Metabolic syndrome components in arterial hypertension

COMPONENTES DA SÍNDROME METABÓLICA NA HIPERTENSÃO ARTERIAL

COMPONENTES DEL SÍNDROME METABÓLICO EN LA HIPERTENSIÓN ARTERIAL

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ABSTRACT

The objectives of this study were to identify and compare the prevalence of metabolic syndrome among hypertensive individuals and people with normal blood pressure measurements. The metabolic syndrome definition used in this study is that of the National Cholesterol Education Program/Adult Treatment Panel (NCEP-ATP III). The data referring to the clinical and biochemical profiles were processed using the SPSS software to obtain absolute frequencies and percentages. The Student's t-test was used to compare the means, with values of p<0.05 considered statistically significant. The sample was comprised of 93 participants with normal blood pressure levels and 168 participants with hypertension. It was found that 60.7% of the individuals with hypertension had metabolic syndrome, versus 18.3% of those with normal blood pressure levels. Individuals with hypertension showed a significant difference in blood pressure levels (p<0.001), abdominal circumference (p<0.001), blood glucose (p<0.05) and plasma triglycerides (p<0.05). The frequency of cardiometabolic risks associated with metabolic syndrome is greater when hypertension is present.

DESCRIPTORS

Metabolic syndrome
Hypertension
Risk factors
Public health nursing

RESUMO

Este estudo teve como objetivo identificar e comparar a prevalência da síndrome metabólica entre hipertensos e normotensos. Os aspectos adotados para a definição de síndrome metabólica foram os definidos pelo National Cholesterol Education Program/Adults Treatment Painel (NCEP-ATP III). Os dados referentes aos perfis clínicos e bioquímicos foram processados no programa SPSS para cálculo de frequências absolutas e porcentagens. Utilizou-se o teste t de Student para comparações das médias, sendo as diferenças consideradas estatisticamente significantes para p<0,05. A amostra foi composta por 93 participantes normotensos e 168 hipertensos. Identificou-se a presença de síndrome metabólica em 60,7% dos hipertensos e 18,3% dos normotensos. Os portadores de hipertensão arterial apresentam diferença significante nos valores de pressão arterial (p<0,001), circunferência abdominal (p<0,001), glicemia (p<0,05) e triglicérides plasmáticos (p<0,05). A frequência dos riscos cardiometabólicos associados à síndrome metabólica é maior na presença de doença hipertensiva.

DESCRITORES

Síndrome metabólica
Hipertensão
Fatores de risco
Enfermagem em saúde pública

RESUMEN

Se objetivó identificar y comparar la prevalencia del síndrome metabólico entre hipertensos y normotensos. Los aspectos adoptados para la definición de síndrome metabólico fueron los definidos por el National Cholesterol Education Progam/Adults Treatment Painel (NCEP-ATP III). Datos referentes a perfiles clínicos y bioquímicos fueron procesados con software SPSS para cálculo de frecuencias absolutas y porcentajes. Se utilizó la prueba T de Student para comparaciones de los promedios, considerándose las diferencias como estadísticamente significativas para p<0,05. Muestra compuesta por 93 participantes normotensos y 168 hipertensos. Se identificó presencia de síndrome metabólico en 60,7% de los hipertensos y en 18,3% de los normotensos. Los hipertensos presentaron diferencia significativa para valores de presión arterial (p<0,001), circunferencia abdominal (p<0,001), glucemia (p<0,05) y triglicéridos plasmáticos (p<0,05). La frecuencia de riesgos cardio-metabólicos asociados al síndrome metabólico se acentúa en presencia de enfermedad hipertensiva.

DESCRIPTORES

Síndrome metabólico
Hipertensión
Factores de riesgo
Enfermería en salud pública

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INTRODUCTION

Metabolic syndrome (MS) is a contemporary disease, characterized by a set of metabolic and cardiac risk factors, which together exacerbate cardiovascular and renal risks[1]. It has been defined in several ways by different organizations, but the common criteria adopted by all the investigators include the concomitant presence of systemic hypertension (SH), abdominal or central obesity, dyslipidemia and changes in glucose homeostasis or basal increase of blood glucose levels[2-3].

The definition of MS proposed by the National Cholesterol Education Program - NCEP, which presented the third revision of the guidelines for diagnosis and management of dyslipidemia, the Adults Treatment Panel, ATP III (NCEP-ATP III), is the most frequently used in clinical practice, due to its simplicity and practicality. According to this definition, individuals who present three or more of the following criteria are classified as having MS: large abdominal circumference (AC), increased levels of serum triglycerides, reduced High Density Lipoprotein Cholesterol (HDL-C), systemic hypertension, and hyperglycemia[4].

From the epidemiological point of view, MS is a pathological manifestation with great impact, allegedly responsible for a significant increase in mortality from cardiovascular disease. Its prevalence is mitigated by hereditary and environmental factors and depends on the diagnostic criterion used, as well as the population attribute. In general, it is estimated that the incidence of MS varies between 12.4% to 28.5% of men and 10.7% to 40.5% of women, not surprising considering increasing lifestyle factors in recent decades[4].

ST is one of the major manifestations of the group of clinical abnormalities that characterize MS, found in 30 to 40% of hypertensive individuals[5]. Among hypertensive individuals with MS, a predominance of injuries to target organs has been frequently described, with a significant addition of cardiovascular risks adding to the unfavorable prognostic impact[6].

Considering the possibility of a significant manifestation of MS components in hypertensive disease, the purpose of this study was to compare the prevalence of MS among normotensive participants. It is hoped that by identifying risk factors in this population group, it will be possible to contribute to the planning of strategies for prevention and early and effective interventions, minimizing the impact resulting from possible complications derived from the association of MS and hypertensive disease.

METHOD

Cross-sectional descriptive study conducted in a mixed health unit of a municipality located north of the state of São Paulo, from June 2008 to February 2009. The sample consisted of patients of the municipal health system served during the period of data collection, who were older than 18 years of age and consented to participate voluntarily in the study. The study excluded pregnant women, patients from the pediatric clinic and patients admitted to the the emergency ward, as well as any cases where it was not feasible to obtain the data needed to identify the presence of MS. Survey participants were classified as hypertensive and normotensive participants, according to the diagnoses obtained from the medical records at the unit.

The research project was approved by the Ethics and Research Committee of the Nursing School of Ribeirão Preto, University of São Paulo, in compliance with Resolution 196/96 of the National Health Council.

The investigation of sociodemographic data included the identification of age, gender, skin color, national origin, marital status, educational level, personal background and family history of cardiovascular disease. These data were collected directly in an interview by means of a standardized questionnaire developed by the investigators.

Systemic hypertension is one of the major manifestations of the group of clinical abnormalities that characterize MS, found in 30 to 40% of hypertensive individuals.

Age was obtained by referencing the date of birth recorded on a personal identification document; when the person did not have any document to present, the self-declared age was taken into consideration.

Skin color was classified as white or non-white, as indicated by the participant.

The variable marital status included two classes, based on self-reported information: with spouse (married or living in a stable arrangement) and with no spouse (single, separated, divorced or widowed).

Regarding education, the individual reported the grade of formal education he/she had completed or the number of years of study completed. This variable was defined according to the following categories: illiterate, incomplete basic education, complete basic education, incomplete high school, complete high school, incomplete higher education, or college degree.

Participants answered questions concerning their family history of cardiovascular disease according to the following possibilities: absent, father and/or mother with disease; another family member with disease (inform kinship); or does not know.

The pathophysiological and phenotypic aspects adopted for the definition of metabolic syndrome were

those defined by NCEP-ATP III and recommended by the Brazilian Guidelines for Diagnosis and Treatment of Metabolic Syndrome[4]: AC > 102 cm for men and > 88 cm for women; triglycerides ≥ 150 mg/dL, HDL-C < 40 mg/dL for men and < 50 mg/dL for women, fasting blood glucose ≥ 110 mg/dL and blood pressure (PA) ≥ 130 mmHg or ≥ 85 mmHg, these capturing the variables investigated.

All technical requirements for achieving accurate blood pressure measurements by indirect method followed the specifications of the Brazilian Guidelines on Hypertension[7]. Validated automatic equipment was used (OMRON - Model HEM-742INT) with cuff size appropriate for the measurement of the brachial circumference. The measurements were performed by the investigator at the time of data collection, obtaining three measurements at intervals of one minute. The average of the last two measurements was considered to be the true blood pressure (BP).

The AC was measured according to the recommendation of the World Health Organization[8], with an accurate inelastic tape measure with increments of 0.1 cm, taken midway between the iliac crest and the lower costal margin.

The blood sample for biochemical measurements was requested by a doctor belonging to the local clinical staff and obtained after fasting for 12 hours, through a vacuum collection system, with obtained samples being forwarded following collection to an accredited Clinical Analysis Laboratory.

The descriptive analyses, with calculation of absolute and percentage frequencies, were performed using the statistical package Statistical Package for Social Sciences - SPSS, version 15.0. The Student T test was used for comparisons of the averages of quantitative data. Results were expressed as means ± standard error of the means (SEM) and the differences were considered statistically significant when $p<0.05$.

RESULTS

The sample consisted of 261 participants, with 93 (35.6%) normotensive participants (NT) and 168 (64.4%) hypertensive participants (HT). Most participants were female (70.5%), naturalized citizens from the state of São Paulo (72.4%), white (78.5%), functionally illiterate (49.8%), living with a partner (66.7%) and having a family history of cardiovascular disease (75.1%). The mean age was 49.04 ± 1.68 years for the normotensive group and 58.78 ± 1.09 years for the hypertensive group, with a statistically significant difference between groups ($p<0.01$).

MS was present in 119 individuals, representing an overall prevalence of 45.6%. We identified the presence of MS in 102 (60.7%) hypertensive subjects and in 17 (18.3%) normotensive subjects (Table 1). All components of MS were considered, including an increase in BP for those with hypertension.

Table 1 - Distribution of the study population according to the number of components of MS, according to the NCEP-ATP III - Dumont, SP - 2008/2009

Group	Number of Components of MS					
	0	1	2	3	4	5
Normotensive Group	11(11.8%)	33 (35.5%)	32 (34.4%)	13 (14.0%)	04 (4.3%)	-
Hypertensive Group	-	11 (6.6%)	55 (32.7%)	46 (27.4%)	37 (22.0%)	19 (11.3%)
Total	11 (4.21%)	44 (16.9%)	87 (33.3%)	59 (22.6%)	41 (15.7%)	19 (7.3%)

In Table 2, we note the distribution of participants according to the presence of components isolated from the diagnosis of MS. The hypertensive group showed a higher frequency of elevated AC, increased levels of serum triglycerides and high blood sugar. Reduced HDL-C was the only components studied that was found to be most frequent in the normotensive group.

Table 2 - Distribution of the study population according to the number of components isolated from the MS, according to the NCEP--ATP III - Dumont, SP - -2008/2009

MS Component	Normotensive Group	Hypertensive Group	Total
↑ AC	52 (55.9%)	131 (78%)	183 (70.1%)
↓ HDL – C	58 (62.4%)	83 (49.4%)	141 (54%)
↑ Triglycerides	26 (28%)	74 (44%)	100 (38.1%)
↑ Blood glucose	16 (17.2%)	43 (25.6%)	59 (22.6%)

Table 3 shows the comparative analysis of mean values of blood pressure, abdominal circumference, serum glucose, HDL-C and triglycerides in study groups. When compared to the normotensive group, hypertensive participants showed higher values of SBP, DBP and AC ($p<0.001$) and higher plasma glucose and triglyceride levels ($p<0.05$). The results of serum concentrations of HDL-C showed that, in the analysis of this parameter, there is no statistical difference between the groups.

Table 3 - Comparative analysis of means of clinical data and biochemical values regarding components of MS, in normotensive and hypertensive participants - Dumont, SP - 2008/2009

Variable	Normotensive Group	Hypertensive Group
SBP(mmHg)	118.0 ± 1.27	138.8 ± 1.47 **
DBP (mmHg)	77.38 ± 1.05	84.6 ± 1.01 **
AC (cm)	93.72 ± 1.31	101.0 ± 1.31 **
Glucose (mg/dL)	92.55 ± 3.07	103.7 ± 2.78 *
HDL-C (mg/dL)	45.67 ± 1.37	48.48 ± 1.26
Triglycérides (mg/dL)	134.7 ± 8.43	162.8 ± 8.05 *

Values are expressed as mean ± EPM, n = 93 to 168 in each group, * p<0.05 compared to the normotensive group; ** p<0.001 compared to the normotensive group.

Table 4 shows the distribution of hypertensive and normotensive participants according to the combination of MS components. Both groups had more frequent elements in terms of the associations among low levels of HDL-C, hypertriglyceridemia and abdominal obesity.

Table 4 - Distribution of hypertensive and normotensive participants in terms of the combination of MS components, according to NCEP-ATP III – Dumont, SP-2008/2009

MS Components	Normotensive Group	Hypertensive Group	Total
↓ HDL-C + ↑ Triglycerides + ↑ AC	8 (8.6%)	-	8 (3.1%)
↑ Blood Glucose + ↓ HDL-C + ↑ AC	3 (3.2%)	-	3 (1.1%)
↑ Blood Glucose + ↑ Triglycerides + ↑AC	1 (1.1%)	-	1 (0.4%)
↑ Blood Glucose + ↓ HDL-C + ↑ Triglycerides	1 (1.1%)	-	1 (0.4%)
↑ Blood Glucose + ↑ Triglycerides + ↓ HDL-C +↑ AC	4 (4.3%)	-	4 (1.5%)
HA +↓ HDL-C + ↑ AC	-	18 (10.7%)	18 (6.9%)
HA +↑ Triglycerides + ↑ AC	-	16 (9.5%)	16 (6.1%)
HA +↑ Blood Glucose + ↑ AC	-	7 (4.2%)	7 (2.7%)
HA +↓ HDL-C + ↑ Triglycerides	-	3 (1.8%)	3 (1.1%)
HA +↑ Blood Glucose + ↓ HDL – C	-	1 (0.6%)	1 (0.4%)
HA +↑ Blood Glucose + ↑ Triglycerides	-	1 (0.6%)	1 (0.4%)
HA + ↓ HDL-C + ↑ Triglycerides + ↑ AC	-	24 (14.3%)	24 (9.2%)
HA +↑ Blood Glucose + ↓ HDL-C + ↑ AC	-	8 (4.8%)	8 (3.1%)
HA +↑ Blood Glucose + ↑ Triglycerides + ↑AC	-	4 (2.4%)	4 (1.5%)
HA +↑ Blood Glucose + ↓ HDL-C + ↑ Triglycerides	-	1 (0.6%)	1 (0.4%)
HA +↑ Blood Glucose + ↑ Triglycerides + ↓ HDL-C +↑ CA	-	19 (11.3%)	19 (7.3%)

DISCUSSION

This study presents an analysis of the prevalence of some components of MS among hypertensive participants in a community within the state of São Paulo.

The results indicate that the prevalence of MS in the overall sample was 45.6%. A recent study, which evaluated the occurrence of the syndrome in Latin American countries, found that rates varied between 18.8% and 43.3%, averaging 24.9% across countries; however, the data obtained may not reflect the real values due to the lack of information available in some of the regions[9].

It was further found that the combination of MS components is higher in hypertensive participants (60.7% vs. 18.3%), exacerbating the cardiovascular risk in this population. Other studies also found that the occurrence of MS among hypertensive participants is very expressive, with values around 70.8%[10] and 30% to 40%[5].

The highest average age observed in the hypertensive group reflects the ages found in the general population, where a trend towards increased blood pressure in older age groups and a high incidence of hypertension among the elderly is observed. Researchers state that approximately 65% of the elderly worldwide are hypertensive, but remind us that the increase in blood pressure related to age is not considered a physiological illness[7].

We identified the predominance of women in both subgroups evaluated. The female population forms the majority of clientele in the health facility where data collection was performed, possibly because the operating hours of the unit coincide with the working hours of the male population, consisting of rural workers, farmers or people who work in the sugarcane/alcohol industry. Moreover, after 40 years of age, the age range that encompasses most of the participants, hypertension becomes more common in women due to the effects of hypoestrogenism[11-12].

Most participants were white, likely due to the strong predominance of individuals of European descent in the population studied. However, the race of the progeny of the participants was not assessed in this study.

With respect to educational levels, most participants are in the category of functional literacy, comprised of individuals who have not completed a basic education and cannot read and/or write well. Among normotensive par-

ticipants, 40.9% had completed at least a basic education, while only 26.2% of the hypertensive participants had. In Brazil, it is known that the higher the age range, the lower the level of education, with a predominance of hypertensive individuals with a low level of education[13].

Regarding risk factors assessed by family history, a history of cardiovascular disease was the most prevalent, with a high frequency in both groups, especially among the hypertensive participants. It is worth considering that it is possible that participants have not been able to precisely state the history of their family's health.

Increased AC was the predominant factor in the total sample and among patients with SAH. It has been shown that AC is a great predictor of incident hypertension, as exceeding the body mass index is a risk factor for pathology and confirms the close relationship between abdominal obesity and MS, which can greatly influence cardiovascular risk[14].

Reduction of HDL-C was the most frequent single component in the normotensive group. Factors related to environment and lifestyle, such as physical inactivity and food consumption, as well as genetic origin or gender, can trigger the onset of primary dyslipidemia. Dyslipidemia can also occur without specific cause[15]. These components were not dealt with in the present investigation.

In terms of the combination of the components of MS, both groups had a similar manifestation of the most common elements (low levels of HDL-C, hypertriglyceridemia and abdominal obesity). Other investigators have reported similar results[10].

The potential for different combinations between components of metabolic syndrome is a tipping point and deserves careful analysis because individual characteristics or specific populations can affect the proportion and distribution of MS components. It is questionable if all combinations expose the individual to the same cardiovascular risk, and it is suggested that longitudinal studies consisting of expressive samples, able to include a sufficient number of people for each combination, be pursued[16].

In the present study, it was found that individuals with MS share aspects of risk for the development of cardiovascular diseases. However, the increase in risk may arise due to the presence of hypertension, as identified in other studies[1,10,17], which showed an increased relative risk of 2.64 times the normal risk in hypertensive participants with metabolic syndrome[18].

The successful therapeutic approach is closely related to clinical and pathophysiological characteristics due to an association between hypertension and MS[19]. National and international guidelines highlight that successful treatment depends on metabolic and lipid control, associated with strict protection of the cardiovascular system, which includes maintenance of the blood pressure at normal or near-normal levels[20]. The therapies proposed emphasize modifications in life style, but pharmacological therapy for hypertension may be necessary in the presence of other cardiovascular risks or for appropriate pressure control[21].

Pointing out that greater attention should be focused on controlling the disease in hypertensive participants at higher cardiometabolic risk highlights the nurse's role in treating these clients, with interventions based on comprehensive and systematic care which enables the implementation of health promotion activities, guidelines and incentives for self-care, aiming at reducing and controlling blood pressure and adherence to the therapy indicated[22].

Another possible bias of this study, also reported in the literature[6], is the consideration that multiple causal factors related to the different indicators evaluated make it difficult to compare the rates of prevalence of the syndrome among diverse populations and different subjects, even with careful use of the criteria defined. Moreover, in the present investigation, we used the definition of the NCEP-ATP III for MS and, in some situations, our findings were compared with those of other studies that used different proposals to define the syndrome.

CONCLUSION

Although high blood pressure can be considered to be one of the most common manifestations associated with metabolic syndrome (MS), there are few Brazilian studies that report the occurrence of different components of MS among hypertensive individuals.

This study demonstrates that the frequency of the cardiometabolic components associated with MS is greater in the presence of hypertensive disease, and that the individuals who have MS share the pathophysiological risk to develop cardiovascular disease.

By pointing out the relationship between these two clinical conditions, the results presented here may provide evidence regarding the relevance of the primary detection of the components of MS in vulnerable groups. Specifically, in the approach to hypertensive individuals, knowledge of the occurrence of clinical and biochemical indicators of the syndrome is essential for effective therapeutic management of the patients, because most of the components can be successfully treated through behavioral and/or pharmacological interventions.

Considering the heterogeneity and multiplicity of morbid conditions that may be involved in the association between hypertension and metabolic syndrome, we emphasize that further research should be conducted to quantify and characterize these components in individuals with high blood pressure, as well as explore the risks of the manifestation of all of these variables in hypertensive individuals.

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