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Correlation between functionality and pulmonary function in injured patients in Intensive Care Units

Correlação entre funcionalidade e função pulmonar em pacientes internados em Unidades de Terapia Intensiva

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RESUMO | INTRODUÇÃO: As complicações adquiridas em UTIs podem afetar negativamente a funcionalidade, mobilidade e função pulmonar, levando a um prognóstico menos favorável. **OBJETIVO:** Correlacionar funcionalidade com função pulmonar na admissão e alta de pacientes internados em UTIs adulto. **MÉTODOS:** Trata-se de um estudo observacional, descritivo e transversal, com abordagem quantitativa. Os dados sociodemográficos foram obtidos nos prontuários; a funcionalidade e mobilidade foram medidas pela FSS-ICU e IMS, respectivamente; e a função pulmonar, representada pela medida da CVL. A análise dos dados foi realizada no programa BioEstat 5.3, com o teste de Shapiro-Wilk para avaliar a distribuição dos dados, e como a mesma não foi normal, utilizamos o teste de Wilcoxon de amostras relacionadas. O nível de significância adotado foi de $p \leq 0,05$ e os coeficientes de correlação com valores entre 0,00 e 0,25 apontaram pouca ou nenhuma correlação; 0,25 a 0,50, um grau fraco de correlação; 0,50 a 0,75, uma correlação de moderada a boa; acima de 0,75, um grau bom a excelente. **RESULTADOS:** Foram incluídos 44 participantes sendo 61,4% sexo masculino. A média da idade foi de 53,68 anos (DP: 16,73), um tempo médio de internação de 3,52 dias (DP: 1,53), diagnósticos predominantemente cirúrgicos (79,5%) e 97,7% receberam alta da UTI. Foi encontrada correlação fraca entre FSS-ICU - CVL e IMS - CVL, mas com significância estatística de 0,01 e <0,01, respectivamente, no momento da alta, mas não no da admissão. **CONCLUSÃO:** Houve baixa correlação entre funcionalidade e mobilidade com função pulmonar no momento da alta de pacientes internados em UTIs.

PALAVRAS-CHAVE: Unidades de terapia intensiva. Limitação de mobilidade. Pacientes internados. Fisioterapia.

ABSTRACT | INTRODUCTION: The complications acquired in ICUs can negatively affect functionality, mobility and pulmonary function, leading to a less favorable prognosis. **PURPOSE:** To correlate function with pulmonary function in the admission and discharge of patients hospitalized in adult ICUs. **METHODS:** This is an observational, descriptive and cross-sectional study with a quantitative approach. Sociodemographic data were obtained in medical records; functionality and mobility were measured by FSS-ICU and IMS, respectively; and pulmonary function, represented by the CVL measurement. Data analysis was performed in the BioEstat 5.3 program, with the Shapiro-Wilk test to evaluate the distribution of the data, and since it was not normal, we used the Wilcoxon test of related samples. The significance level adopted was $p \leq 0.05$ and the correlation coefficients with values between 0.00 and 0.25 indicated little or no correlation; 0.25 to 0.50, a weak degree of correlation; 0.50 to 0.75, a moderate to good correlation; above 0.75, a good to excellent grade. **RESULTS:** We included 44 participants, 61.4% male. The mean age was 53.68 years (SD: 16.73), mean hospitalization time of 3.52 days (SD: 1.53), diagnoses predominantly surgical (79.5%) and 97.7% were discharged from the ICU. We found a weak correlation between FSS-ICU-CVL and IMS-CVL, but with a statistical significance of 0.01 and <0.01, respectively, at discharge, but not at admission. **CONCLUSION:** There was a low correlation between functionality and mobility with pulmonary function at the time of discharge from ICU patients.

KEYWORDS: Intensive care units. Limitation of mobility. Inpatients. Physiotherapy.

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Introduction

With the progress of the care provided in the Intensive Care Units (ICU) and consequent drop in the mortality rate, there was an increase in the survival of people facing severe disease[1]. On the other hand, due to the presence of complications during hospitalization, the clinical and physical prognosis of these patients is less favorable[2,3]. It has already been proven that all organic systems are affected, especially neuromusculoskeletal and pulmonary, because they generate important impacts on the physical function, more commonly known as functionality[4,5].

According to the International Classification of Functioning, Disability and Health (ICF) concepts, functionality "is a term that encompasses all body functions, activities and participation", while disability "includes impairments, limitations of activities or restriction of participation." One of the domains of functionality is mobility, a term described by the ICF as "movement when a change in position or location of the body occurs...", and in this domain include lying down, self-transference, sedestation, orthostasis, ambulation and all forms of change of the center of gravity of the body[6].

There is evidence in the literature that the reduction of functionality may cause lung function impairment such as atelectasis, need for mechanical ventilation (MV), prolonged weaning of MV, respiratory muscle weakness, pneumonia, decreased vital capacity and residual volume[4,5]. These pulmonary complications in the ICU can lead to unsatisfactory results in physical function tests even after discharge from the unit[5].

Based on the foregoing, the objective of the present study is to correlate functionality with pulmonary function in the admission and discharge of patients hospitalized in adult ICU.

Methodology

Type of study

This is an observational, descriptive and cross-sectional study, based on data obtained from functional, mobility and pulmonary function evaluation of patients admitted to Adult Intensive Care Units (ICU) at admission and discharge.

Study field

The research was performed in adult ICU of the General Santos Roberto Hospital (HGRS), located in the city of Salvador, capital of the state of Bahia, located in the Zona da Mata of the Northeast Region of Brazil. The HGRS is a large tertiary hospital, with high complexity, of assistance and teaching. It is also a reference institution in the emergency services, digestive hemorrhage, nephrology, pediatrics, medical clinic, buco-maxillofacial surgery, general surgery, neurosurgery, pediatric and neonatal surgery, high risk maternity, among other specialties.

Study population

The study had the participation of patients admitted to the adult ICU, who obeyed the following inclusion criteria: Signature of Free and Informed Consent Term (FICT) by the same or the accompanying person / family: Age equal or superior to 18 years; Cognitive capacity preserved to obey the measurements measurement commands; Stable hemodynamics, however, if it were compensated by use of vasoactive drugs, that there was no need to increase doses; Clinical stability, with medical release for the accomplishment of the measurements; amputations of lower and / or upper limbs due to low scores on functional and mobility scales Absence of history of previous functional dependency, such as bed rest, or modified functional independence, with the need to use auxiliary devices such as flares, crutches, wheelchairs and derivatives, due to the low score that these patients could obtain in the functional and mobility scales, when compared to the previous functional independents; Absence of the use of Mechanical Ventilation (MV) at the moment of the evaluation due to the necessity of a team and trained to assist in the of functional, mobility and pulmonary function tests, and also because of the need for randomization of the study to compare patients on spontaneous ventilation with those using MV.

Participants who had incomplete data on the functional and mobility scales and / or SVC on the evaluation card, either at discharge or at admission, were excluded from the study.

Data collection

Data collection was performed between December 2017 and October 2018. To obtain the

sociodemographic data, the patients' charts were consulted; Functional State Scale in the ICU (FSS-ICU) and the Mobility Scale in the ICU (IMS), respectively, were applied for the measurement of functionality and mobility; and for the measurement of pulmonary function, the Measurement of Slow Vital Capacity (SVC) was made. All measurements were performed at admission to the unit - at which time the patient was already stabilized, the patient had medical clearance to leave the bed - and after discharge.

The FSS-ICU is a tool that was developed in 2010 by Zanni and collaborators and translated into the Brazilian version by Silva and collaborators in 2017. It evaluates functionality through tasks that include rolling, transferring from the supine position to sitting, moving from sitting to standing, sitting at the edge of the bed and walking. Each domain receives a score ranging from 0 to 7, which indicates the level of care needed by the patient, where 0 is for those patients unable to try or complete the requested task due to muscle weakness, and 7 indicates complete independence for the achievement the task. The total score varies from 0 to 35 points, where higher values indicate a better degree of functionality[7,8].

In relation to IMS, it was developed in 2014, in order to objectively measure the mobility of patients admitted to the ICU. The score varies from 0 to 10 points in a single domain, with zero score expressing a low mobility (interpreted as the patient who only performs passive exercises in the bed) and the score 10 expresses a high mobility (interpreted as the patient who presents independent wandering without help)[9]. The IMS was translated and validated into Brazilian Portuguese in 2016, where the new version presented high agreement and interobserver reliability[10].

SVC is a slow measurement, starting from the full inspiratory position for complete expiration. This variable represents the highest volume of mobilized air, which corresponds to 70-75% of Total Pulmonary Capacity (TPC), as a result of the sum of inspiratory reserve volume, tidal volume and expiratory reserve volume[11]. For SVC measurement, a properly calibrated ventilometer (Ferraris Mark 8 Wright Respirometer®, United Kingdom) was used.

The technique consisted of asking the patients to perform a slow expiration until the Residual Volume (RV), followed by a slow inspiration until the TPC and, thereafter, a slow and constant expiration until the return to the RV. Participants were positioned in a sitting position with lower limbs supported, and angulation of the hips, knees and ankles at 90º. Three measurements were performed, with a time interval of 1 minute between them, and the highest value was chosen, provided that the variation was less than 5%. If it were not, a new maneuver was requested[12].

The highest value obtained (in milliliters) was divided by the ideal predicted weight (in kilograms), using predicted ideal weight for men (50 ± 0.91 x (height in cm 152.4)) and for women (45.5 ± 0.91 x (height in cm 152.4)), with the final unit of measurement expressed in ml / kg[13,14].

Data analysis

Data analysis was performed through the BioEstat 5.3 program, with the Shapiro-Wilk test to evaluate the data distribution. After verifying that the distribution was not normal, we used the Wilcoxon test of related samples, and the Sperman test to evaluate the correlation. The correlation coefficients with values between 0.00 and 0.25 indicated little or no correlation; between 0.25 and 0.50, a weak degree of correlation; between 0.50 and 0.75 suggested a moderate to good correlation; values above 0.75 indicated good to excellent correlation[15]. The significance level adopted was $p \leq 0.05$.

Ethical research aspects

This research presents partial results, since it is inserted in a larger project titled "Evaluation of functionality in patients hospitalized in a highly complex hospital in Salvador, Bahia", approved by the Research Ethics Committee of the General Hospital Roberto Santos (CEP / HGRS) under Opinion 1.752.512 and CAAE No. 59587416.0.0000.5028. The Free and Informed Consent Term (FICT) was registered in two copies, one of which was kept by the researcher for a period of five years, and the other was made available to the participant / family member.

Results

Data were collected from 92 participants who met the inclusion criteria; however, 48 of these were excluded from the analysis due to the incompleteness of the data of the functional and mobility scales and / or the SVC in the evaluation card, either at discharge or on admission. There were 44 participants with the complete data for analysis.

Of these 44 participants, 61.4% were male. The overall mean age was 53.68 years, with a standard deviation (SD) of 16.73, mean hospitalization time of 3.52 days (SD: 1.53), predominantly surgical diagnostic profile (79.5%) and 97.7% progressed with ICU discharge (Table 1).

Table 1. Characterization of the sample of patients hospitalized in adult ICU. Salvador - Bahia - 2018

Variables	n: 44 (%)	Mean (SD)
Sex		
Male	27 (61,4)	
Female	17 (38,6)	
Age (years)		53,68 (16,73)
Length of stay (days)		3,52 (1,53)
Diagnostic profile		
Surgical	35 (70,5)	
Clinical	9 (20,5)	
Clinical outcome		
High	43 (97,72)	
Death	1 (2,27)	

n-sample; SD- standard deviation

In relation to the admission values of the measurements, the FSS-ICU obtained a median of 32.5 points and the IMS, of 8. Already on discharge, these values were of 33 and 10 points, respectively, being found statistical significance <0.01 and 0.03. There was an increase in functionality and mobility assessed at admission, in relation to discharge for both scales. Regarding the values of SVC, the median of admission was 36.4 ml/kg and the high, 39.6 ml/kg, and no statistical significance was found between the values of admission and discharge SVC. These values are described below, in Table 2.

Table 2. FSS-ICU, IMS and SVC scores of patients admitted to adult ICU. Salvador - Bahia - 2018

Measures	Admission (n: 44) Median	High (n: 43) Median	P-value (≤0.05)
FSS-ICU	32,5	33	<0,01
IMS	8	10	0,03
SVC	36,4	39,6	0,16

FSS-ICU- Functional Status Scale in Intensive Care Unit; IMS- Mobility Scale in Intensive Care Unit; SVC - Slow Vital Capacity; n-sample; P-value- level of significance

When we analyzed the FSS-ICU and IMS with SVC of the admission, no statistical significance was found. However, when analyzing these values from the moment of ICU discharge, we found a weak correlation, but with a statistical significance of 0.01 and <0.01 between the FSS-ICU - SVC and IMS - SVC values, respectively, Table 3.

Table 3. Correlation between FSS-ICU-SVC and IMS-SVC of patients hospitalized in adult ICU. Salvador - Bahia - 2018

Measures	Admission (n: 44) - Correlation coefficient	P-value	High (n: 43) - Correlation coefficient	P-value
FSS-ICU – SVC	0,23	0,13	0,37	0,01
IMS – SVC	0,26	0,08	0,48	<0,01

FSS-ICU- Functional Status Scale in Intensive Care Unit; IMS- Mobility Scale in Intensive Care Unit; SVC - Slow Vital Capacity; n-sample; P-value- level of significance

Discussion

The data analyzed in this study showed that there was a low correlation between functionality and mobility with pulmonary function at discharge from patients admitted to Intensive Care Units (ICU), that is, there was an increase in functionality and mobility perceived by the Functional State Scale in Intensive Care Unit (FSS-ICU) and Mobility Scale in Intensive Care Unit (IMS), accompanied by Slow Vital Capacity (SVC), although this correlation was not significant at the time of admission.

The functional and mobility scales used in this study - FSS-ICU and IMS - were included in a systematic review published in 2015 by Parry et al., Which identified only 6 functional measures developed speICFically for the ICU environment and submitted to clinimetric evaluation. Regarding FSS-ICU, the authors reported large deficits in the evaluation of range of motion and decrease in muscle strength, which contributed to the lower functionality of the patients involved. The definite limitation was that this scale can not be used in sedated patients[16].

Regarding IMS, the authors have shown that it is a viable tool with strong interrater reliability to measure and record the maximum mobility level of adult patients in the ICU[16]. According to Kawaguchi[17], author who translated, validated and tested the inter-rater reliability, the IMS presented excellent reliability and concordance, besides being easy to score due to the existence of obvious mobility milestones to be identified by the evaluator.

Even with methodological differences, our findings corroborate with those in the literature that also demonstrate that patients who reach a higher degree of functionality and mobility present better pulmonary function, which translates into an increase in inspiratory muscle strength[18], a shorter time of mechanical ventilation (MV)[19] and reduction in the incidence of pneumonia associated with MV[20].

Most of the studies that investigate functionality present Early Mobilization Protocols (EMP) that include mobility tasks, however, in the ICU in which the data were collected, there were no protocols implemented. However, functional and mobility activities evaluated by FSS-ICU and IMS are integrated in several EMP, where, the higher the level reached in these domains, the better the clinical, physical and tolerance evolution of the patient to the proposed exercises[19,21,22].

In addition, other studies differ from our results, because of the use of a EMP, they also included patients using MV, which allowed for clearer evidence on the improvement of lung function during protocol application and evolution of functional levels and mobility[18-20].

Our results pointed to values of FSS-ICU and IMS that showed increase in the discharge. This may be due to the fact that the majority of the participants were surgical and had a short hospital stay. Murakami et al. (2015), when evaluating the functional evolution of patients admitted to the ICU and implementing a EMP, concluded that 93.3% responded positively to the protocol, and that these patients maintained or improved the functional status regardless of whether the diagnosis was clinical or surgical[22]. However, Borges[23] and Jesus[24] observed a reduction of the functional and mobility domains, respectively, in predominantly surgical populations. Regarding the length of stay in the unit, Jesus[24] and Martinez[2] identified a greater decline in mobility after 48 hours of hospitalization.

Regarding pulmonary function, evaluated by SVC, although it was correlated with functionality and mobility, the values of admission and discharge were not statistically significant, ie, pulmonary function did not increase or decrease, but remained throughout the study. period of hospitalization. This can be attributed to the exclusion of patients in MV, to the high level of functionality and mobility achieved at the scales and to the short period of hospitalization since the reduction of physical function leads to structural and functional damages to skeletal muscles, including ventilatory , which increases the length of stay in this unit and concomitantly the risk of developing new pulmonary complications[2,3].

This study presents limitations such as the lack of control over other confounding variables, such as the use of MV that could increase hospitalization time and impair pulmonary function, as well as the lack of other pulmonary function tests for make the analysis of this variable more robust. In addition, although we did not find studies in the literature that correlated FSS-ICU and IMS with SVC for comparative methodological standardization, this study was able to demonstrate a correlation between these variables, which deserves to be further investigated.

Conclusion

There was a low correlation between functionality and mobility with pulmonary function at discharge from patients admitted to Intensive Care Units (ICU).

Author contributions

Santos GO conceived the initial idea, the design of the study, carried out the bibliographic survey, writing the research project, collecting data, tabulating them, interpreting the results, writing the scientific article and the final corrections. Gaspar LC participated in the project corrections, the bibliographic survey, the study design, the interpretation of the data and the correction of the scientific article. Gomes YS participated in the project corrections, the bibliographical survey, the study design, statistical analysis, data interpretation and scientific article correction. Angels JLM participated in the conception of the initial idea, the design of the research, the statistical analysis and the interpretation of the results. Alves GAA contributed with the writing of the scientific article and the final corrections. Matos JMT participated in the writing of the scientific article and the final corrections of it.

Competing interests

No financial, legal or political competing interests with third parties (government, commercial, private foundation, etc.) were disclosed for any aspect of the submitted work (including but not limited to grants, data monitoring board, study design, manuscript preparation, statistical analysis, etc.).

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