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Nutritional assessment of the critically ill patients with cardiac disease under renal replacement therapy: diagnostic difficulty

Avaliação nutricional do cardiopata crítico em terapia de substituição renal: dificuldade diagnóstica

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ABSTRACT

Objective: Evaluate the nutritional status of patients with cardiac disease and concomitant renal dysfunction requiring renal replacement therapy.

Methods: Patients with cardiac disease and renal failure receiving renal replacement therapy, admitted to an intensive care unit, were submitted to nutritional evaluation, by use of anthropometric measurements and laboratory data.

Results: We studied 43 patients, mean age 64±15 years, 26 were men. The mean left ventricular ejection fraction was 0.36±0.16. Analysis of anthropometric measurements, based on body mass index disclosed that, 18 patients were normal, 6 were underweight and 19 were overweight or obese. Based on measurement of triceps skinfold thickness, 16 patients were considered normal and 27 had some degree of depletion. Measurements of midarm circumference and midarm muscular circumference showed 41 patients with some degree of depletion. Laboratory data revealed 28 patients with depletion based on albumin levels and 27 with depletion based on lymphocyte count.

Conclusions: Malnutrition is common in critically ill patients with cardiac disease and renal failure receiving renal replacement therapy. Nutritional assessment based on body mass index did not prove to be a good index for diagnosis of nutritional disorders. The nutritional evaluation must be complemented in order to identify malnutrition and introduce early nutritional support.

Keywords: Nutritional assessment; Heart failure; Renal failure; Renal replacement therapy

INTRODUCTION

In many countries, including Brazil[1] nowadays, heart failure is one of the main causes of death. In critically ill patients presence of previous myocardial dysfunction or emergence of acute dysfunction such as that secondary to acute myocardium infraction or associated to sepsis, bring about more possibilities for hemodynamic instability. Such instability could lead to impairment of perfusion of organs such as the kidneys, with consequent renal failure.[2]

As such, renal dysfunction is a frequent complication in critically ill patients with heart failure and its presence is associated to a higher risk of death.[3,4] In patients with heart failure (HF), even when asymptomatic or mildly symptomatic, impairment of the renal function, assessed by decreased creatinine clearance, was associated to increased mortality.[5,6]

The importance of a nutritional assessment in critically ill patients must be emphasized as it is known that an impaired nutritional status interferes

with response to clinical or surgical therapeutic interventions. However, notwithstanding the impact that the nutritional status has on prognosis of a patient with cardiac disease, little attention has been paid to nutritional assessment of this population.

It is known that in HF the nutritional status is affected by different factors such as a decrease food ingestion secondary to anorexia, increase of energy expenditure and metabolic changes mediated by neurohormonal and inflammatory stimuli favoring the catabolic routes.[7,8] Once set in, malnutrition contributes to a worsening prognosis of HF.[9]

The objective of this study was to analyze the nutritional profile of critically ill patients with heart failure requiring renal replacement therapy, by using anthropometric measurements and laboratory data.

METHODS

This is an observational study carried out in the Intensive Care Unit (ICU) of the Instituto do Coração do Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo (InCor, HC-FMUSP). The collected data are part of the care routine and are in agreement with the standards of the Research Ethics Committee of FUMSP.

Forty three patients with a diagnosis of heart failure and renal failure and indication for renal replacement therapy (RRT) admitted to the ICU, were included. A clinical cardiologic assessment was performed, including measurement of the left ventricular function by two-dimensional echocardiogram. Nutritional assessment was based upon anthropometric measurement and laboratory data.

Anthropometric measures included: weight (W), height (H) estimate of body mass index (BMI), measurement of triceps skinfold thickness (TSF), midarm circumference (MAC) and estimate of the midarm muscle circumference (MAMC) according to the standardized methodology.[10, 11]

Weight was checked by a bed scale or if this was impossible, by a mobile electronic suspension scale in supine position (operating license PI 8.803.059-8 international classification A 61G7/00, A61G 12/00). Patient height was checked in the supine position with stretched knees using a stadiometer by placing it at the top of the patient's head with the lower part placed against the heels.

The BMI was calculated according to the equation: BMI = current weight (kg)/height^2 (m) and patients were classified according to standards defined by the World Health Organization.[12] Measurements of MAC and TSF were made according to standardized techniques on the non-dominant arm, marking the mid point between the acromion and the oleocranon . At this point the AC was measured with a flexible tape on that point in an adjusted way, avoiding compression or looseness and TSF was measured with an adipometer. The mean of the three measurements of each parameter was considered the final mean. MAMC was calculated using the formula: MAMC(cm) = AC(cm))-[(π x PCT (cm)].[11] Results of these parameters were compared to the Frisanch reference standard[10] and patients were classified according to the percentiles for age, with the measurements smaller or equal to percentile 5 classified as depletion, between percentiles 5 and 15 (included) classified as risk of depletion and above percentile 15 classified as eutrophic.

Laboratory evaluation was carried out by determination of serum albumin, transferrine and lymphocytes. Data were collected regarding the type of nutritional therapy used, calorie and protein intake estimated and received by the patient, Calorie intake was estimated as 25-30 Kcal/kg/day and protein 1-1.5 g/kg/day. Statistical analysis included mean, standard deviation and percentage calculation. Comparative analysis between the minimum calorie and protein offer to each patient and the true ingested quantity was made using the t paired test. The adopted level of significance was of 5%.

RESULTS

Forty-three patients with diagnosis of heart disease and renal failure with indication for RRT were assessed. Mean age was 64 ± 15 years and prevalence of the male gender 26 (60.4%). The mean left ventricle ejection fraction was 0.36 ± 0.16. Prior to admission, twenty nine patients presented a clinical diagnosis of heart failure. In terms of etiological diagnosis, 7 patients presented coronary insufficiency, 14 systemic arterial hypertension, 15 coronary insufficiency associated to hypertension and 7 idiopathic dilated cardiomyopathy. Forty one patients used a vasoactive drug, dobutamine was administered to 24 (55.8%), norepinephrine to11 (25.4%) ands association of norepinephrine and dobutamine to 6 (13.9%). Twenty eight patients (65.1%) presented infection, with the pulmonary focus as the more common in 11 (25.4%), followed by catheter related infection in 10 (23.2%) cases. The most used dialysis method of was slow hemodialysis in 32 (74.4%) patients, 9 (20.9%) were submitted to classical hemodialysis and 2 (4.6%) to peritoneal dialysis.

Assessment of the nutritional status based on BMI classified 18 (42%) as eutrophic, 6 (14%) as underweight, 13 (30%), as overweight and 6 (14%) were obese

(Figure 1). Based on TSF 16(37%) patients were eutrophic, 17(40%) presented risk of depletion and 10 (23%) depletion (Figure 2). Based on MAC as well as MAMC, 41 (95.3%) patients presented depletion. Regarding nutritional assessment, considering the albumin, transferrine and lymphocytes levels, results are seen on table 1.
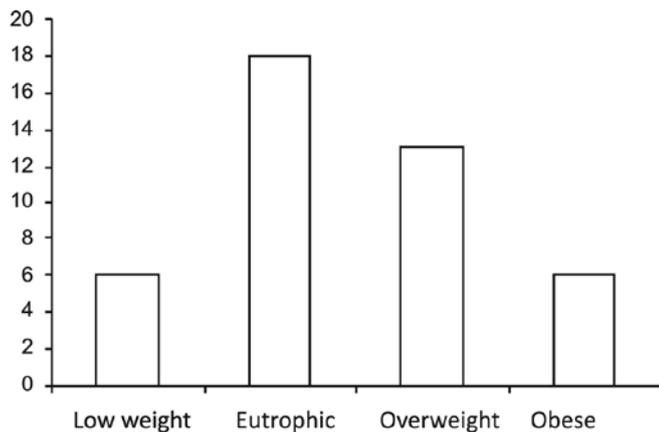

Figure 1 – Classification of the nutritional status based upon the body mass index: low weight patients (N=6), eutrophic (N=18), overweight (N=13) and obese (N=6).
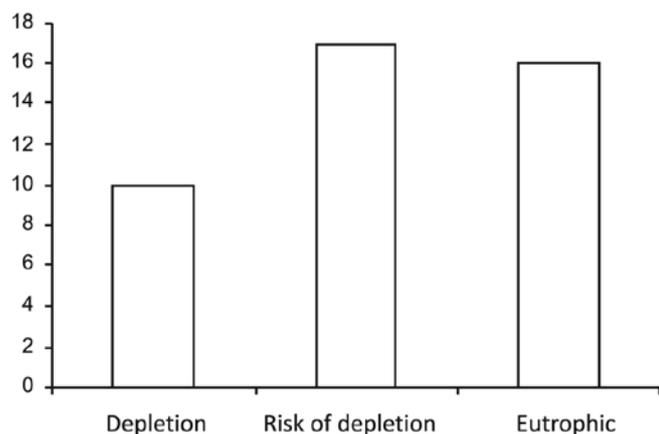

Figure 2 – Classification of the nutritional status based upon the triceps skinfold thickness: patients presenting depletion (N=10), risk of depletion (N=17) and considered eutrophic (N=16).

Mean calorie supply received by the patient was 1632±460 Kcal/day and protein supply was 69±20 g/day. Comparing the calorie and protein supply received with the minimum estimated requirement, there were no significant differences (1632±460 Kcal/day vs. 1644±316 Kcal/day, NS and 69±20 g/day vs. 66±14 g/day, NS respectively). Enteral nutritional support was used in 27 (62.7%) patients. The remaining population received an oral diet. Presence of edema of the lower limb was perceived in 20 (46.5%) patients and anasarca in 6 patients (13.9%).

DICUSSION

Heart failure is one of the major global problems in public health because of its increased prevalence, high mortality rate and high disease associated cost. It is a clinical condition leading to worsening of functional capacity, decreased quality of life and increased morbidity of the patients. HF is associated to neurohormonal activity and to the sympathetic nervous system which , in the long term, contribute to progressive impairment of the cardiac function.[13] Symptoms of pulmonary and systemic congestion appear, as well as those due to low cardiac output. In the presence of a low output and hemodynamic instability, renal perfusion is often impaired. As such, renal dysfunction is frequently detected in patients with heart failure.[14] About 25% of patients hospitalized with an acute decompensate heart failure will, during treatment present with a worsening of the renal function, that is associated to a worse prognosis.[2]

In relation to nutritional status, it is understood that anorexia, change in absorption in addition to immunological and neurohormonal mechanisms play a central role in the development of cardiac cachexia. Among the immunological and inflammatory mechanisms are included, release of the tumor necrosis factor α (TNF α) and other cytokines that participate in the catabolism process, with subsequent loss of weight at HF.[7,8,15]

Table 1 - Classification of the nutritional status based on albumin, transferrine levels and total lymphocyte count

	Eutrophic	Depletion		
		Mild	Moderate	Severe
Total lymphocyte count (cel/mm³)	0	7 (16.3)	9 (20.9)	27 (62.8)
Albumin (g/dl)	0	5 (11.6)	10 (23.3)	28 (65.1)
Transferrine (g/dl)	11 (25.6)	11 (25.6)	15 (34.9)	6 (13.9)

Results are expressed in N (%).

Patients with HF and renal dysfunction, present high morbidity and mortality rates.[4,16] Common risk factors such as arterial hypertension, diabetes mellitus and atherosclerosis, partially explain the high prevalence of coexisting heart and renal failure.[2] Patients in this study, presented high incidence of HF and arterial hypertension, substantiating data in literature.

Use of traditional tools for nutritional assessment is not validated for the critically ill. Calculation of BMI and nutritional classification based on these indexes is probably the easiest and quickest method to be reached at a low cost. However, isolated use of this index may lead to an incorrect conclusion regarding the nutritional status of a specific population such as the one studied, in which manifestation of edema is frequent.[17,18]

TSF is an important indicator of fat mass. On the other hand, MAC and MAMC are important indicators of lean mass reserve, with MAMC less affected by the presence of edema. Of the patients assessed, 40% presented risk of depletion and 23% depletion, based on TSF. Based upon the MAC and MAMC, 95% of patients presented some degree of depletion. However, classification based on BMI disclosed 41% eutrophic and only 14% were underweight.

Complementation of anthropometric evaluation, in addition to obtaining the BMI may be achieved in a simple, fast way and with a minimum use of equipment. Frequently, they are used in a survey of nutritional assessment and may be interpreted by gender, age, and classified according to reference standards.[10]

Determination of plasma proteins such as albumin, pre- albumin and transferrine is used to assess the nutritional status, since decrease of serum concentration of these hepatic synthesis proteins may be a good indicator of protein-calorie malnutrition. However, it is noteworthy that other factors such as state of hydration, liver diseases, increased catabolism, infection or inflammation that may lead to decreased serum concentration of these proteins.[19] In critically ill patients, alterations of protein markers are due to acute response to disease and do not portray the true nutritional status. Total lymphocyte count measures, momentary immune reserves indicating conditions of the organism's defense mechanism.

We perceived that among patients assessed, 65% presented severe depletion based on determination of serum albumin (albumin < 2.4 g/dL), 63% with significant lymphopenia (lymphocytes < 800/mm³) were classified as severe depletion and 14% with severe depletion based on the transferrine level (<100 g/dL). This decrease in protein serum concentration may indicate reduced liver biosynthesis due to a limited supply of energy and protein substrate, often associated to malnutrition.

CONCLUSION

We observed that malnutrition is common in critically ill patients with heart failure and renal failure. Exclusive use of BMI is limited and seems to be a poor method for identification of patients with different levels of depletion. Since it is difficult to reach a precise nutritional diagnosis in this group of patients, different assessment parameters should be used.

RESUMO

Objetivo: Realizar avaliação nutricional em pacientes cardiopatas críticos que necessitem de terapia de substituição renal.

Métodos: Pacientes cardiopatas críticos, internados em unidade de terapia intensiva, que apresentavam insuficiência renal com indicação de terapia de substituição renal foram submetidos à avaliação nutricional com a utilização de medidas antropométricas e análise laboratorial.

Resultados: Foram avaliados 43 pacientes, com idade de 64±15 anos, 26 do sexo masculino. A média da fração de ejeção do ventrículo esquerdo foi de 0,36±0,16. Avaliação do estado nutricional com base no índice de massa corpórea revelou 18 pacientes eutróficos, 6 pacientes com baixo peso, 19 pacientes com sobrepeso ou obesidade. Baseado na medida da prega cutânea tricipital, 16 pacientes eram eutróficos, 27 pacientes apresentaram algum grau de depleção e, com base na circunferência do braço e na circunferência muscular do braço, 41 pacientes apresentaram algum grau de depleção. Dados laboratoriais evidenciaram depleção grave baseado na albumina em 28 pacientes e 27 pacientes tinham depleção grave de acordo com a contagem de linfócitos.

Conclusão: A desnutrição é comum em pacientes cardiopatas críticos em terapia de substituição renal. Avaliação nutricional baseada no índice de massa corpórea não revelou ser bom método para diagnóstico de distúrbios nutricionais nesta população. Há necessidade de complementar a avaliação nutricional para identificação de desnutrição e possibilitar introdução precoce de suporte nutricional adequado.

Descritores: Avaliação nutricional; Insuficiência cardíaca; Insuficiência renal; Terapia de substituição renal

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