Metabolic Syndrome in Hypertensive Patients

Correlation between anthropometric data and laboratory findings

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Cardiovascular disease is the principal cause of morbidity and mortality in Brazil with a mortality coefficient of 442 per 100,000 inhabitants (1). In 90% of the individuals with a diagnosis of arterial hypertension, no causal agent is identified; however, current knowledge tends to suggest the importance of increased BMI (particularly as a result of visceral fat) in the physiopathology of this disease. In 1988, Reaven and Hoffman (2) identified the following components of a specific syndrome that would define increased cardiovascular risk: insulin resistance, glucose intolerance, hyperinsulinemia, elevated triglycerides, reduced HDL cholesterol, and arterial hypertension.

The prevalence of metabolic syndrome increases substantially with aging, as does the incidence of diabetes (3). Metabolic syndrome is strongly predictive of future diabetes (4), and its presence in hypertensive patients who may be at risk for diabetes should be investigated. The objective of the present study was to evaluate the prevalence of metabolic syndrome in hypertensive, nondiabetic outpatients.

RESEARCH DESIGN AND METHODS

This cross-sectional study included 102 hypertensive outpatients consecutively seen between December 2003 and May 2005 at a teaching hospital in Brazil. All patients included were aged >18 years with systemic arterial hypertension diagnosed according to the criteria defined by the IV Brazilian Guidelines for Arterial Hypertension (5). Exclusion criteria consisted of secondary hypertension, clinical or laboratory evidence of congestive heart failure, coronary disease, history of cerebral vascular accident, valve defect, or diabetes.

The following variables were evaluated: age, sex, BMI, arterial pressure, waist circumference, total cholesterol, HDL cholesterol, triglycerides, fasting glucose, and glycemic levels 2 h after a 75-g oral glucose load, fasting insulin, microalbuminuria, and insulin resistance index as determined by homeostasis model assessment. Blood pressure was measured using a previously calibrated aneroid sphygmomanometer with a 12 × 23 cm cuff or a 17 × 32 cm cuff in the case of obese patients. Following a 20-min rest period, blood pressure was taken with the patient seated, with an empty bladder, and without having smoked or consumed coffee or alcohol in the 30 min before the test. Arterial hypertension was defined as arterial pressure ≥130/85 mmHg or treatment with antihypertensive medication. Hypertensive patients were evaluated to define whether they fulfilled the criteria for metabolic syndrome in accordance with the definitions of the National Cholesterol Education Program (NCEP) Adult Treatment Panel III (ATPIII) and the International Diabetes Federation (IDF).

NCEP/ATPIII defines metabolic syndrome as the presence of three or more of the following associated conditions: fasting glucose ≥110 mg/dl, central obesity (waist circumference >102 cm for men and >88 cm for women), arterial pressure ≥130/85 mmHg or pharmacologically treated hypertension, triglycerides ≥150 mg/dl or current use of fibrates, and HDL cholesterol <40 mg/dl for men and <50 mg/dl for women (6).

IDF defines metabolic syndrome as waist circumference ≥90 cm for men and ≥80 cm for women, plus at least two of the following factors: arterial pressure ≥130/85 mmHg or pharmacologically treated, triglycerides ≥150 mg/dl or current use of fibrates, HDL cholesterol <40 mg/dl for men and <50 mg/dl for women or the use of specific pharmacological therapy, and fasting glucose ≥100 mg/dl or previously diagnosed diabetes (7).

Biochemical evaluation was preceded by 3 days of normocaloric diet with no carbohydrate restrictions and a 12-h fasting period. Total cholesterol, HDL cholesterol, and triglycerides were enzymatically measured. LDL cholesterol was calculated using Friedwald's formula [LDL cholesterol = total cholesterol − (HDL cholesterol + triglyceride/5)] for triglyceride levels <400 mg/dl. Diabetes was defined as fasting glucose ≥126 mg/dl or glycemic levels 2 h after a 75-g oral glucose load ≥200 mg/dl (8).

Microalbuminuria was measured using immunoturbidimetry (APTEC, intra-assay coefficient of variation [CV] 3.99% and interassay CV 3.35%), with values ≥40 mg/24 h being considered positive.

RESULTS

Table 1 lists the clinical and laboratory data of the patients in this study. Prevalence of metabolic syndrome was 71.6 and 82.4% according to the NCEP/ATPIII and IDF classification definitions, respectively. Concordance between the two classification systems showed good reproducibility ($k = 0.67$).

There was a statistically significant difference between individuals with and

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Abbreviations: ATPIII, Adult Treatment Panel III; IDF, International Diabetes Federation; NCEP, National Cholesterol Education Program.
A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

Table 1—*Clinical and biochemical characteristics of the study sample*

Variable	Sample	MS according to NCEP criteria		MS according to IDF criteria		*P* NCEP	*P* IDF
		Absent	Present	Absent	Present		
n	102	29	73	18	84		
Males	21	11	10	7	14		
Females	81	18	63	11	70		
Age (years)	60.71 ± 10.45	61.17 ± 12.44	60.52 ± 9.64	59.67 ± 12.57	60.93 ± 10.02	0.778	0.729
Time since diagnosis of hypertension (years)	6.20 ± 5.73	4.86 ± 4.87	6.81 ± 5.94	3.72 ± 4.30	6.74 ± 5.88	0.104	0.031
Weight (kg)	72.73 ± 10.96	69.83 ± 10.21	73.91 ± 11.10	70.39 ± 10.39	73.24 ± 11.07	0.950	0.306
Height (m)	1.59 ± 0.07	1.60 ± 0.07	1.59 ± 0.08	1.60 ± 0.08	1.59 ± 0.07	0.570	0.852
BMI (kg/m^2)	28.70 ± 4.20	27.38 ± 3.76	29.23 ± 4.28	27.66 ± 4.03	28.92 ± 4.23	0.950	0.249
Waist circumference (cm)	96.10 ± 8.76	92.86 ± 8.70	97.38 ± 8.51	91.22 ± 9.58	97.14 ± 8.27	0.768	0.023
Hip (cm)	109.64 ± 9.98	105.93 ± 9.11	111.11 ± 9.99	105.28 ± 10.27	110.57 ± 9.73	0.932	0.057
Glycemia (mg/dl)	106.63 ± 33.98	90.97 ± 12.69	104.53 ± 38.77	87.06 ± 11.91	103.54 ± 36.44	0.053	0.004
Glycemia 2 h following OGTT (mg/dl)	146.71 ± 56.36	115.96 ± 40.20	158.25 ± 57.43	110.94 ± 28.91	154.13 ± 57.91	0.000	0.002
HDL cholesterol (mg/dl)	46.70 ± 12.30	55.52 ± 13.28	43.25 ± 10.12	52.56 ± 9.13	45.49 ± 12.65	0.000	0.002
Triglycerides (mg/dl)	169.02 ± 123.78	97.03 ± 27.67	197.62 ± 135.20	102.11 ± 40.89	183.36 ± 130.86	0.000	0.000
Microalbuminuria (mg/24 h)	24.88 ± 15.97	24.45 ± 13.80	25.05 ± 16.84	23.86 ± 17.04	25.10 ± 15.84	0.932	0.422
Insulin (μU/ml)	8.18 ± 6.08	6.87 ± 6.54	8.69 ± 5.87	6.30 ± 6.05	8.58 ± 6.05	0.006	0.012

Data are means ± SD. MS, metabolic syndrome; OGTT, oral glucose tolerance test (75 g).

without metabolic syndrome according to the NCEP and IDF classifications when the parameters of glucose levels 2 h after a 75-g oral glucose load, HDL cholesterol, and triglycerides were evaluated (Table 1).

According to the NCEP/ATPIII and IDF criteria, the prevalence of abnormal waist circumference was 90.41 and 100%, respectively, while low HDL cholesterol and hypertriglyceridemia had a prevalence of 76.71 and 67.12% and 64.29 and 57.14%, respectively. Abnormal fasting glucose was the variable with the lowest prevalence in the study sample according to both criteria (32.88% according to NCEP/ATPIII and 57.14% according to IDF).

When the percentage of risk factors of the patients with metabolic syndrome is analyzed according to the NCEP/ATPIII classification, 46% of patients in the study sample had three of the defining criteria for metabolic syndrome, whereas 35.7% had two and 17.9% had five of the associated conditions.

CONCLUSIONS — The high prevalence of metabolic syndrome found in this study may be related to the mean age of the study sample and the fact that the data were obtained from an analysis of hypertensive patients in a reference hospital in which the waiting time for an appointment is long.

In a cross-sectional study (10), the prevalence of metabolic abnormalities associated with arterial hypertension in individuals in the control and hypertensive groups ranged from 0.8 to 35.3%, respectively. Around 91.3% of the hypertensive patients had at least one associated cardiovascular risk factor. The combination most frequently found was arterial hypertension and hypertriglyceridemia.

In the present study, the most frequent combination was arterial hypertension and increased waist circumference followed by low HDL cholesterol, which is the factor of the metabolic syndrome most associated with hypertension.

The presence of metabolic syndrome is highly predictive of new-onset diabetes. Many studies show that hyperglycemia at pre-diabetes levels is an independent risk fator for cardiovascular diseases (11,12), and diabetes is accompanied by a significantly increased prevalence of hypertension and dyslipidemia (13).

Detecting metabolic syndrome is a simple method of evaluating individuals at high risk of diabetes, and it is important to investigate its presence in hypertensive patients who may be at risk for diabetes. The synergistic impact of arterial hypertension and other components of metabolic syndrome illustrate the need for screening for the metabolic syndrome in hypertensive patients at initial diagnosis.

In view of the relevance of this topic, our objective with this study on the metabolic syndrome in hypertensive patients was to describe the high prevalence of this syndrome in patients receiving care at a university teaching hospital in the city of Salvador, Brazil, and, based on data from the literature that show the metabolic syndrome to be an important predictor of diabetes, to call attention to the need to investigate this condition in hypertensive individuals.

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