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ORIGINAL ARTICLE

Evaluation of sarcopenia in patients with breast cancer undergoing chemotherapy: a cohort study

Avaliação da sarcopenia em pacientes com câncer de mama submetidas à quimioterapia: estudo de coorte

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Abstract

Introduction: breast cancer is one of the leading causes of morbidity and mortality worldwide. Patients with breast cancer undergo rigorous oncological treatment and usually present weight changes during this period. Sarcopenia is characterized by decreased muscle strength and compromised functional capacities related to severe loss of skeletal muscle tissue. *Objective:* to evaluate the presence of sarcopenia in women with breast cancer undergoing chemotherapy and to correlate changes in body composition with types of treatment. *Methods:* cohort study conducted with women diagnosed with breast cancer and indication for chemotherapy in a private hospital in southern Brazil, followed from July 2018 to February 2020 through nutritional assessment prior to and at the end of treatment. Initial nutritional assessment (t0) occurred before the commencement of any treatment and reassessment (t1) was scheduled for a date after the end of treatment. The collected variables were age in years, body weight, height, waist circumference, physical activity, type of treatment and chemotherapy protocol, symptoms over the period, hand grip strength, percentage of lean mass, percentage of fat mass, water and phase angle (PA). *Results:* a total

of 47 patients completed the study, with a mean age of 47±14 years, mostly sedentary (n=28; 59.6%) and the predominant treatment type was neoadjuvant chemotherapy (n=32; 68%). There was a statistically significant difference in the comparison of t1 with t0 in grip strength (p=0.007) and phase angle (p=0.001), while the difference in lean mass was not significant (p=0.387), characterizing absence of sarcopenia. *Conclusion:* although the diagnosis of sarcopenia was not conclusive for these patients, we observed compromised functional capacities in women with breast cancer at the end of the chemotherapy treatment.
Keywords: Breast neoplasms; sarcopenia. antineoplastics agents; nutritional status.

Resumo

Introdução: o câncer de mama é uma das principais causas de morbidade e mortalidade no mundo. Pacientes com câncer de mama passam por rigoroso tratamento oncológico e geralmente apresentam alterações de peso. A sarcopenia é caracterizada pela diminuição da força muscular e comprometimento das capacidades funcionais relacionadas à perda grave de tecido muscular esquelético. *Objetivo:* avaliar a presença de sarcopenia em mulheres com câncer de mama em tratamento quimioterápico e correlacionar alterações na composição corporal com os tipos de tratamento. *Métodos:* estudo de coorte realizado com mulheres com diagnóstico de câncer de mama e indicação de quimioterapia em um hospital privado do sul do Brasil, acompanhadas de julho de 2018 a fevereiro de 2020 por meio de avaliação nutricional antes e ao final do tratamento. A avaliação nutricional inicial (t0) ocorreu antes do início de qualquer tratamento e a reavaliação (t1) foi agendada para data posterior ao término do tratamento. As variáveis coletadas foram idade em anos, peso corporal, altura, circunferência da cintura, atividade física, tipo de tratamento e protocolo quimioterápico, sintomas ao longo do período, força de preensão manual, percentual de massa magra, percentual de massa gorda, água e ângulo de fase (PA). *Resultados:* completaram o estudo 47 pacientes, com idade média de 47±14 anos, em sua maioria sedentários (n=28; 59,6%) e o tipo de tratamento predominante foi a quimioterapia neoadjuvante (n=32; 68%). Houve diferença estatisticamente significativa na comparação de t1 com t0 na força de preensão (p=0,007) e ângulo de fase (p=0,001), enquanto a diferença na massa magra não foi significativa (p=0,387), caracterizando ausência de sarcopenia. *Conclusão:* embora o diagnóstico de sarcopenia não tenha sido conclusivo para essas pacientes, observamos capacidades funcionais comprometidas em mulheres com câncer de mama ao final do tratamento quimioterápico.
Palavras-chave: Neoplasias da mama; sarcopenia; antineoplásicos; estado nutricional.

Introduction

Breast cancer is one of the leading causes of morbidity and mortality worldwide. In Brazil, epidemiological data indicate that it is the second most common neoplasm, second only to non-melanoma skin tumors. It is a pathology that affects women from all regions, with higher rates in the South and Southeast, with an estimated 73,610 new cases for each year of the triennium 2023-2025 [1].

Patients with breast cancer undergo rigorous oncological treatment and usually present weight changes during this period, related to the distribution of fat mass and losses of lean mass. Sarcopenia is

characterized by decreased muscle strength and compromised functional capacities related to severe loss of skeletal muscle tissue. It can be an important predictive factor for negative outcomes in cancer patients and is associated with increased risk of disease recurrence and death. In some cases, it is considered a serious clinical condition [2,3].

Individuals with sarcopenia present chemotherapy toxicity more severely, as well as lower survival and shorter tumor progression time, in addition to a higher occurrence of complications, longer hospitalizations, and longer stays in the Intensive Care Unit [4-6].

In view of the above, this study aimed to evaluate the presence of sarcopenia in women with breast cancer undergoing chemotherapy and to correlate changes in body composition with types of treatment. It is understood that early identification of the problem may increase awareness of the risks associated with sarcopenia.

Methods

Study design and sample collection

This is a prospective cohort study, conducted between July 2018 and February 2020, at the Breast Center of a private hospital in southern Brazil. The results are reported according to the STROBE statement. The study was approved by the Research Ethics Committee (CEP) of Hospital Moinhos de Vento, Porto Alegre, Brazil (No. 2,710,927).

The study population consisted of women over the age of 18 with a recent diagnosis of breast cancer and an indication for chemotherapy, who did not have metastatic disease, were not lactating, and did not have any conditions associated with muscular degeneration. Patients who did not participate in two nutritional evaluations or who developed metastatic disease after the initial assessment were excluded from the study.

For follow-up purposes, the sample was divided according to therapeutic indication: neoadjuvant treatment (patients who underwent chemotherapy before surgery) and adjuvant treatment (patients who had surgery before starting chemotherapy).

Procedure

Nutritional follow-up referrals were made during a nursing consultation, with the initial nutritional assessment (t0) occurring before the commencement of any treatment. Reassessment (t1) was scheduled for a date after the end of treatment.

The collected variables were age in years, body weight (kg) [7], height (m) [7], waist circumference (cm)[8], physical activity, type of treatment and chemotherapy protocol, symptoms over the period, hand grip strength (HGS), percentage of lean mass (%LM), percentage of fat mass (%FM), water (%W) and phase angle (PA).

Hand grip strength (HGS) and percentage of lean mass (%LM) were used to diagnose sarcopenia, according to EWGSOP criteria [3]. HGS was measured using a CAMRY® electronic dynamometer, and patients were instructed to perform three maximum isometric contractions, with a brief pause between measurements. Reference risk values were considered to be those below 20 kg, using consensus criteria.

To measure lean mass loss, anthropometric evaluation was conducted using a tetrapolar bioelectrical impedance device, Biodynamics 450 (800 μA at 50 kHz), following the methodology proposed by Lukaski[9], with electrodes placed on the upper and lower limbs in a supine position.

Nutritional diagnosis was defined by the World Health Organization, body mass index (BMI) parameters of 2006 [10].

Statistical analysis

Categorical variables were expressed as absolute and relative frequencies, while quantitative variables were presented as means and standard deviations, and in cases of skewness, as medians and interquartile ranges (P25 and P75). Normality was verified using the Shapiro-Wilk test. The comparison between initial and final evaluations was performed using the paired Student's T-test. The Spearman correlation coefficient was used to measure the correlation between age and variation measures [(final - initial) / initial * 100], and the Mann-Whitney test was used to compare variation according to treatment and protocol. The effect of treatment on lean mass was assessed using Cohen's test. A significance level of 5% was adopted, with analyses conducted using SPSS software version 21.

Results

The sample consisted of 47 patients. Table 1 presents general data of the studied population, which had a mean age of 47±14 years, the majority had a sedentary lifestyle (n=28; 59.6%) and the predominant treatment was neoadjuvant (n=32; 68.1%). Regarding the chemotherapeutic agents used, taxanes were present in 100% of the protocols, associated with anthracyclines in 80.9% of cases.

Table 1 - *Characterization of the sample regarding the type of treatment and chemotherapy protocols used. Porto Alegre, RS, Brazil, 2024 (n=47)*

Characteristics	Results (n; %)
Physical activity	
No	28 (59.6)
Yes	19 (40.4)
Type of treatment	
Adjuvant	15 (31.9)
Neoadjuvant	32 (68.1)
Treatment protocols	
Taxanes	47 (100)
Anthracyclines	38 (80.9)
Anti-Her2 antibodies	13 (27.7)
Platinum agents	4 (8.5)

Source: research data, 2020

Table 2 presents anthropometric values and body composition. There was a statistically significant difference in the comparison of t1 with t0 in FFM (p=0.007) and phase angle (p=0.001), with reductions in both values. HGS values below 20 kg were observed in 21 (45%) women at t1, while values above or equal to 20 kg were observed in 25 (54.3%) women.

There was also a decrease in lean mass at the end of the treatment, but this was not statistically significant (p=0.387). The evaluation of the effect of treatment on lean mass yielded a Cohen's d value of 0.13. The percentage of body fat remained above acceptable levels on average at both t0 and t1, with the mean variation between them showing no significant difference (p=0.463).

Table 2 - *Average values of anthropometric variables and body composition before and after treatment. Porto Alegre, RS, Brazil, 2024 (n=47)*

Variables	t0	t1	value*
Weight	69.16	68.82	0.861
BMI (kg/m2)	26.20	26.04	0.553
Lean mass %	68.03	67.24	0.387
Fat mass %	31.71	32.44	0.463
Water %	50.18	48.17	0.100
Hand grip strength	21.16	19.20	0.007
Waist circumference	90.54	90.07	0.569
Phase angle	8.51	7.21	0.001

Source: research data, 2020; *Student's t-test.

Data on the average difference between t0 and t1, the median, and the level of significance of anthropometric measurements and body composition according to the type of treatment and chemotherapy are presented in Table 3. There was a trend towards an increase in hand grip strength in adjuvant treatment, but without statistically significant differences. There was also no relationship between changes in measurements and type of treatment.

Table 3 - *Difference between t0 and t1 in anthropometric measurements and body composition according to the type of treatment*

Variables/Results	Mean±SD	Median[1]	P
Adjuvant (n=15)			
Weight	0.78±7.46	4.24 (-5.43; 5.68)	-0.326
BMI	0.78±7.46	4.24 (-5.43; 5.68)	-0.315
Lean mass	-1.88±7.58	-3.78 (-8.05; -10.95)	0.273
Fat mass	13.12±34.70	7.57 (-10.95; 20.47)	0.223
Water	-6.34±15.08	-2.98 (-7.80; 1.73)	0.119
Hand grip strength	5.57±33.04	2.15 (-15.02; 18.63)	0.059
Waist circumference	-0.19±5.05	1.05 (-4.65; 2.53)	1.00
Phase angle	-17.49±21.30	-11.76 (-35.35; -2.35)	0.361
Neoadjuvant (n=32)			
Weight	-0.94±3.16	-1.06 (-4.72; 4.33)	0.746
BMI	-0.95±6.16	-1.06 (-4.72; 4.33)	0.746
Lean mass	-0.29±10.48	-0.29 (-6.65; 7.78)	0.957
Fat mass	9.34±50.78	0.57 (-13.46; 10.09)	0.706
Water	-0.65±12.94	0.59 (-5.52; 7.54)	0.099
Hand grip strength	-11.73±18.79	-10.44 (-22.64; -1.48)	0.451
Waist circumference	-0.45±6.37	0.00 (-6.19; 5.11)	0.847
Phase angle	-8.25±18.52	-8.39 (-19.96; 0.00)	0.433
Anthracyclines (n=38)			
Weight	-0.29±6.79	-0.14 (-4.55; 5.30)	0.326
BMI	-0.29±6.79	-0.14 (-4.55; 5.30)	0.315
Lean mass	-0.83±10.28	-1.55 (-7.68; 7.57)	0.273
Fat mass	10.29±46.91	4.16 (-10.21; 15.42)	0.223
Water	-0.31±11.40	0.39 (-6.34; 6.96)	0.119
Hand grip strength	-9.06±20.69	-10.11 (-20.64; 2.55)	0.059
Waist circumference	-0.47±6.16	0.00 (-5.93; 4.63)	1.000
Phase angle	-10.88±18.86	-10.78 (-24.11;0.87)	0.361

Her2 blocker (n=13)			
Weight	-0.93±5.45	0.73 (-5.57;3.96)	0.651
BMI	-0.93±5.45	0.73 (-5.57;3.96)	0.651
Lean mass	-3.07±12.63	-6.68 (-13.5;8.43)	0.274
Fat mass	16.74±42.36	6.50 (-13.60;24.53)	0.487
Water	-2.69±14.49	-4.03 (-9.10;7.39)	0.600
Hand grip strength	6.18±31.36	-4.00 (-12.75;19.01)	0.090
Waist circumference	-2.59±5.66	-1.18 (-7.57;1.81)	0.136
Phase angle	6.87±26.18	7.69 (-17.99;2.64)	0.412
Platinum (n=4)			
Weight	-2.83±6.53	-4.11 (-8.25;3.5)	0.446
BMI	-2.83±6.53	-4.11 (-8.25;3.5)	0.446
Lean mass	-5.69±15.81	-6.44 (-19.90;9.90)	0.381
Fat mass	-3.97±18.42	-4.55 (-21.40;14.03)	0.391
Water	3.15±9.63	2.49 (-5.31;12.26)	0.507
Hand grip strength	-7.93±25.64	-15.14 (-26.64;17.97)	0.533
Waist circumference	-2.52±8.07	-4.40 (-2.50; -9.48)	0.617
Phase angle	-3,37±15,9,	-4.55 (-1.06;12.50)	0.391

Source: research data, 2020; 1Data presented as median (P25; P75).

Regarding chemotherapy, there was no statistically significant difference in the comparison of the mean values of anthropometric variables when dividing patients by the type of medication used.

Discussion

In this study, it was observed that lean mass and handgrip strength decreased at the end of the treatment, justifying a possible diagnosis of sarcopenia for these patients. However, the calculated effect of lean mass reduction was considered low, and this decrease was not statistically significant. Nevertheless, hand grip strength showed a significant decrease, although it cannot independently indicate sarcopenia according to the criteria adopted by the EWGSOP consensus [3], as it requires an association with a reduction in lean mass.

Analyzing oncology patients with various types of cancer, a study conducted in Rio Grande do Sul (Southern Brazil) identified an overall prevalence of sarcopenia of 59.6% of cases [11]. Research shows that the prevalence of sarcopenia in oncologic patients can vary between 16% and 70%, with breast cancer having lower rates, ranging between 7.8% and 15.9% [12-14].

Despite the lack of statistically significant differences, a greater reduction in handgrip strength was identified in patients undergoing neoadjuvant treatment compared to those receiving adjuvant treatment (p>0.059) in our study, suggesting that neoadjuvant treatments may negatively impact functional capacity.

Regarding the phase angle, there was a significant decrease at the end of the treatment, which was considered a marker of poor prognosis and functional decline. One study identified that the phase angle had a 22% impact on the variation of muscle strength, regardless of age, indicating that the relationship between phase angle and muscle strength is a potential indicator of disease-related functionality in breast cancer survivors [15].

Therefore, it is feasible to consider that patients, although not classified as sarcopenic, showed declines in functional capacity at the end of the treatment. This factor can compromise the nutritional status of individuals suffering from breast cancer.

The patients in our sample were overweight at the beginning of the treatment and remained so at the end, as waist circumference measurements also indicated visceral fat accumulation at both time points. Overweight and obesity have repeatedly been considered risk factors for disease recurrence and lower survival [16].

In this study, there was no difference in anthropometric measurements regarding the various chemotherapeutic agents, a result that diverges from the literature, which demonstrated an average weight gain of 6 kg during chemotherapy, with a higher propensity in patients receiving taxanes and anthracyclines [16].

Breast cancer has a high incidence and prevalence and is the malignant neoplasm that most often results in negative outcomes for women worldwide. Sarcopenia is a concern for oncology patients as it is associated with poor prognosis. A limitation of this study is the small sample size. Therefore, more studies are needed to investigate sarcopenia in breast cancer patients treated with curative intent.

Limitations and potential of the study

We understand the limitations of the fact that the study has a small sample size and was carried out during the pandemic. And as a potential, demonstrate the need for monitoring these patients.

Conclusion

Although the diagnosis of sarcopenia was not conclusive for these patients, compromised functional capacities were evident in women with breast cancer undergoing chemotherapy due to the decrease in hand grip strength and phase angle, which are considered important nutritional risk markers and are correlated with treatment tolerance and prognosis. This indicates that further investigations are necessary.

Conflict of interest

The authors report no conflicts of interest.

Financing source

None.

Authors' contributions

Conception and design of the research: Vieira AP, Teixeira RL, Bordignon C, Caleffi M, Rosa DD; Data collection:: Vieira AP, Teixeira RL, Bordignon C, Caleffi M, Rosa DD; Data analysis and interpretation: Vieira AP, Teixeira RL, Bordignon C, Caleffi M, Macedo ABT, Rosa DD; Statistical analysis: Vieira AP, Rosa DD; Manuscript writing: Vieira AP, Teixeira RL, Bordignon C, Caleffi M, Macedo ABT, Rosa DD; Critical revision of the manuscript for important intellectual content: Vieira AP, Teixeira RL, Bordignon C, Caleffi M, Macedo ABT, Rosa DD.

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