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ORIGINAL ARTICLE

''Metabolically healthy'' obesity: Prevalence, clinical features and association with myocardial ischaemia

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Summary

Objective: To evaluate the prevalence of the ''metabolically healthy'' (MH) or ''metabolically unhealthy'' (MU) obesity phenotypes and their association with cardiorespiratory fitness and inducible myocardial ischaemia.

Methods: Individuals without known coronary artery disease undergoing myocardial perfusion single-photon emission computed tomography (MPS) were studied. Those without dyslipidemia, hypertension, or diabetes were considered MH, and when ≥ 1 of these was present, MU status was considered present. Summed stress and difference perfusion scores (SSS and SDS, respectively) were calculated; a SDS >1 defined ischaemic MPS.

Results: MH patients were 35.0% of the nonobese population and 23.5% of the obese ($p < 0.001$). The prevalence of ischaemia was not significantly different between MH patients with obesity or MH patients without obesity (10.9% vs 9.1%, $p = 0.3$), except for patients with body mass index $\geq 40 \, \text{kg/m}^2$ (21.9%). MH obese patients were less frequently able to exercise and had lower exercise capacity than the nonobese patients.

Conclusions: The prevalence of myocardial ischaemia was not significantly different between MH obese or nonobese individuals, supporting the concept of the

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''metabolically healthy obesity''. However, there are other factors involved, such as the ability to exercise, that influence the risk of myocardial ischaemia, limiting the ''safety'' of that obesity phenotype.

Introduction

Obesity is a serious, worldwide and growing problem, with an estimated prevalence of 13% in the adult world population and of 17.9% in Brazil in 2014 [1,2] and associated complications ranging from cardiovascular disease to cancer [3,4]. Amongst the population with obesity, individuals without the typical metabolic disorders associated with obesity and hypothesised to have lower risk of complications have been called the ''metabolically healthy'' (MH) obese, who lack a universal definition but in general are considered as those who do not have insulin resistance, lipid disorders, or hypertension [5].

Studies indicate that up to 1/3 of the obese adults can be categorised as MH [5—7]. These are considered to have a risk of cardiovascular disease and mortality that is intermediate between that of MH, normal weight individuals and that of metabolically unhealthy (MU) obese adults [8,9]. Therefore, besides defining different phenotypes of obesity beyond body mass index (BMI), definitions such as MH and MU may allow for the stratification of chronic disease risk and for the prioritization of diagnostic and therapeutic resources in clinical settings [10]. Nonetheless, when assessing populations with an a priori increased risk, such as individuals with obesity, the clinical evaluation of traditional cardiovascular risk factors for the prediction of cardiovascular disease or prognostic stratification is less useful, and further noninvasive testing may provide more accurate evaluation. In that sense, myocardial perfusion single-photon emission computed tomography (MPS) is known for its feasibility in virtually all patients, including the obese, as well as excellent diagnostic and prognostic values [11—13]. The assessment of myocardial ischaemia with MPS in obese individuals may help to understand the different obesity phenotypes as well as to direct patient monitoring. This study aimed to evaluate, in individuals without known coronary artery disease undergoing MPS, the prevalence of the MH and MU obese phenotypes and their association with demographic data, cardiorespiratory fitness and inducible myocardial ischaemia.

Methods

Study population

The research was approved by the institutional review board, and written informed consent was obtained from all patients. From consecutive patients undergoing MPS for clinically indicated reasons at a single centre in Rio de Janeiro, Brazil between 2011 and 2014, those without known coronary artery disease (defined as the history of myocardial infarction, myocardial revascularization by coronary angioplasty or bypass surgery, or the presence of known obstructive epicardial coronary disease detected by coronary computed tomography or coronary angiography and treated medically) were selected. Demographic and clinical variables were ascertained at the time of the study by patient interview and review of medical records. Obesity was defined as a body mass index (BMI) $\geq 30 \, kg/m^2$. Patients were assigned according to the World Health Organization into the following categories: normal weight (BMI $18.5-24.9 \, kg/m^2$), overweight (BMI $25-29.9 \, kg/m^2$), obesity class I (BMI $30-34.9 \, kg/m^2$), class II (BMI $35-39.9 \, kg/m^2$), or class III (BMI $\geq 40 \, kg/m^2$) [14].

Individuals were considered metabolically healthy (MH) if they had none of the following: dyslipidemia, considered as the history of hypercholesterolemia, hypetrygliceridemia or low HDL, alone or in combination (defined by self-report plus the referring physicianís report or the prescription of specific medications for the control of blood lipids); systemic hypertension, defined by history or use of antihypertension medication; or diabetes, considered as the history of diabetes with the use of hypoglycemic medication. Metabolically unhealthy (MU) individuals were considered as those with at least 1 of these 3 risk factors (diabetes, hypertension or dyslipidemia).

Myocardial perfusion single-photon emission computed tomography

Patients underwent treadmill exercise (n = 3313, 59.6%) or pharmacological stress (n = 2250, 40.4%)