

Functional capacity and muscular force of individuals in a unit of intensive surgical therapy

Capacidade funcional e força muscular de indivíduos internados em uma unidade de terapia intensiva cirúrgica

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RESUMO | INTRODUÇÃO: Pacientes pós-cirúrgicos podem apresentar redução da capacidade funcional e força muscular devido as complicações pós-operatórias ou do internamento hospitalar. Porém, até o momento pouco se sabe sobre o estado funcional de indivíduos internados na Unidade de Terapia Intensiva (UTI) cirúrgica. **OBJETIVO:** Verificar a força muscular periférica e a capacidade funcional de indivíduos no pós-operatório internados em uma UTI cirúrgica. **Métodos:** Estudo transversal, descritivo, do qual participaram 72 pacientes admitidos na UTI cirúrgica com idade ≥ 18 anos, de ambos os sexos, no período pós-operatório. Os critérios de exclusão foram os casos onde os pacientes estivessem: hemodinamicamente instáveis, com desordem cognitiva ou com comunicação limitada que comprometesse a acurácia do registro de dados e aqueles que se recusaram a participar da pesquisa. A avaliação da capacidade funcional foi realizada através da medida de independência funcional, a força muscular através do Medical Research Council. **RESULTADOS:** A média de idade 51.2 ± 19 anos, sendo 35 (46,8%) do sexo feminino. A média da capacidade funcional foi $95,7 \pm 21,3$, sendo que 40 (55,6%) dos pacientes apresentaram dependência modificada (assistência de até 25% das tarefas) e 28 (38,9%) independência completa/modificada. A mediana da força muscular periférica foi 58 (48-60). A mediana do tempo de permanência na UTI foi 4 (2-7) dias. O tempo de permanência na ventilação mecânica foi de 24 horas para a maioria dos indivíduos 46 (63,9%). **CONCLUSÃO:** A força muscular periférica dos pacientes internados em UTI cirúrgica no pós-operatório não foi encontrada alterada. No entanto, grande parte dos pacientes apresentaram limitações funcionais.

PALAVRAS-CHAVE: Força muscular. Unidade de terapia intensiva. Atividades de vida diária. Período pós-operatório. Avaliação física.

ABSTRACT | BACKGROUND: Post-surgical patients may present functional capacity reduction and muscle strength due to postoperative complications or hospitalization. However, so far little is known about the functional status of individuals hospitalized in the Intensive Care Unit (ICU). **OBJECTIVE:** To verify the peripheral muscle strength and the functional capacity of an individual in the postoperative period hospitalized in a surgical ICU. **METHODS:** A cross-sectional, descriptive study in which 72 patients admitted to the surgical ICU, aged ≥ 18 years, of both sexes, participated in the postoperative period. Exclusion criteria were cases where patients were: hemodynamically unstable, with cognitive disorder or with limited communication that compromised the accuracy of the data record and those who refused to participate in the study. The functional capacity assessment was performed through functional independence measure, muscle strength through the Medical Research Council. **RESULTS:** The mean age was 51.2 ± 19 years, of which 35 (46.8%) were female. The mean functional capacity was 95.7 ± 21.3 ; 40 (55.6%) of the patients had modified dependence (up to 25% of the tasks) and 28 (38.9%) complete / modified independence. The median of peripheral muscle strength was 58 (48-60). The median length of ICU stay was 4 (2-7) days. The duration of mechanical ventilation was 24 hours for most of the individuals 46 (63.9%). **CONCLUSION:** The peripheral muscle strength of patients admitted to the surgical ICU postoperatively was not found to be altered. However, most patients had functional limitations.

KEYWORDS: Muscle strength. Intensive care units. Activities of daily living. Postoperative period. Physical assessment.

Introduction

The intensive care unit (ICU) is a place of care for critically ill or at risk patients, who require ongoing monitoring and specific care through the assistance of a specialized multidisciplinary team^{1,2}. Individuals who underwent surgical procedures commonly require hospitalization in the ICU due to the need for post anesthetic recovery, resolution of surgical complications and or due to surgical risk³.

Intrinsic factors of the ICU environment, such as prolonged use of neuromuscular blockers, corticosteroids, sedatives, presence of systemic infections, glycemic control, malnutrition, hyperosmolarity, parenteral nutrition, bed rest and mechanical ventilation (MV)^{4,5} may be responsible for a longer period of orotracheal intubation and hospitalization, which negatively impact the patient's health and lead to reduced functional capacity⁶ and quality of life⁷ during or after hospitalization.

One of the main negative outcomes after admission to ICUs is functional capacity, which can be defined as the individual's physical and mental ability to independently and autonomously perform their tasks or actions, as well as basic activities of daily living such as bathing, feeding, transferring, dressing and the instrumental activities of daily life such as: take care of finances, make purchases and use the telephone^{5,8}.

In this way, the muscular strength (MS) is a factor that can influence the functional capacity of the individual as it is related to the speed and quality in the execution of movements⁹. Studies estimate that after seven days of rest there is a decrease of about 20% in MS with an additional loss of 20% of the remaining force in each week^{8,10}, such decline may be related to rest in the bed, which has been commonly recommended as a countermeasure to the postoperative complications in the ICU environment¹¹. Other factors inherent to the hospitalization period, such as infections, and hydroelectrolytic disorders

also contribute to a decrease in MS⁹, which affects the decrease in physical fitness and functional capacity of such individuals in the postoperative period⁸.

Studies have shown that long periods of hospitalization in the ICU are associated with higher morbidity and mortality rates and hospital infections, which can lead to beds unavailability due to the increase in waiting time in the wards until admission to the ICU, reflecting higher hospital costs^{10,12,13}.

In view of the occurrence of postoperative complications and hospitalization leading to the reduction of functional capacity and peripheral muscle strength, and knowing that the functional status of the patients is a prognostic factor of hospitalization and an important variable to determine mortality, it is necessary to evaluate the functionality and muscular strength in the postoperative period^{14,15}. Thus, the objective of this study was to verify the peripheral muscle strength and functional capacity of individuals in the postoperative period admitted to a surgical ICU.

Methods

It is a cross-sectional, descriptive study performed at the surgical ICU of a high complexity hospital, Roberto Santos General Hospital, in Salvador, Bahia, from February 2016 to November 2017. This study was approved by the ethics and research committee of the hospital under ruling number 1752512 (CAAE 59587416.0.0000.5028). All study participants signed the informed consent form (ICF), prepared in accordance with resolution 466/2012 from the Brazilian Ministry of Health.

The study included patients admitted to the surgical ICU aged over 18 years, of both sexes, during the postoperative period. Exclusion criteria were the cases where the patients were: hemodynamically

unstable; with cognitive disorder or with limited communication that compromised the accuracy of data recording; or refused to participate in the study.

All patients received physical therapy support 24 hours where they received a minimum of three visits during the day. The therapeutic plan was drawn according to the clinical diagnosis, with the specific need and tolerance of everyone evaluated by the physiotherapist. Demographic data were collected through a personalized evaluation form containing demographic and clinical data, type of surgical procedure, mechanical ventilation time and Simplified Acute Physiology (SAPS) score, which is a method used to convert the score to hospital mortality index using 12 physiological variables, age, type of admission and three variables related to the underlying disease¹. The patients were then evaluated for functional capacity and muscle strength.

Functional capacity was assessed through the Functional Independence Measure (FIM), which consists of a validated instrument in Brazil that quantitatively evaluates the competence of the individual to perform basic and instrumental activities of daily living. Each daily life activity is scored in degrees ranging from 1 (total dependence) to 7 (complete independence), with a minimum score of 18 and a maximum of 126¹⁶.

Dependency levels can be classified according to the total FIM score, where 18: complete dependence; 19 to 60: modified dependency (assistance of up to 50% of tasks); 61 to 103: modified dependency (assistance of up to 25% of tasks); and 104 to 126: complete / modified independence¹⁷.

The evaluation of muscle strength was performed through the Medical Research Council (MRC), which

uses manual muscle strength tests for six specific movements: shoulder abduction, elbow flexion, wrist extension, hip flexion, knee extension and dorsiflexion of the ankle, bilaterally. The contraction force required in this evaluation ranges from 0 (no contraction) to 5 (normal muscle strength). From the sum of the individual values the total MRC is obtained, this score can vary from 0 (classified as folds) to 60 points (normal force)¹⁸.

The evaluation instruments were administered by a group of evaluators after previous instruction and training in standardization of the methods. When the patient was unable to respond due to the need for invasive mechanical ventilatory support or sedation, the evaluation was performed after artificial airway withdrawal and sedation.

The data were submitted to statistical analysis through the program Statistical Package for the Social Sciences version 22.0. The categorical variables of this study were expressed using absolute frequencies and in percentage, quantitative variables were. In turn, described by mean and standard deviation or median and interquartile range (25-75 percentiles). To test the normality assumption of the variables involved in the study, the Kolmogorov-Smirnov test was applied.

Results

The sample consisted of 72 individuals, of which 35 (48.6%) were female, with a mean age of 51.2 ± 19 . The most prevalent surgical procedure was neurological surgery 26 (36.1%), while the most common comorbidity was systemic arterial hypertension (SAH) present in 35 (48.6%) of the individuals, Table 1.

Table 1. Sociodemographic characteristics of individuals in the postoperative period admitted to a surgical ICU. Salvador - BA, 2016 and 2017

Variables	M ± SD ou f (%)
Age (years)	51,2 ± 19
Sex	
Female	35 (48,6%)
Male	37 (51,4%)
Type of Surgery	
Neurological Surgery	26 (36,1%)
General Surgery	24(33,3%)
Vascular Surgery	12(16,7%)
Urogynecological Surgery	10(13,9%)
Comorbidities	
Arterial hypertension	35 (48,6%)
Smoking	18(25%)
Cardiopathy	14(19,4%)
Diabetes Mellitus	13(18,1%)
Alcoholism	10(13,9%)
Renal insufficiency	6(8,3%)
Obesity	3(4,2%)

The mean functional capacity obtained through FIM was 95.7 ± 21.3 , 40 (44.6%) of the patients had modified dependence (up to 25% of the tasks) and 28 (38.9%) complete / modified independence. The median of the peripheral muscle strength obtained through the MRC was 58 (48-60). The median length of ICU stays was 4 (2-7) days. The duration of mechanical ventilation was 24 hours for most subjects (63.9%). The median SAPS was 36 (27-44), it is noteworthy that 25 patients (34.7%) did not have SAPS collected due to lack of registration of such data in the patient's chart, Table 2.

Table 2. Clinical characteristics of individuals in the postoperative period admitted to a surgical ICU. Salvador - BA, 2016 and 2017

Variables	N=72
MV Time	
Less than 1 day	21 (29,2%)
1 day	46 (63,9%)
2 days	4(5,6%)
3 days	1(1,4%)
Length of stay (days)	4 (2-7)
SAPS	36 (27-44)
MRC	58 (48-60)
FIM	95,7 ± 21,3
Complete dependency	0 (0 %)
Modified dependency (assistance of up to 50% of tasks)	4 (5,6%)
Modified dependency (assistance of up to 25% of tasks)	40 (55,6%)
Complete / modified Independence	28 (38,9%)

MV – Mechanical Ventilation; SAPS – Simplified Acute Physiology; MRC – Medical Research Council; FIM – Functional Independence Measure. Data expressed as frequency, mean ± standard deviation, and median and interquartile range.

Discussion

The findings of the present study demonstrated that the peripheral muscle strength obtained through the MRC in the postoperative period were within the normality values 58 (48-60). These findings are in agreement with the data of the study performed by Borges et al., which showed that a large part of ICU patients present severe motor restrictions, which can lead to muscular weakness and reduction of their functional capacity⁴. On the other hand, these data are corroborated by the study by Dantas et al., who evaluated the MS of 59 patients at the time of admission to the ICU and identified an average MRC of 49.29 ± 11.02^6 , which also is considered within normal values.

One possible explanation for the contradiction with the results presented by Borges et al. is that the present study's population was composed of patients in the recent postoperative period, a fact that may have interfered with the MS outcome. MRC values were found above 48 points, and this is considered normal. In addition, according to Ferreira's study, it was observed that higher MRC score on ICU

admission is predictive of improved muscle strength and functionality during ICU stay¹⁹.

Regarding functional capacity, the present study showed that 55.6% of the patients had functional dependence modified requiring 25% of assistance to perform the tasks classified according to the total MIF score¹⁷. These data are corroborated by a study that used MIF to evaluate the functionality of 41 patients in the recent postoperative period and demonstrated that surgical intervention may cause impairments in the patient's functionality and abilities¹⁴.

In this study, the average length of stay in the surgical ICU was 4 (2-7) days, the mean age of the participants was 51.2 ± 19 years, the median value of the SAPS in these participants was 36 (27- 44). Data from studies show that the average length of stay of patients in the ICUs in Brazil varies from one to six days²⁰, and in international ICUs 5.3 ± 2.6 days of hospitalization²¹, which are similar to this study. In addition, Ferreira et. al as suggested by investigating the factors associated with functional progression of patients admitted to the ICU, such as

a good functional condition, low severity of disease score in ICU admission, absence of sepsis and stroke, and age below 78 , 5 years are predictors favorable to the functional progress of the patient during ICU admission¹⁹. Therefore, based on these data, it is possible to say that the participants in the present study had a good functional prognosis during hospitalization.

Among the comorbidities present in the study population, the most prevalent was hypertension, which has a high prevalence in the adult population, ranging from 22.3% to 43.9%. This clinical condition is one of the main public health problems and is indicated as the main risk factor for cardiovascular and cerebrovascular diseases, which may have contributed to a higher prevalence of neurological surgeries in the study population²².

In a study conducted by Martin et al. with 49 subjects, a significant correlation was observed between muscle strength and MV weaning time, indicating that patients undergoing prolonged MV periods present significant global muscle weakness, which limits their Weaning capacity of the VM and the performance of the ADLs²³. These results corroborate with those described in this study, where the majority of subjects (93%) remained less than 24 hours in the MV. This was probably due to the lack of respiratory pathologies or complications and to have been intubated exclusively for the surgical procedure, having a MV interruption immediately after the effect of anesthetics, which is quite different from general ICUs, where there is a higher prevalence of chronic patients with prolonged hospitalization and difficulty in weaning MV⁴.

This study has strength, such as the evaluation of a specific population and the best understanding of its functional condition at the time of admission to the ICU after performing a surgical procedure. However, one of the limitations was the lack of inferential statistics to identify the variables impacting on the functional capacity and muscle strength of this population.

Conclusion

Although the peripheral muscle strength of patients admitted to the postoperative surgical ICU is not altered, most of these patients have functional limitations, which may be related to recent surgical intervention. Moreover, considering factors associated with the functional progress of patients admitted to the ICU, as higher MRC score on admission to the ICU is predictive of improvement in muscle strength and functionality during ICU stay. In this way, it is possible to say that the participants in the present study had a good functional prognosis during hospitalization.

Author contributions

Lopes LCD participated in the study design, data collection, interpretation of results and writing of the scientific article. Araujo AM contributed to the design and data collection. Lopes TS contributed with the statistical analysis of the data, interpretation of the results and in the critical review of the manuscript. Pires BS and Anjos JLM contributed in the study design, and critical revision of the manuscript.

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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