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Correlation between mobility at admission and clinical and functional outcomes of patients in the Intensive Care Unit

Correlação entre mobilidade na admissão e desfechos clínicos e funcionais de pacientes na Unidade de Terapia Intensiva

Correlación entre la movilidad en el ingreso y los resultados clínicos y funcionales de los pacientes en la Unidad de Cuidados Intensivos

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Abstract:
Objective: to assess the mobility level of patients admitted to an intensive care unit and verify its correlation with length of stay in this unit and in the hospital, as well as with the level of mobility at discharge. **Methods:** a prospective observational study conducted between September and December 2020 in an intensive care unit. Mobility was measured at admission and discharge with the Perme Score. The correlation between initial mobility level, length of stay (intensive care unit and hospital), and mobility at discharge was analyzed using Spearman's correlation test. **Results:** fifty-one patients were included, with a median age of 69 (54-79) years, 54.9% of whom were male. The level of mobility at admission did not significantly correlate with the length of stay in the intensive care unit (r = -0.206, p = 0.147) or in the hospital (r = -0.238, p = 0.092). However, a moderate positive correlation was observed between mobility at admission and discharge (r = 0.662, p < 0.001). **Conclusion:** the level of mobility at admission did not significantly correlate with the length of stay in the intensive care unit or hospital. However, patients who presented better initial mobility tended to maintain or improve their functional capacity until discharge from the intensive care unit.
Keywords: Functional status; Mobility limitation; Intensive care unit; Length of stay.

Resumo:
Objetivo: avaliar o nível de mobilidade dos pacientes admitidos em uma unidade de terapia intensiva e verificar sua correlação com o tempo de internação nesse setor e no hospital, bem como com o nível de mobilidade na alta. **Método**: estudo observacional prospectivo, realizado entre setembro e dezembro de 2020, em uma unidade de terapia intensiva. A mobilidade foi mensurada na admissão e na alta por meio do *Perme Score*. A correlação entre o nível de mobilidade inicial, o tempo de internação (unidade de terapia intensiva e hospitalar) e a mobilidade na alta foi analisada pelo teste de correlação de Spearman. **Resultados**: foram incluídos 51 pacientes, com idade mediana de 69 (54-79) anos, dos quis 54,9% eram do sexo masculino. O nível de mobilidade na admissão não apresentou correlação significativa com o tempo de internação na unidade de terapia intensiva (r = -0,206, p = 0,147) ou no hospital (r = -0,238, p = 0,092). Entretanto, observou-se uma correlação positiva moderada entre a mobilidade na admissão e na alta (r = 0,662, p < 0,001). **Conclusão**: o nível de mobilidade na admissão não se correlacionou significativamente com o tempo de internação na unidade de terapia intensiva ou hospitalar. Contudo, pacientes que apresentaram melhor mobilidade inicial tenderam a manter ou melhorar sua capacidade funcional até a alta da unidade de terapia intensiva.
Palavras-chave: Estado funcional; Limitação da mobilidade; Unidade de terapia intensiva; Tempo de internação.

Resumen:
Objetivo: evaluar el nivel de movilidad de los pacientes ingresados en una unidad de cuidados intensivos y verificar su correlación con el tiempo de hospitalización en este sector y en el hospital, así como con el nivel de movilidad al alta. **Método**: estudio observacional prospectivo, realizado entre septiembre y diciembre de 2020, en una unidad de cuidados intensivos. La movilidad se midió al ingreso y al alta mediante el Perme Score. La correlación entre el nivel de movilidad inicial, el tiempo de hospitalización (unidad de cuidados intensivos y hospitalaria) y la movilidad al alta se analizó mediante la prueba de correlación de Spearman. **Resultados**: se incluyeron 51 pacientes, con una mediana de edad de 69 (54-79) años, de los cuales el 54,9 % eran hombres. El nivel de movilidad al ingreso no presentó una correlación significativa con el tiempo de hospitalización en la unidad de cuidados intensivos (r = -0,206, p = 0,147) o en el hospital (r = -0,238, p = 0,092). Sin embargo, se observó una correlación positiva moderada entre la movilidad al ingreso y al alta (r = 0,662, p < 0,001). **Conclusión**: el nivel de movilidad al ingreso no se correlacionó significativamente con el tiempo de estancia en la unidad de cuidados intensivos o en el hospital. Sin embargo, los pacientes que presentaban una mejor movilidad inicial tendían a mantener o mejorar su capacidad funcional hasta el alta de la unidad de cuidados intensivos.
Palabras clave: Estado Funcional; Limitación de la movilidad; Unidad de cuidados intensivos; Tiempo de internación.

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INTRODUCTION

Several factors negatively contribute to the decline in mobility of patients admitted to the Intensive Care Unit (ICU), directly influencing their recovery, as well as their clinical and functional outcomes. The severity of the disease, the prolonged use of invasive devices and sedatives, the lack of equipment and trained professionals, and an institutional culture that often favors immobility are critical factors that aggravate this situation. These factors not only limit mobility but also exacerbate the physical barriers of the ICU environment, resulting in acquired muscle weakness[1,2].

During hospitalization, patients are often subjected to long periods of bed rest, which contributes to rapid loss of muscle mass[3]. This loss makes immobility a significant risk factor for the development of severe muscle weakness and consequent functional decline, increasing the risk of complications during hospitalization as well as post-discharge[4]. Thus, prolonged immobility can perpetuate a cycle of functional decline that hinders the patient's overall recovery.

In this context, the use of tools that allow for an accurate and continuous assessment of ICU patient mobility is essential[5]. Among the various existing scales, the Perme Intensive Care Unit Mobility Score (Perme Score) stands out as the only one that takes into account multiple potential barriers to mobility, providing a quantitative measure of functional capacity and progression over time[6,7]. The Perme Score allows for mapping the trajectory of patient mobility during their ICU stay, identifying emerging disabilities, predicting potential risk factors, and, based on this, guiding the implementation of early interventions aimed at improving mobility[8].

Targeted interventions, when implemented early, have the potential to significantly reduce the duration of mechanical ventilation (MV), shorten the length of ICU stay, and consequently improve functional outcomes at hospital discharge[9]. A deeper understanding of the relationships between mobility and clinical and functional outcomes can not only identify patients at higher risk for specific interventions, but also optimize the use of rehabilitation resources and offer valuable insights for the implementation of early mobilization programs in ICUs. Furthermore, assessing mobility allows for the adoption of early interventions to improve the mobility of ICU patients, as these interventions can reduce the duration of mechanical ventilation, shorten the length of ICU stay, and improve functional outcomes at hospital discharge[10].

It is assumed that greater mobility upon admission is associated with a shorter length of stay and better mobility levels at discharge, suggesting a more favorable prognosis for these patients. Therefore, this study aimed to evaluate the level of mobility of patients admitted to an

Intensive Care Unit and verify its correlation with the length of stay in this sector and in the hospital, as well as with the level of mobility at discharge.

METHODS

Between September and December 2020, a prospective, analytical, and quantitative observational study was conducted in an adult ICU of a university hospital located in the city of Uberaba, Minas Gerais, Brazil. It was designed following the recommendations of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines[11].

The sample was selected by convenience, and included patients of both sexes, aged 18 years or older, admitted to the ICU. No sample size calculation was performed, as the goal was to capture the largest possible number of patients within the study period. Patients with neuromuscular diseases, those in palliative care, those with agitation, confusion, and/or any other condition that precluded assessment, those who progressed to death, those who refused to participate in the study, and those who did not sign the Informed Consent Form (ICF) were excluded.

To characterize the sample, demographic (sex and age) and clinical information were collected from medical records, including medical diagnosis, Acute Physiology and Chronic Health Evaluation System II (APACHE-II) score at ICU admission, use of invasive mechanical ventilation, need for tracheostomy, and use of vasopressors. In addition, the duration of invasive mechanical ventilation and the length of stay in the ICU and hospital were recorded.

Patient mobility was assessed using the Perme Intensive Care Unit Mobility Score (Perme Score)[8], both at ICU admission and discharge, with a maximum 24-hour time limit for each assessment. Assessments were conducted by a single, properly trained physical therapist. The Perme Score consists of a scale that assesses 15 items divided into seven categories (mental status, potential mobility barriers, functional strength, bed mobility, transfers, gait, and endurance). The total score ranges from 0 to 32 points, with higher scores indicating better mobility. Lower scores on this instrument indicate reduced mobility and a greater number of barriers to mobilization, while higher scores reflect preserved mobility, a reduced need for assistance to perform functional activities, and less interference from potential barriers to mobilization[12].

Continuous data are presented as mean and standard deviation or median and interquartile range (IQR), depending on the data distribution. The Mann-Whitney test was used to compare total scores and individual Perme Score categories between ICU admission and

discharge. Data normality was assessed using the Kolmogorov-Smirnov test. Categorical data were described by absolute and relative frequencies.

To assess the correlation between the initial Perme Score (ICU admission), the length of ICU and hospital stay, and the Perme Score at ICU discharge, the Spearman's correlation coefficient was used. All analyses were performed using the Statistical Package for the Social Sciences (SPSS version 22), with a statistical significance level of $p < 0.05$.

This study was previously approved by the Research Ethics Committee of the Universidade de Uberaba (UNIUBE), under opinion number 3,583,963.

RESULTS

During the study period, 63 patients were evaluated upon admission. Of these, 19% died (n=12), and 81% (n=51) who were discharged included in the final sample (Figure 1).

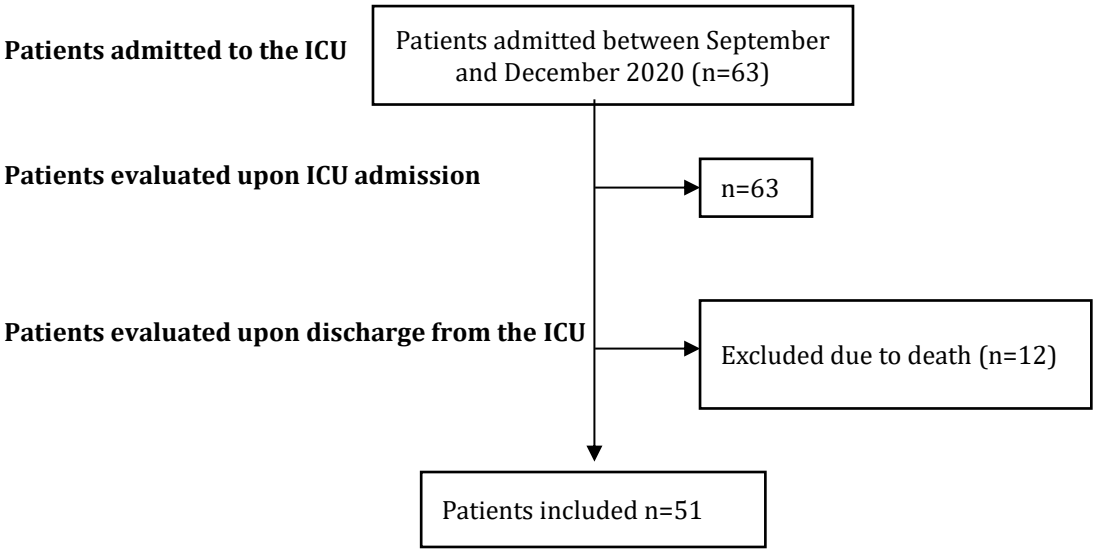

Figure 1. Flowchart of patients included in the study. Uberaba/MG, Brazil, 2025.

Most patients were male (54.9%; n=28), with a median age of 69 (54-79) years, with lung diseases as the most frequent cause of hospitalization (19.6%; n=10). Of the total patients, 43.1% (n=22) used MV, remaining for a median period of 12 (3-18) days. Of the patients on MV, 54.4% (n=12) underwent tracheostomy. Table 1 describes the baseline and clinical characteristics of the patients included in the study.

Table 1. Baseline characteristics and clinical outcomes of the included participants. Uberaba/MG, Brazil, 2025.

Variables	Total (n=51)
Sex, n (%)	
Male	28 (54.9)
Female	23 (45.1)
Age, years, median(IQR)	69 (54-79)
Age>60 years, n (%)	35 (68.6)
Reasons for hospitalization, n (%)	
Pulmonary	10 (19.6)
Neurological	9 (17.6)
Gastrointestinal	7 (13.7)
Orthopedical	7 (13.7)
Kidney	6 (11.8)
Heart	8 (9.8)
Infectious	2 (3.9)
Endocrine	2 (3.9)
Other	3 (5.9)
APACHE-II, median (IQR)	15 (8-22)
Use of vasopressors, n (%)	26 (50.9)
Use of mechanical ventilation, n (%)	22 (43.1)
Days hospitalized, median (IQR)	
ICU	6 (3-18)
Hospital	16 (9-52)

Note: APACHE-II - Acute Physiology and Chronic Health Evaluation System II; IQR - Interquartile Range; ICU - Intensive Care Unit.

The median Perme Score at admission was lower than at discharge from the ICU, 6 (0-9) points versus 13 (6-17) points, respectively ($p<0.001$). When evaluated by category, only endurance showed no statistically significant difference between ICU admission and discharge. Figure 2 shows the comparisons by Perme Score category between ICU admission and discharge.

In the correlation analysis, the Perme Score obtained at ICU admission did not show a statistically significant correlation with ICU length of stay ($R = -0.206$, $p = 0.147$) or with hospital length of stay ($R = -0.238$, $p = 0.092$). In contrast, a moderate to strong positive correlation was observed between Perme Scores at ICU admission and discharge ($R = 0.662$, $p < 0.001$), indicating that patients with better mobility scores at admission tend to maintain or improve their scores until discharge (Table 2).

Figure 2. Comparison by Perme Score category between ICU admission and discharge. Uberaba, Minas Gerais, Brazil, 2025.

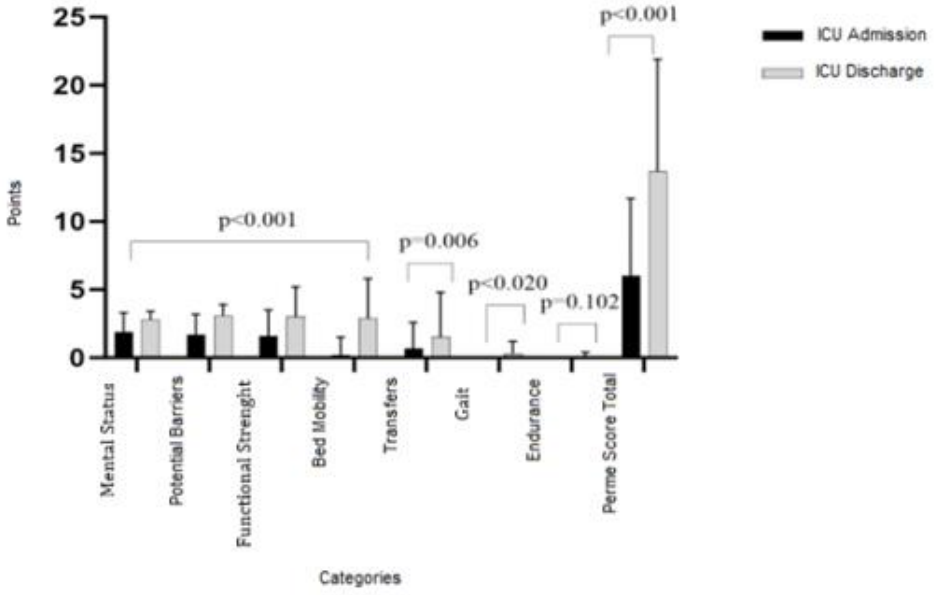

Table 2. Correlation between the Perme Score at ICU admission, length of ICU and hospital stay, and Perme Score at ICU discharge. Uberaba/MG, Brazil, 2025.

Dependent Variables	Independent Variables	R	p value
Length of stay ICU	Perme Score on ICU Admission	-0,206	0,147
Length of stay Hospital	Perme Score on ICU Admission	-0,238	0,092
Perme Score at ICU Discharge	Perme Score on ICU Admission	0,662	<0,001

DISCUSSION

This study assessed the mobility level of patients admitted to an intensive care unit (ICU) using the Perme Score upon admission and investigated possible correlations between the initial score and the length of ICU stay, total hospital stay, and mobility level at ICU discharge. The main findings were: (i) there was a trend toward an increase in mobility level between ICU admission and discharge; (ii) patients who had higher levels of mobility upon admission had similarly higher levels of mobility at discharge; and (iii) there was no significant correlation between the initial level of mobility and the length of ICU stay or total hospital stay.

At ICU admission, a reduced Perme Score was observed, reflecting a low level of patient mobility. One possible explanation for this result is the high prevalence of barriers to mobility identified in this setting, such as the use of medical devices, the presence of vascular access, the use of sedatives, and the administration of vasopressors. These barriers have a strong correlation with the level of mobility of patients admitted to the ICU, indicating that the greater the number of barriers identified, the lower the level of mobility tends to be[13–15].

Upon discharge from the ICU, an increase in the Perme Score was observed compared to admission, indicating a significant improvement in the patients' mobility level. This increase has also been reported in previous studies involving specific populations, such as patients undergoing cardiac surgery[16,17] and liver transplantation[18]. Considering that the level of mobility is directly influenced by the number and impact of barriers present, it is believed that this improvement was enhanced by the reduction of mobility barriers throughout the hospitalization period, as well as by the continuity of physical therapy care, which may have contributed significantly to minimizing the negative effects associated with prolonged hospitalization[19].

Although mobility levels at ICU discharge were higher than those observed at admission, patients achieved few Perme Score categories requiring greater physical effort, such as gait and endurance. Patients who achieve high levels of mobility, such as standing and walking, generally have better functional outcomes and a better quality of life in the long term[20,21].

One possible explanation for the reduced number of patients who achieved higher levels of mobility in this study may be related to ICU-acquired muscle weakness, although this variable was not directly assessed, which is associated with poorer physical function and increased healthcare costs[22]. Furthermore, the study sample was predominantly composed of elderly individuals, who are naturally more predisposed to unfavorable clinical outcomes[23]. Additionally, more than 40% of patients were on mechanical ventilation, a condition often associated with low levels of mobility due to the deleterious effects of prolonged use of sedatives, neuromuscular blockers, and extended periods of immobility[24]. These conditions can significantly impair effective participation in physical therapy interventions.

In this study, no association was observed between the level of mobility assessed by the Perme Score upon ICU admission and the length of stay in either the ICU or hospital. Similarly, a recent prospective observational study involving patients in the postoperative period after cardiac surgery also found no significant association between the initial level of mobility, measured by the Perme Score, and the length of stay in the intensive care unit or hospital[26]. However, other studies have found different results.

In another prospective observational study of patients after cardiac surgery, the level of mobility assessed by the Perme Score was associated with the length of ICU stay[16]. Another study of patients undergoing liver transplantation also showed an association between a higher initial level of mobility, measured by the Perme Score, and a shorter ICU stay[18]. A retrospective analysis of mechanically ventilated patients assessed by the Manchester Mobility Score (MMS)

demonstrated that patients with a score greater than or equal to 5 (able to sit in a chair upon ICU discharge) were more likely to be discharged home and had a shorter total hospital stay[27].

The discrepancies between these findings and those obtained in the present study can be explained by the heterogeneity of the sample, which included patients with different diagnoses, in contrast to the homogeneity of the specific populations in the other studies mentioned. These findings suggest that, despite the relevance of assessing mobility in the clinical context, other factors possibly have a more direct influence on the length of hospital and ICU stay in this specific population.

Declining mobility in the ICU is associated with several factors, especially in patients who already have a low functional level upon admission[28]. When these patients are exposed to additional factors that induce prolonged immobility, such as sedation, use of invasive medical devices, and environmental barriers, they tend to have a reduced level of mobility at the end of their ICU stay, even if higher than the initial level[29].

In this context, one of the fundamental recommendations of the ABCDEF Bundle is the early and continuous implementation of interventions that promote the mobilization of critically ill patients, aiming to minimize the deleterious effects of immobility, such as muscle weakness acquired in the ICU, thus contributing to better functional outcomes and quality of life after hospital discharge[30].

Assessing and monitoring the mobility level of ICU patients is essential, as a significant proportion of these individuals may experience persistent functional impairments after hospital discharge, which can last for months or even years[31,32]. Furthermore, previously frail patients or those with prior functional impairments are more likely to experience an even more pronounced decline in functional capacity[33,34].

The use of the Perme Score allowed for an accurate assessment of the mobility progress of the patients included in this study. Its structuring into specific categories (mental status, functional strength, potential barriers to mobility, bed mobility, transfers, gait, and endurance) facilitates the clear identification of the limitations faced by patients[12]. Furthermore, the instrument's clinimetric properties have already been duly evaluated and validated in the literature, particularly notable for determining the minimal clinically important difference (MCID) and demonstrating the instrument's responsiveness[35].

These aspects confirm its clinical utility in detecting relevant changes in the functional status of patients admitted to intensive care units, significantly aiding in the planning and monitoring of physical therapy interventions. By explicitly considering potential barriers to mobility, the Perme Score is aligned with the guidelines of the International Classification of

Functioning, Disability and Health (ICF), which recommends a comprehensive assessment approach, encompassing dysfunctions, activity limitations, and restrictions on social participation[36].

In clinical practice, the implementation of structured early mobilization programs is essential to optimize the functional recovery of patients admitted to the ICU[37]. However, identifying, understanding, and appropriately managing these barriers is crucial to effectively improve the clinical and functional outcomes of critically ill patients. In this context, the Perme Score stands out as a valuable tool for comprehensively integrating these aspects, fostering a comprehensive clinical approach tailored to the individual needs of ICU patients[38].

CONCLUSION

Based on the results obtained, it can be concluded that mobility, measured by the Perme Score upon ICU admission, did not show a statistically significant association with ICU length of stay or total hospital stay. However, a moderate to strong positive association was identified between mobility levels at ICU admission and discharge, suggesting that patients with better initial mobility tend to maintain higher levels of mobility throughout their hospital stay. Therefore, the Perme Score can be considered a useful tool for monitoring mobility development during patients' ICU stays, although it does not allow for predicting length of stay.

From a practical perspective, these findings reinforce the importance of early mobility assessment as part of care practice in intensive care settings. The systematic use of standardized instruments, such as the Perme Score, can contribute to functional stratification of patients, individualized planning of physical therapy approaches, and more accurate clinical decision-making. Furthermore, identifying patients with reduced mobility upon admission can facilitate early and targeted interventions, potentially improving functional recovery and optimizing care resources.

The limitations of this study include the observational design adopted, which limits the ability to establish cause-and-effect relationships between the variables analyzed. Furthermore, this is a single-center study with a limited sample size, which compromises the generalizability of the results to different clinical settings or other populations with distinct characteristics. In turn, the longitudinal assessment of mobility at two distinct time points (ICU admission and discharge) is noteworthy, enabling a detailed analysis of patients' functional trajectories.

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