

Risk of Sarcopenia in Cancer Patients Undergoing Chemotherapy Treatment

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Risco de Sarcopenia em Pacientes Oncológicos em Tratamento Quimioterápico

Riesgo de Sarcopenia en Pacientes con Cáncer Sometidos a Tratamiento de Quimioterapia

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ABSTRACT

Introduction: Chemotherapy treatment can cause several direct and indirect side effects on muscle tissue. Sarcopenia is related to decreased strength, chemotoxicity, decreased functional performance, increased fatigue, lower tolerance to treatments, postoperative complications, age, and low survival in some types of cancer. **Objective:** Analyze the risk of sarcopenia in hospitalized individuals with cancer undergoing chemotherapy. **Method:** This is a descriptive, cross-sectional study with adult and elderly individuals undergoing cancer treatment in two high-complexity hospitals in Southern Brazil. Sociodemographic conditions were collected using a questionnaire, in addition to performing the handgrip strength test using manual dynamometry and assessing the risk of sarcopenia using the SARC-CalF. **Results:** This study included 131 individuals, in which the prevalence of sarcopenia risk among hospitalized cancer patients undergoing chemotherapy was 55.7%. Regarding the predominance of individuals at risk for sarcopenia, the following variables were observed: 60 years or older (68.9%), non-white race (84%), individuals with incomplete secondary education (62.9%), retired (67.6%), palliative care (76%), and sedentary or irregularly active individuals (61.1%). **Conclusion:** Hospitalized cancer patients undergoing chemotherapy presented a high prevalence of sarcopenia risk.

Key words: Inpatients; Neoplasms; Antineoplastic Agents/radiation effects; Sarcopenia.

RESUMO

Introdução: O tratamento quimioterápico pode ocasionar diversos efeitos colaterais diretos e indiretos ao tecido muscular. A sarcopenia tem relação com a diminuição de força, quimiotoxicidade, diminuição do desempenho funcional, aumento da fadiga, menor tolerância aos tratamentos, complicações pós-operatórias, idade e a baixa sobrevida em alguns tipos de câncer. **Objetivo:** Analisar o risco de sarcopenia em indivíduos com doença oncológica hospitalizados fazendo uso de quimioterapia. **Método:** Estudo descritivo, de temporalidade transversal, com indivíduos adultos e idosos em tratamento oncológico em dois hospitais de alta complexidade do Sul do Brasil. Condições sociodemográficas foram coletadas com a aplicação de um questionário, além da realização do teste de força de prensão palmar por meio da dinamometria manual e avaliação do risco de sarcopenia por SARC-CalF. **Resultados:** Foram incluídos neste estudo 131 indivíduos. A prevalência de risco de sarcopenia entre os indivíduos oncológicos hospitalizados e que realizam tratamento quimioterápico foi de 55,7%. Com relação ao predomínio de indivíduos com risco para sarcopenia, observa-se nas seguintes variáveis: 60 anos ou mais (68,9%), cor não branca (84%), indivíduos com ensino médio incompleto (62,9%), aposentados (67,6%), tratamento paliativo (76%) e indivíduos sedentários ou irregularmente ativos (61,1%). **Conclusão:** Indivíduos oncológicos hospitalizados e que realizam tratamento quimioterápico apresentaram uma elevada prevalência de risco de sarcopenia.

Palavras-chave: Pacientes Internados; Neoplasias; Antineoplásicos/efeitos da radiação; Sarcopenia.

RESUMEN

Introducción: El tratamiento quimioterapéutico puede causar diversos efectos secundarios directos e indirectos en el tejido muscular. La sarcopenia se relaciona con disminución de la fuerza, quimiotoxicidad, menor rendimiento funcional, mayor fatiga, menor tolerancia a los tratamientos, complicaciones posoperatorias, edad avanzada y menor supervivencia en algunos tipos de cáncer. **Objetivo:** Analizar el riesgo de sarcopenia en pacientes hospitalizados con cáncer que reciben quimioterapia. **Método:** Se trata de un estudio descriptivo de temporalidad transversal con adultos y personas mayores que reciben tratamiento oncológico en dos hospitales de alta complejidad del sur del Brasil. Se recopilaron datos sociodemográficos mediante un cuestionario, además de realizar la prueba de fuerza de presión palmar con dinamometría y evaluar el riesgo de sarcopenia mediante el índice SARC-CalF. **Resultados:** Este estudio incluyó a 131 personas, en las que la prevalencia de riesgo de sarcopenia entre los pacientes oncológicos hospitalizados que reciben quimioterapia fue del 55,7 %. En cuanto a la predominancia de individuos con riesgo de sarcopenia, se observaron las siguientes variables: edad igual o superior a 60 años (68,9%), raza no blanca (84%), personas con educación secundaria incompleta (62,9%), jubilados (67,6%), pacientes en cuidados paliativos (76%) y personas sedentarias o con actividad física irregular (61,1%). **Conclusión:** Los pacientes oncológicos hospitalizados sometidos a quimioterapia presentaron una alta prevalencia de riesgo de sarcopenia.

Palabras clave: Pacientes Internos; Neoplasias; Antineoplásicos/efectos de la radiación; Sarcopenia.

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INTRODUCTION

According to the National Cancer Institute (INCA)¹, cancer is defined as a disordered growth of cells that invade tissues and organs. These cells tend to be very aggressive and uncontrollable; additionally, the formation of malignant tumors can spread to other body parts. Actually, cancer is a public health problem, classified as a chronic-degenerative disease and considered one of the main causes of illness and death in the world's population. There are different approaches to treating this illness, the main ones being chemotherapy, radiotherapy, and surgery.

Chemotherapy treatment can cause side effects, such as nausea, vomiting, diarrhea, constipation, mucositis, fluctuations in weight or hormone levels². Anorexia, nausea, and fatigue can be caused by chemotherapy agents. Moreover, indirect harm to the muscle tissue can occur due to mechanisms that intensify proteasome activity, which stimulates the signaling pathways of mitogen-activated protein kinase and extracellular signal-regulated kinase. It also causes mitochondrial dysfunction, regardless of anorexia or nutritional state³.

Sarcopenia is the progressive loss of muscle mass, which is related to decreasing strength and, in more severe cases, can compromise functional activities⁴. In individuals with a cancer diagnosis, sarcopenia is related to chemotoxicity, decreased functional performance, increased fatigue, lower tolerance to treatments, postoperative complications, age, and low survival in some types of cancer^{5,3}.

Analyzing the risk of sarcopenia in people with cancer is thus important, given that worse muscle function consequently leads to decreased lean body mass and muscle performance. In addition, malnutrition can increase the risk of toxicity⁶. Therefore, the present study aims to analyze the risk of sarcopenia in hospitalized individuals with cancer undergoing chemotherapy.

METHOD

This is a descriptive, cross-sectional study with adult and elderly individuals undergoing cancer treatment in two high-complexity hospitals in Southern Brazil.

The sample was composed of individuals aged 18 or older, diagnosed with cancer, of both sexes, regardless of their time since diagnosis or tumor location, who were hospitalized for at least two days. Patients excluded from the study were those who presented physical, functional, and/or mental situations that impaired them from participating or interfered with the test results, individuals with severe audiovisual deficiencies, individuals with incapacitating neurological illnesses and with neuromotor

sequelae that impaired the conduction of the proposed tests, or had acute chronic-degenerative diseases.

The study was conducted in the participating hospitals' units from May to July 2025. Six physiotherapists composed the evaluation team, which was previously trained to apply the research evaluation protocols. The individuals were invited to participate in the study through a Free and Informed Consent Form (FICF), presented in two copies (one for the researcher and one for the research volunteer). After verbally accepting and signing the consent form, data collection was initiated.

The patients were approached in their hospital beds, where they received explanations on the research's objective and procedures. The questionnaires included identification and sociodemographic data, as well as anthropometric, pain, medication use, and physical activity assessments. In addition to completing the questionnaires, individuals underwent a hand grip strength test using manual dynamometry and the risk of sarcopenia was assessed using the SARC-CalF.

Three hydraulic manual dynamometers were used (SH50011; Saehan Corporation, Changwon, South Korea) to assess hand grip strength. The test was conducted with the patient sitting down, back supported, and arms fixed, and they were instructed to keep their elbows flexed at 90 degrees with the forearm unsupported. A demonstration was performed by the examiner for a better understanding of the test, and the patient was explained that they should apply their maximum strength possible when gripping the dynamometer. Before starting the test, the patient reports which is their dominant hand, right or left. Three attempts were conducted bilaterally, and the maximum score for each attempt was exhibited in kilograms on the device's external viewer.

Strength, Assistance with walking, Rising from a chair, Climbing Stairs, and Falls (SARC-F) is a five-question questionnaire that assesses the following domains: strength, assistance with walking, rising from a chair, climbing stairs, and history of falls. Each item is scored from 0 to 2, with a total score of 0 to 10. A ≥ 4 points score is considered suggestive of sarcopenia. SARC-CalF, the instrument used in this study, comprises 5 of the SARC-F domains and calf circumferences. To measure calf circumference, a measuring tape is placed at the largest part of the calf, with the individual sitting down, their leg forming a 90° angle, their feet flat on the ground. A ≤ 34 cm value for men and ≤ 33 cm for women adds 10 points to the original SARC-F score. The maximum SARC-CalF score is 20 points, with a score of ≥ 11 points suggestive of sarcopenia⁷.

In this study, quantitative and qualitative descriptive analyses were conducted. For the quantitative variable, mean

and standard deviation values were used, while the qualitative variable used sums and percentages. For the bivariate analysis, among the qualitative and dichotomous variables, we used the dependent variable “risk of sarcopenia”. Fisher’s exact test was used with a value of $p < 0.05$ to accept statistically significant differences within groups.

This study has been approved by the Passo Fundo University’s Research Ethics Committee and followed Resolution N. 466/12⁸ of the National Health Council, which rules on studies involving human beings, under approval report number 7.204.290 (CAAE (submission for ethical review): 83586824.6.0000.5342).

RESULTS

During data collection, 210 individuals were assessed, of whom 79 were excluded (59 for not receiving chemotherapy treatment and 20 for having finished treatment already). In the end, 131 hospitalized individuals with cancer in chemotherapy treatment were included in this study.

The prevalence of sarcopenia risk among hospitalized individuals who underwent chemotherapy treatment was 55.7%, as demonstrated in Table 1.

According to the characterization of this sample and its relationship with sarcopenia in hospitalized individuals with cancer in chemotherapy treatment, the mean age was 58.04 ± 16.21 years. Regarding the predominance of individuals at risk for sarcopenia, the following variables were observed: 60 years or older (68.9%), non-white race (84%), individuals with incomplete secondary education (62.9%), retired (67.6%), palliative treatment (76%), and sedentary or irregularly active individuals (61.1%), as observed in Table 2.

DISCUSSION

This study observed that the prevalence of sarcopenia risk was 55.7% in oncological individuals undergoing chemotherapy treatment. Furthermore, the factors related to sarcopenia risk were being 60 or older, non-white, not having finished high school, retired, in palliative treatment, and sedentary or irregularly active.

In general, most individuals studied had a risk of sarcopenia, which is in line with the study by Vega⁹, which states that the prevalence of sarcopenia in this population can range from 21% to 71%, while its incidence throughout the treatment can reach 17%.

Sarcopenia is associated with chemotherapy’s increased toxicity. Evidence shows that tumoral mass can contribute to this effect through the liberation of inflammatory cytokines, mediators that reduce appetite, and lipolytic substances that degrade adipose tissue^{3,10}. This justified this study’s chosen subject.

The elderly already have preexisting muscle loss; however, oncological treatment can increase the risk of developing sarcopenia. Given that, the chemotherapy dosage used in the treatment must consider, in addition to the individual’s height and weight, differences in the distribution and metabolism volume of the drug, since there is a decrease in muscle mass and an increase in adipose tissue in aging, which results in changes to body composition, resulting in changes to the pharmacokinetics of chemotherapy drugs¹¹.

One study shows that patients who already have sarcopenia are at an increased risk of suffering from chemotherapy toxicities, in addition to muscle loss¹². One chemotherapy drug that increases sarcopenia is 5-fluorouracil, resulting in generalized weakness, loss of mobility, and increased risk of falls, which affects over 60% of oncological patients¹³.

A meta-analysis assessed low muscle mass in elders during neoadjuvant chemotherapy and found an average loss of 10%. These treatments produced a muscle decrease of 8% to 14% across 100 days of chemotherapy¹⁴.

The study by Tzeng¹⁵ shows similar results to this study. It shows that individuals with sarcopenia are mostly female, elderly, with low education levels, retired, who do not practice enough physical activities.

According to a study by Klassen¹⁶, chemotherapy protocols used in palliative oncology patients contribute to muscle mass loss, regardless of tumor response. The patients with greater muscle or fat loss were on average 73% more at risk of dying than those with fewer losses.

In this research, individuals in palliative treatment have a higher risk of developing sarcopenia, which is in

Table 1. Sarcopenia risk of hospitalized cancer individuals in chemotherapy assessed by SARC-Calf. Passo Fundo, 2025 (n=131)

| SARC-Calf | Categories | n | % |
|----------------|-----------------------|-------------|------|
| Classification | No risk of sarcopenia | 58 | 44.3 |
| | Risk of sarcopenia | 73 | 55.7 |
| Score (m ± SD) | | 6.54 ± 5.76 | |

Captions: m = mean; SD = standard deviation; n = sum; % = percentage.



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Table 2. Characterization of the sample regarding the sarcopenia risk of hospitalized cancer individuals in chemotherapy. Passo Fundo, 2025 (n=131)

| Variables | Categories | Sarcopenia risk n (%) | | | P |
|------------------------|----------------------------------|-----------------------|-----------|------------|--------|
| | | Total (n=131) | No (n=58) | Yes (n=73) | |
| Age group | 18 to 59 years-old | 57 (43.5) | 35 (61.4) | 22 (38.6) | 0.001* |
| | 60 years and older | 74 (56.5) | 23 (31.1) | 51 (68.9) | |
| Sex | Male | 63 (48.1) | 30 (47.6) | 33 (52.4) | 0.486* |
| | Female | 68 (51.9) | 28 (41.2) | 40 (58.8) | |
| Color | White | 106 (80.9) | 54 (50.9) | 52 (49.1) | 0.002* |
| | Non-white | 25 (19.1) | 04 (16.0) | 21 (84.0) | |
| Education | Complete high school or higher | 42 (32.1) | 25 (59.5) | 17 (40.5) | 0.023* |
| | Up to incomplete high school | 89 (67.9) | 33 (37.1) | 56 (62.9) | |
| Retirement | No | 60 (45.8) | 35 (58.3) | 25 (41.7) | 0.005* |
| | Yes | 71 (54.2) | 23 (32.4) | 48 (67.6) | |
| Marital status | Has a spouse | 79 (60.3) | 36 (45.6) | 43 (54.4) | 0.723* |
| | No spouse | 52 (39.7) | 22 (42.3) | 30 (57.7) | |
| Metastasis | No | 86 (65.6) | 39 (45.3) | 47 (54.7) | 0.853* |
| | Yes | 45 (34.4) | 19 (42.2) | 26 (57.8) | |
| Intention of treatment | Healing | 106 (80.9) | 52 (49.1) | 54 (50.9) | 0.026* |
| | Palliative | 25 (19.1) | 06 (24.0) | 19 (76.0) | |
| Radiotherapy | No | 102 (77.9) | 49 (48.0) | 53 (52.0) | 0.138* |
| | Yes | 29 (22.1) | 09 (31.0) | 20 (69.0) | |
| IPAQ | Active and very active | 23 (17.6) | 16 (69.6) | 07 (30.4) | 0.010* |
| | Sedentary and irregularly active | 108 (82.4) | 42 (38.9) | 66 (61.1) | |

Captions: m = mean; SD = standard deviation; n = sum; % = percentage; * = Fisher's exact test; IPAQ = International Physical Activity Questionnaire; **bold** = $p < 0.05$.

line with the study by Queiroz¹⁷, in which there was a sarcopenia prevalence of 32.4%, in addition to impaired muscle strength, inflammatory markers, and altered nutritional state, in addition to less functionality for sarcopenic individuals with advanced cancer. However, that study assessed sarcopenia by measuring the arm muscle circumference and muscle strength through a hand grip strength test using a dynamometer. Individuals who presented a small muscle circumference and low hand grip strength were classified as sarcopenic.

The switch from one sedentary hour a day to one hour of moderate to vigorous physical activity reduced sarcopenia risk, while there was an increase in sarcopenia when the moderate to vigorous physical activity was swapped for sedentary behavior¹⁸. In the review by Steffl¹⁹, six studies demonstrated that physical inactivity was a risk

factor for sarcopenia in elders. The research also addresses 32 studies that demonstrated physical activity to preserve muscle mass, thus being a protective factor for sarcopenia.

This study presents some notable limitations, such as the lack of collection of the following information: hospitalization time, diversity between primary locations of cancer, cancer stages, among others. Moreover, data collection was conducted by a physiotherapist team, which may cause bias in the obtained information. However, they were all previously trained and had clarified doubts before the field research.

CONCLUSION

Hospitalized oncological individuals who underwent chemotherapy treatment presented a high prevalence of



sarcopenia, with the factors related to this outcome being advanced age, non-white skin, economically inactive, in palliative treatment, sedentary, or irregularly active.

CONTRIBUTIONS

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

DECLARATION OF CONFLICT OF INTERESTS

There is no conflict of interest to declare.

DATA AVAILABILITY STATEMENT

All the contents associated with the article are included in the manuscript.

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