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Alexithymia as a risk factor for type 2 diabetes mellitus in the metabolic syndrome: a cross-sectional study

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ABSTRACT

Alexithymia is a clinical trait consisting of diminished introspective and interoceptive capacities that has been shown to implicate elevated autonomic outflow and to bias for hypertension. To estimate relative risk associated with alexithymia in the metabolic syndrome (MetS), we conducted a cross-sectional analysis of patients with manifest type 2 diabetes mellitus (T2DM) or familial diabetes risk ($N=101$; 67 females; age 45.6 ± 13.96) in a nationwide sampled treatment cohort for MetS in the Ukrainian governmental health care system. Laboratory data of single components of the MetS according to International Diabetes Federation Consensus were dependent measures in multivariable regression models with self-reported alexithymia severity (TAS-20) and socio-demographic data. TAS-20 as the sole surviving psychometric predictor for T2DM in the simplest regression equation provided the best model fit: OR 1.073, $Z=19.04$, (95%CIs 1.065–1.081). For microalbuminuria, the best fitting model was OR 1.030, $Z=3.49$ (95%CIs 1.013–1.048). TAS-20 predicted also triglyceride level at Wald-$\chi^2=1299.27$, $Z=36.05$ (95%CIs 0.052–0.058) and blood pressure maximum at Wald-$\chi^2=2309.05$, $Z=48.05$ (95%CIs 2.402–2.606). Our results show that alexithymia severity contributes to MetS by covarying with several of its single components, and that it may be a substantial concurrent indicator of T2DM and cardiovascular risks in MetS.

1. Introduction

Metabolic syndrome (MetS) is a constellation of conditions considered comprising crucial risks conducive to T2DM and cardiovascular disease (CVD). Over the last 12 years, MetS criteria have seen five major revisions in details. However, all operationalized definitions address specific metabolic abnormalities, hypertension and obesity (Eckel et al., 2010). MetS is present in 12.5%–19.1% of patients with normal glucose tolerance (Riediger and Clara, 2011), in 55% of those with impaired fasting glucose tolerance, and in 81% of those with T2DM (Ginsberg and Stalenhoef, 2003). The presence of MetS increased the risk of T2DM manifestation 24-fold during a 5-year period (Sattar et al., 2003). Furthermore, CVD risk climbed towards 20% once T2DM had developed in MetS patients (Girman et al., 2004). MetS risk increases with aging, being 44% in the seventh decade of life having the MetS compared to 7% prevalence in the third decade (Ford et al., 2002). Elevated MetS risks have been reported for depressive disorders and schizophrenia, and also psychological distress increases the risk for MetS by a factor of more than two (Puustinen et al., 2011).

Alexithymia is a trait that comprises impairments in the perception of bodily states, their cognitive representation, and verbal communication. Increasing evidence suggests that alexithymia plays a role in a range of psychiatric, neurological, and internal medical problems, such as schizophrenia (Maggini and Raballo, 2004), traumatic brain injury (Wood et al., 2009) or CVD (Kauhanen et al., 1994). Alexithymia has been suggested to consist of a neurodevelopmental cognitive deficit originating in parent–offspring transmission (Lemche et al., 2004). Several neuroimaging studies have revealed that alexithymia traits are based on brain regions subserving interoception and physiological monitoring (e.g. Lemche et al., 2013). General health behaviors, such as poor dieting habits and sedentary lifestyles known to contribute to MetS, were found influenced by alexithymia (Helmers and Mente, 1999). A corpus of findings in T1DM supports the assumption that mental factors such as alexithymia in parents and in diabetic offspring, and the ability to monitor bodily homeostasis, might have an impact upon glycemic control and hypoglycemic incidence rates (Chatzi et al., 2009; Housiaux et al., 2010; Luminet et al., 2006; Meunier et al., 2008; Topsever et al., 2006). It is therefore possible that interoceptive impairments could also be involved in the emergence of T2DM.

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Given the evidence that the development of T2DM could be partially dependent on autonomic dysbalance, and perhaps also on the ability to monitor homeostasis of satiety levels, we tested the hypothesis, that alexithymia factors may contribute to diabetes risk in MetS. To test the possibility of such an influence, we measured severity of alexithymia and its subfactors in an at-risk sample for T2DM that fulfilled at least three criteria for MetS, and estimated relative risks from psychometric, sociodemographic and endocrinological variables.

2. Methods

2.1. Eligibility criteria and recruitment

The sample was drawn from Caucasian patients treated within the health care system of the Ukrainian Ministry of Transport – with a catchment area encompassing all Ukraine. The targeted participants constituted a national treatment cohort ($N=867$) for metabolic disorders, who were seen once a year at specialized in- and outpatient departments of Railway Hospital No. 2 in Kiev, Ukraine, for preventive screenings. The patients of the total treatment cohort had been elected for annual re-examination based on documented familial risk factors for T2DM. Our internal inclusion criteria were the presence of valid MetS ranges, and exclusion criteria were T1DM as well as endocrinological problems other than MetS. From these 220 MetS patients, approximately 50% were interested in medication treatment only. $N=107$ of the identified MetS patients were willing to undergo further psychiatric examinations and self-report as part of their regular treatment. The patients fulfilling these motivational inclusion criteria were eligible for the present investigation. Of these were excluded patients with any history of psychiatric-neurological illness or substance abuse on the basis of screening interviews ($N=6$).

2.2. Patient sampling

The Institutional Review Board of the National Medical University of the Ukraine had endorsed all procedures. The investigation was conducted in compliance with the Helsinki Declaration (www.wma.net/e/ethicsunit/helsinki.htm). All subjects gave written informed consent to the scientific use of their data, and were reimbursed for their participation. The final sample included $N=101$ individuals (mean age 45.6 ± 0.14 SEM years; education levels 4.73 ± 0.11, 4=junior college level, 67 females) with a primary diagnosis of T2DM, obesity, and/or hypertension. It was in size and composition comparable to research samples typically used in biomarker detection studies in MetS, and in approximately counterbalancing diabetic and non-diabetic patients by design (e.g. Huang et al., 2013).

2.3. Disease classification

All patients had been consensus-diagnosed with one or more of the aforementioned primary diagnoses according to ICD-10 criteria by at least two cardiological and/or endocrinological specialists not involved in the study. The investigator ascertained MetS criteria conforming to International Diabetes Federation (IDF; *www.idf.org/publications*) consensus from patient files. The diagnosis of MetS was established as the presence of three or more of the following features: waist circumference >80 cm in women and >94 cm in men; fasting serum triglycerides ≥ 1.7 mmol/L, serum high-density lipoprotein (HDL) <1.29 mmol/L in women and <1.03 mmol/L in men; systolic/diastolic blood pressure $\geq 130/85$ mm Hg or treated; fasting plasma glucose level ≥ 5.6 mmol/L or T2DM. Laboratory analyses of all biological specimens were performed inhouse with enzymatic methods using commercially available reagents. We report descriptives of all measurements (Table 1), but statistical results pertaining to the IDF criteria only.

2.4. Self-report instruments

Alexithymia was measured using the official Russian language version (www.consilium-medicum.com/article/8766) of the Toronto Alexythymia Scale, 20-item version (TAS-20) (Bagby et al., 1994a; Bagby et al., 1994b). Each item is rated on a 5-point Likert-type scale, ranging from 'strongly disagree' (1) to 'strongly agree' (5). According to the current clinical consensus, alexithymia severity is divided into three groups: subjects with a TAS-20 total score ≥ 61 are considered high-alexithymic, and those with a score ≤ 51 are considered low-alexithymic. Factor analyses have suggested that the TAS-20 has three factors quantifying different dimensions of alexithymia: Factor 1 assesses the capacity to identify emotional feelings and to distinguish them from bodily sensations (F1: Difficulty in Identifying Feelings); Factor 2 reflects the inability to communicate feelings and sensations to other people (F2: Difficulty in Describing Feelings); and Factor 3 indicates Externally Oriented Thinking (F3) (Table 1). These TAS factors are replicable across cultures, with well-established psychometric properties. Additional self-report instruments were administered for control purposes, but are not focus of this report.

2.5. Biological laboratory data and statistical analysis

The laboratory of the Railway Hospital No. 2 was subject to quality control standards imposed by the Ukrainian Ministry of Public Health, and was certified accordingly. We conducted multivariable logistic regression and hierarchical linear regression analyses, following correlation analyses for variables pertaining to the MetS. STATA®/IC 11.2 for Mac (64-bit Intel version) (StataCorp LP, College Station, TX, U.S.A.) was used for the statistical analyses. For comparison and generalizability purposes, we utilized the online data of the well-known *Nhanes2* study ($N=10,531$) (Center for Disease Control, Bethesda, MD: US Health and Nutrition Survey II; protocols at archive.nlm.nih.gov/proj/dxpnet/nhanes/docs/doc/nhanes2/labproc.pdf), accessed through STATA® journal (http://www.stata-press.com/data/r11/nhanes2), to serve as control group.

Table 1
Biological and self-report questionnaire descriptives: comparison of gender differences.

Variables	Men	Women	Student's *t*	*P* Value
Age group	4.26 ± 1.50	4.72 ± 1.32	−1.484	0.143
Education level	4.82 ± 0.99	4.69 ± 1.18	0.611	0.543
Family size	2.85 ± 0.86	3.37 ± 1.20	−2.501	0.014
Number of children	0.79 ± 0.41	0.69 ± 0.47	1.187	0.239
TAS-20 mean score	56.53 ± 13.69	55.54 ± 11.96	0.359	0.721
TAS-20 factor 1	20.47 ± 7.09	20.96 ± 6.52	−0.333	0.740
TAS-20 factor 2	14.59 ± 4.42	12.99 ± 4.08	1.767	0.082
TAS-20 factor 3	21.74 ± 4.76	21.70 ± 4.37	0.035	0.972
Waist cm	100.50 ± 13.61	90.25 ± 7.64	4.074	0.000
Body-mass index	31.59 ± 7.52	32.71 ± 5.85	−0.0757	0.452
Triglycerides mmol/L	2.93 ± 0.92	3.34 ± 0.79	−2.197	0.032
Cholesterol mmol/L	5.86 ± 1.11	6.32 ± 1.19	−1.923	0.059
HDL mmol/L	0.93 ± 0.06	1.11 ± 0.09	−10.874	0.000
LDL g/L	5.16 ± 1.65	6.27 ± 2.89	−1.460	0.154
Microalbuminuria %	35 ± 0.48	33 ± 0.47	0.243	0.809
Systolic blood Pressure mm/Hg	143.97 ± 14.02	147.31 ± 12.65	−1.169	0.247
Diastolic blood Pressure mm/Hg	90.59 ± 6.72	89.03 ± 5.31	1.179	0.244
Type 2 diabetes mellitus	0.53 ± 0.51	0.60 ± 0.49	−0.639	0.525
Fasting plasma glucose mmol/L	6.04 ± 1.57	6.58 ± 2.14	−1.091	0.281

Note: $N=101$. Plus-minus values are mean ± SD. *TAS-20* 20-item Toronto Alexithymia Scale, *HDL* high-density lipoprotein, *LDL* low-density lipoprotein.