ORIGINAL ARTICLE

Correlation Between the Adductor Pollicis Muscle Thickness and the Nutritional Status

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Correlação entre a Espessura do Músculo Adutor do Polegar e o Estado Nutricional

Correlación entre el Espesor del Músculo Adductor Pollicis y el Estado Nutricional

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ABSTRACT

Introduction: Malnutrition is highly prevalent in the oncologic population and is the major cause of morbidity and mortality in the advanced stages of the disease. The adductor pollicis muscle thickness (APMT) seems to be an important variable to assess muscle compartment. **Objective:** To establish cutoff point for malnutrition from APMT among hospitalized oncologic patients. **Method:** Cross-sectional study with 100 oncologic patients hospitalized in a general hospital in Porto Alegre – RS, aged ≥20 years, admitted at the outpatient and evaluated within the first 72 hours of hospital admission. Subjective Global Assessment (SGA) was performed; weight, height, arm circumference (AC), tricipital skinfold (TSF), calf circumference (CC), APMT of the dominant (APMTDH) and non-dominant hand (APMTNDH) were measured; arm muscle circumference (AMC) and body mass index (BMI) were calculated. **Results:** According to the SGA, 31% of the sample was moderately malnourished and 33%, severely malnourished. Malnourished patients had significantly lower values of BMI, AC, TSF, CC, APMTDH and APMTNDH, as well as, longer hospital stay and death. The best cutoff point for APMTDH for the malnutrition outcome was 13.2 mm, (sensitivity of 65% and specificity of 75%) and for APMTNDH, 13.3 mm, with a sensitivity of 65% and specificity of 77%. **Conclusion:** The best cutoff point proposed in this study for APMTDH for the outcome malnutrition was 13.2 mm and 13.3 mm for APMTNDH. However, further studies are needed to confirm our findings.
Key words: Malnutrition; Nutritional Assessment; Nutritional Status; Anthropometry; Neoplasms.

RESUMO

Introdução: A desnutrição é altamente prevalente na população oncológica e aumenta a morbidade e mortalidade nos estágios avançados da doença. A espessura do músculo adutor do polegar (EMAP) parece ser uma variável importante para avaliar o compartimento muscular. **Objetivo:** Estabelecer um ponto de corte da EMAP para desnutrição entre pacientes oncológicos hospitalizados. **Método:** Estudo transversal, entre 100 pacientes oncológicos internados em um hospital geral de Porto Alegre – RS, com idade ≥20 anos, admitidos nas enfermarias e avaliados nas primeiras 72 horas de admissão hospitalar. Foi realizada a avaliação subjetiva global (ASG), mensurados peso, altura, circunferência de braço (CB), prega cutânea triciptal (PCT), circunferência da panturrilha (CP) e a EMAP da mão dominante (EMAPD) e não dominante (EMAPND); calculada a circunferência muscular do braço (CMB) e o índice de massa corporal (IMC). **Resultados:** Conforme a ASG, 31% e 33% eram, respectivamente, moderadamente e gravemente desnutridos. Pacientes desnutridos apresentaram significativamente menores valores de IMC, CB, PCT, CMB, CP, EMAPD e EMAPND, bem como maior tempo de internação e óbito. O melhor ponto de corte da EMAPD para o desfecho desnutrição foi 13,2 mm (sensibilidade 65% e especificidade 75%) e, para EMAPND, foi 13,3 mm (sensibilidade de 65% e especificidade 77%). **Conclusão:** O melhor ponto de corte da EMAPD para o desfecho desnutrição, proposto neste estudo, foi 13,2 mm e, para EMAPND, foi 13,3 mm. No entanto, mais estudos são necessários para confirmar estes achados.
Palavras-chave: Desnutrição; Avaliação Nutricional; Estado Nutricional; Antropometria; Neoplasias.

RESUMEN

Introducción: La desnutrición es altamente prevalente en la población con cáncer y aumenta la morbilidad y la mortalidad en las etapas avanzadas de la enfermedad. *El espesor del músculo adductor pollicis* (EMAP) parece ser una variable importante para evaluar el compartimento muscular. **Objetivo:** Establecer un punto de corte EMAP para la desnutrición en pacientes con cáncer hospitalizados. **Método:** Estudio transversal entre 100 pacientes con cáncer ingresados en un hospital general en Porto Alegre – RS, edad ≥20 años y evaluados dentro de las primeras 72 horas de ingreso hospitalario. Se realizó una evaluación global subjetiva (EGS), se midió el peso, la altura, la circunferencia del brazo (CB), el pliegue cutáneo tricipital (PCT), la circunferencia de la pantorrilla (CP) y la EMAP de las manos dominantes (EMAPD) y no dominantes (EMAPND). Se calcularon la circunferencia muscular del brazo (CMB) y el índice de masa corporal (IMC). **Resultados:** **S**egún la EGS, el 31% y el 33% estaban desnutridos moderada y severamente, respectivamente. Los pacientes desnutridos tuvieron valores significativamente más bajos de IMC, CB, PCT, CMB, CP, EMAPD y EMAPND, así como una mayor estadía hospitalaria y muerte. El mejor punto de corte para EMAPD para el resultado de desnutrición fue 13.2 mm (sensibilidad 65% y especificidad 75%), y para EMAPND fue 13.3 mm (sensibilidad 65% y especificidad 77%). **Conclusión:** El mejor punto de corte para EMAPD para el resultado de desnutrición fue de 13.2 mm y para EMAPND fue de 13.3 mm. Sin embargo, se necesitan más estudios para confirmar nuestros hallazgos.
Palabras clave: Desnutrición; Evaluación Nutricional; Estado Nutricional; Antropometría; Neoplasias.

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INTRODUCTION

Malnutrition is highly prevalent in the oncologic population and increases the morbidity and mortality in the advanced stages of the disease[1,2]; it affects the tolerance to cancer treatment, patient's survival, time of hospitalization negatively, and consequently increases hospital costs[2-4].

Cancer-associated cachexia is characterized by involuntary and progressive loss of body weight and muscle mass being the result of actions of factors from the host and the tumor, including cytokines that lead to systemic inflammatory response[5]. This complex and multifactorial syndrome is associated with metabolic abnormalities, anorexia, early satiety, edema, fatigue, impaired immune function and decline of mental concentration[6]. It is estimated that nearly 50% to 80% of oncologic patients present cachexia, which is responsible for 20% of the deaths[7].

Clinically, oncologic patients present sarcopenia, which apparently is the most deleterious complication, whose prevalence ranges between 20% and 70% depending on the type of the tumor[7]. The risk of mortality is well documented in sarcopenic patients, since muscle mass loss is associated with increase of the catabolic response, higher toxicity of the treatment, high risk of complications, worse clinical evolution and consequently low survival, even with obesity, which adds the risks of overweight to this condition[8].

There are several methods to evaluate the hospitalized patient. The subjective global assessment (SGA)[9] is being utilized in several clinical conditions. It can be considered a marker of the health status, the diagnosis of severe malnutrition is an indication of the disease severity and not only an index of nutrients deficit. However, the European Society for Clinical Nutrition and Metabolism - ESPEN[10] recommends the expansion of the assessment practices related to nutrition as the inclusion of measurement of anorexia, body composition, inflammatory biomarkers, physical functioning among others in oncologic patients.

Among the anthropometric measures, the assessment of the adductor pollicis muscle thickness (APMT) appears to be an important variable to evaluate the muscle compartment because it is considered an objective, fast and low cost measure, in addition of non-invasive[11-13] and useful to detect malnutrition-related early alterations[12]. Reference values and cutoff for malnutrition in relation to APMT in the healthy population have already been published[14]. Nevertheless, it appears to be necessary to establish the reliability of the values referred to APMT cutoff before it can be used as a component of the nutritional screening in hospital environment[15]. Finally, studies evaluating APMT in hospital environment concentrate mainly in the surgical population[16-19], being scarce the literature about the use of this technique in oncologic patients[20,21].

Since oncologic patients have high prevalence of malnutrition and compromise of the muscle mass, measures to help the identification of these two conditions are necessary. In addition, few studies investigated the value of this technique as predictor of the nutritional status and clinical outcomes in oncologic patients; for this reason, the objective of this study was to establish a cutoff of APMT for both hands for malnutrition, considering the diagnosis of SGA as golden standard in hospitalized oncologic patients**.**

METHOD

Cross-sectional study carried out in a general hospital of the City of Porto Alegre – RS, where the sample was defined by convenience. The inclusion criteria were: oncologic patients admitted in the infirmary that could be evaluated in the first 72 hours of hospital admission, age ≥20 years who signed the informed consent form (ICF). The exclusion criteria were: hemodynamic instability, upper limb edema and unilateral or bilateral amputation.

SGA was performed in the clinical evaluation, considering weight and diet changes and presence of symptoms, in addition to physical exam and metabolic demand of baseline pathology to classify the nutritional status. SGA was utilized in this study, classifying the patients in categories A/B/C: (A) well nourished; (B) moderately malnourished or (C) severely malnourished. For the analysis, the patients with some level of malnutrition were grouped and SGA nutritional diagnosis was used as golden standard to establish the cutoff of APMT for malnutrition.

The weight of the individuals was measured in kilos (kg) with digital scale Balmak; the height in centimeters was measured with stadiometer and with these two indicators, the body mass index (BMI) was calculated with cutoff ≤18.5 kg/m^2 for malnutrition of adults until 60 years[22] and ≤22 kg/m^2 for adults from 60 years on[23]. For bed-ridden patients, height was estimated by the height of the knee and body weight, through the equation of Chumlea et al.[24] for both genders and life cycle.

The arm (AC) and the calf (CC) circumference were measured in cm with inelastic metric tape, accuracy of 1mm, according to the techniques described in Lohman et al.[25]. For CC, values below 31 cm indicated reduction of muscle mass[26]. The tricipital skinfold (TSF) was measured with plicometer Cescorf®. The arm muscle circumference (AMC) was obtained from the values of AC and TSF through the equation: AMC (cm) = AC (cm) – π x [TSF(mm/10)]. For classification of AMC, the values in percentile proposed by Frisancho[26] were used.

The APMT measurement was carried out with the patient seated, arm bent at approximately 90°, forearm and hand on the knee. Patients were guided to keep the hand relaxed. Plicometer of the brand Cescorf® with 10g/mm² continuous pressure pinching the adductor muscle at the vertex of an imaginary triangle formed by the extension of the thumb and index[27] was utilized. The procedure was carried out in the non-dominant hand (APMTNDH) and in the dominant hand (APMTDH) in triplicate being utilized the mean as measure of APMT. To classify the values obtained, cutoff was defined for both hands. The measure of APMT was conducted for all the patients by the same nutritionist who was trained with professionals of reference in relation to the required technique for evaluation of the APMT.

The Statistical Package for the Social Sciences (SPSS), version 17.0 for Windows was utilized for all the statistical analyzes. The continuous variables were described as mean and standard deviation and the categorical, as absolute and percentage figures. Student tests t or Wilcoxon Mann-Whitney, and Fisher exact t were utilized for comparisons. To select the cutoff for APMT, it was adopted the analysis of the technique of curves Receiver Operating Characteristic (ROC). Curve ROC was generated by plotting the sensitiveness in y-axis as function of 1 – specificity in x-axis. The statistical significance of each analysis was verified by the area under the curve ROC and by the confidence interval of 95% (CI 95%). The respective CI 95% and values of p<0.05 were considered significant.

RESULTS

Between November 2016 and March 2017, 100 patients were enrolled, being 38 men (38%), 62 women (62%). The mean age was 66.1±15.9 years and mean BMI was 24.7±5.1 kg/m². The patients were evaluated in average in 1.8±1.1 days after the hospitalization. The median of the time of hospitalization was 10 days (CI 95% 7.9-12.1) and 13 deaths were registered. According to SGA, 36% of the sample was considered well nourished, 31% moderately malnourished and 33% severely malnourished.

The mean of APMTDH was 14±4.64 mm and of the APMTNDH was 13.4±4.1mm. Table 1 shows the characteristics of the sample according to the nutritional status. Patients classified as malnourished presented significant lower values of BMI, AC, TSF, AMC, CC, APMTNDH and APMTDH as well as more time of hospitalization and death.

Table 1. Characteristics of the participants according to the Subjective Global Assessment [mean ± standard deviation, median (IQR) or n (%)]

	Nourished (SGA=A)	Malnourished (SGA=B and C)	Value p
Age (years)	63.6±15.8	67.5±15.9	0.23*
Gender			0.67†
Males	15 (38.5)	23 (60.5)	
BMI (Kg/m²)	28.03±4	22.84±4.8	<0.01*
AC (cm)	30.9±3.1	24.9±4.8	<0.01*
TSF (mm)	18.9±7.8	13.6±6	<0.01*
AMC (cm)	25±3.9	21.5±3.5	<0.01*
CC (cm)	36.4±5.9	31.8±6.2	<0.01*
APMTDH	16.6±5.4	12.6±3.5	<0.01*
APMTNDH	15.8±3.7	12.1±3.7	<0.01*
Time of hospitalization (days)	5 (3-8)	8 (6-13)	<0.01‡
Outcome			0.03†
Death	1 (7.7)	12 (92.3)	

Captions: BMI: Body Mass Index; AC: arm circumference; TSF: tricipital skinfold; AMC: arm muscle circumference; CC: calf circumference; APMTDH: adductor pollicis muscle thickness of the dominant hand; APMTNDH: adductor pollicis muscle thickness of the non-dominant hand. *Test t of Student; †Fisher exact test; ‡Wilcoxon-Mann-Whitney test.

In total, 36 individuals presented previous diagnosis of hypertension, 18 individuals of *diabetes mellitus* and seven with chronic obstructive pulmonary disease. Figure 1 shows the frequency of the neoplasms. The most frequent were intestine and breast, and 19% of the patients had metastatic neoplasm.

Figure 2 shows the curve ROC of APMT of both hands and the respective areas under the curve for this population. The best cutoff for APMTDH for the outcome malnutrition was 13.2 mm with sensitivity of 65% and specificity of 75% and for APMTNDH was 13.3 mm with sensitivity of 65% and specificity of 77%.

Among 51 individuals considered malnourished by APMTDH and APMTNDH were classified as nourished by SGA, respectively, nine and eight. Table 2 presents the anthropometric variables according to APMT cutoff for malnutrition. For both hands, the values and BMI, AC, AMC and CC were significantly lower in malnourished patients compared with nourished. The APMTDH presented correlation with CC, BMI, AC and AMC (all, p<0.01) and non-statistically correlated with TSF (p=0.07). The APMTNDH was correlated with CC, BMI, AC (all, p<0.01), TSF (p=0.01) and AMC (p=0.02).

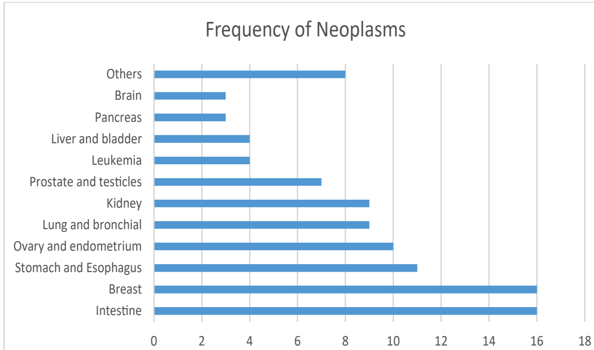

Figure 1. Frequency of neoplasms of the population evaluated

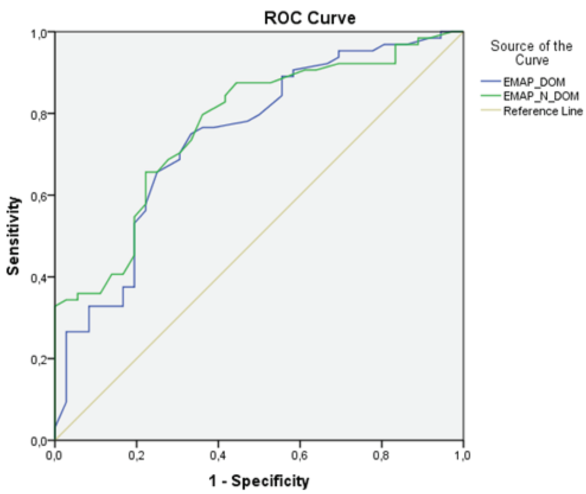

Figure 2. Relation of APMT with malnourishment

Captions: APMTDH: adductor pollicis muscle thickness of the dominant hand (area under the curve: 0.74 [CI 95% 0.64-0.84]); APMTNDH: adductor pollicis muscle thickness of the non-dominant hand (area under the curve: 0.77 [CI 95% 0.68-0.86]).

DISCUSSION

The results of this study demonstrate that the cutoff established for malnutrition diagnosis by APMT of both hands presented sensitivity and specificity values relatively low (respectively, APMTDH 65% and 75%; APMTNDH 65% and 77%). For being a cutoff initially thought for nutritional diagnosis, high specificity values would be expected. Differently, Gonzalez et al.[16] compared the results of APMT with SGA in surgical patients and noticed that APMT presented low sensitivity (dominant: 34.9%, non-dominant: 37.7%), but high specificity (dominant: 98.7%, non-dominant: 97.8%) to identify malnutrition.

Another study of surgical population[12] observed cutoff for malnutrition according to APMT of the right and left hands, respectively, 13.4 mm and 13.1 mm, sensitivity of 72.37% and 77.33% and specificity of 100% for both hands. In this sense, considering the findings of this study, of the surgical population and the data of the systematic review recently published[15], it is believed that other studies with the oncologic population would be necessary until a cutoff for this population can be established.

In the healthy population, means of APMT among men and women are, respectively, 26.1±4.4 mm and 19.8±3.3 mm for APMTDH; 25.1±4.4 mm and 18.7±3.1 mm for APMTNDH[28]. However, cutoff for APMT to define nutritional risk and/or malnutrition appear to vary widely according to the population studied. Among cardiopath admitted at the intensive care unit, cutoff of APMTDH associated to outcome malnutrition was <6.5 mm (area under the curve 0.82; CI 95% of 0.73 to 0.91)[29].

In this study, the APMT was similar to the other anthropometric variables utilized to evaluate the muscle compartment and that are relevant to establish nutritional diagnosis in hospitalized oncologic patients. Patients classified as malnourished by SGA presented significantly more time of hospitalization and death and lower values of BMI, AC, TSF, AMC, CC, APMTDH and APMTNDH. In addition, it is observed that cutoff for APMT of both hands was associated to the other anthropometric variables, except TSF.

Table 2. Anthropometric variables according to the cutoff of APMT for malnutrition [mean ± standard deviation]

	APMTDH			APMTNDH		
	Eutrophic (n=49)	Malnourished (n=51)	Value p*	Eutrophic (n=51)	Malnourished (n=49)	Value p*
BMI (Kg/m²)	27±4.3	22.5±4.9	<0.01	26.8±4.4	22.5±4.9	<0.01
AC (cm)	29.5±3.4	24.8±5.3	<0.01	29.4±3.5	24.6±5.3	<0.01
TSF (mm)	17.1±8	14.2±6.1	0.09	17.1±7.8	14±6.1	0.07
AMC (cm)	24±3.7	21.9±4.1	0.02	23.8±3.7	21.9±4.2	0.05
CC (cm)	36±5.3	30.9±6.4	<0.01	35.9±5.3	30.8±6.5	<0.01

Captions: BMI: Body Mass Index; AC: arm circumference; TSF: tricipital skinfold; AMC: arm muscle circumference; CC: calf circumference; APMTDH: adductor pollicis muscle thickness of the dominant hand; APMTNDH: adductor pollicis muscle thickness of the non-dominant hand. *Test t of Student.

In relation to the association between APMT, SGA and the other anthropometric variables, some similar studies were conducted in the oncologic population. A study of Silva et al.[30] evaluated the nutritional status of 43 oncologic patients, considering APMT, BMI, TSF, CC among others. There was slight discrepancy among the parameters utilized as APMT and SGA, but significant differences were obtained between the values of AC and APMT, indicating that these parameters can be useful in the identification of nourished and malnourished patients since cutoff values are defined.

Similar to the findings of this study, Poziomyck et al.[21] investigated 74 adults and older adults submitted to resection of gastrointestinal tract tumors with the objective of evaluating which would be the most sensitive method of nutritional evaluation. SGA, APMT, BMI, AC, AMC, percent of weight loss and TSF, in addition of biochemical exams were utilized. The results revealed that APMT (<8.8 mm) and the SGA (≥ B) were reliable in foreseeing mortality and can be used in clinical practice (p<0.01).

Among surgical patients, Melo et al.[18] conducted a study to estimate the prevalence of malnutrition by APMT in 151 eligible surgical patients. Anthropometric measures as AC, TSF and BMI, percent of weight loss and APMT measure were utilized for both hands. The authors observed high prevalence of malnutrition, in addition to significative association between nutritional diagnosis according to APMT and measures of AC, TSF and BMI, demonstrating that adductor muscle appears to be a good method to diagnosing muscle depletion and malnourishment in this population.

A study of Bragagnolo et al.[17] evaluated 124 patients submitted to gastrointestinal tract major surgery and concluded that APMT can be utilized as predictor of mortality (RR=1.26; CI 95%: 1.03-1.55; p=0.02) and tends to be predictive of complications, in addition of being an important tool to evaluate the nutritional status in surgical patients. This study still evaluated the association of APMT with SGA, which presented significant correlation among them, although SGA has not remained in the final model for regression analysis. The AMC was the variable that influenced most the measure of APMT in this population after the adjustments.

For being an exploratory cross-sectional design study, it has limitations because reverse causality interpretation may have occurred. The spectrum of the population investigated (oncologic patients treated in a general hospital with high prevalence of severer forms of the disease) could have limited the inference of the results. The sample (defined by convenience) might not has been enough to analyze these variables.

CONCLUSION

The best cutoff for APMTDH for the outcome malnutrition proposed in this study was 13.2 mm and for APMTNDH, 13.3 mm. The utilization of malnourishment indicators for evaluation of the nutritional risk between the population in general is already established and, among oncologic patients, there is still necessity of more studies to determine more robust anthropometric indicators in what concerns the associations between the altered nutritional profile and the prediction of risk for outcomes.

CONTRIBUTIONS

Camila Weschenfelder contributed substantially for the conception and design of the study, analysis and interpretation of data, wording and critical review. Sabrina Côrrea Salgueiro contributed for the gathering, analysis and interpretation of the data, wording and critical review. All the authors approved the final version to be published.

DECLARATION OF CONFLICT OF INTERESTS

There is no conflict of interests to declare.

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