Original Article

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Barriers to early mobilization in a neurological intensive care unit

Barreiras para mobilização precoce em uma unidade de terapia intensiva neurológica

Lucas Lima Ferreira[1], Barbara Rufino Andreasse[2], Maria Júlia Seccatto[2], Adriana Claudia Lunardi[3]

ABSTRACT

Objective: To quantify the prevalence of barriers to early mobilization (EM) in a neurological intensive care unit (ICU) and compare clinical and functional outcomes between patients with and without barriers to EM. **Method:** Retrospective observational study conducted in the neurological ICU of a teaching hospital. Collected data: sex, age, diagnosis, comorbidities, days of hospitalization, length of stay on mechanical ventilation, functionality at discharge using the ICU mobility scale (IMS), rates of discharge or death in the ICU, and barriers. **Results:** A total of 468 patients were included, 58% male, mean age 57.1±16.7 years. The most prevalent barriers were fatigue, need for rest, and somnolence (23%), deep sedation and/or paralysis (17%), and baseline or new immobility/weakness (11%). The group with barriers had a significantly higher SAPS III score and ICU length of stay (p= 0.001) than the group without barriers. The group without barriers had a significantly higher IMS score (p= 0.001) and ICU discharge rate (p= 0.006) than the group with barriers to out-of-bed ambulatory care. **Conclusion:** The most prevalent barriers to out-of-bed ambulatory care were fatigue, need for rest and somnolence, deep sedation and/or paralysis, and baseline or new immobility/weakness. The group with barriers to out-of-bed ambulatory care had higher prognostic scores for disease severity and ICU length of stay than the group without barriers, which had better functionality at discharge and a higher number of ICU discharges than the group with barriers to out-of-bed early mobilization.

Keywords: Intensive Care Units, Early Ambulation, Mobility Limitation

RESUMO

Objetivo: Quantificar a prevalência de barreiras para mobilização precoce (MP) em uma unidade de terapia intensiva (UTI) neurológica e comparar desfechos clínicos e funcionais entre pacientes com e sem barreiras para MP. **Método:** Estudo observacional retrospectivo, realizado na UTI neurológica de um hospital escola. Foram coletados: sexo, idade, diagnóstico, comorbidades, dias de internação, tempo de permanência em ventilação mecânica, funcionalidade na alta, por meio da escala de mobilidade em UTI (EMU), taxas de alta ou óbito na UTI e barreiras. **Resultados:** 468 pacientes foram incluídos, 58% do sexo masculino, média de idade de 57,1±16,7 anos. As barreiras mais prevalentes foram fadiga, necessidade de descanso e sonolência (23%), sedação profunda e/ou paralisia (17%) e linha de base ou nova imobilidade/fraqueza (11%). O grupo com barreiras apresentou escore *Simplified Acute Physiology Score* (SAPS III) e tempo de internação na UTI significativamente maiores (p= 0,001) que o grupo sem barreiras. O grupo sem barreiras apresentou escore EMU (p= 0,001) e a taxa de alta da UTI (p= 0,006) significativamente maiores que o grupo com barreiras para MP. **Conclusão:** As barreiras mais prevalentes para MP fora do leito foram fadiga, necessidade de descanso e sonolência, sedação profunda e/ou paralisia e linha de base ou nova imobilidade/fraqueza. O grupo com barreiras para MP apresentou escore prognóstico de gravidade da doença e tempo de internação na UTI maiores que o grupo sem barreiras, que apresentou melhor funcionalidade na alta e maior número de altas da UTI que o grupo com barreiras para MP fora do leito.

Palavras-chaves: Unidades de Terapia Intensiva, Deambulação Precoce, Limitação de Mobilidade

[1]Universidade Cidade de São Paulo
[2]União das Faculdades dos Grandes Lagos
[3]Universidade de São Paulo

Corresponding Author
Lucas Lima Ferreira
E-mail: lucas_lim21@hotmail.com

Conflict of Interests
Nothing to declare

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INTRODUCTION

Due to prolonged hospital stays, critically ill patients admitted to intensive care units (ICUs) may develop ICU-acquired weakness and are at high risk for complications resulting from long term immobilization, such as muscle contractures, loss of strength and functional capacity, and cardiovascular and respiratory complications. This is directly associated with decreased quality of life and increased morbidity and mortality in these patients.[1-5]

Early mobilization (EM) is a critical intervention for functional recovery and prevention of complications in ICU patients. It consists of a set of therapeutic activities, which are gradually performed and immediately initiated upon patient stabilization. These activities include general kinesitherapy exercises, neuromuscular electrical stimulation, bed and bedside sitting, chair transfers, orthostatism, and ambulation, among other therapies.[3-6]

Despite its potential benefits, EM is not routinely practiced in ICUs. Scientific evidence on EM in the ICU shows a low prevalence of out-of-bed mobilization, especially in patients on MV.[7] Currently, the same situation has been observed in Brazilian ICUs, where only 10% of patients on MV are out-of-bed mobilized.[8] The low rates of out-of-bed EM are due to several barriers, which, according to the causative agent, can be classified as patient-related, structural, cultural, and procedural barriers,[9] and modifiable and non-modifiable barriers.[10]

The most common barriers to EM include the lack of standardized protocols, inadequate staff training, unstable medical conditions, structural problems such as a lack of medical equipment and devices, a lack of qualified personnel, and a lack of financial resources to purchase equipment and specialized human resources for EM implementation in the ICU.[11-17] Identifying potential barriers to EM is important for developing strategies to combat them, as well as determining whether the absence of barriers creates important outcomes in the ICU. Furthermore, specialized ICUs, such as the neurological unit, present even more challenges for progressive out-of-bed EM activities, due to the particularities of the neurocritical patient.

OBJECTIVE

To quantify the prevalence of barriers to out-of-bed medical care in a neurological ICU and compare clinical and functional outcomes between patients with and without barriers to out-of-bed medical care in the ICU.

METHOD

This is an analytical retrospective observational study, which followed the recommendations of the STROBE[18] guideline, carried out at the Neurological Intensive Care Unit of Hospital de Base, in the city of São José de Rio Preto, SP, Brazil.

The study included patients aged 18 years or older of both genders, who were admitted to the neurological ICU between January 1st and December 31st, 2022. Exclusion criteria included patients admitted for less than 24 hours, discharged, or who died during this period.

Initially, sample characterization variables such as sex, age, diagnosis, comorbidities, and the Simplified Acute Physiology Score (SAPS III) were collected. Subsequently, the most prevalent barriers to out-of-bed EM were collected and classified by barrier type according to the definition by Dubb et al.[9] (Chart 1).

Chart 1. Classification of barriers to early mobilization[9]

Barrier
PATIENT – PE
PE-1: Severe illness severity, "very sick" or "very well" patients
PE-2: Hemodynamic instability, arrhythmias
PE-3: Respiratory instability/distress, ventilator asynchrony
PE-4: Pain
PE-5: Poor nutritional status
PE-6: Obesity (e.g., BMI ≥30)
PE-7: Baseline and/or new immobility/weakness
PE-8: Deep sedation and/or paralysis
PE-9: Delirium, agitation
PE-10: Patient refusal, lack of motivation, anxiety
PE-11: Fatigue, need for rest, drowsiness
PE-12: Palliative care
PE-13: ICU devices and equipment
PE-14: Hemodynamic monitoring equipment
PE-15: ICU-related devices
STRUCTURE – E
E1: Limited staff, time constraints
E2: Lack of an early mobilization program/protocol
E3: Inadequate staff training
E4: Limited equipment
E5: Early discharge (before mobilization)
CULTURE – C
C1: Lack of a culture of mobilization
C2: Lack of team knowledge and experience regarding risks/benefits
C3: Early mobilization is not a priority
C4: Lack of team support or adherence
C5: Lack of patient/family knowledge
PROCESS – PR
PR1: Lack of planning and coordination
PR2: Unclear expectations, roles, and responsibilities
PR3: Missing/delayed daily screening for eligibility
PR4: Risk to mobilization providers (stress, injuries)

The data were then divided into a group with barriers to ICU care and a group without barriers to ICU care. From there, the following variables were collected: length of hospital stay, length of stay on mechanical ventilation (MV), functionality at discharge (using the ICU Mobility Scale (IMS), and ICU outcomes such as discharge or death for comparison between the groups. All variables were collected from an online Google Drive® spreadsheet and from the patients' MVPEP® electronic medical records, updated daily by

physiotherapists in the neurological ICU.

The SAPS III is a prognostic score for the severity of the illness leading to ICU admission and the probability of death within 28 days. It consists of 20 different variables measurable upon patient admission to the ICU. The variables are divided into demographics, reasons for ICU admission, and physiological variables. These represent the degree of disease impairment and the assessment of health status prior to hospital admission, which indicates premorbid conditions. Each of the variables analyzed is weighted according to the severity of the physiological disorder. In theory, the lowest value attributed by the score is 16, and the highest is 217 points.[19]

The IMS scale, validated for Portuguese as the ICU Mobility Scale (IMS) by Kawaguchi et al.[20] was developed to measure the mobility of ICU patients. Its score ranges from zero to ten in a single domain. A score of zero indicates low mobility and complete functional dependence in patients who performed only passive exercises in bed, and a score of 10 indicates high mobility and functional independence in patients who ambulate independently without assistance.

The clinical outcomes which were analyzed between the groups with and without barriers to out-of-bed mobility were: age, SAPS III score, length of stay on MV and ICU stay, and ICU discharge and death rates. The functional outcome was the level of functional mobility at ICU discharge. This paper followed the ethical principles established in Resolution No. 466/2012 of the National Health Council and was submitted to the Research Ethics Committee (CEP) of the União das Faculdades dos Grandes Lagos (UNILAGO) by CAAE 80137824.0.00000.5489 and approved by opinion No. 6.955.880. It was authorized by the CEP, waiving the need to sign the free and informed consent form, since it is a documentary study based on databases.

A database was created in Microsoft Excel®, and descriptive statistics were performed, presenting variables as means, standard deviations or medians, interquartile ranges, absolute numbers, and percentages. The Kolmogorov-Smirnov test was used to analyze data distribution normality, followed by inferential statistics with the Mann-Whitney test to compare ordinal numerical variables and Fisher's exact test to compare categorical variables between the groups with and without EM barriers. Statistical analyses were performed using BioStat version 3.0 for Windows®, and p-values ≤0.05 were considered statistically significant.

RESULTS

A total of 468 patients were included in the neurosurgical ICU during the study period. Among the included patients, there was a mean age of 57 years, a mean SAPS III score of 47.9 points, and a predominance of males (58%). Regarding admission diagnoses and comorbidities, brain tumor resection (27%) and arterial hypertension (64%) were found to be the most prevalent (Table 1).

880 barriers for EM were found, it was found that the PE-11 barrier with 23% (n= 201), followed by the PE-8 barrier with 17% (n= 150), and the PE-7 barrier with 11% (n= 98), were the most prevalent (Table 2).

The number of days patients were not moved out of bed due to barriers was also analyzed, with a median of 79 [6–685] days.

When comparing the clinical and functional outcomes analyzed between patients with and without barriers to rapid pacemaking, it was found that the group with barriers had a significantly higher median SAPS III score and length of ICU stay (p<0.001) than the group without barriers. The group without barriers also had significantly higher functionality at discharge (p= 0.00) and a significantly lower number of deaths (p= 0.00) than the group with barriers to rapid pacemaking (Table 3).

Table 1. Sociodemographic and clinical characteristics of patients in the neurological ICU

Variable	% (n)	Mean ± standard deviation
Sex (M/F)	M – 58 (273) F – 42 (195)	–
Age (years)	–	57.1±16.7
SAPS III	–	47.9±17.8
Medical diagnosis		
Brain tumor resection	27 (54)	–
Spinal arthrodesis	12 (25)	
SAH	9 (19)	
Stroke	3 (13)	
TBI	1.5 (7)	
Comorbidities		
High blood pressure	64 (90)	–
Diabetes mellitus	23 (32)	
Smoking	16 (22)	

M: male. F: female. SAPS III: Simplified Acute Physiology Score; SAH: subarachnoid hemorrhage; TBI: traumatic brain injury

DISCUSSION

The results of this study demonstrated that the most prevalent barriers to out-of-bed EM were fatigue, need for rest, and drowsiness (PE-11), deep sedation and/or paralysis (PE-8), and baseline or new immobility/weakness (PE-7). The group with barriers to EM had a longer SAPS III and ICU length of stay than the group without barriers. The group without barriers to EM had better functionality at discharge and a higher number of ICU discharges than the group with barriers to out-of-bed EM.

Dubb et al.[9], in their review study, identified 28 barriers to EM, of which 50% were patient-related, 18% structural barriers, 18% cultural barriers, and 14% process-related, which were used as the basis for this study. In Paulo et al.[1], although barriers related to patient conditions are the most limiting and relevant, as also indicated in the current study, hemodynamic instability (PE-2) was the most cited, followed by sedatives and analgesia. In the Brazilian guidelines for early mobilization in the ICU,[21] hemodynamic instability was presented as the greatest limitation for performing EM, which differs from the study presented, where the most prevalent barrier was PE-11, defined as fatigue, need for rest, and drowsiness.

A recent study[22] sought to identify the barriers to the implementation and execution of EM in critically ill patients in two hospitals and found that the patient-related barriers most cited by professionals were hemodynamic instability (85.8%), loss of devices (58.9%), and endotracheal intubation (55.3%). Among structural barriers, the lack of guidelines or protocols was identified, and among cultural and process-related barriers, the lack of a responsible professional to evaluate patients suitable for initiating rehabilitation was noted. These results contradict those found in the current study and can be explained by the characteristics of the ICUs. In the study by Azer et al.[22] barriers were analyzed in general ICUs, while in this study, barriers in a neurological ICU were stratified.

Table 2. Prevalence of barriers to PM among patients admitted to the neurological ICU

Barrier	Frequency (n)	Percentage (%)
PE-1: High severity of illness, "very sick" or "very well" patients	36	4
PE-2: Hemodynamic instability, arrhythmias	125	14.2
PE-3: Respiratory instability/distress, ventilator asynchrony	69	8
PE-4: Pain	4	0.44
PE-5: Poor nutritional status	0	0
PE-6: Obesity (for example: IMC≥30)	15	1.7
PE-7: Baseline and/or new immobility/weakness	98	11
PE-8: Deep sedation and/or paralysis	150	17
PE-9: Delirium, agitation	30	3.4
PE-10: Patient refusal, lack of motivation, anxiety	100	11.36
PE-11: Fatigue, need for rest, drowsiness	201	23
PE-12: Palliative care	20	2.27
PE-13: ICU devices and equipment	0	0
PE-14: Hemodynamic monitoring equipment	0	0
PE-15: ICU-related devices	0	0
E1: Limited staff, time constraints	26	3
E2: Lack of an early mobilization program/protocol	0	0
E3: Inadequate staff training	0	0
E4: Limited equipment	2	0.22
E5: Early discharge (before mobilization)	0	0
C1: Lack of a culture of mobilization	0	0
C2: Lack of team knowledge and experience regarding risks/benefits	0	0
C3: Early mobilization is not a priority	0	0
C4: Lack of team support or adherence	0	0
C5: Lack of patient/family knowledge	0	0
PR1: Lack of planning and coordination	4	0.44
PR2: Unclear expectations, roles, and responsibilities	0	0
PR3: Missing/Late Daily Screening for Eligibility	0	0
PR4: Risk to mobilization providers (stress, injuries)	0	0

Table 3. Clinical and functional outcomes of patients with and without barriers to EM

Variable	Group with Barriers (n= 369)	Group without Barriers (n= 99)	p-value*
Age (years)	61 [18-93]	61 [21-93]	0,66
SAPS III	50 [16-105]	34 [16-87]	<0,0001
MV (days)	7 [1-11]	10 [1-14]	0,65
Hospitalization (days)	6 [1-43]	3 [1-23]	<0,0001
Functionality (high)	5 [0-10]	7 [0-10]	0,001
Outcome: Discharge/Death (n)	296/73	91/8	0,006†

*EM: early mobilization; SAPS III: Simplified Acute Physiology Score; MV: mechanical ventilation; *Mann-Whitney test; † Fisher's exact test*

Oliveira et al.[23] described the knowledge of physiotherapists about barriers to EM in the ICU. 94% identified that patients are not too sick to be mobilized, 70% reported a lack of EM training in the ICU where they work, 50% stated that a lack of planning prevents the procedure from being performed, and 60% stated that the lack of knowledge of the team, patient, and family about the risks and benefits of EM is not a constraint.

Other perceived barriers to EM in the ICU among members of the multidisciplinary team were evaluated by a cross-sectional study[24] that identified the unavailability of professionals and time for EM, excessive sedation, delirium, risk of musculoskeletal self-injury, and excessive work stress as the main barriers.

Other authors[25] reported, in a literature review, that the most common barriers to EM include hemodynamic instability, the presence of vascular access, sleep disturbances, patient safety, lack of communication and teamwork among multiple professionals, staff shortages, inadequate time, delirium, extreme sedation, risk of musculoskeletal injury, and work-related stress. These results corroborate the findings of this study regarding the most prevalent barriers and highlight the need for immediate measures to address modifiable barriers and improve EM.

Leditschke et al.[10] reported modifiable and non-modifiable barriers to early mobilization. Modifiable barriers included vascular access catheters in the femoral position, sedation management, procedure time, agitation, and low Glasgow Coma Scale score. Non-modifiable factors included hemodynamic instability, respiratory instability, neurological instability (difficulty controlling intracranial hypertension), and physician orders.[10] The results of this study corroborate those found in this study, as fatigue, need for rest, and drowsiness, in addition to deep sedation, were the

most prevalent barriers to early mobilization and can be classified as modifiable barriers, as drowsiness may be associated with the overuse of sedatives and analgesics in the ICU.

Regarding clinical outcomes, the group with barriers to early mobilization had a longer SAPS III and ICU length of stay than the group without barriers. In the study by Figueiredo et al.[3], which aimed to characterize clinical practice and identify barriers related to PM in an ICU, the mean SAPS III score was 63.47 ± 13.37 points, a difference from the current study, in which the mean SAPS III score was 47.9 points and the median was 50 and 34 points in the groups with and without barriers to EM, respectively.

This demonstrates that the patients in this study presented less severe health conditions. According to the authors[3], although there was no significant difference in SAPS III scores between the study groups, patients who did not reach the seated level due to a higher score were the least mobilized during their ICU stay. It is possible to conclude that these patients developed more severe clinical conditions during their hospital stay, a factor that in itself is an important patient-related barrier to out-of-bed EM.

Regarding clinical outcomes, it was observed that the group without barriers to mechanical ventilation had better functionality at discharge and a higher rate of discharges from the ICU than the group with barriers to out-of-bed mechanical ventilation. Ramos et al.[4] sought to associate functionality and length of stay of critically ill patients in an ICU and found an inversely proportional correlation between these variables, demonstrating that the longer the length of ICU stay, the lower the functionality at discharge in neurological and lung disease patients. These findings, although not comparable to the present study due to methodological differences, demonstrate that the length of ICU stay and the presence of barriers to mechanical ventilation directly impact patient functionality.

Other current scientific evidence on clinical outcomes of neurological patients in the ICU has demonstrated longer ICU length of stay in patients on prolonged MV, higher SAPS III scores and length of ICU stay, and lower ICU discharge rates in patients who failed ventilator weaning.[26,27] These results corroborate the present study in the comparisons of these outcomes between patients with and without barriers to out-of-bed EM, although the cited studies did not stratify possible barriers or the functionality outcome.

To our knowledge, this is the first study that, in addition to stratifying the prevalence of barriers to EM, compared clinical and functional outcomes of patients with and without barriers admitted to a neurological ICU. Therefore, the clinical implications of this study highlight the importance of identifying and minimizing potential barriers to EM in the ICU, as these barriers can have an important impact on clinical outcomes, such as length of stay in the ICU and hospital, functionality, and discharge and death rates.

The limitations of this study were its retrospective design, the lack of complete data in the Google Drive spreadsheets of the neurological ICU physiotherapy service, and the barriers included in the study, as they did not address all potential barriers to out-of-bed EM that are present in the daily routine of an ICU.

CONCLUSION

The most prevalent barriers to out-of-bed early mobilization were fatigue, need for rest, and somnolence (PE-11), deep sedation and/or paralysis (PE-8), and baseline or new immobility/weakness (PE-7). The group with barriers to early mobilization had higher prognostic scores for disease severity and length of ICU stay than the group without barriers. The group without barriers to early mobilization had better functionality at discharge and a higher number of ICU discharges than the group with barriers to out-of-bed early mobilization.

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