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Depression but not anxiety is associated with metabolic syndrome in primary care based community sample☆

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Summary
Introduction: Metabolic syndrome (MetS) and depression are considered important risk factors for diabetes and cardiovascular disease. Recent evidence suggests that depression can be an important predictor of MetS. Data on the association between anxiety and MetS remain mixed. In a large primary care based community sample we investigated an association of depressive and anxiety disorders and symptoms with MetS.
Methods: A total of 1115 (51% men, mean age 62.0 ± 9.6 years) randomly selected individuals of 45 years and older were evaluated for: (i) MetS using the World Health Organization (WHO), National Cholesterol Education Program Adult Treatment Panel III (NCEP/ATP III) and International Diabetes Federation (IDF) criteria; (ii) current major depressive episode (MDE) and current generalized anxiety disorder (GAD), the Mini International Neuropsychiatric interview; (iii) lifetime MDE; and (iv) symptoms of depression and anxiety, the Hospital Anxiety and Depression scale (HADS). Socio-demographic characteristics (education, residence, marital status and social status) and medical histories (physical activity, smoking status, alcohol consumption and histories of myocardial infarction and stroke) were also evaluated.
Results: After adjusting for socio-demographic status, medical histories and current GAD, current MDE and lifetime MDE were associated with greater prevalence of MetS according to the WHO criteria (OR = 1.7, 95%CI [1.1—2.7] and OR = 3.7, 95%CI [2.4—5.7], respectively, $p \leq 0.001$). Lifetime MDE was also associated with MetS according to the IDF and NCEP/ATP III criteria. On the other hand, current GAD was not associated with MetS in multivariate regression models when adjusted for current MDE. Similar results were obtained when evaluating an

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association between depression/anxiety symptoms and MetS, since elevated depressive, but not anxiety, symptoms were independently associated with MetS.
Conclusions: Depressive, but not anxiety, disorders and symptoms are associated with greater prevalence rate of MetS. Assessment and management of MetS risk factors should be considered in depressed individuals.

1. Introduction

Metabolic syndrome (MetS) is a constellation of cardiovascular disease risk factors, including central obesity, hyperglycemia, dyslipidemia, and arterial hypertension (Eckel et al., 2005). MetS is strongly associated with type 2 diabetes mellitus and cardiovascular disease morbidity and mortality (Eckel et al., 2005). Increasing age is a strong risk factor for Mets. For example, it is estimated that the prevalence of MetS doubles in individuals of 40 years of age older, and more than a half of elderly population suffer from MetS (Ford et al., 2002; Gupta et al., 2004; Horakova et al., 2005).

Most prevalent presentations of mental distress are symptoms of depression or anxiety. It is well-established that depression is associated with increases risk for diabetes mellitus (Mezuk et al., 2008) and cardiovascular disease (Musselman et al., 1998) in apparently healthy individuals, and it has been suggested that MetS should be considered as pre-morbid condition that precedes the development of clinically overt diabetes mellitus and cardiovascular disease in depressed patients (Pan et al., 2012). Indeed, a number of studies have consistently document that depressive symptoms or disorders are an important risk factor for MetS (Kinder et al., 2004; Heiskanen et al., 2006; Goldbacher et al., 2009; Foley et al., 2010; Pan et al., 2012). However, to the best of our knowledge, studies evaluating the association of depressive symptoms and disorders with MetS in the same cohort are lacking.

The results of the studies on association between anxiety and MetS remain mixed. Some authors have reported more anxiety disorders (Carroll et al., 2009) and greater anxiety symptoms severity (Roohafza et al., 2012) in MetS patients, while others failed to replicate such associations (Skilton et al., 2007; Takeuchi et al., 2009). Depression, a common comorbidity of anxiety disorders, may be an important confounder evaluating an association between anxiety and MetS. Towards this end, further studies delineating an association between anxiety and MetS are warranted, since anxiety symptoms and disorders are common in general population (Kessler et al., 2005).

Three major sets of MetS diagnostic criteria are commonly used across research studies and in clinical practice. According to the World Health Organization (WHO), the diagnosis of the MetS requires the presence of insulin resistance plus any two additional risk factors (Alberti and Zimmet, 1998). However, assessment of insulin resistance can be challenging in routine clinical settings. As a consequence, the National Cholesterol Education Program Adult Treatment Panel III (NCEP/ATP III) (Expert Panel, 2001) has emphasized other metabolic and cardiovascular risk factors, and excluded insulin resistance from the MetS diagnostic criteria. Finally, according to the International Diabetes Federation (IDF), abdominal obesity is the required feature of the MetS (International Diabetes Federation, 2005). The NCEP/ATP III and IDF MetS diagnostic criteria can be more readily applied in routine clinical setting, since they do not require assessment of insulin resistance. As a consequence, the NCEP/ATP III and IDF criteria are the most widely employed. Studies simultaneously employing three major sets of MetS diagnostic criteria when evaluating an association between psychological distress and MetS could potentially fortify significance of such association and contribute to the literature exploring reliability of different MetS criteria.

Therefore, the primary aim of the study was to investigate the association of depressive and anxiety disorders with MetS, diagnosed according to the WHO criteria in a large primary care based community sample of middle aged and elderly individuals. The secondary aim was to replicate these findings using depression and anxiety scores of the standard scale as well as less sophisticated MetS criteria.

2. Subjects and methods

2.1. Procedures and subjects

From February 2003 until January 2004 the study subjects were recruited from a Primary Health Care Centre (PHCC). The PHCC employs 24 family physicians and covers all inhabitants at Raseiniai district that includes 6 towns and 19 villages. Men and women of 45 years of age and older were randomly selected (using probability systematic method — step of selection from list every fourth subject) from the database of inhabitants registered at the PHCC. There were no exclusion criteria. Invitation letters were sent to all eligible subjects via regular mail.

A total of 1624 subjects met the study criteria. One-thousand one-hundred and twenty subjects (564 men and 556 women) responded to the invitation and were studied (response rate 69%; 68% for men and 70% for women). Five individuals (two men and three women) were not included in the analyses because they arrived for the study visit less than 12 h after their last meal ($n = 3$) or refused from psychiatric assessment ($n = 2$). Therefore, the final sample was comprised of 1115 subjects. Characteristics of subjects who have not responded to the invitation to participate in study were not significantly different from those who responded, but women who have not responded were older ($p < 0.05$).

The study visit took place in the morning at the PHCC. In an invitation letter, all subjects were asked to fast for at least 12 h prior to the study visit. On arrival, venous blood samples were drawn and urine samples were collected for biochemical evaluations. Next, anthropometric characteristics and