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ASSOCIATION OF THE COMPONENTS OF METABOLIC SYNDROME AND CAROTID ARTERY DISEASE AND THE SIGNIFICANCE OF ELEVATED BLOOD PRESSURE

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Abstract

Introduction:Metabolic syndrome (MetS) is a combination of at least 3 of the following conditions: elevated blood pressure (HTA), glycemia, waist circumference, triglycerides or decreased high density lipoprotein (HDL). It is not known whether the association with carotid artery disease (CAD) is the same in people with different numbers of MetS components and in people with MetS with and without hypertension. Objective: To determine the association of MetS components with CAD and to determine the role of elevated blood pressure as a component of MetS with CAD, by determining the prevalence of CAD in patients with MetS with or without elevated blood pressure. Material and methods: The research sample included a total of 118 patients (65 males, 53 females) with MetS. Blood pressure, waist circumference, glycemia, triglycerides and HDL cholesterol were measured according to standard routine protocols. CAD estimation was done with a Color Doppler Duplex ultrasound scan with a 7.5 MHz linear probe on the extracranial segment of the carotid arterial tree (ACC, bifurcation, ACI, ACE). Ultrasound consensus criteria for carotid stenosis were used for the ultrasound assessment of the presence of CAD. Results: The prevalence of CAD in terms of gender distribution was not significant (p <0.05),33.96% in women and 36.92% in men. The extent of CAD was associated with elevated SBP, triglycerides, and glycemia. While the increase of age, SBP and decrease of HDL were associated with the occurrence of CAD. In subjects with metabolic syndrome and high blood pressure, a higher prevalence of CAD has been found. Conclusion:The prevalence of CAD did not show a significant association with gender, but there is a significant association with the increase in the number of MetS components. Subjects with MetS and HTA were more strongly associated with CAD. Analogously, blood pressure control could reduce CAD prevalence.

Keywords: atherosclerosis, arterial hypertension, metabolic syndrome, carotid artery disease

АСОЦИЈАЦИЈА НА КОМПОНЕНТИТЕ НА МЕТАБОЛНИОТ СИНДРОМ И КАРОТИДНАТА АРТЕРИСКА БОЛЕСТ И ЗНАЧЕЊЕТО НА ПОКАЧЕНИОТ КРВЕН ПРИТИСОК

Апстракт

Вовед:Метаболниот синдром (MetS) претставува комбинација од најмалку 3 од следниве состојби: покачен крвен притисок (HTA), гликемија, обем на половина, триглицериди или намалени липопротеини со висока густина (HDL). Не е познато дали асоцираноста со каротидната артериска болест (CAD) е иста кај лицата со различен број на компоненти на MetS и кај лица со MetSco и без покачен крвен притисок.**Цел:** Да се одреди асоцираноста на бројот на компонентите на MetScoCAD

и да се утврди улогата на покачениот крвен притисок како компонента од MetS со CAD, преку одредување на преваленцата на CAD кај пациенти со MetS со или без покачен крвен притисок. **Материјал и методи:** Истражувачкиот примерок го чинеа 118 испитаници (65 мажи, 53 жени)соMetS.Крвниот притисок, обемот на половината, гликемијата, триглицеридите и HDL холестеролот беа мерениСо стандардни методи. Проценката на CAD беше правена со Color Doppler Duplex ултрасонографско иследување со линеарана сонда од 7,5 MHz, на екстракранијалниот сегмент од каротиднотоартериско стебло (ACC,бифуркацијата, ACI, ACE). За ултрасонографската проценка за постоење на CADбеа користениУлтразвучни консезус критериуми за каротидна стеноза. **Резултати:**Преваленцата на CAD во однос на половата дистрибуција небеше сигнификантна($p < 0,05$), 33,96% кај жени и 36,92% кај мажи.Степенот на CAD беше поврзан со покачување на систолниот крвен притисок (SBP), триглицеридите и гликемијата. Додека зголемувањето на возраста, SBP и намалувањето на HDL беа поврзани со појава на CAD. Кај лица со MetS и SBP, застапеноста на CAD е поголема. **Заклучок:** Преваленцијата на CAD непокажа значителна поврзаност со полот на испитаниците, но постои значителна поврзаност со зголемувањето на бројот на компонентите на MetS. Субјектите со MetS и HTA имаат поголема поврзаност со CAD. Аналогно, контролата на HTA може да ја намали преваленцата на CAD.

Клучни зборови: атеросклероза, артериска хипертензија, метаболен синдром, каротидна артериска болест

Introduction

Metabolic syndrome (MetS) is a combination of at least 3 of the following conditions: elevated blood pressure (HTA), glycemia, waist circumference, triglycerides or decreased high density lipoprotein (HDL). Despite numerous scientific efforts, there is still some uncertainty about the exact pathophysiological mechanism of the metabolic syndrome. According to some, insulin resistance is central, and according to others it is obesity. But, of course, a number of genetic and environmental factors also have an impact [1]. Elevated blood pressure (HTA) is a medical condition with persistently raised blood pressure in the arteries [2]. Carotid artery disease (CAD) usually involves atherosclerotic changes in the arterial wall, such as thickening of the intima media, plaque formation, and other changes in the arterial wall that will result in narrowing or complete obstruction of blood flow.

Objective

To determine the association of MetS components with CAD and to determine the role of the number of MetS components and the role of elevated blood pressure as a component of MetS with CAD, by determining the prevalence of CAD in patients with MetS with or without elevated blood pressure.

Material and methods

The research sample included a total of 118 patients (65 males, 53 females) with MetS, aged ≥ 30 and ≤ 80 years, who met the NCEP ATP III (National Cholesterol Education Program, Adult Treatment Panel III) diagnostic criteria, having any of the three or more of the following parameters: 1. Abdominal obesity - increased waist circumference values ≥ 102cm (40 in), women ≥ 88 cm (35 in); 2. Increased triglycerides ≥ 150 mg/dL (1.69 mmol/L), or treatment for elevated triglycerides (eg fibrates or nicotinic acid); 3. Decreased HDL cholesterol values for men <40 mg/dL (1.03 mmol/L), women <50 mg/dL (1.29

mmol/L), or medication treatment for lower HDL cholesterol levels (e.g. fibrates or nicotinic acid); 4. Elevated blood pressure values: systolic ≥ 130 mmHg and / or diastolic ≥ 85 mmHg, or treatment with hypertension medications; 5. Elevated fasting blood glucose values ≥ 100 mg/dL (5.6 mmol/L), or treatment with antidiabetic drugs. Subjects were clinically and biochemically processed in the PHI CCIH "8 mi Septemvri" Skopje, from January 2017 to January 2018, according to a pre-standardized protocol. Inclusion criteria: people with MetS according to NCEP ATP III criteria, age ≥ 30 and ≤ 80 years. Exclusion criteria: individuals without MetS, pregnant women, nursing mothers, age < 30 and >80. All participants were informed about the purpose of the research and informed consent was obtained prior to the study. MetS assessment was performed according to NCEP ATP III (National Cholesterol Education Program, Adult Treatment Panel III). Waist circumference was measured at the end of the slow expirium with a soft, elastic band in the upright position of the subject at the midpoint between the upper edge of the iliac bone and the lower edge of the last rib. A mean of two blood pressure measurements with a standard sphygmomanometer was used after a short rest in the sitting position. In the main laboratory at GCH "8-mi Septemvri" - Skopje, venous blood samples were taken after an overnight fasting to assess the following parameters: fasting glycemia, triglycerides and high density lipoprotein cholesterol (HDL-C). CAD evaluation was performed by ultrasound scan of the extracranial carotid arteries with an EsaoteMyLab ™ 70 XVG, with a linear probe with a transmission frequency of 7.5 MHz, using B-mode, color and doppler mode. CAD assessment was performed using Ultrasound Consensus Criteria for Carotid Stenosis: I Absence of Stenosis (Normal Finding) - No Plaques, Normal IMT, PSV <125 cm/s, ACI/ACC Ratio to PSV <2, EDV <40 cm/s; 2. II Stenosis <50%: present plaque - 50%, IMT thick, PSV <125 cm/s, ACI/ACC ratio of PSV <2, EDV <40 cm/s; III Stenosis - 50-69% IMT thick, visible plaque> 50%, PSV 125-230 cm/s, ACI/ACC ratio of PSV 2-4, EDV 40-100 cm/s. IV Stenosis 70% to subocclusive (up to 99%): visible narrowing> 50%, PSV> 230 cm/s, ACI/ACC ratio to PSV> 4, EDV> 100 cm/s; V Subocclusion/near occlusion: Significant visible narrowing; nearly occluded artery, PSV may be low or no detectable, ACI/ACC ratio of PSV variable, EDV variable; VI Occlusion: no flow, lumen visible, PSV no flow, undetectable, ACI/ACC ratio to PSV not applicable, EDV not applicable.

Results

Age analysis showed that men in this study were older than women. In addition to the results for age and gender distribution, results were also obtained for the clinical and biochemical characteristics of the subjects by gender (Table 1).

In terms of gender distribution in the subjects studied, men were more likely to have elevated glycemia, increased triglycerides in the blood and HTA, while women were more likely to have decreased HDL and increased waist circumference.

Analysis of the number of MetS components by gender distribution showed that among females 32 had 3 components, 17 had 4, and 4 females had all 5 components. For men, the figures were 43, 16 and 6 respectively (Fig. 1)

The prevalence of CAD in terms of gender distribution was not significant ($p > 0.05$), 33.96% in women and 36.92% in men. The prevalence of CAD increased with the increase in the number of MetS components (Fig. 2).

Table 1 Clinical and biochemical characteristics of the subjects by gender distribution

Variables	Women	Man
N	53	65
Age (year)	61.62±9.62	62.57±9.64
SBP (mmHg)	136.92±12.83	144.38±12.01
DBP (mmHg)	87.21±7.17	89.85±5.95
Waist circumference (cm)	99.27±8.32	97.28±7.94
HDL cholesterol (mmol / L)	1.81±0.72	1.12±0.49
Triglycerides, (mmol / L)	2.12±0.82	3.33±1.42
Glucose, (mmol / L)	5.88±0.78	6.56±1.27

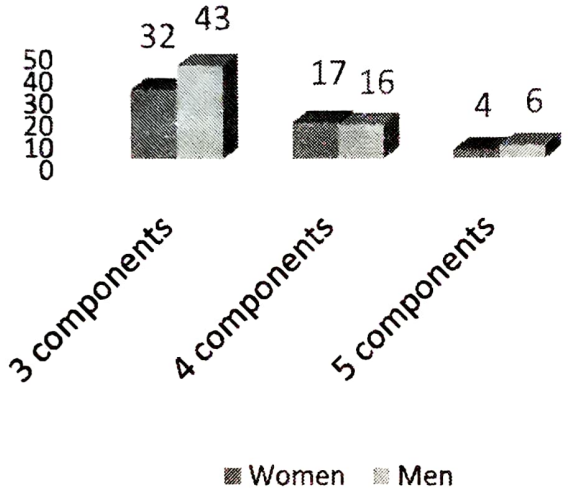

Figure 1 Analysis of the number of MetS components by gender distribution

Additional analysis of the individual variables showed that CAD levels were associated with elevated systolic blood pressure (SBP), triglycerides and glycemia. While increasing age, SBP, and decreasing HDL were associated with CAD. In people with MetS and HTA, the prevalence of CAD is higher. The assessment of the impact of the number of MetScomponents and HTA as its component on the occurrence of CAD was additionally examined in subjects with different number of MetS components and with or without HTA as a MetS component. The results showed (Fig. 3) that the prevalence of CAD was significantly lower in subjects with MetS without HTA compared to subjects with MetS with HTA, and prevalence of CAD increased with increasing number of MetS components.

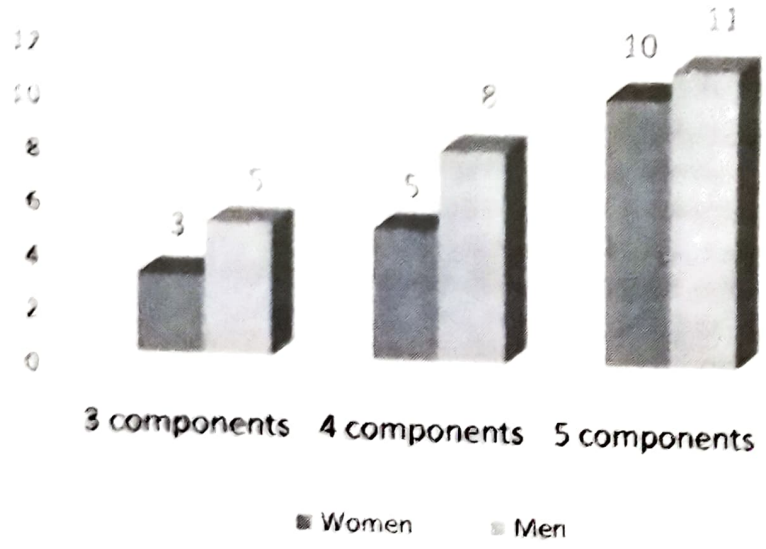

Figure 2 CAD prevalence by gender and number of metabolic syndrome components

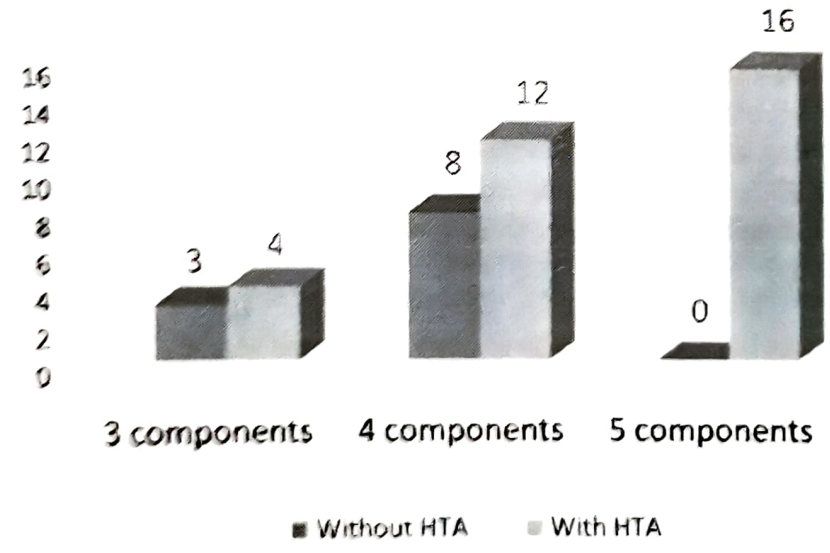

Figure 3 Prevalence of CAD in MetSsubjects by component number, distribution with and without HTA

Discussion

Metabolic syndrome is a complex of multiple risk factors and is a worldwide phenomenon of enormous socioeconomic and public health importance. According to current data from numerous epidemiological studies about 20 - 25% of the world population suffers from metabolic syndrome. The prevalence of MetS exceeds 20% in persons over 20 years of age and 40% in older age groups. [3-8] Results of scientific studies showed a prevalence of MetS of 24.4% in women and 28.7% in men [9]. In this study, the prevalence of CAD in terms of gender distribution was 33.96% for women and 36.92% for men, which is not much different from previous studies.

Data from available literature and research conducted undoubtedly point to the association of MetS with cardio and cerebrovascular risk [10]. But what is intriguing from a scientific and clinical point of view is the connection of the different components of MetS with CAD. That is, whether they equally affect the occurrence of CAD or any of the components is more strongly associated with CAD. The results of this study showed a strong association of CAD with HTA as a component of MetS, which has been confirmed in other studies [9]. Results from other studies have shown an association of MetS and CAD and coronary heart disease (CHD) [11]. The study investigated the association between MetS components and carotid atherosclerosis and the impact of the number of MetS and HTA components on CAD. According to the literature available, different components of MetS contribute differently to initiation, progression, and complications of CAD. The association of HTA with the onset and progression of CAD has been confirmed in numerous studies [12–15]. HTA encourages the development of atherosclerotic plaques, which is confirmed by the results of previous scientific research. HTA has been recognized as a strong risk factor for atherosclerotic disease [16]. In the SMART study,HTA, hypertriglyceridemia and low HDL-cholesterol were the most common combination of abnormalities [17]. In the SU.VI.MAX vascular study, HTA has again been shown to be the most important component of MetS in terms of the structure and function of large arteries [18]. The results of this study confirmed the association of HTA as a MetS component with CAD, as well as the positive association of the increased number of MetS components with CAD, especially if HTA is one of the MetS components.

Conclusion

The results of this study showed that the risk of CAD is higher in people with a greater number of MetS components and if HTA is one of the components of MetS. Such knowledge can significantly influence the clinical focus of prevention and treatment of CAD in people with MetS.

Reference

1. Hanley AJ, Karter AJ, Festa A, D'Agostino R Jr., Wagenknecht LE, Savage P, Tracy RP, Saad MF, Haffner S, Insulin Resistance Atherosclerosis Study. Factor analysis of metabolic syndrome using directly measured insulin sensitivity: the Insulin Resistance Atherosclerosis Study. Diabetes. 2002;51:2642–2647.

2. Chobanian AV, Bakris GL, Black HR, et al. Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. Hypertension. 2003 Dec. 42(6):1206-52.
3. Ford ES, Giles WH, Dietz WH. Prevalence of the metabolic syndrome among US adults: findings from the third National Health and Nutrition Examination Survey. JAMA. 2002;287:356 -359.
4. Hunt KJ, Resendez RG, Williams K, Haffner SM, Stern MP. National Cholesterol Education Program versus World Health Organization Metabolic Syndrome in relation to all-cause and cardiovascular mortality in the San Antonio Heart Study. Circulation. 2004;110:1245–1251.
5. Park YW, Zhu S, Palaniappan L, Heshka S, Carnethon MR, Heymsfield SB. The metabolic syndrome: prevalence and associated risk factor findings in the US population from the Third National Health and Nutrition Examination Survey, 1988 – 94. Arch Intern Med. 2003;163: 427– 436
6. Malik S, Wong ND, Franklin SS, Kamath TV, L'Italien GJ, Pio JR, Williams R. Impact of the metabolic syndrome on mortality from coronary heart disease, cardiovascular disease, and all causes in United States adults. Circulation. 2004;110:1239 –1244.
7. Meigs JB, Wilson PW, Nathan DM, D'Agostino RB Sr, Williams K, Haffner SM. Prevalence and characteristics of the metabolic syndrome in the San Antonio Heart and Framingham Offspring Studies. Diabetes. 2003;52:2160 –2167
8. Bonora E, Kiechl S, Willeit J, Oberhollenzer F, Egger G, Bonadonna RC, Muggeo M. Bruneck Study. Metabolic syndrome: epidemiology and more extensive phenotypic description. Cross-sectional data from the Bruneck Study. Int J ObesRelatMetabDisord. 2003;27:1283–1289.
9. ConcettaIrace, Claudio Cortese, Elio Fiaschi, Claudio Carallo, Giorgio Sesti, Eduardo Farinaro, Agostino Gnasso. Components of the Metabolic Syndrome and Carotid Atherosclerosis Role of Elevated Blood Pressure. Hypertension. 2005;45:597-601.
10. Grundy SM. Pre - diabetes, metabolic syndrome, and cardiovascular risk. J Am CollCardiol. 2012;59(7):635 - 43.
11. Enzo Bonora, MD, PHD1, Stefan Kiechl, MD2, Johann Willeit, MD2, Friedrich Oberhollenzer, MD3, Georg Egger, MD3, Riccardo C. Bonadonna, MD1 and Michele Muggeo, MD1. Carotid Atherosclerosis and Coronary Heart Disease in the Metabolic Syndrome. Prospective data from the Bruneck Study. Diabetes Care 2003; 26(4): 1251-1257.
12. Chambless LE, Folsom AR, Davis V, Sharrett R, Heiss G, Sorlie P, Szklo M, Howard G, Evans GW. Risk factors for progression of common carotid atherosclerosis: the Atherosclerosis Risk in Communities Study, 1987–1998. Am J Epidemiol. 2002;155:38 – 47
13. Su TC, Jeng JS, Chien KL, Sung FC, Hsu HC, Lee YT. Hypertension status is the major determinant of carotid atherosclerosis: a community-based study in Taiwan. Stroke. 2001;32:2265–2271.
14. Nieto FJ, Diez-Roux A, Szklo M, Comstock GW, Sharrett AR. Short- and long-term prediction of clinical and subclinical atherosclerosis by traditional risk factors. J ClinEpidemiol. 1999;52:559 –567.
15. Paivansalo M, Rantala A, Kauma H, Lilja M, Reunanen A, Savolainen M, Kesaniemi A, Suramo I. Prevalence of carotid atherosclerosis in middle-aged hypertensive and control subjects. A cross-sectional systematic study with duplex ultrasound. J Hypertens. 1996;14:1433–1439.
16. O'donellCj, Ridker Pm, Glynn Rj, Berger K, Ajani U,Manson Je et al. Hypertension and borderline isola-ted systolic hypertension increase risk of cardiovas-cular disease and mortality in male physicians.Circulation 1997; 95: 1132-7.29.

17. Gorter Pm, OlijhoekJk, Van DerGraaf Y, A LgraA,RabelinkTj, VisserenFl Smart Study Group. Preva-lence of the metabolic syndrome in patients withcoronary heart disease, cerebrovascular disease,peripheral arterial disease or abdominal aortic aneurysm. Atherosclerosis 2004; 173: 363-9.

18. Czernichow S, Bertrais S, Blacher J, OppertJm, Galanp, Ducimetiere P et al. Metabolic syndrome in relationto structure and function of large arteries: a predo-minant effect of blood pressure. Am J Hypertens2005; 18: 1154-60.