Special Section on Obesity

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Obesity and Fractures in Postmenopausal Women: A Primary-care Cross-Sectional Study at Santa Maria, Brazil

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Abstract

Obesity and osteoporosis are chronic disorders with increasing prevalence worldwide. The aim of this study was to investigate the association between obesity and fracture in postmenopausal women from Santa Maria, Brazil. A cross-sectional study was carried out at Santa Maria (parallel 29° south), Brazil. Postmenopausal women aged ≥55 yr who had at least 1 appointment at the primary care in the 2 years before the study were recruited from March 1, 2013 to August 31, 2013. The Global Longitudinal Study of Osteoporosis in Women study questionnaire was applied with permission of The Center for Outcomes Research, University of Massachusetts Medical School. Height and weight were measured according to the World Health Organization protocol. Bone fractures (excluding hand, feet, and head) that occurred after the age of 45 yr were considered as the outcome. Overall, 1057 women completed the study, of whom 984 had body mass index measured. The mean (standard deviation) age and body mass index of the women included in the study were 67.1 (7.6) yr and 29.2 (5.5) kg/m^2, respectively. The prevalence of fractures in obese and nonobese women was similar (17.3% vs 16.0%); 41.4% of all fractures occurred in obese women. Obese postmenopausal women make a substantial contribution to the overall burden of prevalent fractures in this population. Our results provide further evidence in support of the concept that obesity is not protective against fracture.

Key Words: Bone fractures; obesity; osteoporosis; postmenopause.

Introduction

Obesity and osteoporosis are chronic disorders with increasing prevalence worldwide. Both are key causes of morbidity and mortality in the elderly and share a complex multifactorial pathophysiology involving genetic, environmental, and hormonal factors *(1)*.

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Body mass index (BMI) is a major determinant of bone mineral density (BMD) *(2−4)*. Until recently, it was widely believed that obesity was protective against fracture as a result of higher BMD and the protective effects against falls of soft tissue padding *(5)*. However, in 2010, a high prevalence of obesity was reported from the United Kingdom in postmenopausal women with incident fracture *(6)* and subsequently in the Global Longitudinal Study of Osteoporosis in Women (GLOW), a multinational study; a similar prevalence and incidence of fractures was demonstrated in obese and nonobese postmenopausal women *(7)*.

High BMD associated with obesity may reflect the mechanical demands on the skeleton *(8,9)*. Nevertheless, a higher BMD in obese people may not confer adequate

protection against fractures, particularly in view of the higher incidence of falls in this population *(10,11)*. Moreover, risk factors for fracture in obese people have not been fully characterized. The Study of the Osteoporotic Fractures found some similarities with risk factors in women of normal weight (age, previous fracture, and low BMD) *(12)*.

The objective of this study was to evaluate the association between obesity and fracture in postmenopausal women from Santa Maria, Brazil and to identify factors associated with fracture in obese women. To the best of our knowledge, this was the first study to be carried out in Latin America.

Methods

Study Design and Population

A cross-sectional study was carried out at the municipality of Santa Maria, parallel 29° south, Brazil. Women aged ≥55 yr who had attended at the basic health unit (UBS) at least once in the 24 months before the study were invited to participate. The UBS is equivalent to the primary care service in the United Kingdom. All the UBS practices at the municipality of Santa Maria were included. The target population was informed about the study through advertisements in their UBS plus personal invitation by the investigators while they were attending the UBS. Women with cognitive impairment, difficulty with communication, and those who were still menstruating were excluded. The recruitment period was from March 1, 2013 to August 31, 2013.

This study was approved by the Center for Continuing Education in Health of the Health Department of the Municipality of Santa Maria (Ofício 492/2012/SMS/NEPeS) and by the Ethics Committee of the Federal University of Santa Maria (CAAE 11166012.6.0000.5346). All study procedures were in accordance with the Declaration of Helsinki and the Brazilian Resolution 196/96. Informed consent was obtained from all participants.

Measurements

A questionnaire including information about demographic characteristics (age, gender, education level, weight, and height), lifestyle (physical activity, alcohol, and tobacco use), previous fractures, family history of fractures, menopause, medications, and comorbidities was administered *(13,14)*. The questionnaire was translated into Portuguese by 2 of the researchers (RMC and MOP) with the authorization of the GLOW study investigators and The Center for Outcomes Research, University of Massachusetts of Medical School. Additionally, quality of life was evaluated by the SF-36 questionnaire (license number QM016471) *(15)*.

Alcohol abuse was defined as an intake of 21 or more units per week *(13,14)*. Physical activity was quantified by the number of days that a woman had walked for at least 20 minutes in the last 30 days *(13,14)*.

Weight was measured at the UBS with the patient wearing only light clothing without shoes. All scales used in the study were validated by the Brazilian National Institute of Metrology, Quality and Technology *(16)*. Weight was measured in kilograms and was recorded to 1 decimal place. Height was measured according to the recommendations of the World Health Organization (WHO) *(17)*. BMI was calculated using the formula weight in kg divided by the square of height in meters. Obesity was defined as BMI ≥30 kg/m^2. The BMI categories were defined according to the WHO: underweight (BMI ≤18.49 kg/m^2), normal weight (BMI ≥ 18.5 ≤ 24.9 kg/m^2), overweight (BMI ≥ 25 ≤ 29.9 kg/m^2), obesity I (BMI ≥ 30 ≤ 34.9 kg/m^2), obesity II (BMI ≥ 35 ≤ 39.9 kg/m^2), and obesity III (BMI ≥ 40 kg/m^2) *(18)*.

Outcomes

Self-reported fractures (excluding hand, feet, head, and high-impact fractures) that occurred after the age of 45 yr were considered as the outcome. Self-report of fractures has been shown to be reliable *(19,20)*. Major fractures were defined as hip, forearm, humerus, or clinical vertebral.

Statistical Analysis

Data were reported as prevalence rate (percent). The Fisher exact and Student's *t* tests were used to assess the association between BMI and fractures. Associations between fracture sites and obesity were evaluated using the Fisher exact test. Possible factors associated with fractures were first evaluated by the Fisher exact test, Student's *t* test, and chi-square test. Data are expressed as mean (standard deviation), prevalence rate (percent), and proportional distribution. Univariate logistic regression models were calculated for all factors that showed a *p* value <0.1. These factors were then included in backward conditional logistic regression models. All logistic models were tested for goodness of fit by the Hosmer-Lemeshow test and showed a good fit. The results of these models were expressed as odds ratio (OR) and 95% confidence intervals (CIs)Associations were considered significant when the *p* value was <0.05. Statistical analysis was performed using SPSS for Windows, version 19 (IBM Brazil, São Paulo, Brazil).

Results

Population Characteristics

Overall, 1301 women were invited to participate in the study. Of those, 239 declined and 5 did not meet the inclusion or exclusion criteria. Of the 1057 women who completed the study, 984 had their BMI measured (Fig. 1). The mean (standard deviation [SD]) age and BMI of the women included in the study were 67.1 (7.6) yr and 29.2 (5.5) kg/m^2, respectively. The prevalence of obesity was 40.9% (25.3% obese I; 14.2% obese II, and obese III). Only 1.3% of the study population was underweight. In the evaluated group, 162 women (16.5%) had a history of fracture, of whom 109 (11.1%) had a major fracture. The characteristics of the women included in the study are shown in Table 1. Although the reported BMI (collected in the questionnaire) showed a strong correlation