Yoğun Bakım Derg 2018; 9 (1): 12-7
DOI: 10.5152/dcbybd.2018.1718

Factors Affecting Early Mobilization in the Intensive Care Unit and the Functional Status after Discharge

Yoğun Bakım Ünitelerinde Erken Mobilizasyonu ve Taburculuk Sonrası Fonksiyonel Durumu Etkileyen Faktörler

Fatma Gül Yurdakul[1], Özlem Balkız Soyal[2], Aslı Çalışkan Uçkun[1], Nevzat Mehmet Mutlu[2], Işıl Özkoçak Turan[2], Hatice Bodur[1]

[1]Clinic of Physical Medicine and Rehabilitation, Ankara Numune Training and Research Hospital, Ankara, Turkey
[2]Clinic of Anesthesia and Reanimation, Ankara Numune Training and Research Hospital, Ankara, Turkey

Cite this article as: Yurdakul FG, Balkız Soyal Ö, Çalışkan Uçkun A, et al. Factors Affecting Early Mobilization in the Intensive Care Unit and the Functional Status after Discharge. Yoğun Bakım Derg 2018; 9 (1): 12-7.

Corresponding Author / Sorumlu Yazar: Fatma Gül Yurdakul
E mail: fatmagulonder@gmail.com

Author Contributions: Concept – H.B., I.Ö.T., A.Ç.U.; Design – F.G.Y., A.Ç.U.; Supervision – A.Ç.U., Ö.B.S., M.N.M.; Resources – Ö.B.S., A.Ç.U., M.N.M.; Data Collection and/or Processing – A.Ç.U., Ö.B.S., M.N.M.; Analysis and/or Interpretation – F.G.Y., H.B., A.Ç.U.; Literature Search – H.B., I.Ö.T.; Writing Manuscript – A.Ç.U., F.G.Y.; Critical Review – H.B., I.Ö.T.

Yazar Katkıları: Fikir – H.B., I.Ö.T., A.Ç.U.; Tasarım – F.G.Y., A.Ç.U.; Denetleme – A.Ç.U., Ö.B.S., M.N.M.; Kaynaklar – Ö.B.S., A.Ç.U., M.N.M.; Veri Toplanması ve/veya İşlemesi – A.Ç.U., Ö.B.S., M.N.M.; Analiz ve/veya Yorum – F.G.Y., H.B., A.Ç.U.; Literatür Taraması – H.B., I.Ö.T.; Yazıyı Yazan – A.Ç.U., F.G.Y.; Eleştirel İnceleme – H.B., I.Ö.T.

Abstract

Objective: The purpose of this study is to assess the mobilization rates in an intensive care unit (ICU) and factors affecting early mobilization, and to compare the clinical characteristics of mobilized and non-mobilized patients.

Material and Methods: Eighty-six patients who were hospitalized for at least 3 days and mobilized before the ICU were included. The diagnosis at the ICU admission, comorbidities, the best mobility level during hospitalization, discharge status, and Ramsay and Acute Physiologic and Chronic Health Evaluation (APACHE II) scores were recorded. The mobilization status of the surviving patients 1 month after discharge was evaluated.

Results: Fifty-eight (67.4%) patients were not mobilized during their hospitalization. When mobilized and non-mobilized groups were compared; ages, duration of hospitalization in days, and APACHE II scores were lower, while the functional improvement after discharge was significantly higher in the mobilized group (p-values <0.001 for this analysis).

Conclusion: We found that the mobilization rate was quite low compared to studies from other countries. The most important modifiable barrier to mobilization was mechanical ventilation, and we found that mobilization in ICU may improve the discharge functional status.

Keywords: Critical care, APACHE, early ambulation, mechanical ventilator

Received: 27.02.2018 • **Accepted:** 09.05.2018

Available Online Date: 16.08.2018

Öz

Amaç: Bu çalışmanın amacı, yoğun bakım ünitesinde (YBÜ) mobilizasyon oranını ve mobilizasyona engel olan faktörleri değerlendirmek, mobilize olan ve olamayan hastaların klinik özelliklerini karşılaştırmaktır.

Gereç ve Yöntemler: Yoğun bakım ünitesinde en az üç gün yatışı olan ve daha önce mobilize olan 86 hasta dahil edildi. YBÜ'ye geliş tanısı, komorbiditeler, hospitalizasyon süresi, yatışı boyunca en iyi mobilizasyon düzeyi, mekanik ventilasyon ihtiyacı, taburculuk durumu, Ramsay ve Acute Physiologic and Chronic Health Evaluation (APACHE) II skoru kaydedildi. Taburculuktan bir ay sonra hastaların mobilizasyon durumu değerlendirildi.

Bulgular: Elli sekiz (%67,4) hasta hiç mobilize olamadı. Mobilize olan ve olmayan hastalar karşılaştırıldığında; yaş, hospitalizasyon süresi ve APACHE II skoru mobilize olan grupta daha düşük iken, taburculuk sonrası fonksiyonel iyileşme mobilize olan grupta daha yüksek idi (p değeri <0,001 olarak bulundu).

Sonuç: Mobilizasyon oranlarımızın diğer ülkelerde yapılan çalışmalara göre daha düşük olduğu görüldü. Mobilizasyonun önündeki en önemli modifiye edilebilir engelin mekanik ventilasyon olduğu görüldü. YBÜ'de mobilizasyonun taburculuk sonrası fonksiyonel durumu iyileştirmede etkili olabileceği sonucuna varılmıştır.

Anahtar kelimeler: Yoğun bakım, APACHE, erken mobilizasyon, mekanik ventilator

Geliş Tarihi: 27.02.2018 **Kabul Tarihi:** 09.05.2018

Çevrimiçi Yayın Tarihi: 16.08.2018

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Ankara Numune Training and Research Hospital (Approval Date: 27.04.2016 / Decision No: 895/2016).

Informed Consent: Written informed consent was obtained from patients or patients' parents who participated in this study.

Peer-review: Externally peer-reviewed.

Conflict of Interest: Authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

Etik Komite Onayı: Bu çalışma için etik komite onayı Ankara Numune Eğitim ve Araştırma Hastanesi Etik Kurulu'ndan (Tarih: 27.04.2016 / Karar No: 895/2016) alınmıştır.

Hasta Onamı: Yazılı hasta onamı bu çalışmaya katılan hastalardan veya hastaların ailelerinden alınmıştır.

Hakem Değerlendirmesi: Dış bağımsız.

Çıkar Çatışması: Yazarlar çıkar çatışması bildirmemişlerdir.

Finansal Destek: Yazarlar bu çalışma için finansal destek almadıklarını beyan etmişlerdir.

Introduction

Bed rest is required for vital treatments in the intensive care units (ICU). However, it may lead to muscle weakness, neuropathy, and critical illness myopathy (1). As it has been reported, muscle weakness ranges between 25% and 50% in intensive care patients, and functional disability due to the weakness can continue for months after discharge from the ICU. Prolonged mechanical ventilation and the long duration of an ICU stay are known to be risk factors for critical illness weakness (2-6).

Patient mobilization in the ICU is an efficacious and safe activity to improve the function and quality of life after discharge from the ICU. Early mobilization (EM) can be defined as the physical activity started within the first 2 to 5 days of ICU admission (7). EM is an essential physical therapy method to prevent the side effects of immobilization in ICU patients. Pain control, early diagnosis and treatment of delirium, and an appropriate cooperation with the patient are factors to be considered for a successful EM (8-11). Mobilization is recommended for all patients in the ICU to reduce mortality, delirium frequency, hospitalization period, and functional disability (12-17). Many active mobilization protocols, including the active or resistive range of motion exercises, sitting in a bed or chair, bed exercises, transfers, standing up, and walking, have been identified (5, 18, 19). Some of the factors described in the literature that complicate mobilization include hemodynamic instability, the presence of catheters, nasogastric tube, endotracheal tube, anxiety about injuring the patient, and insufficient staff and equipment (8, 20, 21).

Although there have been various studies in the literature showing the benefits of and barriers to mobilization in other countries, in our country, the number of studies is limited. Therefore, we aimed to assess our mobilization rates in the ICU and factors affecting mobilization, and to compare the clinical characteristics of mobilized and non-mobilized patients.

Table 1. Ramsay Sedation Scale (22)

Score	
1	Anxious, agitated, restless
2	Cooperative, oriented, tranquil
3	Responsive to commands only
4	Brisk response to light glabellar tap or loud auditory stimulus
5	Sluggish response to light glabellar tap or loud auditory stimulus
6	No response to light glabellar tap or loud auditory stimulus

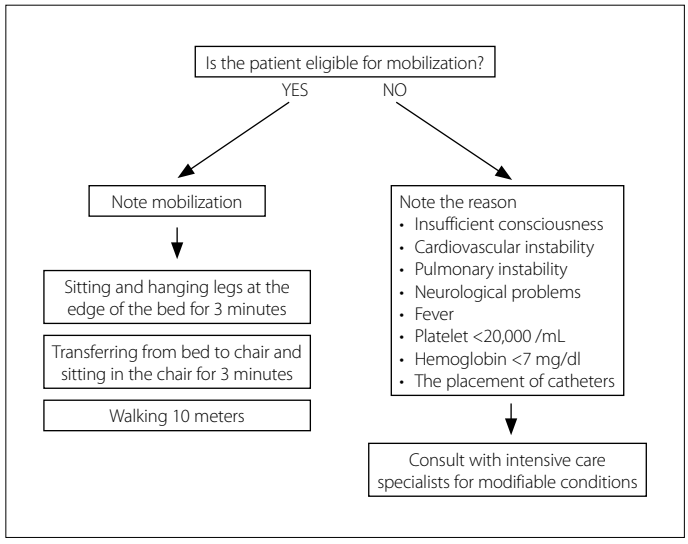

Figure 1. Mobilization flowchart.

Material and Methods

A prospective observational study was planned in our 25-bed general adult intensive care clinic from April to December 2016. The study protocol was approved by the Ethics Committee of Ankara Numune Training and Research Hospital. Written informed consent was obtained from patients, or patients' first-degree relatives, included in this study. All patients were evaluated by the same physical medicine and rehabilitation specialist. Exclusion criteria were age under *18* years, severe dementia and Alzheimer's, the bone and spinal fractures requiring absolute stabilization, and mobilization difficulties before the intensive care.

The age, gender, diagnosis at the ICU admission, comorbidities, length of the ICU hospitalization, best mobility level during hospitalization, mobility level at discharge, mechanical ventilation requirement, and discharge status were evaluated. The body temperature, complete blood count, routine biochemical tests, and cardiac and pulmonary parameters were recorded. The Ramsay score and the Acute Physiologic and Chronic Health Evaluation (APACHE II) score were calculated.

The APACHE II score is assessed using data from the first 24 hours after the ICU admission. It is obtained as the sum of the acute physiology score (12 parameters), age, and chronic health condition. This score is used to detect the severity of disease and estimated mortality rate in intensive care patients (22).

The Ramsay Sedation Scale is the most commonly used scale for the consciousness level of patients (23, 24). The scoring is shown in Table 1. The patients with the Ramsay score 2 or 3 were evaluated for mobilization.

Mobilization potentials of the patients were assessed daily and modifiable conditions (such as the sedation level) were consulted with intensive care specialists (Figure 1). Vital parameters were monitored

during the mobilization activities. Increasing or decreasing 10–20 heart beats/minute, the symptoms of cardiac stress (e.g., clamminess, chest/arm/neck pain, and shortness of breath), at least a 20% change in the blood pressure, an increasing respiratory rate, intercostal retractions, and deterioration of oxygenation were considered as hemodynamic instability, and mobilization was postponed till these symptoms resolved. In daily examination, the findings that supported ischemia on electrocardiogram, cardiac arrhythmias, acute pulmonary embolism, acute myocarditis, pericarditis, unstable angina, and high-dose positive inotropic therapy were accepted as parameters to defer activities (25, 26). Unsuitable factors for mobilization are listed in Table 2. Mobilization activities were graded at three levels: (1) sitting with legs hanging at the edge of the bed for 3 minutes; (2) transferring from bed to chair and sitting in the chair for 3 minutes; and (3) walking 10 meters. The best mobilization level was recorded during the ICU stay. The necessary assistance was given to patients for all types of mobilization (active assistant rehabilitation), and mobilization progressed gradually from easy to difficult, depending on the patient's tolerance. During hospitalization, a worsening mobilization level was recorded.

All patients included in the study were evaluated again 1 month after discharge, and we noted whether there was a progress in mobility compared to discharge status.

Statistical analysis

The Statistical Package for Social Sciences (SPSS) for Windows 20 package program was used for the statistical analyses. The Shapiro–Wilk test was used to test for normality; the results of this test indicated whether parametric and non-parametric tests should be performed. The general descriptive statistics for continuous variables were summarized as the mean, median, and standard deviation values. When analyzing the differences of the continuous variables between the two groups, the Independent Samples T-test for two independent groups was used for data with normal distribution (age), and the Mann–Whitney U test was used for data without normal distribution (hospitalization duration, APACHE II). The differences between categorical variables were determined using the chi-squared or Fisher's exact tests. The threshold for statistical significance was set at $p<0.05$.

Table 2. Unsuitable parameters for mobilization

Cardiac parameters	Heart rate >130 beats/min or <40 beats/min
	Active myocardial ischemia
	Mean arterial pressure <65 mmHg or >110 mmHg
	Systolic blood pressure <90 mmHg or >200 mmHg
Respiratory parameters	FiO_2> 0.6
	O_2 saturation <90%
	Respiratory rate >35/minute
	PEEP >10 cm H_2O
	PaO_2/FiO2 <300
Hemodynamic parameters	Hb <7 mg/dL
	Platelet <20,000 /mL
Other parameters	Fever >38°C
	Increased intracranial pressure

FiO_2: inspired fraction of oxygen; PEEP: positive end expiratory pressure; PaO_2: oxygen pressure; Hb: hemoglobin

Results

Eighty-six patients (43 female and 43 male) of 190 patients were included in the study due to exclusion criteria and loss to follow-up (Figure 2). The mean age was 69.05±16.08 years. The duration of the ICU hospitalization was 19 (3–120) days. The mean APACHE II score was 12.48±7.06.

The most frequent cause of the ICU admission was pulmonary diseases: 34 patients (39.5%). The reasons for ICU hospitalization and co-existing conditions of patients are shown in Table 3.

The mobilization levels of patients were the following: 58 (67.4%) patients had no mobilization; 9 (10.4%) patients sat with legs hanging at the edge of the bed; 16 (18.6%) patients sat in the chair; and 3 (3.4%) patients walked. Twenty of 28 mobilized patients had mobilization in the first 3 days. There were no complications related to mobilization during the rehabilitation sessions.

The diagnosis for ICU hospitalization was evaluated. In the mobilized group, the diagnosis was determined as pulmonary disease in 10 patients (35.7%), neurological disease in 10 patients (35.7%), cardiac disease in 3 patients (10.7%), diabetic ketoacidosis in 3 patients (10.7%), and hepatic disease in 2 patients (7.1%). In non-mobilized group, the diagnosis was found to be pulmonary disease in 24 patients (41.4%), neurological disease in 22 patients (37.9%), cardiac disease 10 in patients (17.2%), diabetic ketoacidosis in 1 patient (1.7%), and orthopedic disease in 1 patient (1.7%).

When the mobilized and non-mobilized groups were compared, the age, hospitalization duration, and APACHE II score were lower in the mobilized group ($p<0.001$) (Table 4). Two mobilized patients regressed due to hemodynamic instability and respiratory failure. These patients were not mobilized again. The worsening of the clinical condition was not associated with the mobilization session.

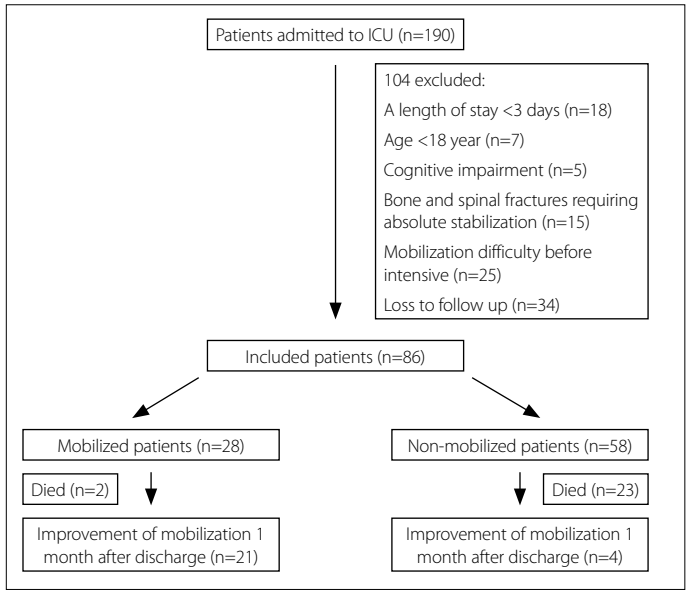

Figure 2. Flow of patients through the study.

Table 3. Diagnosis at admission to the intensive care clinic and co-existing disorders

	Diagnosis at admission to the intensive care clinic						
Co-existing disorders	**Pulmonary disease**	**Neurologic disease**	**Cardiac disease**	**Diabetic ketoacidosis**	**Hepatic disease**	**Orthopedic disease**	**Total**
Pulmonary disease	-	2	2	0	0	0	4
Cardiac disease	10	17	-	1	1	1	30
Neurologic disease	4	-	1	2	0	0	7
Orthopedic disease	6	3	4	0	0	-	13
Malignancy	12	3	3	0	0	0	18
Renal disease	1	1	1	0	1	0	4
Psychiatric disorder	1	0	0	1	0	0	2
None	0	6	2	0	0	0	8
Total	34	32	13	4	2	1	86

Table 4. Age, gender, hospitalization duration, and APACHE II score of mobilized and non-mobilized patients

	Mobilized patients (n=28)	**Non-mobilized patients (n=58)**	**Total (n=86)**	**p**
Age(year) (mean, ±)	60.17±14.80	73.34±14.98	69.05±16.08	p<0.001*
Gender (F/M)	16/12	27/31	43/43	p=0.357
Hospitalization duration (day)				
(mean, ±)	10.75±7.20	24.34±22.36	19.91±19.82	
(median, min–max)	8.00 (3–32)	19.50 (3–120)	19.00 (3–120)	p<0.001*
APACHE II				
(mean, ±)	9.17±5.83	14.08±7.09	12.48±7.06	
(median, min–max)	6.5 (3–29)	13 (5–43)	12 (3–43)	p<0.001*
One month after discharge Improvement in mobility[a]	21	4	25	p<0.001*

F: female; M: male, min: minimum; max: maximum; APACHE: Acute Physiologic and Chronic Health Evaluation
*: p<0.05
a:Whether there was an improvement in mobility compared to discharge status was recorded

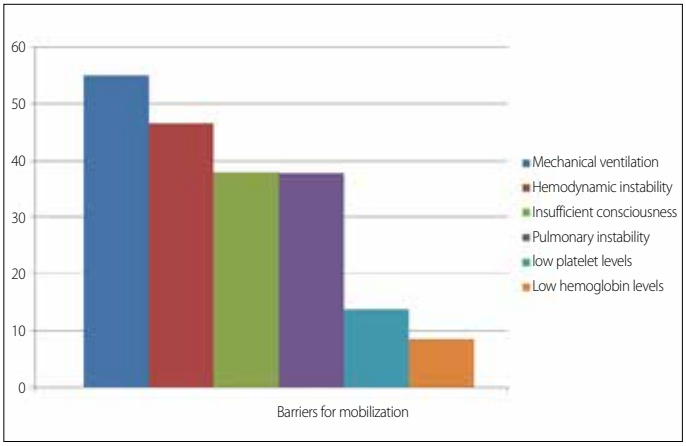

Figure 3. Barriers to mobilization.
1–Mechanical ventilation (55.2%); 2–Hemodynamic instability (46.6%); 3–Insufficient consciousness=Ramsay 4–6 (38%); 4–Pulmonary instability (37.9%); 5–Low platelet levels, platelet<20000 (13.8%); 6–Low hemoglobin levels, <7 mg/dL (8.6%)

Of the 86 patients followed, 32 (55.2%) were mechanically ventilated, and none of the mechanically ventilated patients were mobilized. On the other hand, 28 (51.9%) non-ventilated patients were mobilized. Some of the patients had multiple barriers for EM. Factors that prevent mobilization were found to be mechanical ventilation (55.2%), hemodynamic instability (46.6%), insufficient consciousness [patients with the Ramsay score 4–6 (38%)], pulmonary instability (37.9%), low platelet levels (13.8%), and low hemoglobin levels (8.6%). Thirteen (22.4%) non-mobilized patients had no barrier to mobilization except mechanical ventilation (Figure 3).

The discharge status of these patients were as follows: mortality (29.1%), transfer to service (34.9%), transfer to the palliative care unit (23.3%), home discharge (11.6%), and transfer to another ICU (1.2%). The mortality and palliative care unit transfer rates were higher in the non-mobilized group, while the rate of transfer to service was higher in the mobilized group (Table 5).

One month after discharge, patients were re-evaluated about their mobilization status. The mobilization level of 25 patients improved compared to discharge functional status. Twenty-one (84%) of these patients were mobilized during the ICU stay, while 4 (16%) patients were not mobilized. There was a relation between the functional improvement after discharge and mobilization in the ICU (p<0.001).

Table 5. Patients' discharge status

	Mobilized Patients	Non-mobilized Patients	Total Patients
Died	2 (7.1%)	23 (39.7%)	25 (29.1%)
Palliative care transfer	1 (3.6%)	19 (32.8%)	20 (23.3%)
Home	5 (17.9%)	5 (8.6%)	10 (11.6%)
Another clinic (non-ICU)	20 (71.4%)	10 (17.2%)	30 (34.9%)
Another ICU	0 (0%)	1 (1.7%)	1 (1.2%)
Total	28	58	86

ICU: intensive care unit

Discussion

In this study, we aimed to explore the mobilization rates, factors affecting mobilization, and patients' functional outcomes after discharge, and to compare the clinical characteristics of mobilized and non-mobilized patients. Our findings suggest that mobilization rates were moderately low, and the most common barrier for mobilization was mechanical ventilation. We found that mobilized patients had a shorter hospitalization duration, lower APACHE II scores, and better functional status after discharge.

Early mobilization is a current and frequently discussed issue in the ICU patients. Although patients with mechanical ventilation had EM in several studies (27, 28), mechanically ventilated patients could not be mobilized at all or could be mobilized at very low rates in some reports (16, 17). In a multi-center study with 12 ICUs, although there was a skillful physical therapy staff, no mobilization was achieved in 1079 (84%) of 1288 planned EM episodes (27). In studies on EM, the barriers for rehabilitation were also investigated. In a review with 40 studies, 28 unique barriers to EM were detected, and the most common barriers were patient related. Analyzed barriers in this review were as follows: 14 (50%) were patient related, 5 (18%) structural, 5 (18%) ICU cultural, and 4 (14%) process-related barriers (28). The text from Australia and Scotland cohorts suggest that the most frequent barrier was sedation. Cardiac and neurological instability and endotracheal tubes were also commonly noticed barriers (29). Leditschke et al. (11) found that the most frequent avoidable causes were the presence of femoral vascular access, timing of procedures, and sedation management. On the other hand, unavoidable factors preventing mobilization were respiratory instability, hemodynamic instability, neurologic instability, and diseases (e.g., pelvic fractures) requiring bed rest. They said that inexperienced staff and inadequate equipment (such as a portable mechanical ventilator) were other barriers to mobilization. The presence of a central venous catheter, use of vasopressors, dialysis treatment, sedation, delirium, and left ventricular assist device were not determined to be barriers for EM (8, 18). We observed that our mobilization rate in the intensive care was not very low, but we could not mobilize any of the mechanically ventilated patients. The main barriers to mobilization in our study were the presence of mechanical ventilation, cardiovascular instability, pulmonary instability, and insufficient consciousness. Although our mobilization barriers are similar to the examples in the literature, catheters were not reported because the maximum mobilization was evaluated after these problems were modified. On the other hand, reasons unrelated to the patients for our low mobilization rate may be considered as inexperience in the rehabilitation of the ICU patients, anxiety about harming critically ill patients, and an inadequate number of portable mechanic ventilators and skillful rehabilitation auxiliaries.

The APACHE II score that shows severity of illness was assessed in the ICU mobilization studies. The mean APACHE II score of our patients was 12.48, and it was lower in the mobilized group as compared to the non-mobilized group. The APACHE II score is directly related to the mobility rates as it shows the well-being of the patient. There are studies that showed higher mobilization rates than our results, even if the APACHE II score was higher than ours. Leditschke et al. (11) discovered that patients were mobilized on 54% of patient days, and their mean APACHE II score was 14.7. The reason for the better mobility rate despite the high score may be considered that they accepted passive transfer with an elevator, sling, or other instrument as mobilization. In another study with including only mechanically ventilated patients, the mean APACHE II score was 18, and mobilization was not achieved in 84% of 1288 mobilization attempts (27). The APACHE II score may be a marker for mobilization in ICUs, and it may be a predictor to focus on the appropriate patients. The APACHE II score that is calculated as routine in our ICU may be added to parameters such as diagnosis, cooperation, age, and orthopedic status for patient selection.

In a randomized controlled study that assessed the discharge functional status, a 6-min walking distance, the isometric quadriceps force, and the Short Form 36 Health Survey questionnaire were higher in the therapy group. Admission to the rehabilitation department after discharge was lower in the therapy group (30). In a study from the United States, it was found that survivors who received physical therapy during the ICU treatment had better results for function, a decreased hospital length of stay, and better weaning from mechanical ventilation (12). In studies based on the evidence in favor of EM, European respiratory intensive care associations and the European Community recommend practicing the EM techniques and muscle training for the intensive care patients (31). Our results supported that hospitalization duration was shorter in the EM group and 1 month after discharge, a greater functional improvement was seen in mobilized patients. Significantly, a better functional improvement after discharge in the mobilized group than in the non-mobilized group in the ICU stay may support the importance of mobilization in the ICU.

This study had some limitations. Mobilized patients in the intensive care had already better clinical parameters than immobilized patients, the functional status before the rehabilitation program was not evaluated with specific tests, and this study has relatively a small patient population. Longitudinal studies in larger samples with control groups are needed to confirm our preliminary findings.

Conclusion

This study indicates lower ICU mobilization rates that have not been examined adequately in our country compared to reports from other countries. The most important modifiable barrier to mobilization was mechanical ventilation. The present study provides data on mobilization rates, barriers to mobilization and potential positive outcomes, and on whether mobilization in the ICU can improve the discharge functional condition.

References

1. Chambers MA, Moylan JS, Reid MB. Physical inactivity and muscle weakness in the critically ill. Crit Care Med 2009; 37: 337-46. [CrossRef]

2. Stevens RD, Dowdy DW, Michaels RK, et al. Neuromuscular dysfunction acquired in critical illness: a systematic review. Intensive Care Med 2007; 33: 1876-91. [CrossRef]
3. Ali NA, O'Brien JM Jr, Hoffmann SP, et al. Acquired weakness, handgrip strength, and mortality in critically ill patients. Am J Respir Crit Care Med 2008; 178: 261-8. [CrossRef]
4. Herridge MS, Tansey CM, Matté A et al. Functional disability 5 years after acute respiratory distress syndrome. N Engl J Med 2011; 364: 1293-304. [CrossRef]
5. Herridge MS. Legacy of intensive care unit-acquired weakness. Crit Care Med 2009; 37: 457-61. [CrossRef]
6. Brower RG. Consequences of bed rest. Crit Care Med 2009; 37: 422-8. [CrossRef]
7. Hodgson CL, Berney S, Harrold M, et al. Clinical review: early patient mobilization in the ICU. Crit Care 2013; 17: 207. [CrossRef]
8. Bailey P, Thomsen GE, Spuhler VJ, et al. Early activity is feasible and safe in respiratory failure patients. Crit Care Med 2007; 35: 139-45. [CrossRef]
9. Morandi A, Brummel NE, Ely EW. Sedation, delirium and mechanicalventilation: the 'ABCDE' approach. Curr Opin Crit Care 2011; 17: 43-9. [CrossRef]
10. Özçelik Z, Uçar N, Yılmaz D, et al. Administration of Early Mobilization in Intensive Care Unit Patients and Effects of Early Mobilization on Patient Hemodynamics. J Turk Soc Intens Care 2017; 15: 53-8. [CrossRef]
11. Leditschke A, Green M, Irvine J, et al. What are the barriers to mobilizing intensive care patients? Cardiopulm Phys Ther J 2012; 23: 26-9.
12. Morris PE, Goad A, Thompson C, et al. Early intensive care unit mobility therapy in the treatment of acute respiratory failure. Crit Care Med 2008; 36: 2238-43. [CrossRef]
13. Schweickert WD, Pohlman MC, Pohlman AS, et al. Early physical and occupational therapy in mechanically ventilated, critically ill patients: a randomized controlled trial. Lancet 2009; 373: 1874-82. [CrossRef]
14. Kayambu G, Boots R, Paratz J. Physical therapy for the critically ill in the ICU: a systematic review and meta-analysis. Crit Care Med 2013; 41: 1543-54. [CrossRef]
15. Stiller K. Physiotherapy in intensive care: an updated systematic review. Chest 2013; 144: 825-47. [CrossRef]
16. Nydahl P, Ruhl AP, Bartoszek G, et al. Early mobilization of mechanically ventilated patients: a 1-day point-prevalence study in Germany. Crit Care Med 2014; 42: 1178-86. [CrossRef]
17. Berney SC, Harrold M, Webb SA, et al. Intensive care unit mobility practices in Australia and New Zealand: a point prevalence study. Crit Care Resusc 2013; 15: 260-5.
18. Bourdin G, Barbier J, Burle JF, et al. The feasibility of early physical activity in intensive care unit patients: a prospective observational one-center study. Respir Care 2010; 55: 400-7.
19. Denehy L, Skinner EH, Edbrooke L, et al. Exercise rehabilitation for patients with critical illness: a randomized controlled trial with 12 months of follow-up. Crit Care 2013; 17: 156. [CrossRef]
20. Morris PE. Moving our critically ill patients: mobility barriers and benefits. Crit Care Clin 2007; 17: 1-20. [CrossRef]
21. Hodgson CL, Berney S, Harrold M, et al. Clinical review: Early patient mobilization in the ICU. Crit Care Med 2013; 17: 207.
22. Knaus WA, Draper EA, Wagner DP, et al. APACHE II: a severity of disease classification system. Crit Care Med 1985; 13: 818-29. [CrossRef]
23. Ramsay MAE, Savege TM, Simpson BRJ, et al. Controlled sedation with alphaxolone/alphadolone. Br Med J 1974; 22: 656-9. [CrossRef]
24. Hansen-Flaschen J. Beyond the Ramsay scale: need for a validated measure of sedating drug efficacy in the ICU. Crit. Care Med 1994; 22: 732-3. [CrossRef]
25. Stiller K. Safety issues that should be considered when mobilizing critically ill Patients. Crit Care Clin 2007; 23: 35-53. [CrossRef]
26. Stiller K, Phillips A. Safety aspects of mobilising acutely ill in patients. Physiotherapy Theory and Practice 2003; 19: 239-57. [CrossRef]
27. Hodgson C, Bellomo R, Berney S, et al. Early mobilization and recovery in mechanically ventilated patients in the ICU: a bi-national, multi-centre, prospective cohort study. Crit Care 2015; 19: 81. [CrossRef]
28. Dubb R, Nydahl P, Hermes C Barriers and Strategies for Early Mobilization of Patients in Intensive Care Units. Ann Am Thorac Soc 2016; 13: 724-30. [CrossRef]
29. Harrold ME, Salisbury LG, Webb SA et al. Early mobilisation in intensive care units in Australia and Scotland: a prospective, observational cohort study examining mobilization practises and barriers. Critical Care 2015; 19: 336. [CrossRef]
30. Burtin C, Clerckx B, Robbeets C, et al. Early exercise in criticallyill patients enhances short-term functional recovery. Crit Care Med 2009; 37: 2499-505. [CrossRef]
31. Gosselink R, Bott J, Johnson M, et al. Physiotherapy for adult patients with critical illness: recommendations of the European Respiratory Society and European Society of Intensive Care Medicine Task Force on Physiotherapy for Critically Ill Patients. Intensive Care Med 2008; 34: 1188-99. [CrossRef]