



## The risk of metabolic syndrome in patients with arterial hypertension in relation to psychological and biological risk factors

Rizik od nastanka metaboličkog sindroma kod bolesnika sa arterijskom hipertenzijom u odnosu na psihološke i biološke faktore rizika

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### Abstract

**Background/Aim.** A type of personality and negative emotional reactions could be important for clustering biological risk factors for a cardiovascular disease in patients with arterial hypertension (AH). This study investigated if the patients with AH and psychological characteristics of the Distressed Type of personality with elevated anxiety/depression/aggression, have a higher risk of metabolic syndrome (MS) and explored value of the assessed parameters for MS occurrence. **Methods.** A total of 85 patients with AH were included in the cross-sectional observational study. Type D Scale-14 (DS-14) was used to detect Type D (Distressed) personality. The Hospital Anxiety and Depression Scale (HADS) assessed the levels of anxiety and depression and the Buss Perry Aggression Questionnaire (BPAQ) was used for the assessment of aggression. The explored biological parameters included: blood pressure, lipid status, body mass index (BMI), the occurrence of diabetes mellitus (DM) and MS. **Results.** Type D patients were frequently more anxious, aggressive and had more frequent MS compared to non-type D. Type D females were younger, more anxious and had a greater prevalence of DM than those with non-type D personality. A multivariate analysis revealed that in type D personality patients with AH, depression had predictive value for MS. **Conclusion.** The occurrence of both MS and AH was in correlation with the type D personality, anxiety and depression. Early detection/treatment of depression in patients with AH and Type D personality could decrease a risk of metabolic syndrome.

**Key words:** metabolic syndrome; hypertension; cardiovascular diseases; risk factors; personality; questionnaires; depression; comorbidity.

### Apstrakt

**Uvod/Cilj.** Tip ličnosti i negativne emocionalne reakcije mogu biti značajni za grupisanje bioloških i psiholoških faktora rizika od nastanka kardiovaskularnih bolesti kod bolesnika sa arterijskom hipertenzijom (AH). Cilj rad bio je da se istraži da li bolesnici sa AH i psihološkim karakteristikama ličnosti sklonih distresu, sa povišenim nivoima anksioznosti/depresivnosti/agresivnosti, imaju veći rizik od prisustva metaboličkog sindroma (MS) i prediktivnu vrednost ovih parametara od pojave MS. **Metode.** Ukupno 85 bolesnika bilo je uključeno u opservacionu studiju preseka. *Type D Scale* (DS-14) je korišćena u cilju određivanja D (distres) tipa ličnosti, *the Hospital Anxiety and Depression Scale* (HADS) za određivanje nivoa anksioznosti i depresivnosti, a *the Buss Perry Aggression Questionnaire* (BPAQ) za utvrđivanje agresivnosti. Ispitivanje bioloških parametara uključivalo je određivanje nivoa krvnog pritiska, lipidnog statusa, indeksa telesne mase (ITM), prisustva dijabetesa melitusa (DM) i MS. **Rezultati.** Bolesnici D tipa ličnosti imali su veću zastupljenost povišene anksioznosti, agresivnosti i MS u odnosu na one bez D tipa ličnosti. Žene D tipa ličnosti su bile mlađe, imale povišenu anksioznost i veću prevalencu DM u odnosu na one koje nemaju tip D ličnosti. Multivarijantna analiza pokazala je da je depresija nezavisan faktor rizika za pojavu MS kod bolesnika sa AH i D tipom ličnosti. **Zaključak.** Udruženost MS i AH je u korelaciji sa tipom D ličnosti, anksioznošću i depresijom. Rano otkrivanje/lečenje depresije kod bolesnika sa AH i D tipom ličnosti može biti korisno za smanjivanje rizika od metaboličkog sindroma.

**Ključne reči:** metabolički sindrom; hipertenzija; kardiovaskularne bolesti; faktori rizika; ličnost; upitnici; depresija; komorbiditet.

## Introduction

The National Cholesterol Education Program (NCEP) Adult Treatment Panel III (ATP III) recognized that multiple metabolic elements were cardiovascular risk factors and renamed the constellation of these metabolic risk factors as “The Metabolic Syndrome” (MS)<sup>1</sup>. The criteria included any of the following factors: obesity, defined as waist circumference  $\geq 102$  cm in males and  $\geq 88$  cm in females [based on the 1998 National Institute of Health (NIH) obesity clinical guidelines], while arterial hypertension (AH) was defined as blood pressure  $\geq 130/85$  mmHg, fasting glucose  $> 110$  mg/dL, triglycerides  $\geq 150$  mg/dL and high density lipoprotein cholesterol (HDL-c)  $< 40$  mg/dL based on the Joint National Committee guidelines<sup>1</sup>.

In psychosomatic cardiology, biological and psychological factors play a key role in the onset and prognosis for a heart disease. Arterial hypertension is a major risk factor and if AH is associated with MS, the development of atherosclerosis and a heart disease is more certain<sup>2</sup>. Psychosomatic approach indicates psychological factors: suppressed anger and hostility as toxic for psycho-physiological pathway leading to hypertension. Such psychological features increase autonomic arousal, which causes peripheral resistance and contributes to the development of hypertension<sup>3</sup>. Type D (distressed) personality construct has a tendency to experience negative affect in social relations and to inhibit its expression. This type of personality is similar to neuroticism, meaning that individuals express their tension mainly by somatization<sup>4</sup>. They also have a higher risk of cardiovascular morbidity and mortality in both genders, regardless of cultural background. Type D personality in patients with hypertension, together with depression and anxiety<sup>5</sup> could increase the risk of the coronary artery disease (CAD). There are different findings about the correlation between biological and psychological parameters in cardiac patients. In some studies, patients with serious hypertension had higher anxiety, depression and neuroticism than normotensives<sup>6</sup>. In other studies, there was no relation between type D personality and psychological distress in elderly hypertensive patients<sup>7</sup>.

Gender differences were also spotted. Controlled anger, an unhealthy lifestyle, and a high level of hopelessness were more frequent predictive factors for hypertension in men<sup>8</sup> than in women who expressed anger more openly. Other studies found that women who express or suppress anger have twice the risk of cardiovascular morbidity than men<sup>9</sup>.

In our clinical practice, we have noticed anger issues and negative emotions in patients with hypertension. Considering different findings about the influence of emotional characteristics on the onset of CAD risk factors, we wanted to determine psychological characteristics of patients diagnosed with arterial hypertension (AH) as a possible link between AH and the presence of MS.

The aim of our study was to investigate if the patients with AH and psychological characteristics of type D personality, experiencing anxiety or depression, have a higher risk of MS in comparison to those without distressed personality. Also, it was assessed if any of the psychological parameters was predictive of MS in the patients with AH in our study.

## Methods

### Subjects

Our sample was a part of a larger pool of patients with AH and CAD treated at the Institute for Prevention, Treatment and Rehabilitation of Rheumatic and Cardiovascular Diseases “Niška Banja”, where the approval from the Institutional Ethics Committee for this cross-sectional observational study protocol was obtained. The research was done during the 6-month-period, from January to September 2015. The total sample of 148 patients were consecutively recruited on admission in an out-patient setting. After explaining the purpose of the study, an informed consent was obtained from each subject.

The inclusion criteria for the study were: patients diagnosed with AH without a history of CAD. Their regular AH treatment included diuretics,  $\beta$ -blockers, ACE inhibitors, angiotensin receptor blockers, calcium channel blockers and  $\alpha 1$ -blockers, alone or combined. The exclusion criteria were: CAD confirmed by percutaneous coronary angiography or myocardial infarction, severe medical conditions such as stroke, dementia, renal insufficiency, psychiatric disorder and malignant illness.

Patients filled the questionnaires to assess psychological variables in the waiting room, after their regular cardiologic check-up. Finally, 85 subjects completed questionnaires and were analyzed. The differences in the presence of psychological and biological factors between D type and non-D Type personality, as well as the gender differences among D subgroup personality were assessed.

### Instruments

The demographic data such as: gender, age, marital status and smoking habits were explored by the semi-structured general questionnaire. Biological parameters of the patients: systolic/diastolic blood pressure, total cholesterol, HDL-c, low density lipoprotein cholesterol (LDL-c), triglycerides, blood glucose, body mass index (BMI), the occurrence of diabetes mellitus (DM) and MS, were collected from the medical database of the patients.

The self-assessment questionnaires for psychological variables were used. The Type D Scale-14 (DS-14) detected type D personality<sup>10</sup>. It consists of two seven-item subscales measuring emotional and behavioral dimensions: negative affectivity (NA) and social inhibition (SI). A 5-point Likert scale measured the intensity of these dimensions: zero (not true) to four (true). A total score of  $\geq 20$  denotes type D personality, while the cut off score  $\geq 10$  on both subscales indicates the presence of NA and SI as personality traits, and an overall tendency to experience and act in an inhibited way in social situations.

The Hospital Anxiety and Depression Scale (HADS) assessed the levels of anxiety and depression<sup>11</sup>. This is a suitable instrument for non-psychiatric subjects because it explores emotional and cognitive symptoms, but without somatic symptoms of anxiety and depression, making it applicable for medical and cardiac patients. A 7-item subscale defines the intensity of each emotion. The item scores are classified on a scale

range from zero (not present) to three (severe problem). Scores  $\geq 10$  on both subscales indicate the presence of the elevated anxiety and depression that could be clinically significant and the total HADS score  $\geq 20$  indicates the actual emotional distress experienced in the past week.

The Buss Perry Aggression Questionnaire (BPAQ), a self-measuring instrument of 29 items, was used for the assessment of aggression<sup>12</sup>. Every item ranges from one (extremely not characteristic of me) to five (extremely characteristic of me). The Scale includes four subscales that measure hostility (cognitive component), anger (emotional), verbal and physical aggression (behavioral component). Higher scores on each subscale and a higher total result indicate greater aggressiveness and certain features of hostile tendency.

#### Statistical analysis

Statistical Package for Social Science (SPSS 18.0) was used for all statistical analyses. For continuous variables, Student's *t*-test, Welch's test (two-tailed), and the Mann-Whitey test were used to assess the differences in mean scores of variables between the groups when appropriate, while the chi-squared ( $\chi^2$ ) test was used for the frequency comparison. The Pearson's correlation was performed to estimate the association between characteristics, which occur both in a positive or negative manner. The association between MS and psychological and biological factors was estimated through a univariate logistic regression analysis.

Multivariate regression models were used for all significant parameters from the univariate analysis to determine the predictive value of those factors for MS.

## Results

### General characteristics of the sample

In the total sample, the age range was from 42 to 75 years. The average age of the subjects was  $64.52 \pm 7.92$ . Out of 85 patients, there were 53 women. One third of the sample (36.47%) was without a partner and the majority of subjects were non-smokers. Only five patients in the type D subgroup and three in the non-type D subgroup were consuming cigarettes for longer than a year (9.41%). The type D personality group had 50 (58.82%) subjects vs. 35 (41.17%) subjects in the non-type D group. There were 34 females in the D type subgroup (68%).

### The psychological parameters

NA was the most prominent characteristic of type D personality, while the SI, anxiety, depression and total distress scores were not out of range. In the same subgroup of patients, aggression subscales revealed hostility as the most prominent dimension, followed by anger, physical aggression and verbal aggression, respectively.

### Comparison between type D and non-type D subgroups

A comparison between type D ( $n = 50$ ) and non-type D ( $n = 35$ ) patients revealed a significant difference in all evaluated psychological variables. Anxiety, depression and distress (total HADS) score, total Aggression score, and all four dimensions of aggressiveness were more prominent in the type D subgroup. All biological variables were without significant difference present, except for MS, which was significantly higher in the type D subgroup (Table 1).

**Table 1**  
Data related to parameters studied in the type D versus non-type D subgroup

Variables	Type D ( $n = 50$ )	Non-type D ( $n = 35$ )	<i>p</i>
Age (years), mean $\pm$ SD	$63.14 \pm 8.33$	$66.59 \pm 6.88$	0.041 <sup>‡</sup>
Gender (M/F), n	16/34	16/19	0.134 <sup>§</sup>
Type D score, mean $\pm$ SD	$28.45 \pm 6.23$	$13.26 \pm 4.28$	$< 0.001$ <sup>†</sup>
Anxiety score, mean $\pm$ SD	$9.51 \pm 3.58$	$4.50 \pm 2.09$	$< 0.001$ <sup>†</sup>
Depression score, mean $\pm$ SD	$8.27 \pm 3.72$	$4.61 \pm 2.25$	$< 0.001$ <sup>†</sup>
Distress score, mean $\pm$ SD	$17.70 \pm 6.55$	$9.11 \pm 3.38$	$< 0.001$ <sup>†</sup>
Anger score, mean $\pm$ SD	$19.62 \pm 6.52$	$15.44 \pm 5.45$	0.001 <sup>†</sup>
Physical aggression score, mean $\pm$ SD	$16.84 \pm 5.85$	$12.85 \pm 4.48$	0.001 <sup>†</sup>
Verbal aggression score, mean $\pm$ SD	$14.33 \pm 4.46$	$12.05 \pm 3.49$	0.026 <sup>†</sup>
Hostility score, mean $\pm$ SD	$23.70 \pm 6.54$	$18.17 \pm 5.50$	$< 0.001$ <sup>†</sup>
Aggression score, mean $\pm$ SD	$74.84 \pm 16.09$	$58.52 \pm 14.77$	$< 0.001$ <sup>†</sup>
Blood glucose (mmol/L), mean $\pm$ SD	$6.28 \pm 1.68$	$5.71 \pm 1.08$	0.258 <sup>†</sup>
Cholesterol (mmol/l), mean $\pm$ SD	$5.75 \pm 1.18$	$5.79 \pm 0.88$	0.500 <sup>†</sup>
HDL-c (mmol/L), mean $\pm$ SD	$1.21 \pm 0.30$	$1.20 \pm 0.30$	0.285 <sup>†</sup>
LDL-c (mmol/L), mean $\pm$ SD	$3.57 \pm 0.99$	$3.86 \pm 0.69$	0.429 <sup>†</sup>
Triglyceride (mmol/L), mean $\pm$ SD	$1.91 \pm 0.99$	$1.73 \pm 1.06$	0.960 <sup>†</sup>
Systolic blood pressure (mmHg), mean $\pm$ SD	$155.60 \pm 11.85$	$160.61 \pm 15.55$	0.098 <sup>†</sup>
Diastolic blood pressure (mmHg), mean $\pm$ SD	$91.58 \pm 10.27$	$92.02 \pm 11.08$	0.865 <sup>†</sup>
Body mass index (kg/m <sup>2</sup> ), mean $\pm$ SD	$29.29 \pm 3.43$	$29.74 \pm 4.36$	0.882 <sup>†</sup>
Diabetes mellitus, n (%)	14 (28)	7 (20)	0.644 <sup>§</sup>
Metabolic syndrome, n (%)	30 (60)	13 (37.1)	0.046 <sup>§</sup>
Average number of risk factors, mean $\pm$ SD	$2.76 \pm 1.14$	$2.41 \pm 1.05$	0.124 <sup>†</sup>

<sup>†</sup>Mann-Whitney test; <sup>‡</sup>*t* test; <sup>§</sup>chi-squared test ( $\chi^2$ ).

SD – standard deviation; M – male; F – female; HDL-c – high density lipoprotein cholesterol; LDL-c – low density lipoprotein cholesterol.

**Table 2**  
**Psychological and biological risk factors in the type D hypertensive patients –gender differences**

Variables	Type D men (n = 16)	Type D women (n = 34)	<i>p</i>
Age (years), mean ± SD	67.13 ± 7.16	61.31 ± 8.27	0.030 <sup>‡</sup>
Anxiety score, mean ± SD	7.87 ± 2.80	10.25 ± 3.66	0.035 <sup>‡</sup>
Depression score, mean ± SD	7.68 ± 2.86	8.54 ± 4.06	0.624 <sup>‡</sup>
Distress score, mean ± SD	15.12 ± 5.25	18.88 ± 6.85	0.084 <sup>‡</sup>
Anger score, mean ± SD	18.25 ± 6.77	20.25 ± 6.41	0.393 <sup>‡</sup>
Physical aggression score, mean ± SD	18.58 ± 6.44	16.05 ± 5.48	0.127 <sup>‡</sup>
Verbal aggression score, mean ± SD	14.00 ± 3.52	14.48 ± 4.87	0.625 <sup>‡</sup>
Hostility score, mean ± SD	21.75 ± 5.19	24.60 ± 6.95	0.140 <sup>‡</sup>
Aggression score, mean ± SD	73.62 ± 15.61	75.40 ± 16.50	0.570 <sup>‡</sup>
Blood glucose (mmol/L), mean ± SD	5.67 ± 0.80	6.56 ± 1.90	0.210 <sup>‡</sup>
Cholesterol (mmol/L), mean ± SD	5.31 ± 1.45	5.97 ± 0.98	0.061 <sup>‡</sup>
HDL-c (mmol/L), mean ± SD	1.14 ± 0.28	1.23 ± 0.31	0.651 <sup>‡</sup>
LDL-c (mmol/L), mean ± SD	3.15 ± 1.09	3.79 ± 0.88	0.073 <sup>‡</sup>
Triglycerides (mmol/L), mean ± SD	1.73 ± 0.80	2.05 ± 1.13	0.482 <sup>‡</sup>
Systolic blood pressure (mmHg), mean ± SD	155.68 ± 15.12	155.57 ± 10.27	0.654 <sup>‡</sup>
Diastolic blood pressure (mmHg), mean ± SD	93.12 ± 10.62	90.85 ± 10.18	0.397 <sup>‡</sup>
Body mass index (kg/m <sup>2</sup> ), mean ± SD	28.31 ± 3.11	29.75 ± 3.52	0.188 <sup>‡</sup>
Diabetes mellitus, n (%)	1 (6.25)	10 (28.6)	0.039 <sup>§</sup>
Metabolic syndrome, n (%)	7 (43.7)	23 (65.7)	0.337 <sup>§</sup>
Average number of risk factors, mean ± SD	2.31 ± 1.07	2.97 ± 1.12	0.068 <sup>‡</sup>

<sup>‡</sup>Mann-Whitney test; <sup>‡</sup>t test; <sup>§</sup>chi-squared test ( $\chi^2$ ).

SD – standard deviation; M – male; F – female; HDL-c – high density lipoprotein cholesterol; LDL-c – low density lipoprotein cholesterol.

The group was taking a stable dose of anti-hypertensive and anti-lipid medications, but their biochemical parameters were in the upper normal range. Despite the therapy, the average systolic and diastolic blood pressure values were higher for the entire group. BMI was over the upper limit, indicating that the group was mildly overweight. There were no statistically significant gender differences in the levels of biological and psychological parameters throughout the sample.

After dividing the sample into subgroups, gender differences among D type patients showed that women had a higher prevalence of DM than men (Table 2).

In order to find which parameters were related to the occurrence of MS in our patients with AH, a univariate regression was performed. The obtained data indicated that in the type D subgroup, anxiety and depression were significant risk factors for MS (Table 3).

**Table 3**

Risk factors for metabolic syndrome			
Parameter	OR	95% CI	<i>p</i>
Gender	1.340	0.558–3.214	0.512
Type D personality	2.721	1.112–6.657	0.028
Negative affectivity	1.068	0.995–1.146	0.067
Social inhibition	1.045	0.949–1.151	0.368
Anxiety	1.163	1.030–1.321	0.015
Depression	1.214	1.057–1.395	0.006
Total aggression	1.022	0.996–1.049	0.092
Hostility	1.065	0.994–1.142	0.075

OR – odds ratio; CI – confidence interval.

All statistically significant factors obtained from the univariate regression analysis were processed in a multivariate logistic regression, but none of the parameters was found to be significant. In the multivariate regression analysis, which in-

cluded type D personality, age and depression, it was revealed that depression can be considered as a significant predictive factor for MS [odds ratio (OR) 1.172; *p* = 0.043 (Table 4)]. The depression score increased by one, increasing the chance of MS by 17% and adjusting the remaining parameters in the model (Table 4).

**Table 4**

**Risk factors for metabolic syndrome – Multiple regression analysis**

Models	Parameters	OR	95% CI	<i>p</i>
2	Age	0.981	0.925–1.040	0.516
	Type D	1.526	0.545–4.271	0.421
	Depression	1.172	1.005–1.366	0.043
1	Age	0.982	0.926–1.041	0.533
	Type D	1.336	0.416–4.291	0.627
	Depression	1.150	0.968–1.366	0.113
	Anxiety	1.043	0.877–1.240	0.638

OR – odds ratio; CI – confidence interval.

## Discussion

According to the findings about CAD risk factors in the literature<sup>5,6</sup>, we noticed that a hostile attitude, easily experienced negative emotions in social interactions, and increased anxiety and depression, are important for clustering risk factors in patients with AH. In this out-patient sample, we assumed that those with type D personality had a greater MS risk, which could lead to cardiovascular consequences in the future. Type D personality was presented in more than half of the sample, corroborating our clinical assessment about psychological issues in patients with AH.

These findings are quite different from those reported by Ringoir's et al. study<sup>7</sup>, where the subjects with AH

were less distressed and only 8% were found with type D personality, while 5% experienced anxiety and/or depression. On the other hand, our results were more similar to those from a cross-cultural analysis of a larger sample performed in South Eastern Europe. Type D personality was found in 35% of patients with cardiovascular diseases, which was significantly associated with the prevalence of high blood pressure, smoking and depression, but not with a severe heart disease<sup>13</sup>. The similarity between the socio-cultural characteristics of patients in these regions may be the reason for such findings. Suppressed negative emotions in their social relations and unsatisfactory life conditions are often present. Living without a partner at an old age, a lack of social support, low monthly income or a high ambition and a failure to achieve life goals, may be the reason for the increased cardiovascular reactivity and distressed reactions. The high prevalence of type D personality in persons with AH in our sample ought to be explored in the light of these potential influencing factors.

The literature data suggest that a sub-syndrome depression is more frequently associated with AH in comparison to healthy subjects<sup>14</sup>. In a prospective study conducted in Finland<sup>15</sup>, major depression was three times more likely to develop in men with AH, while a research in Taiwan indicated a higher incidence of hypertension in patients diagnosed with depression<sup>16</sup>. Our subjects were not clinically depressed (did not meet the criteria for this diagnosis), but the level of depressiveness was higher in 19% of the sample, while anxiety was present in a quarter of the sample. Although the patients were tenser and more dysphoric than depressed, their mood was unstable and they get annoyed by something that is beyond their control up to few times a day, and the total distress score was not out of the range. These findings were more consistent with the conclusions seen in different meta-analysis cohort studies, which dealt with the relation of these two major health problems<sup>14-16</sup>, where depression was ruled out as a potential risk factor for AH.

The findings that consider emotional reaction were in agreement with those suggested for people with type D personality. A hostile attitude and cynicism create cognitive disposition to perceive other people in a negative context and to experience angry feelings and verbal or physical aggressive behavior in a destructive but non-constructive way. The suggestion that the psychological factor is potentially "toxic" for the cardiovascular system is confirmed in other studies<sup>17</sup>. In our patients' population, hostility was the most prominent dimension, followed by verbal aggression, and the inner tension was sometimes relieved through explosive reactions to the close ones. There is a belief that controlled negative emotions could stimulate catecholamine release and contribute to AH<sup>14,15</sup>. Suppressed, long-standing emotional tension causes an increase in hypothalamic-pituitary-adrenal (HPA) axis activity<sup>18</sup>. Such elevation of the cortical and catecholamine release/synthesis enhances atherosclerosis<sup>19</sup>. Despite pharmacologic treatment, average blood pressure, BMI and all biochemical values (serum levels of total cholesterol, HDL-c, LDL-c fractions,

triglycerides, blood glucose) were slightly elevated in the whole sample. The finding was similar to the observation of Strike et al.<sup>20</sup> who found that hostile attitudes and angry feelings were connected with risk behaviors such as smoking, unhealthy diets, and obesity, as well as higher total cholesterol and LDL-c, and DM as major issues for the onset and progression of CAD.

Our assumption that type D patients with AH were more vulnerable in clustering all biological parameters was surprisingly not confirmed, as only MS, but not other biological parameters, was more prevalent in the type D personality group. The results were in accordance with the findings of the study conducted in our country. This research involved 79 patients with CAD, where MS was more prevalent in type D subjects with AH<sup>21</sup>. Also, in some large cohort prospective studies<sup>22-24</sup>, MS and AH were clustered in subjects with type D personality, suggesting an increasing risk of CAD and diabetes.

The association between two biological factors could be explained by the influence of the increased inner tension on the HPA axis (catecholamine and cortisol instability) in type D patients with consecutive dyslipidaemia, one of the basic factors of MS. In addition, psychological parameters in our type D hypertensive patients, such as depression, anxiety and hostility, are often associated with behavioral risks (unhealthy eating habits, smoking, a lack of physical activity), thus contributing to a higher prevalence of MS. Beside biological causes, some attention should be given to psychological adversities, due to their possible importance of risk factor clustering.

Metabolic syndrome was more prevalent in the type D subgroup, thus we assumed psychological characteristics could mediate this relation. Regression analysis (univariate) confirmed that in patients with type D personality, anxiety and depression might be independent risk factors for MS, while the multivariate regression analysis indicated that none of the parameters is predictive of MS in our patients with AH (Model 1).

Nevertheless, after we had included only type D personality, depression and age in the multivariate regression (Model 2), the result indicated depression to be a significant predictive factor for MS. It is in accordance with findings that MS is associated with the incidence of depression and with a low recovery rate from depression in older adults<sup>25</sup>. In our sample, a depression level was significantly higher in the type D group, but none of the patients had a depressive disorder. The result indicates a possible benefit of further psychiatric evaluation of the patients for early recognition of depressive symptoms and treatment, if necessary. According to our experience in treating psychological issues in patients with AH, supportive psychotherapy, counseling and relaxation techniques are helpful for coping with stressors and achieving better emotional balance. It would be useful to conduct a prospective study with the follow-up of our subjects, to explore their cardiovascular and psychiatric outcomes in relation to type D personality, emotional and biological parameters.

### Study limitation

It is not possible to argue that the studied sample of 85 patients is relatively small, especially those with type D personality. In addition, the study lacks some regular follow-ups that might reveal changes in the evaluated risk factors. These two deficiencies restrict our findings making it difficult to derive accurate conclusions. However, preliminary data obtained from our country and from an interesting study group can contribute to this pool of knowledge related to this topic. Our future research will be focused on psychological and biological changes of parameters, the health outcome of these hypertensive patients and characteristics of other groups of hypertensive subjects with different clinical comorbidities.

### Conclusion

This study found the high prevalence of type D personality among patients with arterial hypertension. The type D personality patients were more distressed, anxious, depressed

and hostile, and had a higher prevalence of metabolic syndrome compared to the non-type D personality hypertensive patients. The presence of both MS and AH positively correlated to type D personality, anxiety and depression. However, the elevated depression had a predictive value for MS in patients with hypertension and type D personality. It could be considered as a possible link between hypertension and MS. The female type D personality hypertensive patients had more prominent anxiety and more frequent MS and DM than male patients. An early detection of depression, psychological support or treatment of patients with arterial hypertension could be beneficial for their emotional well-being and a decreased risk of MS, especially in those with type D personality.

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