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Patients admitted to an intensive care unit who do not adopt an antigravity posture have a higher odds of death

Pacientes internados em unidade de terapia intensiva que não adotam postura antigravitacional apresentam maiores chances de óbito

Pacientes hospitalizados en unidad de cuidados intensivos que no adoptan postura antigravitacional pueden tener mayores posibilidades de fallecimiento

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ABSTRACT | Until now, few functional performance markers are able to predict death in Intensive Care Units (ICUs). This study aimed to identify the association between non-adoption of antigravity posture and death in patients admitted to an adult ICU. It is a retrospective and analytical study, performed through the analysis of medical records. Association between non-adoption of antigravity posture and death was tested by multiple logistic regression adjusted for gender, age, disease severity (measured by Acute Physiology and Chronic Health Classification System II [Apache II]), time of invasive mechanical ventilation (IMV), and period of sedation. The odds ratio (OR) with confidence interval (CI=95%) was estimated. A total of 92 sequential patients were included in the study. A strong association between the non-adoption of antigravity posture in the ICU and death (ORadjusted=37.7, CI=4.76-293, p=0.001) was observed. Thus, one can conclude that patients who did not adopt an antigravity posture during ICU admission had a much higher odds of mortality. This simple strategy to classify functional capacity of critical patients can be routinely used by the team as a simple and dichotomous variable for ICU mortality prognosis.

Keywords | Critical Care; Intensive Care Units; Early Ambulation; Rehabilitation; Exercise Therapy.

RESUMO | Ainda há poucos marcadores de desempenho funcional com capacidade de predizer óbito em unidades de terapia intensiva (UTI). O objetivo do presente estudo foi identificar a associação entre a não adoção de postura antigravitacional e óbito em pacientes internados em uma UTI adulto. Trata-se de um estudo retrospectivo e analítico, realizado através da análise de prontuários. A associação entre a não adoção de postura antigravitacional e óbito foi testada por regressão logística múltipla ajustada por sexo, idade, gravidade da doença (mensurada pelo *Acute Physiology and Chronic Health Classification System II* [Apache II]), tempo de ventilação mecânica invasiva (VMI) e tempo de sedação. A *odds ratio* (OR) foi estimada com intervalo de confiança de 95%. Foram incluídos no estudo 92 pacientes sequenciais. Houve forte associação entre a não adoção de postura antigravitacional em UTI e óbito (ORajustada=37,7; IC=4,76-293; p=0,001). Conclui-se que pacientes que não adotaram postura antigravitacional durante o internamento em UTI apresentaram chances

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muito mais elevadas de mortalidade. Essa simples estratégia de classificação da capacidade funcional de pacientes críticos pode ser utilizada rotineiramente por equipes de saúde como uma variável simples e dicotômica de prognóstico de mortalidade em UTI.
Descritores | Cuidados Críticos; Unidades de Terapia Intensiva; Deambulação Precoce; Reabilitação; Terapia por Exercício.

RESUMEN | Aún existen pocos marcadores de desempeño funcional con capacidad de predecir la muerte en Unidades de Cuidados Intensivos (UCI). El presente estudio tuvo como objetivo identificar la asociación entre la no adopción de postura antigravitacional y el óbito en pacientes hospitalizados en una UCI adulto. Se trata de un estudio retrospectivo y analítico, realizado mediante análisis de historia clínica. La asociación entre la no adopción de postura antigravitacional y el fallecimiento fue probada por regresión logística múltiple ajustada por sexo, edad, gravedad de la enfermedad (medida por la *Acute Physiology And Chronic Health Classification System II* [Apache II]), tiempo de ventilación mecánica invasiva (VMI) y tiempo de sedación. Se estimó la *odds ratio* (OR) con intervalo de confianza (IC=95%). Se incluyeron en el estudio 92 pacientes secuenciales. Se observó una fuerte asociación entre la no adopción de postura antigravitacional en UCI y el óbito (ORajustada=37,7; IC=4,76-293; p=0,001). De esta forma, se puede concluir que pacientes que no adoptaron postura antigravitacional durante la hospitalización en UCI tuvieron posibilidades mucho más elevadas de mortalidad. Esta simple estrategia de clasificación de la capacidad funcional de pacientes críticos puede ser utilizada de manera rutinaria por el equipo de salud como una variable simple y dicotómica de pronóstico de mortalidad en UCI.
Palabras clave | Cuidados Críticos; Unidades de Cuidados Intensivos; Ambulación Precoz; Rehabilitación; Terapia por Ejercicio.

INTRODUCTION

Early, gradual, and progressive mobilization of critically ill patients admitted to intensive care unit (ICU) has been used as a treatment strategy to avoid, minimize, or reverse the deleterious effects of prolonged immobility in bed[1]. For this purpose, several protocols with strict security criteria were designed and stratified into mobilization levels ranging from passive exercises to deambulation[2-6].

For the execution of movements against gravity by a critically ill patient, involving axial load of the spine or long bones, such as in sitting position, standing position, and deambulation, the therapist should ensure various neurological, hemodynamic, ventilation, and oxygenation criteria, related to the diagnosis, the risk of complications, and the level of life support, among others[2-8].

The decision to mobilize patients against the action of gravity involves a complex multifactorial analysis, which reflects the critically ill patient's general health[8-11]. Thus, the adoption or non-adoption of antigravity posture can be a good functional marker, with ability to predict adverse outcomes in the ICU[12,13]. In this sense, this study aims to investigate the association between non-adoption of antigravity posture and death in patients admitted to an adult ICU.

METHODOLOGY

This is a retrospective and analytical study, conducted on the adult ICU of Hospital Geral Prado Valadares (HGPV) in Jequié (BA), Brazil. The ICU in this hospital has 10 beds, is classified as general (that is, it covers several clinical specialties), and has physical therapy service with at least one professional physical therapist for 24 hours a day, including weekends.

This study included patients admitted to the ICU from January 15 to May 15 2016, with length of stay longer than 48 hours, who underwent mobilization. Patients who were discharged, were transferred, or died in 48 hours or less were excluded, as well as those without mobilization in their medical records.

The dependent variable was death during ICU hospitalization, and the independent variable was non-adoption of antigravity posture during ICU hospitalization. The adoption or non-adoption of antigravity posture was categorized using the protocol adapted from Morris et al.[2], which is divided into four levels of mobilization:

- Level 1: passive mobilization of the upper (UL) and/or lower limbs (LL);
- Level 2: active assisted mobilization of the upper and/or lower limbs, and/or transfer training in bed and/or hip bridge exercise;
- Level 3 Sitting position in the bed, and/or trunk balance training and/or easier transfer to the chair;
- Level 4 Standing balance training, and/or pre-gait training and/or deambulation in the unit.

The cases in which patients remained only in level 1 or 2 were defined as non-adoption of antigravity posture.

Covariates

Information related to demographic and clinical characteristics of each patient were collected: age (in years), gender (male or female), diagnosis (clinical or surgical), sepsis diagnosis (yes or no), severity of disease scored using the Acute Physiology and Chronic Health Evaluation II score (Apache II), use (yes or no) and period using invasive mechanical ventilation (IMV) (in days), use of sedatives (yes or no) and period of sedation (in days), length of stay (in days), and outcome (discharge or death).

Apache II is used for monitoring the severity of the disease and for prognosis of the potential critically ill patient during the first 24 hours in the ICU. The tool is composed of 15 items that score vital signs, oxygenation, blood pH, sodium, potassium, creatinine, hematocrit, leukocytes, bicarbonate (in the absence of gasometry), Glasgow Coma Scale, and score according to age and chronic disease. The final score ranges from 0 to 71 points, and the higher the value, the higher the odds of mortality[14].

Statistical analysis

Descriptive analysis was performed by calculating the frequencies for categorical variables, and mean and standard deviation for quantitative variables. The association between non-adoption of antigravity posture and death covariates was initially tested by binary logistic regression (crude association), and only the variables with $p \leq 0.20$ were considered for adjusted analysis. Multivariate analysis was performed by multiple logistic regression (stepwise forward method), and odds ratio was estimated using a 95% confidence interval (CI). The analyses were performed using the software Package for Social Sciences (SPSS), version 21.0.

RESULTS

From January 15 to May 15, 2016, 127 patients were admitted to the ICU. Of those people, 92 met the inclusion criteria of this study. Figure 1 shows the flow chart of distribution of patients.

Table 1 shows the demographic and clinical characteristics of the patients studied and the categorical and quantitative variables. One observes 51.1% of the sample was composed of men, 67.4% of primary diagnoses were clinical, 28.3% of patients had sepsis at some time during the hospitalization, and the admission Apache II average score regarding the severity of the disease was 18.1 (±8.2) points. Of the patients, 79.3% used IMV and 76.1% used sedation.

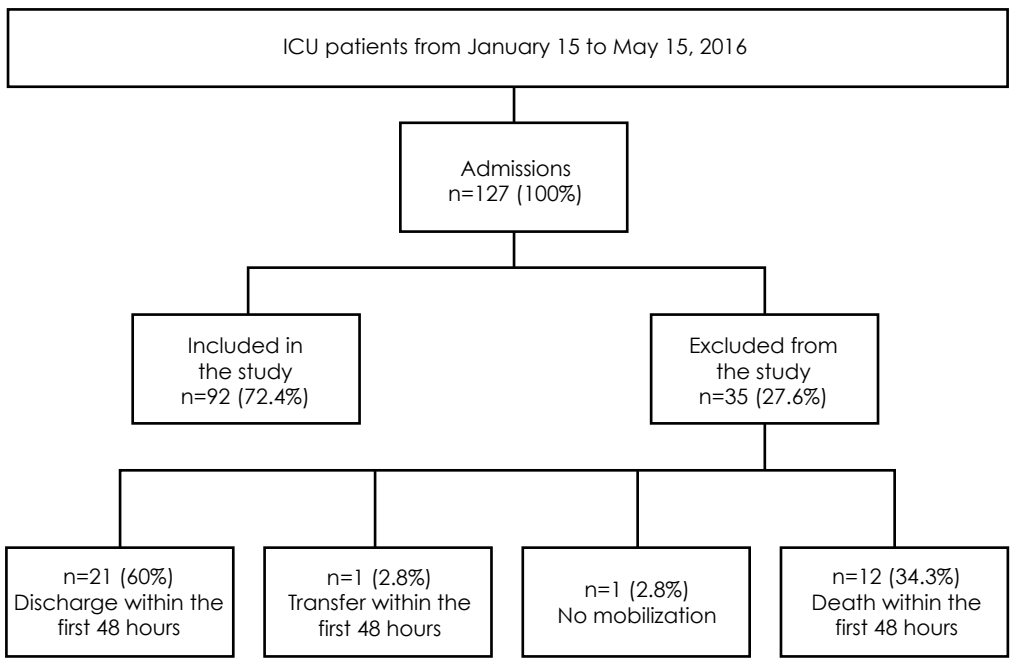

Figure 1. Flow chart of distribution of patients.
N: total population; n: sample.

Table 1. Demographic and clinical characteristics of the patients included in this study

Categorical Variables	N (%)	Death			
		Yes		No	
		n	%	n	%
Gender					
Female	45 (48.9)	19	65.5	26	41.3
Male	47 (51.1)	10	34.5	37	58.7
Diagnosis (type)					
Clinical	62 (67.4)	22	75.9	40	36.5
Surgical	30 (32.6)	7	24.1	23	63.5
Use of IMV					
Yes	73 (79.3)	28	96.6	45	71.4
No	19 (20.7)	1	3.4	18	28.6
Sedation					
Yes	70 (76.1)	25	86.2	45	71.4
No	22 (23.9)	4	13.8	18	28.6
Antigravity posture					
No	63 (68.5)	27	93.1	36	57.1
Yes	29 (31.5)	2	6.9	27	42.9

Quantitative Variables	Mean (SD)	Death	
		Yes	No
		Mean (SD)	Mean (SD)
Age (in full years)	54.1 (19.0)	60.4 (14.2)	51.2 (20.2)
Apache II Score (points)	18.1 (8.2)	23.1 (7.8)	15.4 (7.2)
Duration of IMV (in days)	10.5 (10.8)	14.4 (11.1)	8.8 (10.3)
Period of sedation (in days)	6.1 (7.2)	7.7 (8.7)	5.4 (6.3)
Duration of ICU hospitalization (in days)	11.8 (8.9)	12.7 (8.2)	11.4 (9.3)

N: total population; n: sample; IMV: invasive mechanical ventilation; SD: standard deviation; Apache II: *Acute Physiology and Chronic Health Evaluation II*; ICU: intensive care unit.

Table 2 shows the results of the crude association between non-adoption of antigravity posture and death, as well as the crude association between covariates and death. Considering p≤0.20, gender, age, Apache II, mechanical ventilation, and period of sedation were considered for the adjusted analysis.

Table 2. Crude association between clinical and demographic characteristics of the patients studied and death

Variables	Death		
	OR	95% CI	p-value
Non-adoption of antigravity posture	18.0	3.94-82.3	<0.001
Females	2.70	1.08-6.75	0.033
Age	1.03	1.01-1.05	0.034
Clinical diagnosis	0.55	0.20-1.49	0.243
Apache II Score	1.15	1.07-1.23	<0.001
Duration of IMV (in days)	1.05	1.01-1.09	0.023
Period of sedation (in days)	1.04	0.98-1.11	0.168
Duration of ICU hospitalization (in days)	1.02	0.97-1.07	0.519

OR: odds ratio; CI confidence interval; p-value: significance level; Apache II: Acute Physiology and Chronic Health Evaluation II; IMV: invasive mechanical ventilation; ICU: intensive care unit.

The adjusted analysis (Table 3) continued to show strong inverse correlation between non-adoption of antigravity posture and death, that is, individuals who did not adopt antigravity posture during hospitalization were more likely to die while still in the ICU.

Table 3. Result of the multiple logistic regression adjusted for association between non-adoption of antigravity posture and death in patients admitted to the ICU

Variables	Death		
	OR	95% CI	p-value
Non-adoption of antigravity posture	37.4	4.76-293	0.001
Females	2.27	0.60-8.52	0.226
Age	1.01	0.97-1.05	0.674
Apache II Score	1.16	1.05-1.28	0.005
Duration of IMV (in days)	1.08	0.99-1.17	0.083
Period of sedation (in days)	0.98	0.87-1.11	0.796

OR: odds ratio; CI confidence interval; p-value: significance level; Apache II: Acute Physiology and Chronic Health Evaluation II; IMV: invasive mechanical ventilation; ICU: intensive care unit.

DISCUSSION

This study showed patients who did not adopt antigravity posture during hospitalization in the adult ICU had higher odds of mortality. Therefore, the antigravity posture can be a simple functional assessment strategy, which can be easily employed in clinical practice, and its non-adoption may be a prognostic factor for mortality in the ICU. This is an important result, which shows strong association between a functional performance indicator and mortality.

Evidences that early, gradual, and progressive mobilization of ICU patients reduces the odds of mortality already exist. This is due to the fact that an adequate early mobilization program, focused on active therapies, improves the patient's functional capacity[15] due to the increased strength of the peripheral and respiratory muscles[3]. This reduces the time of use of IMV[16,17] and the duration of ICU hospitalization[17,18] and, consequently, the chances of complications[17,19] that can worsen the patient's clinical condition[7,13,20,21].

Most of the current studies on mobilization are controlled and randomized clinical trials that compare groups of patients undergoing specific protocols with standard care physical therapy[2,4,5,22]. Thus, these studies show an interventional aspect of the mobilization. Increasingly common in ICUs, especially in high levels and out of bed[14,23], mobilization can also be seen as a prognostic factor.

This study may be the first to present a dichotomized mobilization strategy (adoption or not of gravitational posture) able to predict ICU mortality. Although

several studies report the biological plausibility[10,24-26], the association of death with such a simple functional capacity indicator still had not been shown. This simple strategy to classify functional capacity in critically ill patients can be routinely used by the team as one of the prognostic variables of mortality in ICUs.

This study had limitations regarding the lack of availability of data on barriers to mobilization that are not strictly derived from the severity of the disease, such as body mass index, for example. Obese patients may be unable to sit or stand due to motor problems and to the need for professional help, and not necessarily because of a clinical judgement based on severity criteria.

Also, we did not have information about the previous functional status of the patients. Patients who are already dependent, with previous functional complications (for instance, contractures and deformities), may have greater difficulties in adopting antigravity posture.

Even so, we believe that accessing these data would not interfere significantly in the analysis. Despite being observational and analyzing medical records, the strength of association was very great in this study, even after adjusting variables that could be confounding factors, such as Apache.

CONCLUSION

This study showed patients who did not adopt antigravity posture during hospitalization in the adult ICU had higher odds of mortality. This simple strategy to classify functional capacity in critically ill patients can be routinely used by the team as one of the prognostic variables of mortality in ICUs.

REFERENCES

1. Cameron S, Ball I, Cepinskas G, Choong K, Doherty TJ, Ellis CG, et al. Early mobilization in the critical care unit: a review of adult and pediatric literature. J Crit Care. 2015;30(4):664-72. doi: 10.1016/j.jcrc.2015.03.032
2. Morris PE, Goad A, Thompson C, Taylor K, Harry B, Passmore L, et al. Early intensive care unit mobility therapy in the treatment of acute respiratory failure. Crit Care Med. 2008;36(8):2238-43. doi: 10.1097/CCM.0b013e318180b90e
3. Dantas CM, Silva PFS, Siqueira FHT, Pinto RMF, Matias S, Maciel C, et al. Influência da mobilização precoce na força muscular periférica e respiratória em pacientes críticos. Rev Bras Ter Intensiva. 2012;24(2):173-8. doi: 10.1590/S0103-507X2012000200013
4. Feliciano V, Albuquerque CG, Andrade FMD, Dantas CM, Lopez A, Ramos FF, et al. A influência da mobilização precoce no tempo de internamento na Unidade de Terapia Intensiva. ASSOBRAFIR Ciênc. 2012;3(2):31-42
5. Carvalho TG, Silva ALG, Santos ML, Schäfer J, Cunha LS, Santos LJ. Relação entre saída precoce do leito na unidade de terapia intensiva e funcionalidade pós-alta: um estudo piloto. Rev Epidemiol Control Infect. 2013;3(3):82-6
6. Murakami FM, Yamaguti WP, Onoue MA, Mendes JM, Pedrosa RS, Maida ALV, et al. Evolução funcional de pacientes graves submetidos a um protocolo de reabilitação precoce. Rev Bras Ter Intensiva. 2015;27(2):161-9. doi: 10.5935/0103-507X.20150028
7. Hodgson C, Bellomo R, Berney S, Bailey M, Buhr H, Denehy L, 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(1):81-91. doi: 10.1186/s13054-015-0765-4
8. Harrold ME, Salisbury LG, Webb SA, Allison GT. Early mobilisation in intensive care units in Australia and Scotland: a prospective, observational cohort study examining mobilisation practises and barriers. Crit Care. 2015;19(1):336-9. doi: 10.1186/s13054-015-1033-3
9. Kasotakis G, Schmidt U, Perry D, Grosse-Sundrup M, Benjamin J, Ryan C, et al. The surgical intensive care unit optimal mobility score predicts mortality and length of stay. Crit Care Med. 2012;40(4):1122-8. doi: 10.1097/CCM.0b013e3182376e6d
10. Sigler M, Nugent K, Alalawi R, Selvan K, Tseng J, Edriss H, et al. Making of a successful early mobilization program for a medical intensive care unit. South Med J. 2016;109(6):342-5. doi: 10.14423/SMJ.0000000000000472
11. Nydahl P, Ruhl AP, Bartoszek G, Dubb R, Filipovic S, Flohr HJ, et al. Early mobilization of mechanically ventilated patients: a 1-day point-prevalence study in Germany. Crit Care Med. 2014;42(5):1178-86. doi: 10.1097/CCM.0000000000000149
12. Herridge MS, Tansey CM, Matté A, Tomlinson G, Diaz-Granados N, Cooper A, et al. Functional disability 5 years after acute respiratory distress syndrome. N Engl J Med. 2011;364(14):1293-304. doi: 10.1056/NEJMoa1011802
13. Hermans G, Mechelen HV, Clerckx B, Vanhullebusch T, Mesotten D, Wilmer A, et al. Acute outcomes and 1-year mortality of ICU-acquired weakness: a cohort study and propensity matched analysis. Am J Respir Crit Care Med. 2014;190(4):410-20. doi: 10.1164/rccm.201312-2257OC
14. Knaus WA, Draper EA, Wagner DP, Zimmerman JE. APACHE II: a severity of disease classification system. Crit Care Med. 1985;13(10):818-29
15. Berney S, Haines K, Skinner EH, Denehy L. Safety and feasibility of an exercise prescription approach to rehabilitation across the continuum of care for survivors of critical illness. Phys Ther. 2012;92(12):1524-35. doi: 10.2522/ptj.20110406
16. 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(6):1543-54. doi: 10.1097/CCM.0b013e31827ca637
17. McWilliams D, Weblin J, Atkins G, Bion J, Williams J, Elliott C, et al. Enhancing rehabilitation of mechanically ventilated patients in the intensive care unit: a quality improvement project. J Crit Care. 2015;30(1):13-8. doi: 10.1016/j.jcrc.2014.09.018

18. Hopkins RO, Mitchell L, Thomsen GE, Schafer M, Link M, Brown SM. Implementing a mobility program to minimize post-intensive care syndrome. AACN Adv Crit Care. 2016;27(2):187-203. doi: 10.4037/aacnacc2016244

19. Hunter A, Johnson L, Coustasse A. Reduction of intensive care unit length of stay: the case of early mobilization. Health Care Manag. 2014;33(2):128-35. doi: 10.1097/HCM.0000000000000006

20. Stiller K. Physiotherapy in intensive care: an updated systematic review. Chest. 2013;144(3):825-47. doi: 10.1378/chest.12-2930

21. Laurent H, Aubreton S, Richard R, Gorce Y, Caron E, Vallat A, et al. Systematic review of early exercise in intensive care: a qualitative approach. Anaesth Crit Care Pain Med. 2016;35(2):133-49. doi: 10.1016/j.accpm.2015.06.014

22. Dong Z, Yu B, Sun Y, Fang W, Li L. Effects of early rehabilitation therapy on patients with mechanical ventilation. World J Emerg Med. 2014;5(1):48-52. doi: 10.5847/wjem.j.issn.1920-8642.2014.01.008

23. Berney SC, Harrold M, Webb SA, Seppelt I, Patman S, Thomas PJ, et al. Intensive care unit mobility practices in Australia and New Zealand: a point prevalence study. Crit Care Resusc. 2013;15(4):260-5

24. Borges RC, Carvalho CR, Colombo AS, Borges MPS, Soriano FG. Physical activity, muscle strength, and exercise capacity 3 months after severe sepsis and septic shock. Intensive Care Med. 2015;41(8):1433-44. doi: 10.1007/s00134-015-3914-y

25. Iwashyna TJ, Cooke CR, Wunsch H, Kahn JM. Population burden of long-term survivorship after severe sepsis in older Americans. J Am Geriatr Soc. 2012;60(6):1070-7. doi: 10.1111/j.1532-5415.2012.03989.x

26. Williams PT. Inadequate exercise as a risk factor for sepsis mortality. PLoS One. 2013;8(12):1-7. doi: 10.1371/journal.pone.0079344