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Phenotype of sarcopenic obesity in older individuals with a history of falling

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ABSTRACT

Background: Although sarcopenic obesity is associated with disability in middle-aged community-dwelling individuals, the phenotype of sarcopenic obesity in people 65 and older, especially those with a history of falls, remain unknown. To fill this knowledge gap, the goal of this study was to obtain a comprehensive phenotype of sarcopenic obesity in this high-risk population.
Methods: Cross-sectional study of 680 subjects (mean age = 79 ± 9, 65% female) assessed between 2009 and 2013 at the Falls and Fractures Clinic, Nepean Hospital (Penrith, Australia). The assessment included a comprehensive examination, posturography, gait velocity, grip strength, bone densitometry and body composition by DXA, and blood tests for biochemical status. Patients were divided into four groups based on DXA and clinical criteria: 1) sarcopenic obese; 2) non-sarcopenic obese; 3) sarcopenic and; 4) non-sarcopenic/non-obese. The difference between groups was assessed by one-way ANOVA, chi-square analysis, and multivariable linear regression.
Results: Sarcopenic obese subjects were older (81.1 ± 7.3), mostly female and more likely to have lower bone mineral density, lower grip strength, slower gait velocity, and poor balance. Sarcopenic obese individuals also showed significantly higher parathyroid hormone and lower vitamin D.
Conclusions: We identified a particular set of clinical and biochemical characteristics in our subgroup of sarcopenic obese older fallers. Identification of these particular characteristics in the clinical setting is essential in order to prevent poor outcomes in this high-risk population.

1. Introduction

In modern society, the convergence of obesity and aging is yielding a subgroup of older individuals at greater risk of disability, falls, and fractures, otherwise known as sarcopenic obesity (Ormsbee et al., 2014; Stenholm et al., 2008). Aging causes a progressive decline in muscle mass, independent of any disease process, called sarcopenia. Sarcopenia is an important cause of disability, loss of independence and frailty in the elderly (Kim & Choi, 2013). The combination of obesity and sarcopenia in the elderly potentiate each other, maximizing their effects on disability, morbidity and mortality (Ormsbee et al., 2014; Stenholm et al., 2008). These "fat frail" have a dual hit, as they are weak due to sarcopenia and need to carry greater weight due to obesity (Zamboni, Mazzali, Fantin, Rossi, & Di Francesco, 2008).

Together, sarcopenia and obesity not only cause disability (Stenholm et al., 2008), but also increase the risk of osteoporosis, falls and fractures (Ormsbee et al., 2014). Hence, one of the aims of this study was to examine how this balance is tipped when an older individual with a previous history of falls also has sarcopenic obesity. A recent study by Scott et al. (2014), performed in a community-dwelling low-risk population (mean age 69-year-old), reported that dynapenic obesity (low muscle strength + obesity), but not sarcopenic obesity, is predictive of increased falls risk

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score. Considering that their study was performed in middle-aged subjects and that sarcopenia has a greater clinical significance in older persons (Mithal et al., 2013; Perna, Guido, Grassi, & Rondanelli, 2015; Urano and Inoue, 2015) – especially in those with a history of falls – a second aim of our study was to determine the effect of sarcopenic obesity on falls risk in an older population with previous history of falls.

In addition, the third aim of this study was to characterize the functional and biochemical status of sarcopenic obese older individuals. Whether sarcopenic obese individuals have poor balance, which would predispose them to falls, remains unknown. In addition, understanding the nutritional deficits that are particular to these individuals could be easily identified and most time modifiable. Overall, in this study, we hypothesized that sarcopenic obese older fallers have a particular set of functional and biochemical characteristics that should be promptly identified in order to prevent poor outcomes in this high-risk population.

2. Materials and methods

2.1. Subjects

With approval and oversight from the Nepean Blue Mountains Local Health District Human Ethics Research Committee we performed a cross-sectional study assessing all patients referred to the Falls and Fractures Clinic at Nepean Hospital (Penrith, NSW) (Gomez, Curcio, Suriyaarachchi, Demontiero, & Duque, 2013) between 2009–2013. Patient identifiers including name, address, or telephone number were not collected. Eligibility criteria to be assessed at the clinic included a mini-mental status examination (MMSE) >17/30, able to mobilize with a walker or cane(s), and at least one of the following: previous history of fall (s) within the last year, established gait and/or balance problem (e.g. by Get Up and Go Test), unexplained fall with apparent complex medical cause(s), history of symptomatic or asymptomatic fragility fracture(s) (last 5 years) and clinical or radiological BMD risk of fractures. The study was conducted in accordance with the ethical standards set forth in the Helsinki Declaration (1983).

2.2. Definition of falls

Falls were defined as “unexpected and involuntary loss of balance, causing the person an undesired contact with the ground” (Lamb, Jørstad-Stein, Hauer, & Becker, 2005). The occurrence of falls was assessed in a retrospective manner asking the participant, 1) whether they have suffered a fall and, 2) the number of falls experienced during the six months prior to the day of the assessment.

2.3. Clinical assessment

Height was measured with a digital stadiometer. The nutritional assessment was performed by completing the Mini-nutritional Assessment (MNA) tool (Kaiser et al., 2009). A comprehensive medical assessment was performed including comorbidities, self-report of decreased mobility in the last 3 months, family history, fracture history, osteoporosis risk assessment (hormone replacement therapy [HRT], menopause age, smoking, alcohol), falls risk (hearing & visual deficit, altered elimination, impaired mobility), and assessment of postural drop.

2.4. BMD and body composition by dual-energy X-ray absorptiometry (DXA)

BMD in femoral neck and body composition (fat and lean mass) were assessed using a Hologic DPX-IQ Discovery DXA machine (GE Healthcare, Pollards Wood, UK), which was used throughout the study with quality control being performed using a spine and body composition phantom prior to testing. Total body fat, total body fat percentage, and appendicular lean mass (ALM) were calculated.

2.5. Grip strength

Grip strength was measured following the Groningen Elderly Test using a Smedley Hand Dynamometer (CH Stoteltin Co., Wood Dale, IL) (Soer, van der Schans, & Geertzen, 2009). The best of three attempts (with 30 s rest between them) was recorded.

2.6. Gait assessment

A GAIT Rite® (CIR Systems Inc, Havertown, PA) instrumented walkway (810 cm × 89 cm × 0.625 cm, sample rate = 80Hz) was positioned along a straight section of the walkway to record spatiotemporal gait data.

2.7. BMI

Body mass index was defined as a person’s weight in kilograms divided by the square of their height in meters.

2.8. Obesity, sarcopenia, and sarcopenic obesity

Obesity was defined following the recommendations of the American Heart Association (AHA) (Cornier et al., 2011). This definition is considered more accurate than just BMI calculation because, although BMI has been useful to describe secular changes in adiposity at the population level, BMI cannot always properly discriminate the risk of chronic disease at the individual level, which was one of the aims of the present study. Sarcopenia was determined by fulfillment of at least two of the following accepted criteria (Cruz-Jentoft et al., 2010; Laurentani et al., 2003): gait velocity <80 cm/second, grip strength <20 kg for females and <30 kg for males and height adjusted appendicular lean mass (ALM/ht^2) <5.5 kg/m^2 (female) and <7.26 kg/m^2 (male). Sarcopenic obesity was defined according to previous reports (Ormsbee et al., 2014; Stenholm et al., 2008), modified following AHA criteria as previously described (Scott et al., 2014). Based on DXA and clinical criteria, patients were divided into four groups: 1) sarcopenic obese; 2) non-sarcopenic obese; 3) sarcopenic and; 4) non-sarcopenic/non-obese.

2.9. Postural assessment

The Balance Rehabilitation Unit (BRU) is a recently validated and reliable method that combines variable somatosensory, visual and vestibular conditions, which are used to assess and train balance(Boersma et al., 2012). The assessment component of the BRU (posturography) evaluates postural control responses to different types of visual and visual-vestibular stimulation on standing surfaces of different firmness. The posturography report is automatically generated by the software integrated with the BRU system and includes limits of stability (LOS) and center of pressure (COP) under several different conditions. Low LOS and high COP are associated with high falls risk. The assessment takes about 30 min to perform.

2.10. Serum measurements

Venous blood was collected from resting subjects for the measurement of serum 25(OH) vitamin D3 (VitD), calcium, creatinine, parathyroid hormone (PTH), and albumin. These serum parameters were selected based on previous studies assessing