Metabolic Syndrome in Polish Ischemic Stroke Patients

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Background: Metabolic syndrome (MetS) predisposes individuals to cardiovascular disease or stroke development. We aimed at evaluating the prevalence of MetS in a population of acute ischemic stroke (IS) patients from central Poland and at estimating the relationship between MetS and stroke risk. *Methods:* We analyzed 672 IS patients who were consecutively admitted to stroke units. The control group was composed of 612 patients with other neurologic disorders. MetS was diagnosed if 3 of 5 factors were present (obesity, increased blood pressure, increased triglycerides, low high-density lipoprotein [HDL] cholesterol, and fasting hyperglycemia) according to the Unified Criteria for Clinical Diagnosis of the Metabolic Syndrome (2009). *Results:* MetS was diagnosed in 61.2% of stroke patients versus 18.1% of the control group ($P < .001$). Multiple logistic regression showed that MetS was 1.8 times more common in women than in men (odds ratio [OR], 1.8; 95% confidence interval [CI], 1.4-2.5). The adjusted OR (95% CI) associated with MetS was 2.44 (1.48-3.64; $P < .001$) for IS. Hypertension and hypertriglyceridemia were the most frequent disturbances of IS patients (87.2% and 68.2%, respectively). The analysis of the interaction between MetS and its components showed significant associations with hypertension (OR, 2.15; 95% CI, .98-4.24; $P < .01$), high triglyceride levels (OR, 4.35; 95% CI, 2.87-9.43; $P < .0001$), and low HDL cholesterol levels (OR, 5.12; 95% CI, 3.15-8.20; $P < .001$). *Conclusions:* Over 60% of Polish IS patients have MetS. The prevalence of MetS was significantly higher in women than in men. Thus, MetS may be a risk factor for IS. **Key Words:** Metabolic syndrome—prevalence—ischemic stroke—Poland.
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Metabolic syndrome (MetS) is not a disease in itself but a cluster of mutually connected metabolic disturbances and factors that significantly increase the risk of atherosclerosis, type 2 diabetes, and cardiovascular complications (including cerebral stroke). MetS is associated with comorbidities such as abdominal obesity, arterial hypertension, increased blood glucose, and lipid metabolism disturbances.[1] A coincidence of these metabolic disturbances is usually referred to as MetS; however, names such as syndrome X, polymetabolic syndrome, insulin resistance syndrome, Reaven's syndrome, or the deadly quartet are used as well.[2–4] Although the concept of MetS has existed for over 80 years, there is no clear-cut definition of this syndrome, and there are no definite diagnostic criteria to compare the results obtained in

different studies. One of the first definitions of MetS was provided by the World Health Organization (WHO) in 1998.[5] However, because of its incompleteness, it was repeatedly revised in subsequent years. Attempts were made to establish the diagnostic criteria for MetS, for example, by the team of experts of the National Cholesterol Education Program Exert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults, Adult Treatment Panel III (NCEP-ATP III; 2001), International Diabetes Federation (IDF; 2005), American Heart Association (AHA), and National Heart, Lung and Blood Institute (NHLBI).[6–8] In 2009, an international panel of experts proposed standardized diagnostic criteria that included ethnicity and common factors among IDF, AHA-NHLBI, and NCEP-ATP III.[9]

The main thrust of the MetS diagnostic procedure is to identify patients with a higher risk of cardiovascular diseases and provide them with proper medical care to prevent and treat the syndrome's complications. The worldwide prevalence of MetS is increasing rapidly, and its relationship with stroke has been reported in numerous studies.[10–13] However, such studies are still extremely rare in Poland.

The aim of the present study was to evaluate the prevalence of MetS in a population of Polish patients with ischemic stroke (IS) and to estimate the relationship between MetS and stroke risk.

Patients and Methods

The study included 672 patients (387 women and 285 men) aged 32-93 years who were consecutively hospitalized because of IS in 2 stroke units in the Swietokrzyskie region (central Poland) in 2013. Cerebral stroke was diagnosed according to the criteria proposed by WHO.[14] Head computed tomography was performed in all cases to confirm IS. The control group was composed of 612 patients treated simultaneously for other disorders (pain syndromes, epilepsy, dementia, and demyelinating diseases). Clinical data concerning the patients were gathered prospectively from the hospital's computer database OPTIMED. Patients were eligible for study participation according to the Unified Criteria for Clinical Diagnosis of the Metabolic Syndrome for the European population (2009).[9] MetS was diagnosed if any 3 of 5 metabolic disturbances were observed (abdominal obesity, arterial hypertension, hypertriglyceridemia, reduced high-density lipoprotein [HDL] cholesterol level, and fasting hyperglycemia). Waist circumference was measured on the day of admission. The lipid levels in blood serum were measured routinely in the hospital laboratory within the first 24 hours of hospitalization. Fasting glucose levels in serum were measured after at least 8 hours since the last meal on the seventh day following the stroke. Increased arterial blood pressure (BP) was diagnosed according to the definitions of MetS, that is, if during hos-

pitalization, after 7 days following the stroke, the systolic BP was found to be 130 mm Hg or more and/or the diastolic BP was 85 mm Hg or more for at least 2 times. The Medical Ethics Committee approved the study, and all of the subjects or their relatives provided written informed consent before participating in the study.

We analyzed the prevalence and differences in the occurrence of MetS for both groups and in relation to age and sex (Table 1). Data are presented as frequencies and percentages and are expressed as the mean ± standard deviation. Differences between the 2 sexes were assessed by Student *t* test for continuous variables. The age-specific distributions of MetS of the studied population were calculated separately for men and women and between the age-groups. The chi-squared test was used to compare categorical variables. Multiple logistic regression analysis was performed to investigate the independent association of variables with MetS. The results were expressed as crude or adjusted odds ratios (ORs) with 95% confidence interval [CI]. A *P* value less than .05 was considered statistically significant. Data were analyzed using SPSS for Windows 10.1 (SPSS Inc., Chicago, IL, USA).

Results

Based on the unified diagnostic criteria for the European population (2009), MetS was diagnosed in 61.2% of IS patients and 18.1% of patients in the control group (*P* < .001). The prevalence of MetS in IS patients was significantly higher in women than in men (39.7% versus 21.5%, respectively; *P* < .001). Multiple logistic regression showed that MetS was 1.8 times more common in women than in men (OR, 1.8; 95% CI, 1.4-2.5). Such differences were not observed in the control group (Fig 1). In logistic regression analysis, the crude OR for MetS was 2.76 (95% CI, 1.74-4.12; *P* < .001). After adjusting for sex, age, and body mass index, the association between MetS and stroke risk was significant (OR, 2.44; 95% CI, 1.48-3.64; *P* < .001; Table 2). Hypertension and hypertriglyceridemia were the most frequent disturbances in IS patients (87.2% and 68.2%, respectively). The prevalence of the individual components of MetS in the study population is shown in Figure 2. The analysis of the interaction between MetS and its components showed significant associations with hypertension (OR, 2.15; 95% CI, .98-4.24; *P* < .01), high triglyceride levels (OR, 4.35; 95% CI, 2.87-9.43; *P* < .0001), high fasting glucose levels (OR, 2.65; 95% CI, 1.23-6.15; *P* < .002), and low HDL cholesterol levels (OR, 5.12; 95% CI, 3.15-8.20; *P* < .001). Sex had no influence on the occurrence of other metabolic disturbances associated with MetS. Abdominal obesity was relatively rare; it occurred in only 31.5% of cases (Fig 2). However, a steady, gradual increase in MetS prevalence was observed in relation to age, and this tendency was more marked in women than in men.