge of the underlying pathophysiological mechanisms remains limited, and prevention and treatment strategies should not be considered in isolation. This study presents a comprehensive intervention strategy based on the ESCAPE protocol that addresses early nutrition, rehabilitation exercises, sleep management, pain control, and family involvement, which effectively reduces the risk of PICS and shortens mechanical ventilation time, ICU stay, and total hospitalization duration. However, this study was conducted at a single institution. Future research should aim for multi-center, large-sample studies to further validate the effectiveness of the comprehensive intervention strategy based on the ESCAPE protocol.

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