Influence of Hospitalization Time about Respiratory Muscle Strength and Functional Level of Adults with Leukemia and Lymphoma

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Influência do Tempo de Internamento sobre a Força Muscular Respiratória e Nível Funcional de Adultos com Leucemia e Linfoma

Influencia del Tiempo de Internamiento sobre la Fuerza Muscular Respiratoria y Nivel Funcional de Adultos con Leucemia y Linfoma

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Abstract

Introduction: Hematologic neoplasms, leukemias and lymphomas are pathologies that affect the blood or tissues that form it. During the hospitalization period patients may develop functional capacity reduction, which may interfere with their respiratory function. **Objective:** Evaluate the influence of hospitalization time about respiratory muscle strength and functional level of adults with leukemia and lymphoma. **Method:** Observational study, with longitudinal design and quantitative approach, performed at the onco-hematological ward of the University Hospital Complex Professor Edgard Santos (Hupes). The assessment of respiratory muscle strength was measured using the manovacuometer and functional capacity using the Karnofsky Performance Scale (KPS). **Results:** During the hospitalization time, there was a decrease in the maximum expiratory pressure (PEM) (p=0.000), but no significant difference was observed in the maximum inspiratory pressure (PIM) (p>0.05). In relation to KPS, the patients presented functional level of 70%. **Conclusion:** This study demonstrated that PEM was altered during hospitalization, but there was no modification of the PIM and the functionality of the patients.

Key words: Leukemia; Lymphoma; Karnofsky Performance Status; Length of Stay; Muscle Strength.

Resumo

Introdução: As neoplasias hematológicas, leucemias e linfomas são patologias que afetam o sangue ou tecidos formadores dele. Durante o período de hospitalização, os pacientes podem desenvolver redução da capacidade funcional que pode interferir na sua função respiratória. **Objetivo:** Avaliar a influência do tempo de internamento sobre a força muscular respiratória e o nível funcional de adultos com leucemia e linfoma. **Método:** Estudo observacional, com delineamento longitudinal e abordagem quantitativa, realizado na enfermaria onco- -hematológica do Complexo Hospitalar Universitário Professor Edgard Santos (Hupes). A avaliação da força muscular respiratória foi mensurada pelo manovacuômetro e a capacidade funcional pela escala de desempenho de Karnofsky (KPS). **Resultados:** No decorrer do tempo de internamento dos pacientes, houve uma diminuição da pressão expiratória máxima (PEM) (p=0,000), porém não foi observada diferença significativa na pressão inspiratória máxima (PIM) (p>0,05). Em relação à KPS, os pacientes apresentaram nível de funcionalidade de 70%. **Conclusão:** Este estudo demonstrou que a PEM foi alterada durante o internamento, porém não houve modificação da PIM e da funcionalidade dos pacientes.

Palavras-chave: Leucemia; Linfoma; Avaliação de Estado de Karnofsky; Tempo de Internação; Força Muscular.

Resumen

Introducción: Las neoplasias hematológicas, leucemias y linfomas son patologías que afectan a la sangre o tejidos formadores de él. Durante el período de hospitalización los pacientes pueden desarrollar una reducción de la capacidad functional, que puede interferer en su función respiratoria. **Objetivo:** Evaluar la influencia del tiempo de internamiento sobre la fuerza muscular respiratoria y nivel funcional de adultos con leucemia y linfoma. Método: Estudio observacional, con delineamiento longitudinal y el enfoque cuantitativo, realizado en la enfermería onco-hematológica del Complejo Hospitalario Universitario Profesor Edgard Santos (Hupes). La evaluación de la fuerza muscular respiratoria se midió utilizando el manovacuómetro y la capacidad funcional utilizando la escala de rendimiento de Karnofsky (KPS). **Resultados:** En el transcurso del tiempo de internamiento de los pacientes, hubo una disminución de la presión espiratoria máxima (PEM) (p=0,000), pero no se observó diferencia significativa en la presión inspiratoria máxima (PIM) (p>0,05). En relación a KPS, los pacientes presentaron un nivel de funcionalidad del 70%. **Conclusión:** Este estudio demostró que la PEM fue alterada durante el internamiento, pero no hubo modificación de la PIM y de la funcionalidad de los pacientes.

Palabras clave: Leucemia; Linfoma; Estado de Ejecución de Karnofsky; Tiempo de Internación; Fuerza Muscular.

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INTRODUCTION

Hematologic neoplasms, leukemia and lymphomas are pathologies that affect the blood or its formative tissues [1]. The estimate of new cases of leukemia is 5,940 new cases in men and 4,860 in women, further to 5,370 new cases of non-Hodgkin's lymphoma in men and 4,810 in women; the new cases of non-Hodgkin's lymphoma correspond to 1,480 in men and 1,050 in women for each year of the period 2018-2019 [2].

Thus, either getting ill or chemotherapy treatment are accountable for changing the metabolism of the patients with neoplasm, being common the reduction of the nutrition and consequent loss of muscle mass, which is the factor responsible for diffuse weakness [3,4]. Further, the respiratory muscular strength can be modified, with reduction of the diaphragm muscle and thoracic expansibility, which induces the modification of the cough mechanism [5,6].

The evaluation of the respiratory muscular strength is a simple test to measure the strength and early detection of the presence of muscular debilitation, since the weakness is a condition that, depending on the degree, ultimately reduces the pulmonary ventilation, vital capacity and favors the morbidity by infections [7]. The use of specific scores is an advantageous safe and low cost conduct that are widely adopted in the clinical practice to evaluate the functionality[8].

The functional level is a predictor of health that determines the physical capacity of the individual, which grants its well-being because it signifies the skill to manage life in aspects such as capabilities to perform basic daily living activities (ADL) as bathing, clothing, grooming and mobility and instrumental activities of daily living (IADL) with skills to do and resolve issues with the direct participation of the individual in the society, associated to the degree of independence [9,10]. The Karnofsky performance status (KPS) in oncology is adopted for decision taking, where it is possible to classify patients according to their functional level[8].

During hospitalization, the patients may develop reduction of the functional capacity that can interfere in their respiratory function, which increases the morbimortality rates[11]. The publications about evaluation of the respiratory muscular strength, capacity and functional impairment are scarce; thus, the possibility of evaluation along the time widens the knowledge because offers relevant information about health research and understand its evolving during hospital stay. In addition, it corroborates the information for care and treatment, which facilitates the decision taking through evidence-based therapeutic proposals.

The objective of this study was to evaluate the influence of internment time on the respiratory muscular strength and the functional level of adults with leukemia and lymphoma.

METHOD

It is an observational, longitudinal design and quantitative approach study conducted in a high complexity hospital facility of "Complexo Hospitalar Universitário Professor Edgard Santos (HUPES)" from February to July, 2017. This study is part of the research trial approved by the Institutional Review Board of "HUPES" of "Universidade Federal da Bahia", report number 1.805.649. The study complied with the ethics in research involving human beings and with ordinance CNS 466/12. The patients were informed and signed the Informed Consent Form (ICF).

The present study addressed patients with hematologic cancer in treatment, evaluated during the first, fifth and tenth day of hospitalization. Fifty six patients with leukemia and lymphoma with more than 18 years old, of both gender, admitted to the oncohematologic ward were eligible to join the study; however, 31 patients were excluded because they did not accept to join the study, patients who were in aerial or contact isolation, clinical instability, difficulties of understanding and with neuromusculoskeletical comorbidities, ten patients were excluded because they were released prior to the tenth day of hospitalization.

Data collection occurred in three periods during the hospitalization; a form with sociodemographic information was filled out (age, gender, civil status, occupation), anthropometric measures of weight and height and Body Mass Index (BMI) were collected in an electronic chart. In addition, each patient was evaluated with measurement instruments for maximum inspiratory pressure (MIP) and maximum expiratory pressure (MEP) and the level of functional capacity per score obtained in KPS. The patients were evaluated by only one reviewer during 40 minutes.

The respiratory muscle was evaluated by the analogic manovacuometer (WIKA, model 611.10, Brazil) whose score has intervals of 10 cmH_2O and variation of -150 to +150 cmH_2O, utilized to quantify the muscular strength of the respiratory mechanic. MIP and MEP are verified based in the residual volume and total pulmonary capacity, respectively, through voluntary efforts. All the time, the patients were encouraged by the reviewer to perform maximum efforts with three maneuvers for each evaluation and it was noted the one with the higher value. The maximum respiratory effort and maximum expiratory

effort were kept for three seconds. The equipment was utilized according to the technique of standard mensuration by the *American Thoracic Society* (ATS) and *European Respiratory Society* (ERS)[12]. The nozzle adjusted to the manovacuometer had an orifice of 2 mm, to avoid contraction of the buccinator muscles because of the intraoral pressure [13].

To determine the functional level and the evolution of the patient with the treatment, the KPS scale was completed; it consists of 11 topics, ranging from 0 to 100 where, the lower the score, worse is the expectation of recovery of the infirmity or return to the regular activities. The scale describes the profile of the population with cancer, classifying the patients according to the degree of their functional skills and deficiencies in three groups, pursuant to their degree of physical ability to work and carry on their daily activities and care needs: capable of carrying on regular activity, does not need special care (80% to 100%); unable to work, capable of living at home and take care of personal needs, but a variable amount of assistance is necessary (50% to 70%); unable to take care of itself, requires the same amount of institutional or hospital care, the disease may be rapidly progressing (0% to 40%), in addition to compare the efficiency of the utilization of different therapies, which allows to determine the individual prognosis for each patient [14,15].

The analysis of the demographic and clinical data was performed through descriptive statistics. The continuous variables are expressed in measures of central tendency and dispersion and the dichotomic or categorical variables, with measurements of frequency. The Kolmogorov-Smirnov test was used to evaluate the normality of the data and the test Kruskal-Wallis for comparison of the variables with time of internment. The level of significance adopted was $p<0.05$. The *software Statistical Package for Social Sciences*, version 14.0 (SPSS Inc Chicago, IL, USA) was used for statistical analysis.

RESULTS

From February to July 2017, 15 patients were evaluated. Among them, eight patients with leukemia (53%) and seven with lymphoma (47%). The demographic and clinical data are described in Table 1.

The MIP did not have significant variation during the first, fifth and tenth day of hospitalization, being observed the median 60 cmH_2O. In every evaluation, the minimum MIP was 30 cmH_2O; the first quartile (Q1-25%) shows that the patients presented MIP of 50 cmH_2O; and in the third quartile (Q3-75%), of the first and tenth days, it was 80 cmH_2O. Some patients presented MIP higher than the median of the group (Figure 1).

Table 1. Demographic and clinical data of oncohematologic patients

Variable	n=15
Age: median (interval) – years	
Male	37(20-66)
Female	29(20-54)
Hemoglobin (g/dl)	8.1 (6.8-11)
Height (cm)	1.63±0.23
Body Mass Index	21.7±0.36
Gender	n (%)
Male	7 (47%)
Female	8 (53%)
Type of cancer	n (%)
Leukemia	8 (53%)
Lymphoma	7 (47%)
Chemotherapy	n (%)
Cycle 1	11 (73.3%)
Cycle 3	2 (13.3%)
Cycle 4	2 (13.3%)
Work	n (%)
Yes	4 (27%)
No	11 (73%)
Marital status	n (%)
With spouse	9 (60%)
Without spouse	6 (40%)

Note: Results expressed in median (minimum-maximum), percent (%) or mean ± standard deviation.

In the evaluation of MEP, it was observed variation between the median during hospitalization. MEP was higher in the fifth day, 60 cmH_2O. A significant reduction was verified for MEP between the fifth and tenth days of hospital internment ($p=0.000$), since in the fifth day of hospital stay, MEP increased. In every evaluation, some patients had higher MEP than the group (Figure 2).

The median of the functionality of the patients during the first, fifth and tenth day of hospitalization did not have variation, meaning 70%, but it was observed that in the tenth day, the maximum amplitude of functionality was Q3-75%, different from the first day, but not statistically significant, $p=1.121$, Figure 3.

The evaluation of the respiratory muscular strength and the functional level of the patients according to gender are in Table 2.

DISCUSSION

There are but a few publications about the functionality of oncohematologic patients in Brazil. The present study reviews the internment time-related aspects on the respiratory function and the functional level of the oncologic patients because they are not well known yet.

In that sense, it appears to be indispensable the evaluation of the respiratory muscular strength and the

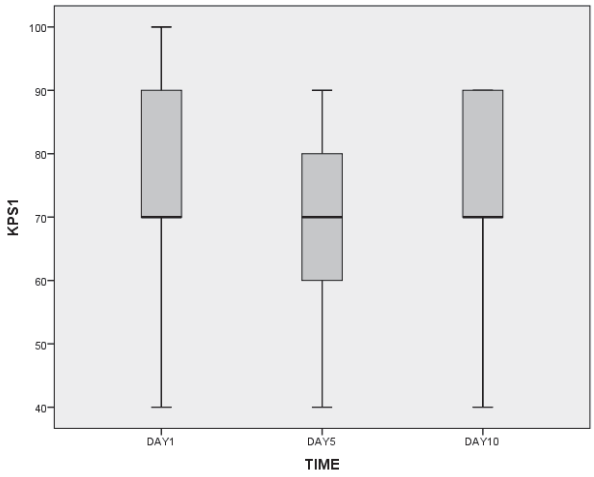

Figure 1. Effects of hospitalization in MIP of the oncohematologic patients
Note: The patients were evaluated in HUPES in the first, fifth and tenth day of hospitalization (n=15).

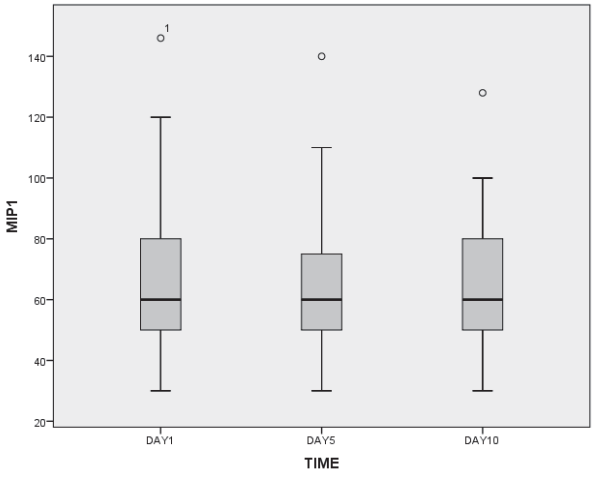

Figure 2. Effects of hospitalization in MEP of the oncohematologic patients MEP
Note: The patients were evaluated in HUPES in the first, fifth and tenth day of hospitalization (n=15).

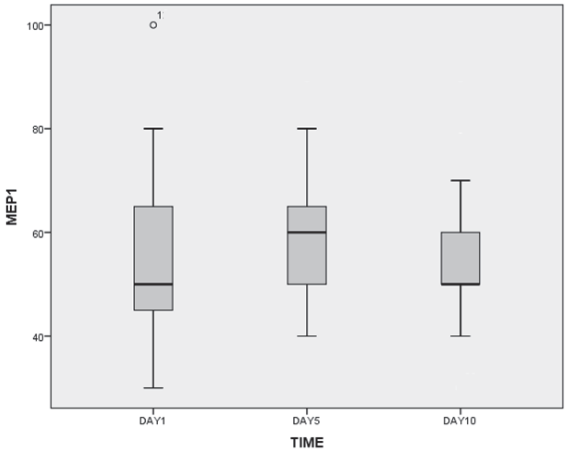

Figure 3. Effects of hospitalization on the functional level of the oncohematologic patients
Note: The patients were evaluated in HUPES in the first, fifth and tenth day of hospitalization (n=15).

Table 2. Evaluation of the respiratory muscular strength and functionality of the oncohematologic patients according to gender

Variables	1° day	5° day	10° day
MIP F (cmH_2O)	60 (30-80)	60 (40-80)	60 (30-100)
MIP M (cmH_2O)	70 (40-146)	50 (30-140)	60 (50-128)
MEP F (cmH_2O)	55 (30-80)	50 (40-80)	55 (30-80)
MEP M (cmH_2O)	50 (30-100)	60 (40-90)	50 (40-90)
KPS M (%)	90 (40-90)	80 (40-90)	80 (40-90)
KPS F (%)	70 (50-70)	60 (50-90)	70 (50-90)

Captions: MIP F = female maximum inspiratory pressure; MIP M = male maximum inspiratory pressure; MEP F = female maximum expiratory pressure; MEP M = male maximum expiratory pressure; KPS M = male group functional performance scale; KPS F = female group functional performance scale.
Note: Results are expressed in median (minimum-maximum).

functional capacity to help to understand the factors that go beyond the process of getting ill, comprehending other domains, mainly those related to basic ADL and to IADL, and granting a wider amplitude of the treatment. To know the profile of the hospitalized patients seems to help devising preventive strategies of treatment-associated comorbidities to reduce the functional limitations [9].

The present study shows that men are older than women, the BMI was within the normal range and the majority of the patients was in the first cycle of chemotherapy – a treatment involving phases and has effects that are contingent on the type of the drug administered [16]. All the patients had distinguished degrees of anemia, being associated to the alteration of hematopoiesis[17]. Carbonell et al.[18] showed in a study with 82 patients that a low functional performance in KPS is influenced by reduced levels of hemoglobin.

It was not found significant variation in MIP during the hospitalization, this may be associated to the profile of patients admitted in this ward, because the majority was not restricted to bed. But a few patients had a very low MIP. Corroborating the data of this study, Grande et al.[19], in their research with 93 patients hospitalized, most of them with neoplasm, did not find reduction of MIP as well in the patients who were on physiotherapy (55.8±28.5 a 53.3±28.5) (p=0.087), as opposed to Suesada et al.[20], who, in their study, evaluated 78 patients before and after the hospitalization of five days and encountered reduction of MIP (83.3±25.0 to 70.9±23.1) cmH_2O (p=<0.001). Values of MIP with one third of the normal are predictors of respiratory failure and hypercarbia ($PaCO_2$ >45 mmHg)[12].

In relation to MEP, there were change of the values during the hospital stay, being observed a descent when comparing the fifth and tenth day (p=0.000). This

reduction can be related either to the hospitalization or to the effects of chemotherapy, because in the tenth day, the patients were in the nadir, a period between the administration of the cytotoxic drugs and the occurrence of a low hematologic counting with possibility of pain, fatigue, in addition to being more prone to remain in bed [21]. Grande et al.[19] observed relation between the time of internment and the values of MEP (53.2±25.1 to 50.7±26.1) (p=0,054), confirming our findings. Suesada et al.[20] have also encountered descent of MEP from 98.3±21.9 to para 89.3±24.0 cmH_2O. A MEP below 60 cmH_2O is predictive of ineffective cough with tendency to retention of secretion [12].

As for gender, there were no difference between the medians of MIP and MEP among the female and male groups. However, men failed to keep the respiratory pressure during interment and women succeeded in keeping in the fifth and tenth day. During hospitalization, the reduction of the fitness is associated to the processing of getting ill with damages that interfere directly in the functionality and quality of life of the ill[22].

The majority of the patients of our research had a good functional level in the first day of hospitalization, being capable of carrying over the basic ADL without assistance and to work, with score of 80 to 100%, but there were a reduction of the functionality in the fifth day; this can be justified by the inclusion of the peripheral venous access, the weight of the chemotherapy pump that restrains some activities, being accountable for the necessity of assistance, from 50% to 70%. In the tenth day, the majority of the patients had a good functional level. However, the maximum functionality reached was lower than in the first evaluation.

This evidence can be justified, in part, by the level of health care supplied to the patients during hospitalization, since the majority of them have more than one physiotherapy activity per day, which demonstrates the importance of the physiotherapist as health-care provider during the patients treatment; in addition, this improvement is associated to the adaptability of the patient to the hospital environment, mainly in what concerns the emotional relation through the perception of an affectionate bond between the therapist and the patient, the psychosocial approach supplied by the multifunctional team and the family while supporting and encouraging the treatment.

The findings of this study corroborate also the findings of Da Costa et al.[23], that found that hospitalization beyond seven days affects the functional independence of the patients. According to Wedding et al.[24], the functionality is affected with ageing; the median of KPS in his work was 80% in young patients.

It was proved in the present study that, even with neoplasm, the oncohematologic patients had a good functional level, but the modification occurred during the hospitalization, may be associated to the cycle of chemotherapy since the majority was in the first cycle with not so aggressive effects to the organism.

According to the median, men were more functional than women in every evaluation. Though there are similar comorbidities, they showed more ability to carry on basic ADL and IADL. However, there was a descent of the functionality during the fifth and tenth day, which evidenced the effects of the treatment in the physical function of the hospitalized patients [21]. Though women presented a lower functional level than men, they managed to keep their functionality during hospitalization. These data suggest that the patients that keep a good level of respiratory muscular strength are prone to have a good capacity of carry on more complex daily activities that involve more energy expenditure.

Nonetheless, this study had limitations in relation to the reduced size of the sample, loss of patients and difficulties of evaluation because some procedures during the treatment and the chemotherapy cycle may have interfered in the results. In addition, the paucity of studies with the same goal restricted the comparison of our data.

CONCLUSION

Hospitalization may change the respiratory muscular strength and the functional capacity of interned patients. Whereas the aspects observed, the time of internment modifies the MEP of the oncohematologic patients but does not reduce MIP and the functionality. However, more studies are mandatory to prove the effects of internment over the respiratory muscular strength and the functionality of the patients.

CONTRIBUTIONS

Natali dos Santos Nascimento participated of the study conception and design, collection and interpretation of data, wording and review of the scientific article. Nicolly Del Carmen Parra Molina Mattos, Samara de Souza Marques and Thais Conceição Cruz participated of study conception and design, search, collection and interpretation of data and review of the article. Camila Reinbold Rezende participated of the study conception and design and review of the article. Cássio Magalhães da Silva e Silva participated of study design, statistical analysis and review of the article.

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DECLARATION OF CONFLICT OF INTERESTS

There are no conflicts of interests to declare.

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