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Effect of the Early Introduction of Mild Mobilization Performed by Nurses on the Recovery of Patients in the Intensive Care Unit

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Abstract

Rationale: Recent studies have reported the effectiveness of the early introduction of rehabilitation for preventing muscle weakness in patients in the intensive care unit (ICU). The early introduction of full-scale rehabilitation by a physical therapist is difficult in some cases because of disease severity and/or patient conditions. However, mild mobilization by a nurse (MMN), as a part of standard care performed, may have a positive effect on patient recovery. We examined the effect of the early introduction of MMN on the recovery of patients in the ICU. **Methods:** We retrospectively examined patients admitted to Niigata University Hospital's ICU during between April 2014 and March 2015 who were receiving mechanical ventilation for 7 days or more. Patients were divided into two groups according to the date of initiation of MMN: group L comprised patients for whom MMN was started after 72 hours and group E comprised patients for whom MMN was started within 72 hours after ICU admission. The data were analyzed using the Fisher test, Mann-Whitney U test, and Wilcoxon test. Statistical significance was defined as $P < 0.05$. **Results:** Sixty-three patients were included: 42 patients in group L and 21 in group E. There was no significant difference between the two groups in patients' background, including the type of illness, steroid use, presence of sepsis or diabetes, and sequential organ failure assessment (SOFA) score on ICU admission; however, the SOFA score at ICU discharge was significantly decreased in group E compared to that in group L (6.21 versus 4.30; $P = 0.034$). **Conclusion:** Our results indicate that MMN may reduce disease severity if started within 72 hours after ICU admission.

1. Introduction

Recent studies have demonstrated that supportive care can increase the survival rate of critically ill patients [1] [2] [3]. Patients in the intensive care unit (ICU) can rally from critical illness; subsequently, they return to daily life. Critically ill patients have a lower quality of life (QOL) because of a functional disorder of their body or mind [4] [5] [6]. Therefore, patients in the ICU after hospital discharge may have a worse QOL [4] [5]. In a previous study, improvement in the disease severity has not been shown as an effect of earlier ambulation on patients on artificial breathing [7]. The efficacy of early mobilization has been reported, and the effects of early mobilization on patients on artificial breathing include the following: improved functional independence, reduced ICU delirium, reduced duration of mechanical ventilation, reduced ICU length of stay, reduced hospital length of stay, improved 6-minute walk distance, improved QOL, and improved muscle strength. Recent studies have demonstrated that early mobility in the ICU is safe and feasible, with a potential reduction in short-term physical impairment by the intervention of a physical therapist. However, the effectiveness of early mobilization with an ICU nurse has not been reported until now [8] [9] [10]. Although a nurse is included in the early ambulation team, only the effect of intervention by a team has been shown [11] [12]. Therefore, the present study aimed to evaluate the effectiveness of enforcing early mobilization and nursing care for patients admitted in the ICU.

2. Method

2.1. Patients Selection

We retrospectively examined patients admitted to Niigata University Hospital's ICU between April 2014 and March 2015.Inclusion criteria were receiving mechanical ventilation for 7 days or more, and patients aged ≥20 years and ≤75 years who were diagnosed as having sepsis, pneumonia, acute respiration failure, or exacerbation of chronic respiratory failure were included in the present study. Exclusion criteria were as follows: patients aged ≥75 years or ≤20 years, those for whom the ICU nurse did not perform mobilization, and patients hospitalized more than twice in the ICU.

We defined mild mobilization by a nurse (MMN) when an ICU nurse performs an active range of motion or passive range of motion, passive sitting position, and breathing exercise more than once to a patient since ICU admission.

Ninety patients were selected for analysis. This study was approved by the research ethics committee of Niigata University Graduate School of Health Sciences (approval no.: 124). The histogram of the start of the intervention for MMN showed a bimodal distribution over 4 days (Figure 1). Patients were divided into two groups by the date
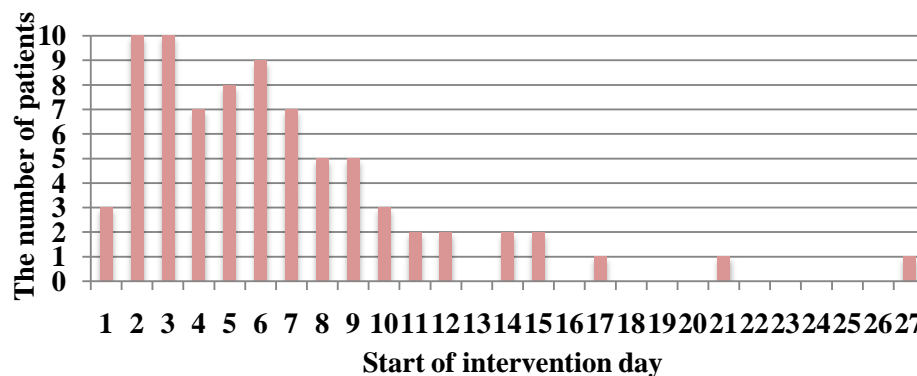
Figure 1. The start day of mild mobilization of a nurse. Mean ± SD: 6.47 ± 4.69 days Median: 6 days.

of initiation of MMN: group L comprised patients with MMN starting after 72 hours, and group E comprised patients with MMN starting within a 72-hour period after ICU admission. We extracted data on patients' background (sex, basic disorder, and the presence of diabetes mellitus) from their medical charts. We also extracted the following clinical data on ICU admission from patients' medical charts: age, height, weight, body mass index (BMI), sequential organ failure assessment (SOFA) score, albumin level, blood urea nitrogen (BUN) level, creatinine (Cr) level, C-reactive protein (CRP) level, glucose level, glutamic oxaloacetic transaminase (GOT) level, glutamic pyruvic transaminase (GPT) level, total bilirubin level, and white blood cell (WBC) count. In addition, we extracted the following data on the features of nursing care during ICU admission from the medical charts: change in the body position, bed leaving, rehabilitation, and bed bath. Lastly, we extracted the following data on patients' clinical features on ICU discharge from the medical charts: age, height, weight, BMI, SOFA score, albumin level, BUN level, Cr level, CRP level, glucose level, GOT level, GPT level, total bilirubin level, WBC count, Glasgow Coma Scale (GCS) score, and ventilator days. There were no missing physiological data or data outliers.

2.2. Statistical Analysis

Data were analyzed using the Fisher test and Mann-Whitney U test. Statistical significance was defined as $P < 0.05$. All statistical analyses were performed using EZR (Saitama Medical Center, Jichi Medical University, Saitama, Japan), which is a graphical user interface for R (The R Foundation for Statistical Computing, Vienna, Austria). More precisely, it is a modified version of R commander designed to add statistical functions frequently used in biostatistics.

3. Results

3.1. Clinical Features and Background of the Patients

Of 63 enrolled patients, 42 were classified into group L, and 21 were classified into group E. Group L and group E were comparable in sex, basic disorder and the presence of diabetes mellitus (Table 1).

Table 1. Clinical features and background of patients.

	Group L, n = 42	Group E, n = 21	P-value
Average age (years)	58.77 ± 13.25	58.00 ± 13.52	0.478
Sex (%)			>0.999
Female	19 (67.8)	9 (32.2)	
Male	23 (65.7)	12 (34.3)	
Basic disorder (%)			0.187
Pneumonia (lung disorder)	22 (61.1)	14 (38.9)	
Sepsis (serious bacterial disease)	13 (86.6)	2 (13.4)	
Atherosclerosis (heart disease)	7 (58.3)	5 (41.7)	
Diabetes mellitus (%)			0.999
Negative	25 (65.7)	13 (34.3)	
Positive	17 (68.0)	8 (32.0)	

3.2. Clinical Features on ICU Admission

The BUN level was significantly lower in group L than in group E (39.97 mg/dL vs. 31.57 mg/dL, P = 0.041). All clinical data, except the BUN level, were not significantly different between groups L and E (Table 2).

3.3. Clinical Features at ICU Discharge

Group L and group E were comparable in frequency of changing the patients' body position, bed leaving, rehabilitation, and clean care (Table 3). We evaluated the effects of the features of nursing care, and we found that nursing care was performed the same way in both groups.

3.4. Features of Nursing Care during ICU Discharge

The SOFA score at discharge was significantly lower in group E than in group L (6.21 versus 4.30; P = 0.034). All nursing care data, except the SOFA score at discharge, was not significantly different between groups L and E. There was no significant difference in the ventilator days between the two groups (group L: 9.47 versus group E: 8.50; P = 0.344). Although not significant, the GCS score improved more in patients in group E than in those in group L (13.80 versus 11.86; P = 0.113) (Table 4).

4. Discussion

First, we will discuss the characteristics of nursing care during ICU admission. In general, changing the patient's body position prevents pressure sores, reduces pain due to bed rest, and facilitates postural drainage [13]. The complications reportedly associated with bed rest among patients in the ICU are as follows: pneumonia, atelectasis, orthostatic hypotension, atrophy of the muscles, pressure sores, and psychological stress [14] [15] [16] [17] [18]. Recent studies have demonstrated that early mobilization is effective

Table 2. Clinical features on ICU admission.

	Mean ± SD		P-value
	Group L, n = 42	Group E, n = 21	
Height (cm)	160.25 ± 9.89	163.10 ± 9.42	0.661
Weight (kg)	57.73 ± 14.13	55.96 ± 15.91	0.584
BMI (kg/m²)	21.86 ± 5.47	20.84 ± 4.26	0.53
SOFA score at admission	10.10 ± 4.47	8.54 ± 4.06	0.29
Albumin level (g/dL)	2.41 ± 0.74	2.75 ± 0.88	0.118
BUN level (mg/dL)	39.97 ± 28.63	31.57 ± 32.02	0.041
Cr level (mg/dL)	1.5 ± 1.34	1.28 ± 1.30	0.41
CRP level (mg/L)	17.83 ± 13.95	10.59 ± 9.33	0.054
Glucose level (mg/dL)	170.78 ± 71.03	161.47 ± 63.74	0.726
AST level (IU/L)	151.64 ± 251.41	94.90 ± 178.27	0.243
ALT level (IU/L)	124.38 ± 256.42	59.00 ± 84.19	0.089
T.bil level (mg/dL)	3.08 ± 5.27	1.49 ± 1.77	0.305
WBC count (10³/μL)	10,204.76 ± 9041.48	11,057.62 ± 5928.44	0.293

SD: Standard Deviation; BUN: Blood Urea Nitrogen; Cr: Creatinine; CRP: C-Reactive Protein; GOT: Glutamic Oxaloacetic Transaminase; GPT: Glutamic Pyruvic Transaminase; T. bil: Total bilirubin; WBC: White Blood Cell.

Table 3. Features of nursing care during ICU admission.

	Mean ± SD		P-value
	Group L, n = 42	Group E, n = 21	
Changing body position	9.77 ± 4.84	8.27 ± 5.84	0.163
Bed leaving	1.34 ± 0.68	1.12 ± 0.79	0.139
Rehabilitation	0.08 ± 0.25	0.103 ± 0.162	0.683
Bed bath	1.23 ± 0.74	1.36 ± 1.61	0.342

SD, standard deviation.

Table 4. Clinical features at ICU discharge.

	Mean ± SD		P-value
	Group L, n = 42	Group E, n = 21	
ICU stay (day)	17.76 ± 12.19	15.80 ± 9.98	0.486
SOFA score at discharge	6.21 ± 3.40	4.30 ± 2.79	0.034*
Alb level (g/dL)	2.51 ± 0.69	2.57 ± 0.66	0.731
BUN level (mg/dL)	35.69 ± 34.02	31.1 ± 32.29	0.226
Cr level (mg/dL)	1.20 ± 1.91	0.85 ± 0.86	0.569
CRP level (mg/L)	4.33 ± 4.07	4.69 ± 5.01	0.804
Glucose level (mg/dL)	135.59 ± 39.15	123.80 ± 40.07	0.117
GOT level (IU/L)	76.33 ± 126.04	36.80 ± 15.62	0.448
GPT level (IU/L)	120.02 ± 330.72	43.33 ± 24.73	0.089
T.bil level (mg/dL)	3.08 ± 5.27	1.49 ± 1.77	0.05
WBC count (K/mcL)	10,213.33 ± 5122.60	7818.57 ± 2611.78	0.073
GCS score	11.86 ± 3.77	13.80 ± 1.63	0.113
Ventilator days	9.47 ± 3.77	8.50 ± 6.92	0.344

BUN: Blood Urea Nitrogen; Cr: Creatinine; CRP: C-Reactive Protein; GOT: Glutamic Oxaloacetic Transaminase; GPT: Glutamic Pyruvic Transaminase; T. bil: Total bilirubin; WBC: White Blood Cell; GCS: Glasgow Coma Scale.

in patients in the ICU for preventing complications due to bed rest. Consequently, the first recommended intervention of early mobilization is changing the body position every 2 hours [11] [18]. The mobility protocol by Morris et al. proposed that patients in the ICU should be turned and repositioned every 2 hours [11]. However, in our study, the body position was changed every 3 hours. The SOFA score at discharge was significantly lower in group E than in group L ($P = 0.034$). Thus, our study's findings suggest that changing the body position every 3 hours is sufficiently effective.

The second point we will discuss is the relationship between MMN and the SOFA score. Our results showed no significant difference in the clinical features and background of patients in both groups. Thus, the clinical features and background of patients were comparable between group L and group E. In our study, the SOFA score was used to evaluate the disease severity of patients in the ICU. The SOFA score is composed of scores from six organ systems, graded from 0 (normal) to 4 (the most abnormal) according to the degree of dysfunction/failure, with a daily score of 0 - 24 points [19]. The results indicate that there was no significant difference in the SOFA score at admission. However, there was a significant difference in the SOFA score at discharge (**Figure 2**). Previous studies have shown mixed results regarding reduced mechanical ventilation and an improved level of consciousness as an effect of early mobilization in patients in the ICU [20]. The mean ventilator days were shorter in group E than in group L, and the mean GCS score at discharge improved more in group E than in group L; however, these findings were insignificant. Improvement in the SOFA score may be affected by shorter ventilation days and/or an improved GCS score by MMN.

5. Limitations

Several limitations of this study should be acknowledged. An inherent limitation of our study is that it was a retrospective chart review. Therefore, we cannot rule out the possibility of selection and survivor bias. Patients in both groups were recruited at different
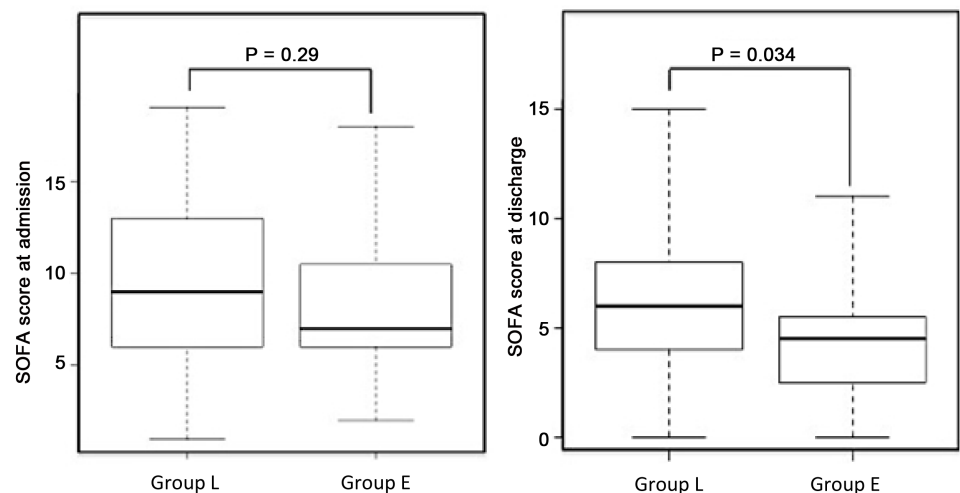

Figure 2. There was no significant difference between the groups in the SOFA score at admission. The SOFA score at discharge was significantly lower in Group E compared with Group L.

time points, and the decision to perform MMN was not randomized. Additionally, missing data precluded some patients from being included in the analysis. Accordingly, a prospective study will be necessary to elucidate the advantage of early mobilization by an ICU nurse, and we hope our present study's findings provide a cornerstone for such clinical research.

6. Conclusion

Our study's results indicate that MMN may reduce disease severity if started within 72 hours after ICU admission.

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Conflicts of Interest

The authors declare no conflicts of interest.

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