

EVALUATION OF THE SIGNIFICANCE
OF THE PSYCHOSOCIAL RISK FACTORS
IN PATIENTS WITH CEREBROVASCULAR DISEASE

Nedelia Shtonova, Latchezar Traykov, Lachezar Grozdinski*

Received on April 6, 2020
Accepted on May 26, 2020

Abstract

The report presents a randomized study to assess the significance of psychosocial (PS) factors for the dominant brain form of atherosclerosis – cerebrovascular disease (CVD), using a battery of original tests to assess and quantify the psychosocial status of the subjects and a validated test for conventional risk factors, compiled in an integrated questionnaire. The study enrolled a total of 201 subjects: normal control group (NC, $N=100$); group of patients with CVD (CVD; $N=101$). The test for conventional risk factors (I) found significantly higher negative values in patients with CVD, in comparison to the clinically healthy control group. In the case of the specific PS tests II (Psychosocial Personality Assessment), III (Spiritual Dysfunction), and IV (Stress and Adaptation), we found significantly lower parameter values in the CVD group vs. the NC group. The study using the cognitive test V, found again significantly lower test values in patients with CVD, compared to the NC subjects. On the basis of the settled standards, it was found that PS test II, III and IV parameters were normal in 76% of cases in the clinically healthy subjects and were risky or pathological in almost 60% of cases in patients with atherosclerosis. The deteriorated quality of life and lack of happiness comprise a major risk factor for the onset and development of atherosclerosis. The relative risk (RR) for developing atherosclerosis in conventional risk factors according to Test I is 1.5. In the case of the PS risk factors, the RR values are 1.5. These findings firmly demonstrate that the psychosocial factors are just as significant risk factors for atherosclerosis as the conventional ones.

Key words: cerebrovascular disease, psychosocial risk factors, stress

Introduction. Despite the significant progress in our understanding of atherogenesis there is still a prevailing albeit atavistic notion that atherosclerosis is a passive process of arterial ageing and cholesterol deposition that causes them to narrow and eventually block. This oversimplification of the atherosclerotic process involving multiple factors and having complex etiopathogenesis inevitably leads to the misconception that a therapeutic intervention based solely on serum lipid lowering drugs will be a successful strategy for management of atherosclerosis [1-4]. But any clinician involved in the treatment of atherosclerosis is perfectly aware that in reality these processes are far more complicated and patients could suffer a myocardial infarction with low cholesterol level, and moreover the atherosclerotic process often progresses independently from the control and treatment of blood pressure, cholesterol and blood glucose, and could be specifically triggered by emotional stress and psychosocial traits [1-3,5-7].

It is clear that these conventional physical and biochemical parameters are neither the only risk factors nor the decisive ones to govern the onset and development of atherosclerosis. There are some large scale epidemiological studies and a number of limited trials on the role of psychosocial factors, and the role of stress is constantly emphasized [4,8,9]. But stress is usually an episodic factor, although it can often be repeated. It does not completely encompass and reflect the persistent personality and/or spiritual dysfunction that affect the overall functioning of all biological systems [2,4,10].

The psychosocial dysfunction, caused by a variety of factors such as war conflicts, natural calamities, crises, migration, lack of emotional empathy, social support, freedom, happiness, family, professional realization, can lead to disrupted regulation and coordination of all bodily systems leading in concert to deteriorated protection and adaptation [1,6,9,11-14]. This inevitably leads to the development of various severe conditions such as atherosclerosis or oncological diseases. But the atherosclerosis patient, when examined by a specialist, typically receives a pharmacological treatment with significant pill burden or is offered an endovascular invasive procedure or surgery. In practice, the psychosocial dysfunction of the patient is not diagnosed, and even less is attempted to treat [2].

Apparently a deeper clinical and epidemiological evaluation of the role of psychosocial factors in atherosclerosis as a whole and in its various clinical forms is needed. On these grounds we sought to conduct a randomized study to assess the significance of psychosocial (PS) factors in cerebrovascular disease (CVD). To meet this objective we developed and validated a battery of tests to assess and quantify the psychosocial status of the subjects as the dominant qualitative end-point, allowing the juxtaposition of atherosclerosis patient from a matched population of subjects free of vascular disease.

Material and methods. Subjects. The study enrolled a total of 201 subjects that were examined using a clinical-epidemiological questionnaire comprising an integral battery of tests. The study enrolled two main populations – normal

control group (NC) – a total of 100 subjects over 55 years of age with no history, clinical and echographic evidence of atherosclerosis (infarction, stroke, peripheral thrombosis); and a group of 101 age and sex matched patients with carotid and intracerebral atherosclerosis (CVD group).

Risk factor assessment. Investigation of the conventional and PS risk factors was performed at once by completing a clinic-epidemiological questionnaire by the patient, under the guidance and control of the clinician, conducting the study. The questionnaire contains a battery of four atherosclerosis risk factors assessment tests and a cognitive – mental function test. The tests for atherosclerosis assessment were elaborated and introduced by the authors. Within an initial pilot study tests were validated and thereafter they were performed for the study of patients with confirmed CVD.

Test I – for the assessment of the main physical, biochemical and hereditary risk factors for atherosclerosis, namely, hypertension, dyslipidaemia, diabetes mellitus, smoking and heredity. Maximal score a total of 100 negative points.

Psychosocial Test II – Psychosocial assessment of the personality – assessment of the social and personal realization, a total of ten questions including quality of life, happiness, professional, social, family and financial realization. Total score: from –100 to +100.

Psychosocial Test III – Spiritual Function or Dysfunction; a total of 20 questions evaluating the spiritual discontent of the patient. It includes questions about love, empathy, good, mutual help, justice, aggression, revenge, forgiveness, animal killing, spirituality, faith, egoism, freedom, optimism. Total score: from –100 to +100.

Psychosocial Test IV – Stress and Adaptation; a total of five questions evaluating the experienced, self-reported stress and distress and the adaptation to it. Maximum number of negative points – 100.

Cognitive Screening Test) V – A total of five neuropsychological tests for the assessment of global cognitive function, memory and executive functions.

Diagnostic methods for screening and exclusion of atherosclerosis. The exclusion methods for NC group comprised clinical examination, echo-Doppler, Doppler – ABI; The diagnostic methods for the screening and diagnosis of carotid atherosclerosis and CVD included clinical examination, echo-Doppler of carotid arteries and angiography.

Data processing and statistics. The data were treated by variation and distribution analysis, relative risk ratio determination (RR), stigma analysis for score value stratification, and data regression analysis to evaluate the correlation levels. All analyses were performed with SPSS software (SPSS Inc, Chicago, Illinois, USA).

Results. Conventional and psychosocial risk factor assessment. In the study of CVD patients vs. the NC group the comparative evaluation of the mean scores from the applied psychosocial tests II, III, IV, and the risk factor

T a b l e 1

Score data from the conventional risk factor and psychosocial risk factor assessment in CVD patients vs. the NC group

Tests	Group	<i>N</i>	Mean score	SD	SEM	<i>T</i>	<i>p</i>
Test RF score	NC	100	-36.00	23.66	2.56	5.09	0.001*
	CVD	101	-54.38	23.92	2.53		
Test PS-II score	NC	100	72.88	18.42	1.99	3.60	0.001*
	CVD	101	61.12	24.22	2.58		
Test PS-III score	NC	100	65.58	19.30	2.09	2.08	0.05*
	CVD	101	60.00	18.08	1.91		
Test PS-IV score	NC	100	-60.47	24.87	2.69	1.98	0.05*
	CVD	101	-67.41	25.11	2.66		

test I revealed a statistically significant reduction of the parameters of tests II and III with a concomitant increase of the negative result of tests I and IV. This corroborates that the psychosocial factors of personality and spiritual discomfort have worsened parameters in patients with CVD. Thus, the personality and spiritual dysfunction found in patients with cerebral atherosclerosis is important and plays a role in the onset and development of the atherosclerotic process. Similar results were also found with the known risk factors – Test I (Table 1).

Mental function. In the study of mental functions using the cognitive test in NC group (36.16 ± 1.44 ; Mean \pm SD) vs. CVD group (28.66 ± 2.53 ; Mean \pm SD) statistically significantly lower values were found in the patient group ($T = 14.08$; $p < 0.001$). Nevertheless it is an issue of interpretation whether this is a risk factor on its own, or represents a consequence of the atherosclerotic process, or both. However, it must be pointed out that in our patient group were included only non demented subjects with so-called mild cognitive impairment (defined as test score global cognitive functioning > 24 points).

Relative risk determination. The investigation of the relative risk ratios (RR) for the development of CVD, a relatively high RR was found for both conventional risk factors ($1.5 p \leq 0.01$) and psychosocial factors studied ($1.5 p \leq 0.0002$).

Signal assessment analysis for test score stratification. Using the signal assessment method and the established norms, we analysed the group distribution of the values of the parameters for the complex assessment of PS tests in the different groups with atherosclerosis (Table 2).

In CVD group (patients with cerebral atherosclerosis) it was found that 54% of the test parameters were lagging or below the norm, while in the NC group this percentage was more than twice as low (24%). The risk group in patients with atherosclerosis is also high – 18%.

Correlation analysis. Applying data regression analysis we investigated the correlation of the changes of the studied parameters in CVD group vs. group 0. There was a high level of correlation for the changes in the studied parameters

T a b l e 2

Signal assessment of the PS tests II–IV parameters

Group	<i>N</i>	Mean	SD	Normal scores $\pm 1/2$ SD 77.8–59.9	Scores under average $\frac{1}{2} - 1$ SD 59.9–42.1	Lagging scores –1 to –2 SD 42.1–6.7	Significantly lagging scores under –2 SD under 6.7
CVD	101	51.75	40.08	47 (46.5%)	16 (15.8%)	21 (20.7%)	17 (16.8%)
NC	100	77.86	35.75	76 (76%)	10 (10%)	13 (13%)	1 (1%)

in the individual groups and in general for all atherosclerosis patients, with correlation coefficient values, as follows: 0.739 (NC vs. CVD). This proves that the reduction in the parameters of psychosocial tests is not accidental and the influence of psychosocial factors on the occurrence and development of atherosclerosis is an objective and plausibly quantifiable process.

Moreover we compared the parameters of the PS tests (II–IV) in patients with either unilateral or bilateral carotid atherosclerosis. There was a statistically significant reduction in the composite assessment of the PS test parameters in patients with bilateral carotid pathology (44.5 ± 17.4) as compared to those with a unilateral disease (54.3 ± 17.4 ; $t = 2.49$; $p \leq 0.01$) and there was a moderate correlation between them ($R = 0.353$).

Discussion. In this study we sought to determine the significance of psychosocial factors for the cerebrovascular disease, by means of a battery of original tests to assess in a quantitative fashion the psychosocial status of the subjects enrolled, together with a validated test for the conventional risk factors, brought together in an integrated questionnaire.

The test for conventional risk factors (I) found substantially higher negative values in patients with CVD, as compared to the matched healthy cohort. The results of PS tests II (Psychosocial Personality Assessment), III (Spiritual Dysfunction) and IV (Stress and Adaptation), revealed considerably lower parameter values in the CVD group as compared to the NC group. In examining the significance of specific questions from the PS tests, we found that some of them are more sensitive and their negative parameters reflect more often the personal and spiritual dysfunction, representing a risk factor for atherosclerosis and CVD. The analysis of question clusters assessing the happiness and quality of life revealed that there was a statistically significant difference between the answers for both questions between CVD and NC groups. This proves that the deteriorated quality of life and the experience of misfortune are risk factors and evoke vascular pathology in corroboration of the literature data [6,15,16]. In an exemplar study BAUNE and ALJEESH [16] sought to determine the association of psychological stress (assessed by SCL-90 test) and quality of life (QOL; as assessed by the WHOQOL-BREF questionnaire), among cardiovascular patients with hyperten-

sion plus stroke or hypertension only. The patients with stroke had significantly lower QOL scores than those without stroke and a significantly higher level of stress.

Deteriorated psychosocial parameters lead to personal dysfunction, which is a risk factor and affects the emergence and development of various forms of atherosclerosis in parallel to other published reports [5]. For instance in the Gutenberg health study BEUTEL et al. [17] have analysed cross-sectionally the type D personality associated personal dysfunction and its correlates in a population-based sample of 5000 Mid-Europeans aged 35–74 years. Type D subjects were characterized by lower socioeconomic status, lack of a partnership, increased depression, anxiety, depersonalization, and health care utilization, and noteworthy the dysfunctional personality patterns were independently associated with coronary heart disease (OR = 1.54, $p = 0.044$) and an unambiguous cardiotoxic impact.

The signal assessment has shown that in CVD atherosclerosis the percentage of patients with lagging or significantly abnormal scores was significantly higher as compared to the matched control cohort. This confirms the thesis that psychosocial tests have negatively altered parameters in patients with cerebral atherosclerosis.

Finally, the correlation analysis has shown a plausible association between the parameters of the PS tests in the patients group. The juxtaposition of the PS test scores in patients with unilateral or bilateral carotid atherosclerosis demonstrated a more pronounced worsening in the latter to further evidence that the more deteriorated PS parameters are consistent with a more severe atherosclerotic process, and vice versa. This well corroborates the findings of BUNDE and SULTS [18] that sought to determine the association between Cook–Medley Hostility Scale scores and premature coronary artery disease (CAD) morbidity and mortality in a quantitative fashion. The abnormal hostility scores were significantly related to both CAD severity and conventional risk factor abnormal values, namely body mass index, waist-to-hip ratio, insulin resistance, lipid ratio, triglycerides, glucose, socioeconomic status, alcohol consumption, and smoking. These quantitative relationships are further supported by a longitudinal follow-up study of 80 women amongst the patients enrolled in the Stockholm Female Coronary Angiography Study [19]. The subjects were evaluated for stress exposure and coronary atherosclerosis progression using serial quantitative coronary angiography and it was firmly established that women with high stress from either family or work had significant disease progression over 3 years, whereas those with low stress had only slight progression.

Conclusion. Taken together our findings demonstrate the significance of psychosocial factors in atherosclerosis and raise the issue of revising the concept of both the etiopathogenesis of this disease and the role and the importance of the individual risk factors for its onset and progression. The applied battery of

original tests revealed that the persistent personal and spiritual dysfunction and impaired stress adaptation play a significant role as risk factors in patients with atherosclerosis. Noteworthy PS tests can be performed in people without clinical signs of atherosclerosis, as a non-invasive, plausible high-throughput pre-screening instrument and in case of an established pathological test, the patients could be screened for atherosclerosis and treated for psychosocial dysfunction.

REFERENCES

- [1] BROTMAN D. J., S. H. GOLDEN, I. S. WITTSTEIN (2007) The cardiovascular toll of stress, *Lancet*, **370**(9592), 1089–1100.
- [2] STEPTOE A., L. BRYDON (2009) Emotional triggering of cardiac events, *Neurosci. Biobehav. Rev.*, **33**(2), 63–70.
- [3] BRYDON L., K. MAGID, A. STEPTOE (2006) Platelets, coronary heart disease, and stress, *Brain Behav. Immun.*, **20**(2), 113–119.
- [4] GU H. F., C. K. TANG, Y. Z. YANG (2012) Psychological stress, immune response, and atherosclerosis, *Atherosclerosis*, **223**(1), 69–77.
- [5] COMPARE A., P. M. MOMMERSTEEG, F. FALETRA, E. GROSSI, E. PASOTTI et al. (2014) Personality traits, cardiac risk factors, and their association with presence and severity of coronary artery plaque in people with no history of cardiovascular disease, *J. Cardiovasc. Med. (Hagerstown)*, **15**(5), 423–430.
- [6] DIMSDALE J. E. (2008) Psychological stress and cardiovascular disease, *J. Am. Coll. Cardiol.*, **51**(13), 1237–1246.
- [7] CARROLL D., S. EBRAHIM, K. TILLING, J. MACLEOD, G. D. SMITH (2002) Admissions for myocardial infarction and World Cup football: database survey, *BMJ*, **325**(7378), 1439–1442.
- [8] ROSENSTROM T., M. JOKELA, C. R. CLONINGER, M. HINTSANEN, M. JUONALA et al. (2012) Associations between dimensional personality measures and preclinical atherosclerosis: the cardiovascular risk in Young Finns study, *J. Psychosom. Res.*, **72**(5), 336–343.
- [9] ROSENGREN A., S. HAWKEN, S. OUNPUU, K. SLIWA, M. ZUBAID et al. (2004) Association of psychosocial risk factors with risk of acute myocardial infarction in 11 119 cases and 13 648 controls from 52 countries (the INTERHEART study): case-control study, *Lancet*, **364**(9438), 953–962.
- [10] STRIKE P. C., K. MAGID, D. L. WHITEHEAD, L. BRYDON, M. R. BHATTACHARYYA et al. (2006) Pathophysiological processes underlying emotional triggering of acute cardiac events, *Proc. Natl. Acad. Sci. USA*, **103**(11), 4322–4327.
- [11] CARROLL D., L. K. HARRISON, D. W. JOHNSTON, G. FORD, K. HUNT et al. (2000) Cardiovascular reactions to psychological stress: the influence of demographic variables, *J. Epidemiol. Community Health*, **54**(11), 876–877.
- [12] ORTH-GOMER K., S. P. WAMALA, M. HORSTEN, K. SCHENCK-GUSTAFSSON, N. SCHNEIDERMAN et al. (2000) Marital stress worsens prognosis in women with coronary heart disease: The Stockholm Female Coronary Risk Study, *JAMA*, **284**(23), 3008–3014.

- [13] WATANABE H., M. KODAMA, N. TANABE, Y. NAKAMURA, T. NAGAI et al. (2008) Impact of earthquakes on risk for pulmonary embolism, *Int. J. Cardiol.*, **129**(1), 152–154.
- [14] MATSUO T., S. SUZUKI, K. KODAMA, K. KARIO (1998) Hemostatic activation and cardiac events after the 1995 Hanshin-Awaji earthquake, *Int. J. Hematol.*, **67**(2), 123–129.
- [15] SHEPHERD J. (2011) Happiness and Health: Associations with Cardiovascular Disease Risk Factors, A thesis submitted to Auckland University of Technology in partial fulfilment of the requirements for the degree of Master of Public Health (MPH), Centre for Physical Activity and Nutrition, Auckland University of Technology.
- [16] BAUNE B. T., Y. ALJEESH (2006) The association of psychological stress and health related quality of life among patients with stroke and hypertension in Gaza Strip, *Ann. Gen. Psychiatry*, **5**, 6.
- [17] BEUTEL M. E., J. WILTINK, Y. TILL, P. S. WILD, T. MUNZEL et al. (2012) Type D personality as a cardiovascular risk marker in the general population: results from the Gutenberg health study, *Psychother. Psychosom.*, **81**(2), 108–117.
- [18] BUNDE J., J. SULTS (2006) A quantitative analysis of the relationship between the Cook–Medley Hostility Scale and traditional coronary artery disease risk factors, *Health Psychology*, **25**(4), 493–500.
- [19] WANG H. X., C. LEINWEBER, R. KIRKEEIDE, B. SVANE, K. SCHENCK-GUSTAFSSON et al. (2007) Psychosocial stress and atherosclerosis: family and work stress accelerate progression of coronary disease in women, The Stockholm Female Coronary Angiography Study, *J. Intern. Med.*, **261**(3), 245–254.

Department of Neurology
Medical University of Sofia
 1 St. Georgi Sofiiski St
 1431 Sofia, Bulgaria
 e-mail: traykov_l@yahoo.fr
 nellyish@yahoo.com

**Department of Angiology and Phlebology*
Acibadem City Clinic
 127 Okolovrasten pat St
 1407 Sofia, Bulgaria
 e-mail: grozdinski@abv.bg