

# Analysis of Muscle Strength and Mobility of Patients with Hematologic Cancer Consulted at Physiotherapy in a High Complexity Oncology Clinic

doi: <https://doi.org/10.32635/2176-9745.RBC.2022v68n4.2548>

*Análise de Força Muscular e Mobilidade de Pacientes com Câncer Hematológico Atendidos pela Fisioterapia em um Centro de Assistência de Alta Complexidade em Oncologia*

*Análisis de Fuerza Muscular y Movilidad de Pacientes con Cáncer Hematológico Atendidos por Fisioterapia en un Centro de Atención de Alta Complejidad en Oncología*

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## ABSTRACT

**Introduction:** Cancer is the name given to a set of more than 100 diseases characterized by abnormal and accelerated growth of cells, and can be considered solid or hematological. Hematological neoplasms lead to specific changes that can contribute to inactivity, mainly due to the high risk of bleeding, inducing functional losses, being important to perform physical therapy to prevent or minimize these losses. **Objective:** Analyze the muscle strength and mobility of patients with hematological cancer admitted to a reference hospital in the Federal District. **Method:** Retrospective, quantitative longitudinal study. The collection was performed with secondary data from electronic medical records and physical therapy monitoring spreadsheets from June to December 2020. Muscle strength was analyzed using manual dynamometry and also with the Medical Research Council scale (MRC) and mobility by the ICU Mobility Scale (IMS). **Results:** Of the 86 individuals screened, 43 were eligible for the study. No significant differences were noticed in muscle strength and mobility in an analysis from admission to hospital discharge. There was a moderate and significant association between MRC and IMS at admission ( $r=0.575$  and  $p<0.001$ ) and at discharge ( $r=0.481$  and  $p=0.001$ ). No significant associations between dynamometry and mobility were found. **Conclusion:** This study allowed the identification of the profile of onco-hematological patients in follow-up, suggesting that physiotherapy contributed to maintain the functionality of these patients.

**Key words:** hematologic neoplasms; muscle strength; mobility limitation; physical therapy department, hospital.

## RESUMO

**Introdução:** Câncer é o nome dado a um conjunto de mais de 100 doenças, caracterizado pelo crescimento anormal e acelerado de células, podendo ser considerado sólido ou hematológico. As neoplasias hematológicas levam a alterações específicas que podem contribuir para a inatividade, principalmente pelo alto risco de sangramento, induzindo perdas funcionais, tornando importante a realização da fisioterapia para prevenir ou minimizar essas perdas. **Objetivo:** Analisar a força muscular e a mobilidade de pacientes com câncer hematológico internados em um hospital de referência do Distrito Federal. **Método:** Estudo quantitativo, retrospectivo e longitudinal. A coleta foi realizada a partir de dados secundários de prontuários eletrônicos e planilhas de acompanhamento da fisioterapia, abrangendo o período de junho a dezembro de 2020. Foram analisadas a força muscular, por meio da dinamometria manual e da escala *Medical Research Council* (MRC), e a mobilidade, por meio da *ICU Mobility Scale* (IMS). **Resultados:** Dos 86 indivíduos rastreados, 43 foram elegíveis para a pesquisa. A análise entre a admissão e a alta hospitalar não revelou diferenças significativas na força muscular e mobilidade. Houve associação moderada e significativa entre MRC e IMS na admissão ( $r=0,575$  e  $p<0,001$ ) e na alta ( $r=0,481$  e  $p=0,001$ ). Não houve associações significativas entre dinamometria e mobilidade. **Conclusão:** Este estudo permitiu identificar o perfil dos pacientes onco-hematológicos em acompanhamento, sugerindo que a fisioterapia contribuiu para a manutenção da funcionalidade desses doentes.

**Palavras-chave:** neoplasias hematológicas; força muscular; limitação da mobilidade; serviço hospitalar de fisioterapia.

## RESUMEN

**Introducción:** Cáncer es el nombre que se le da a un conjunto de más de 100 enfermedades, caracterizado por un crecimiento normal y acelerado de células, y puede ser considerado sólido o hematológico. Las neoplasias hematológicas conllevan alteraciones específicas que pueden contribuir a la inactividad, principalmente por el alto riesgo de hemorragia, induciendo pérdidas funcionales, haciendo que la fisioterapia sea importante para prevenir o minimizar estas pérdidas. **Objetivo:** Analizar la fuerza muscular y la movilidad de pacientes con cáncer hematológico, ingresados en un hospital de referencia del Distrito Federal de Brasil. **Método:** Estudio cuantitativo, retrospectivo y longitudinal. La recolección se realizó a partir de historias clínicas electrónicas y planillas de seguimiento de fisioterapia, abarcando el período de junio a diciembre de 2020. Se analizó la fuerza muscular, mediante la dinamometría manual y la escala *Medical Research Council* (MRC), y la movilidad, mediante la escala *ICU Mobility Scale* (IMS). **Resultados:** De las 86 personas seleccionadas, 43 fueron elegibles para la investigación. En el análisis entre el ingreso y el alta hospitalaria no se observaron diferencias significativas en la fuerza muscular y la movilidad. Hubo una asociación moderada y significativa entre el MRC e el IMS al ingreso ( $r=0,575$  y  $p<0,001$ ) y al alta ( $r=0,481$  y  $p=0,001$ ). No hubo asociaciones significativas entre la dinamometría y la movilidad. **Conclusión:** Este estudio permitió identificar el perfil de los pacientes onco-hematológicos seguidos, sugiriendo la contribución de la fisioterapia al mantenimiento de la funcionalidad de estos pacientes.

**Palabras clave:** neoplasias hematológicas; fuerza muscular; limitación de la movilidad; servicio de fisioterapia en hospital.

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## INTRODUCTION

Cancer is a set of diseases where abnormal cells divide without control and can invade nearby tissues, usually very aggressive and difficult to manage<sup>1</sup>. There are two subdivisions of types of cancer: solid, when the tumor is malignant and hematologic when hematopoietic precursors of the bone marrow are affected<sup>2</sup>.

Usually, hematologic cancer is characterized by alterations of the immune system that can spread to several parts of the body, more frequent in the blood, bone marrow, lymph ganglia, spleen and liver and the main types are leukemia, lymphoma and multiple myeloma<sup>3</sup>. According to the National Cancer Institute José Alencar Gomes da Silva (INCA)<sup>4</sup>, more than 25 thousand new onco-hematologic cases are anticipated for each year of the triennium 2020-2022, the most incident is non-Hodgkin lymphoma with an estimate of 12 thousand cases annually.

Patients with cancer tend to reduce their physical activity which can be associated with more pronounced energetic expenditure inherent to the disease or even the chemotherapy treatment and eventually intense fatigue<sup>5,6</sup>. Some specific alterations may occur if the malignant neoplasm is characterized as hematological which may contribute to inactivity; in addition, the hematological patient is dealing with results of lab tests and possibly thrombocytopenia and eventually bleeding, clear obstacles to physical activity<sup>7</sup>.

The inactivity and the disease's specific factors as weight loss, oncologic fatigue, anemia and others these patients are submitted to in the course of the treatment can cause reduction of muscle strength and important functioning deficits<sup>8</sup>. To prevent or minimize these losses, physiotherapy is necessary most of all for hospitalized patients to reduce the functioning deficit and promote strength gain, resistance and independence whenever possible<sup>9</sup>.

Nowadays there are evidences about the efficacy of physiotherapy during hospitalization of oncologic patients, mainly in solid tumors due to postoperative complications, respiratory function, length of hospital stay or posthospitalization satisfaction of these patients<sup>10,11</sup>. However, the literature is poor on the effects of physiotherapy of hospitalized patients with hematological neoplasms.

The objective of the study was to analyze the muscle strength and mobility of patients with hematologic cancer hospitalized in an infirmary of a tertiary hospital of the Federal District and compare these variables at admission and discharge and correlate both.

## METHOD

Quantitative, retrospective, longitudinal study with data from June to December 2020 at a tertiary hospital of the Federal District with secondary data; muscle strength

and mobility information were extracted from follow-up charts of physiotherapy and clinical and demographic data from electronic charts.

The current study is part of an umbrella project titled, "Profile of the hemato-oncologic patients at a public tertiary hospital of the Federal District: a multiprofessional vision" approved by the Institutional Review Board of "Instituto de Gestão Estratégica de Saúde do Distrito Federal", report number 4.206.295, CAAE (submission for ethical review) number 34449720.8.0000.8153.

Patients aged 18 years or older, hospitalized at the infirmary for one week or more, who underwent at least three physiotherapy sessions during this period, regardless of having initiated clinical treatment or not or with previous comorbidities before the admission were enrolled. Those with no or unconfirmed diagnosis of hematological cancer, who were hospitalized more than once during the collection period and who were not submitted to complete physiotherapy evaluation at admission or discharge were excluded.

Muscle strength and mobility were evaluated through physiotherapy spreadsheets where tests performed at admission and discharge were registered. Skilled and trained physiotherapists and residents conducted the tests with instruments.

The peripheral muscle strength was evaluated by the test of handgrip strength with manual dynamometer with a digital dynamometer, brand CAMRY, model EH101, recommended by the American Society of Hand Therapists<sup>12</sup>. All the patients were seated in an armless chair with both feet laying on the floor, hips and knees flexed at approximately 90°; the shoulder tested was adducted in a neutral position for rotation, elbow bent at 90° and forearm in neutral position and the hand of the untested limb resting on the homolateral thigh. Each hand was measured three times consecutively with one-minute interval, initiating with the dominant hand; the highest value measured for each limb was analyzed, only the dominant limb was logged at the spreadsheet.

The scale Medical Research Council (MRC) was utilized to appraise the muscle strength of six muscle groups bilaterally, three of the upper limbs and three of the lower limbs, assigning a score from 0 (no visible muscle contraction) to 5 (regular movement), with a maximal total score of 60<sup>13</sup>.

The ICU Mobility Scale (IMS) was adopted to measure the mobility of critically ill patients with a score from 0 to 10 were "0" is nothing – lying in bed – and 10, walking independently without a gait aid<sup>14</sup>.

The sociodemographic and clinical data of the patients were evaluated by the physiotherapists collected from electronic charts: sex, age, diagnosis (type of hematologic

cancer), comorbidities, time of diagnosis, type of clinical treatment and outcome.

The Shapiro-Wilk test was utilized to analyze the normality of the variables. A descriptive analysis was conducted to characterize the sample through the median and interquartile range (IQR) for numerical variables and absolute frequency (f) and percent (%) for the categorical variables.

The paired Wilcoxon test was applied to compare the measures of muscle strength and mobility between the moments evaluated. The Spearman's correlation test was utilized to investigate the associations between the measures of muscle strength and mobility, considering  $r=0$ , null; 0.1 to 0.3, weak; 0.4 to 0.6, moderate; 0.7 to 1.0, strong<sup>15</sup>. The analyzes were performed with the Statistical Package for the Social Sciences (SPSS), version 23, with level of significance of  $p<0.05$ .

## RESULTS

During the study period, 86 patients who were hospitalized at the onco-hematological infirmary were screened, but only 43 were found eligible as shown in Figure 1.

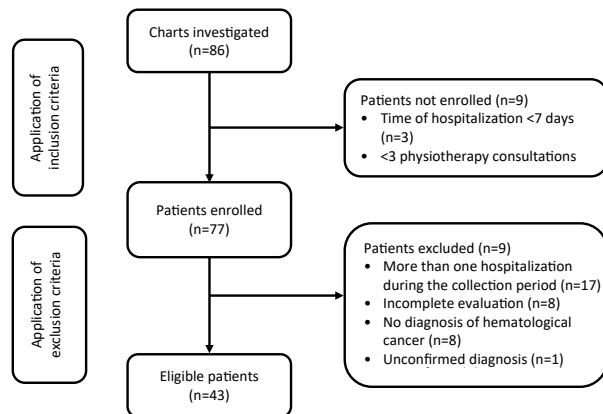


Figure 1. Study flowchart

The sample consisted mainly of males (51%), with median age (IQR) of 53 years (41-46), most of them without comorbidities (54%). The main type of cancer identified was lymphoma (54%), diagnosed in less than one year (86%) mostly, and chemotherapy as the prevalent treatment (56%). The treatment was initiated in less than one year for 56% of the patients, hospitalized during a median time (IQR) of 15 days, submitted from five to 23 physiotherapy sessions during this period and the main outcome was home discharge (82%), as shown in Table 1.

From admission to hospital discharge, no significant differences were found for muscle strength and mobility of the onco-hematologic patients in follow up as shown in Table 2.

Table 1. Sociodemographic and clinic characteristics of onco-hematological patients in follow-up

Variables*	Descriptive measures (n=43)
<b>Sex, f (%)</b>	
Female	21 (49)
Male	22 (51)
<b>Age, median (IQR)</b>	
	53 (41-65)
<b>Comorbidities, f (%)</b>	
Yes	20 (46)
No	23 (54)
<b>Diagnosis, f (%)</b>	
Leukemia	14 (33)
Lymphoma	20 (47)
Myeloma	9 (20)
<b>Time of diagnosis, f (%)</b>	
Less than 1 year	37 (86)
From 2 to 5 years	4 (9)
More than 5 years	2 (5)
<b>Treatment, f (%)</b>	
Chemotherapy	24 (56)
Radiotherapy	16 (37)
Combined	3 (7)
<b>Time of treatment, f (%)</b>	
Less than 1 year	24 (56)
From 2 to 5 years	3 (7)
More than 5 years	3 (7)
Not informed	14 (30)
<b>Length of hospital stay, median (IQR)</b>	
	15 (7-31)
<b>Physiotherapy, median (IQR)</b>	
	11 (5-23)
<b>Outcome, f (%)</b>	
Home discharge	35 (82)
Death	4 (9)
In-hospital transference	4 (9)

(\*) Median and interquartile range (IQR), absolute frequency (f) and percent (%).

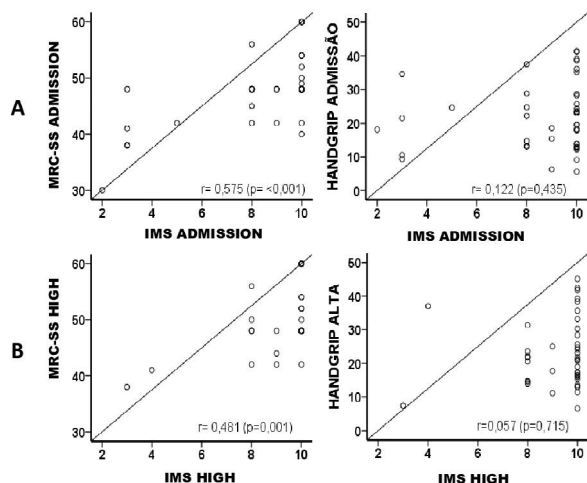
Table 2. Analysis of the muscle strength and mobility of onco-hematologic patients during hospitalization (n=43)\*

Variables	Admission	Discharge	p
MRC-SS	48 (48-52)	48 (48-52)	0,284
HANDGRIP	10 (8-10)	10 (8-10)	0,345
IMS	20 (13-28)	22 (15-30)	0,265

Captions: MRC-SS = Medical Research Council Sum-Score; HANDGRIP = dynamometer; IMS = ICU Mobility Scale.

(\*) For admission and discharge, the data were expressed in median (interquartile range); and p value for the paired Wilcoxon test with level of significance of  $\leq 0.05$ .

Moderate and significant association among MRC-SS and IMS at admission ( $r=0.575$  and  $p<0.001$ ) and at discharge ( $r=0.481$  and  $p=0.001$ ) was found. No significant associations among dynamometry and mobility either at admission or discharge were detected (Graph 1).



**Graph 1.** Association of the measurements of muscle strength and mobility of onco-hematologic patients during hospital stay

**Captions:** MRC-SS = Medical Research Council Sum-Score; IMS = ICU Mobility Scale; HANDGRIP = dynamometer; r = Spearman's correlation coefficient; p = value of the Spearman's correlation test.

## DISCUSSION

Males were prevalent in the current study diagnosed with lymphoma, corroborating the findings of the study by Pastores et al.<sup>16</sup>, who addressed the particularities of hospitalized hematological patients but the mean age was slightly higher (62), possibly associated with different sample sizes.

The study by Hui et al.<sup>17</sup> revealed that length of hospital stay for these patients at advanced stages exceeded 14 days, similar to the present study. As the main outcome was home discharge, it is possible that these patients were not at advanced stages of the disease, which contributes for shorter length of hospital stay similar to the study by Candrilli et al.<sup>18</sup>, who hypothesized a period from seven to 12 days of hospitalization for hematological patients with or without renal disease.

The non-significant difference between the evaluations of muscle strength and mobility at admission and hospital discharge for all the variables (MRC, IMS and dynamometry) can be associated with an expressive number of patients who were in chemotherapy and performing physical activities, which can contribute to avoid functional losses but not always mean gains in strength and improvement of functionality<sup>19</sup>.

Chemotherapy causes side effects to oncologic patients with functional losses and poor performance during physical activities due to fatigue, for example<sup>20,21</sup>. This fact may not help the gain of strength and improve the functional level as the present study suggests, corroborating the findings of Nascimento et al.<sup>22</sup>, who concluded that mobility had no significant change at discharge for the patients who were hospitalized and in chemotherapy.

The study by Nava et al.<sup>23</sup> with a sample of postoperative oncologic patients with solid tumors found significant correlation between muscle strength and mobility, reinforcing the present study. However, they utilized specific data collection instruments for upper limbs as dynamometry and functionality questionnaires because it was the area affected by the neoplasm.

Carvalho et al.<sup>24</sup> adopted a similar perspective of functional analysis and peripheral muscle strength of oncologic patients in their study with pre and postoperative evaluation of mobility through the Functional Status Scale for the Intensive Care Unit (FSS-UCI) and muscle strength, through dynamometry. The association between muscle strength and mobility was proven and validated the conclusions of that study for this population. The last two articles did not address hematologic cancer, but the neoplasms investigated caused important functional impacts in general<sup>25,26</sup>.

Physiotherapy is important during hospitalization of oncologic patients, specifically for those with hematological cancer to maintain the motor functioning and quality-of-life<sup>27,28</sup>.

Poor and incomplete data of the charts without description of staging or reason for hospitalization for most of the patients enrolled is an obstacle for a thorough analysis of the sample, a clear limitation of the study. The comparison with the present study was also hampered due to the paucity of studies with similar objective and patients' profile.

## CONCLUSION

It is possible to suggest that there is correlation between IMS and MRC when admission and discharge of oncohematological patients in physiotherapy are compared, but for the other variables investigated the results were not significant. The study allowed the identification of the profile of oncohematological patients in follow up; even if significant differences of muscle strength and mobility at admission and hospital discharge were not found, without palpable losses or gains, the contribution of physiotherapy to maintain the functionality of these patients is an important finding.



## CONTRIBUTIONS

All the authors contributed substantially to the study design, acquisition, analysis and interpretation of the data, wording and critical review. They approved the final version to be published.

## DECLARATION OF CONFLICT OF INTERESTS

There is no conflict of interests to declare.

## FUNDING SOURCES

None.

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Recebido em 19/1/2022  
Aprovado em 21/6/2022