Nutrition 28 (2012) 616–622

Contents lists available at ScienceDirect

Nutrition

journal homepage: www.nutritionjrnl.com

Applied nutritional investigation

The obesity paradox in elderly patients with heart failure: Analysis of nutritional status

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ARTICLE INFO

Article history:
Received 29 May 2011
Accepted 13 October 2011

Keywords:
Obesity paradox
Heart failure
Body mass index
Nutrition
Anthropometrics
Handgrip

ABSTRACT

Objective: The *obesity paradox* refers to the improved survival of obese compared with non-obese elderly or diseased patients for reasons that are not clear. To assess the relative roles of fat and other factors in this improved survival, we analyzed the prognostic value of overweight and obesity elderly patients with heart failure (HF), controlling for other nutritional data such as midarm anthropometrics, serum proteins, and muscle strength.

Methods: Two hundred forty-four patients (83.2 ± 0.5 y old) hospitalized for HF were included. A nutritional survey was performed in all patients. After discharge, the patients were followed up by telephone.

Results: Fourteen patients (5.7%) died during hospitalization. The median survival was 984 d. Patients with better nutritional status as assessed by the body mass index (BMI), subjective score, midarm muscle area, triceps skinfold thickness, handgrip, lymphocyte count, and serum albumin, prealbumin, and cholesterol levels showed better short- and long-term prognoses. Obese patients with a BMI above 30 kg/m^2 showed a better long-term prognosis than those with a BMI from 25 to 30 kg/m^2, those with a BMI from 20 to 25 kg/m^2, and those with a BMI lower than 20 kg/m^2. However, survival was not significantly related to a triceps skinfold thickness above the 95th percentile. Obese and overweight patients were younger and had better a nutritional status than those with a normal or decreased BMI as shown by the anthropometrics, subjective score, handgrip, lymphocyte count, hemoglobin, and serum albumin, prealbumin, and cholesterol levels. All the nutritional data correlated closely with each other. New York Heart Association class also correlated with nutrition-derived data: as the HF class increased, the nutritional status deteriorated. On multivariate analysis, to predict long-term survival, neither BMI nor triceps skinfold thickness showed an independent predictive value, whereas a larger midarm muscle area did.

Conclusion: The obesity paradox was confirmed in this series of elderly patients with HF. Those with a high BMI and improved survival had a better nutritional status and New York Heart Association functional class than those with a lower BMI, which may explain the differences in survival.

Introduction

Obesity is a serious problem in the Western world. In the United States, adult obesity is present in 32% of the population and in 45% in blacks [1]. Obesity is a pivotal feature of the metabolic syndrome and a cause of diabetes, hyperlipidemia, and hypertension, which are cardiovascular risk factors associated with premature death [2]. However, in elderly people and patients with certain diseases, such as renal failure and use of dialysis, chronic obstructive pulmonary disease, cancer, coronary disease, and heart failure (HF), overweight (body mass index [BMI] 25–30 kg/m^2) and obesity (BMI >30 kg/m^2) are associated with better long-term survival than a normal weight (BMI 20–25 kg/m^2). This finding, based on empirical results in diseased and elderly people, is known as the *obesity paradox* [3–5].

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doi:10.1016/j.nut.2011.10.006

The obesity paradox has been studied extensively in HF [6–18]. In the previous 10 y, many studies have reported better survival in patients with HF in relation to obesity, but the reasons underlying the paradox are poorly understood. It is not clear why obese patients with HF should have a better survival than their normal-weight counterparts when being overweight is a well-known cardiovascular risk factor. Moreover, coronary disease is the main cause of HF and obesity is a long-term risk factor for the development of HF [19,20].

Two main hypotheses have been proposed to explain the improved survival of obese patients with HF. One is that fat per se, by directly neutralizing tumor necrosis factor-α and lipopolysaccharide or by adipokine production, may exert a helpful effect [21–23]. The other is that excess fat could be associated with other known beneficial factors, such as younger age, increased muscle and serum proteins, increased muscle strength, and better functional capacity. An association between low BMI and functional impairment in effort, with a poor prognosis, has been reported [7,9].

Most studies on the obesity paradox, even those including multivariate analysis, have included BMI as the sole nutritional parameter. The objective of the present study was to analyze the prognostic value of overweight and obesity in elderly patients with HF by controlling for other nutritional data such as midarm anthropometrics, serum proteins, and muscle strength by dynamometry. Because HF is a frequent condition in the elderly and nutritional status changes with age, we also included very old patients.

Materials and methods

We included 244 patients hospitalized for HF (diagnosed according to Framingham criteria) from January 2005 through July 2008 at the internal medicine unit of a country hospital (Tres Mares Hospital at Reinosa, Cantabria, Spain). The patients were 115 men and 129 women with an age range of 55 to 100 y (median age 85 y, quartiles 79–89 y).

Comorbidity

Diseases and cardiovascular risk factors were recorded according to diagnoses at discharge. They included previous cardiovascular diseases such as coronary disease, 64 (26.2%), in 7 cases with a previous revascularization procedure; stroke, 50 (20.7%); peripheral arterial vascular disease, 22 (9.1%); and atrial fibrillation in 137 (56.1%) patients; other cardiovascular risk factors such as hypertension were recorded in 157 (64%) patients; hyperlipidemia in 69 (28.3%); overweight (BMI between 25 and 30 kg/m^2) in 94 (40.2%); obesity (BMI higher than 30 kg/m^2) in 67 (28.6%); diabetes mellitus in 75 (30.7%) and smoking habit in 81 (33.3%) of the patients. We also recorded excessive alcohol consumption, 26 (10.7%); anaemia, 67 (27.5%); chronic renal failure, 51 patients (20.9%); and CPOD in 99 (40.6%) patients.

Cognitive status was assessed by the Mini Mental Status Examination (MMSE) [24] and functional ability was assessed by the Barthel index [25]. The study was approved by the institutional review board; informed consent was obtained from all patients.

Nutritional assessment

Body mass index, measured as weight (kilograms) divided by height (meters) squared, was determined after admission when most cases of fluid retention had been resolved with diuretics. Midarm circumference and triceps skinfold thickness (TSF) were measured using a Holtain Lipocaliper (Holtain Ltd. Crymych, Dyfed, UK); midarm muscle area (MAMA) also was measured [26]. Anthropometric parameters were compared with those of a Spanish sample of normal adults of the same sex and age. Results are expressed as a percentage of the 50th percentile (median) of the normal population and are classified as percentiles [27].

The subjective nutritional evaluation included examinations of the muscle masses of the upper and lower limbs and of the temporal muscle; severe atrophy was assigned 2 points, moderate atrophy was assigned 1 point, and an absence of atrophy was assigned 0 point. Bichat's fat and subcutaneous fat atrophy were scored in the same way. Thus, a subjective nutritional score was obtained based on the sum of the assigned points. As previously reported, a score of 0 to 2 was considered normal, a score 3 to 4 as mild malnutrition, and a score higher than 4 as severe malnutrition [28]. To assess muscle function, the handgrip strength of the dominant hand was determined using a Collin dynamometer (Integra Miltex, York, PA, USA) and selecting the best of three determinations [29]. During follow-up, anthropometrics and analytical determinations were repeated two times at intervals of approximately 6 mo.

HF assessment

All patients were diagnosed according to Framingham criteria [30]. Chest X-ray and electrocardiography were performed in all patients. In 221 patients, transthoracic echocardiography was performed, and left ventricular hypertrophy, left ventricular ejection fraction (LVEF), systolic or diastolic dysfunction, and dilated myocardiopathy were assessed. Ejection fraction was classified as normal (>45%), slightly decreased (40–45%), moderately decreased (30–39%), and severely decreased (<30%). HF was assessed according to the New York Heart Association (NYHA) functional classification (classes I to IV).

Statistical analysis

Because most variables were not normally distributed, they were compared using non-parametric tests such as the Kruskal-Wallis test, the Mann-Whitney *U* test, and the Spearman rank correlation coefficient, as necessary. Stepwise logistic regression was performed to discern which parameters yielded the independent predictive value for hospital survival. After discharge, all patients were followed by telephone calls. Kaplan-Meier curves and log-rank test were performed to assess differences in survival from inclusion. Cox regression with covariate survival analysis was performed to discern which parameters showed an independent prognostic value. All tests performed were two-tailed. Differences at $P < 0.05$ were considered statistically significant. Statistical analysis was performed using SPSS 15.0 (SPSS, Inc., Chicago, IL, USA).

Results

Two hundred forty-four patients (115 men and 129 women, mean age 83.2 ± 0.5 y) with HF admitted to a country hospital were included. Cognitive status was assessed by the MMSE; 207 patients (85 %) scored 24 points or higher and were considered normal, whereas the remaining 37 patients (15.2%) scored lower than 24 points and were considered to have an impaired cognitive status. Seventeen patient (7%) had MMSE scores from 21 to 23 points (slight cognitive impairment), 14 (5.7%) scored from 11 to 20 points (mild impairment), and 6 (2.5%) scored lower than 10 points (severe dementia). Functional ability was assessed using the Barthel index: 138 patients (56.6 %) scored 100 points and were considered normal, whereas 106 patients (43.4%) showed impaired functional ability: 36 (14.8%) had a score of 60 to 95 points (mild dependence), 42 (17.2%) had a score of 20 to 55 points (moderate dependence), 24 (9.8%) had a score of 20 to 35 points (severe dependence), and 4 (1.6%) had a score lower than 20 points (total dependence). Forty patients (16.4%) were institutionalized in nursing homes.

Nutritional status

Malnutrition and obesity were frequent in these patients. According to the subjective nutritional assessment, 207 (85%) were normal, 2 (1%) were moderately malnourished, and 34 (14%) were severely malnourished. According to the BMI analysis, 15 patients (6.4%) had a BMI lower than 20 kg/m^2 (underweight), 58 (25%) had a BMI from 20 to 25 kg/m^2 (normal), 94 (40%) had a BMI from 25 to 30 kg/m^2 (overweight), and 67 (29%) had a BMI higher than 30 kg/m^2 (obese), with obesity categories of grade I (30–35 kg/m^2) in 48 patients (19.7%), grade II (35–40 kg/m^2) in 15 patients (6.1%), and grade III (>40 kg/m^2) in 4 patients (1.6%).

Midarm anthropometrics showed that 20.7% of the patients had MAMA values below the 5th percentile and 10.3% had values from the 5th to the 10th percentiles and 2.2% of patients had TSF