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Inverse association between hyperthymic affective temperament and coronary atherosclerosis: A coronary computed tomography angiography study

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ABSTRACT

Objective: A bidirectional relationship exists between psychiatric disorders and cardiovascular diseases, however less is known with regards to personality traits. Accumulating data suggest that affective temperaments are both associated with psychiatric and somatic diseases. The aim of our study was to evaluate the associations between different affective temperaments and the presence of coronary atherosclerosis.
Methods: 200 consecutive patients referred to coronary computed tomography angiography (CCTA) due to suspected coronary artery disease (CAD) were included in our study. Medical history and demographic parameters were recorded and all patients completed the Temperament Evaluation of Memphis, Pisa, Paris, and San Diego Autoquestionnaire (TEMPS-A) and the Beck Depression Inventory (BDI). The presence of coronary artery disease was evaluated based on the CCTA images.
Results: 39 patients were free of any coronary atherosclerosis (CCTA-) and 161 had coronary atherosclerosis (CCTA +). Hyperthymic affective temperament score was higher in CCTA- subjects as compared to CCTA + (13.1 ± 3.0 vs 11.5 ± 4.6, p = 0.010, respectively). Hyperthymic affective temperament score showed a significant independent, inverse relationship with coronary atherosclerosis (OR: 0.91 CI: 0.82–0.99, p = 0.04).
Conclusion: Our results suggest that hyperthymic affective temperament is independently associated with the absence of CAD. It requires further research to delineate the mechanism mediating the effect of hyperthymia on better coronary artery health and establishing potential biochemical or behavioral factors, both of which could be exploited for prevention and treatment purposes. But it is plausible, that the evaluation of affective temperaments have importance both in relation with psychiatric and cardiovascular disorders.

1. Introduction

Cardiovascular diseases are the leading cause of morbidity and mortality in most industrialized countries, even though highly effective preventive treatments are available. In the past 40 years both invasive and non-invasive methods were established to diagnose and treat coronary artery disease (CAD). Importantly, coronary computed tomography angiography (CCTA) has emerged as a reliable, non-invasive tool for the evaluation of the extent, severity and distribution of CAD [1].

Various personality traits were found to be associated with cardiovascular risk factors and diseases. High trait anxiety and hostility were linked to elevated pulse wave velocity [2], while in the Baltimore Longitudinal Study of Aging middle-aged adults with suppressed anger

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had elevated carotid arterial stiffness [3]. Anger, hostility and anxiety are also documented risk factors for CAD [4,5]. Moreover, anger and hostility also appear to predict a variety of cardiovascular outcomes [6,7].

Temperament is regarded as an inherited part of personality and represents the biologically stable core of emotional reactivity [8]. Affective temperaments (depressive, cyclothymic, hyperthymic, irritable and anxious) are subclinical, trait-related manifestations and commonly the antecedents of minor and major mood disorders [9]. Temperaments are important predictors of psychopathology and suicidal behavior and may be used for better delivery of appropriate care to patients with bipolar disorders in the clinical practice [10]. Besides their associations with psychiatric disorders, affective temperaments were recently found to be related to cardiovascular risk factors and diseases as well. In chronic hypertensive patients elevated blood pressure was demonstrated with high cyclothymic temperament as well as an increased level of arterial stiffening with low hyperthymic score [11]. Furthermore, cyclothymic temperament was also associated with coronary events in hypertensive patients [12].

However, limited information is available regarding the relationship between affective temperaments and coronary atherosclerosis. Therefore our objective was to assess the relationship between affective temperaments and the presence of CAD. We hypothesized that individual affective temperament scores may be related independently of traditional cardiovascular risk factors to the presence of coronary atherosclerosis, as obtained by CCTA. Based on our previous findings [11,12], we supposed a positive association in case of cyclothymic and an inverse association in case of hyperthymic temperament.

2. Methods

2.1. Patients

In the present cross-sectional single center study, 200 consecutive Caucasian patients with stable chest pain referred for clinically indicated CCTA examination were involved. Among stable chest pain patients the referrer physicians' previous diagnosis was: typical angina (n = 15, 7.5%) atypical angina (n = 86, 43%) or non-anginal chest pain (n = 99, 49.5%), definitions, based on the proper guideline [13]. Prior to the CCTA exam autoquestionnaires were completed and collected by the examiners. The demographic, anthropometric and medical history data of all patients were recorded. Patients with known coronary artery disease, previous coronary intervention or coronary bypass operation, with ongoing psychiatric disorders or with dementia potentially interfering with the completion of questionnaires were excluded from our study.

Prior to participation, all patients gave written informed consent. The study was approved by the Scientific and Research Ethics Committee of the Medical Research Council, the Hungarian Ministry of Health (ETT TUKEB 570/2014) and was carried out in accordance with the tenets of the Declaration of Helsinki.

2.2. Evaluation of affective temperaments and depression

The *Temperament Evaluation of Memphis, Pisa, Paris and San Diego Autoquestionnaire* (TEMPS-A) was used to assess affective temperaments on depressive, cyclothymic, hyperthymic, irritable and anxious subscales, requiring 'yes' (score 1) or 'no' (score 0) answers [14]. TEMPS-A contains 110 items (109 in the version for males) and the questions of the various temperament types are grouped together as follows:

1. depressive temperament: questions 1 to 21 (21 points)
2. cyclothymic temperament: questions 22 to 42 (21 points)
3. hyperthymic temperament: questions 23 to 63 (21 points)
4. irritable temperament: questions 64 to 84 (21 points in women, 20 in the men's version)
5. anxious temperament: questions 85 to 110 (26 points).

TEMPS-A has been extensively studied, translated into > 25 languages and validated in several of the latter. Similarities and differences were also found in national samples which suggest that distribution of affective temperaments has both universal and cultural-specific characteristics [15].

The *Beck Depression Inventory* (BDI) is a 21-question multiple-choice, self-report questionnaire, one of the widely used instruments for measuring the severity of depression. Participants are asked to make ratings on a four point scale, where a higher score correlates with more severe depression [16].

2.3. Coronary computed tomography angiography

All patients underwent prospectively ECG-triggered CCTA using a 256-slice CT scanner (Philips Brilliance iCT, Best, The Netherlands) with the following parameters: 270 msec rotation time, 128 × 0.625 mm collimation, tube voltage of 100–120 kVp and tube current 200–300 mAs according to patient's BMI. One hour prior to the examination brachial blood pressure and heart rate were measured and registered. It was measured once, on the left arm in sitting position with a validated Omoron M3 device and these results are reported. The main purpose of this measurement before CCTA examinations is to check heart rate. Per os metoprolol was administered if patient's heart rate exceeded 65 beats/min. All patients received sublingual nitroglycerin (0.8 mg) to induce proper vasodilation during CCTA. Images were reconstructed using iterative reconstruction algorithms with 0.4 mm slice thickness (iDose^4 and IMR, Philips Healthcare, Cleveland, OH, USA).

2.4. Assessment of coronary artery disease

Images were evaluated by experienced readers (3–10 year experience in cardiac CT) to assess the extent, severity and distribution of CAD. All readers assessed coronary lesions according to SCCT guidelines using a 18-segment coronary tree model [17]. We defined CAD with the presence of any plaque in the coronary arteries. Based on the presence of any coronary plaque we distinguished two groups of patients: patients with CAD (CCTA +) and patients without CAD (CCTA-). Representative cases of patients with (Panel A) and without CAD (Panel B) and atypical chest pain are shown on Fig. 1.

2.5. Statistical analysis

Descriptive data are expressed as mean ± standard deviation or median with interquartile ranges or percentages. Normality of continuous parameters was tested with the Kolmogorov-Smirnov test. Descriptive characteristics and hemodynamic parameters, TEMPS-A and BDI scores were compared between CCTA + and CCTA- groups using unpaired Student's *t*-tests or Mann–Whitney rank-sum test for data failing tests of normality. Univariate logistic regression analysis was used to study the determinants of coronary artery disease. Parameters which were significant using univariate logistic regression were entered into a multivariate logistic model to assess independent association with the presence of CAD. A two-sided $p < 0.05$ was considered to be significant. SPSS (Armonk, NY, USA version 24.0) was used for all calculations.

3. Results

A total of 200 patients were enrolled in our study. Table 1 summarizes patient characteristics, cardiovascular risk profile, BDI and TEMPS-A questionnaire scores. Based on CCTA results, 39 patients were free of coronary atherosclerosis (CCTA-) and 161 of them had coronary atherosclerosis of any degree (CCTA +). Age and mean systolic blood pressure were significantly lower in CCTA- subjects as compared to the