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THE ASSOCIATION OF OBESITY AND CEREBROVASCULAR DISEASE IN YOUNG ADULTS – A PILOT STUDY

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SUMMARY – Obesity has been recognized as an isolated risk factor for stroke. In obese patients, other risk factors for stroke such as hypertension, hyperlipidemia, ischemic heart disease and obstructive sleep apnea are more frequently present. The aim of this study was to assess the presence of obesity among other risk factors for stroke in younger adult patients with ischemic stroke. It was a pilot study performed in ischemic stroke patients aged 18-55. In addition to the routine diagnostic work-up, body height, weight and waist circumference were measured in study patients. The study included 50 patients, 23 female and 27 male. The mean age of male patients was 39.8±10.5 and of female patients 41.6±7.7 years. In control group The mean waist circumference was 94.9±5.8 cm in the control group and 102.6±9.8 cm in the male stroke group. There was no significant difference in waist circumference between the control and patient female groups and in body mass index among all groups. In younger males, waist circumference could be considered as an important risk factor for stroke.

Key words: *Obesity – complications; Brain ischemia – etiology; Brain ischemia – pathology; Body mass index*

Introduction

In the last decades, cerebrovascular disease is increasingly present in younger age groups[1]. Besides classic risk factors for atherosclerosis and cerebrovascular disorders such as age, sex, cigarette smoking, arterial hypertension, hyperlipidemia, ischemic heart disease, diabetes and others, some 'new' risk factors such as homocysteine, lipid subtypes, intima-media thickness (IMT), infective agents and obesity have also been identified and widely investigated[2,3]. It is known that a number of disorders that are risk factors for cerebrovascular disorders such as arterial hypertension, diabetes mellitus, hyperlipidemia and obstructive sleep apnea are more frequently present in obese individuals. In addition, some studies suggest that obesity is also an independent risk factor for cerebrovascular disease[3,4]. The measures of obesity include body mass index (BMI), waist-to-hip ratio, waist circumference, and waist-to-stature ratio. BMI is a measure of body fat based on height and weight that applies to both adult men and women. It is defined as the individual's body weight divided by the square of his/her height, and the unit of measure is kg/m^2. The World Health Organization considers a BMI of less than 18.5 as underweight, greater than 25 as overweight, and above 30 as obesity[5,6]. Metabolic syndrome that includes abdominal obesity, diabetes mellitus, insulin resistance, arterial hypertension and hyperlipidemia is identified as an independent risk factor for cardiovascular disorders[7].

Studies performed up to now have demonstrated clear association between an increased risk for car-

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diovascular disorders and increased BMI, abdominal obesity and metabolic syndrome[8]. Until recent years, no such clear association between cerebrovascular disorders and obesity was established and results of completed studies report data on all stroke patients, but with no data on younger age groups.

The aim of our study was to investigate the association between obesity and stroke in young adults.

Subjects and Methods

It was a pilot study performed at University Department of Neurology, Sestre milosrdnice University Hospital, Zagreb. The study included patients with ischemic stroke aged 18-55. In all patients, thorough medical history was taken and standard diagnostic work-up performed (blood tests, CT or MRI brain scan, ultrasound of carotid and vertebral arteries, ECG)[2]; in addition, body weight and height and waist circumference were measured and BMI was calculated (BMI=weight (kg)/height^2(m^2)).

Control group included healthy age- and sex-matched volunteers. In the control group, body weight, height and waist circumference were measured and BMI was calculated. Statistical a nalysis of the data collected was performed using standard statistical package for Windows, data were compared using Student's t-test and χ^2-test, and statistical significance was set at $P<0.05$.

Results

The study included 50 patients, 23 female and 27 male, with ischemic stroke aged 18-55, and 30 healthy volunteers as control group. The mean age of male patients was 39.8±10.5 years and of female patients 41.6±7.7 years. The mean age of male controls was 39.55±7.84 years and of female controls 40.0±9.05 years.

In control group, the mean BMI was 22.66±1.26 kg/m^2 in males and 21.77±3.04 kg/m^2 in females. The mean BMI was 23.82±4.17 kg/m^2 and 21.81± 2.93 kg/m^2 in male and female stroke patients. A significant difference was found in the mean waist circumference between male controls and male stroke patients (94.9±5.8 cm *vs.* 102.6±9.8 cm; $P<0.05$) (Fig. 1). The mean waist circumference was 78.67±3.21 cm in female controls and 77.67±3.47 cm in female stroke patients; the between-group difference was not statistically significant.

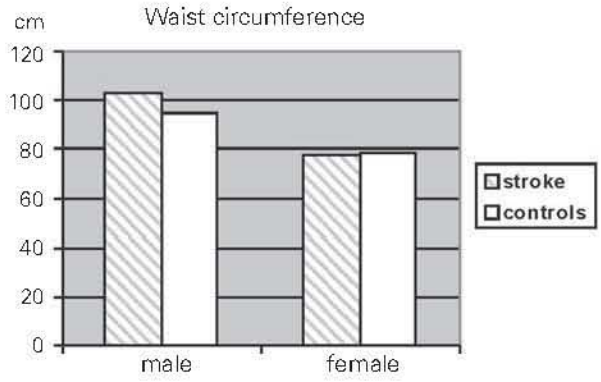

Fig. 1. Comparison of waist circumference between young adult stroke patients and controls.

Discussion

According to previous studies, BMI is clearly associated with the risk of cardiovascular disorders. Prospective studies have also shown that higher BMI, especially BMI >30 kg/m^2 in male subjects, is strongly associated with an increased risk of cerebrovascular accidents[9]. For females, BMI was linearly associated with a higher risk of ischemic stroke, whereas no clear evidence was found for an increased risk of hemorrhagic stroke[10]. The results of our pilot study are concordant with those reported by Suk *et al.*, showing that along with BMI, abdominal obesity is also a risk factor for cardiovascular and cerebrovascular disorders in males[11]. A prospective study in 45,449 females has shown that abdominal obesity measured as waist-to-hip ratio, waist-to-height ratio and waist circumference is also a strong predictor of stroke risk, even better than BMI, also in women[12]; our results did not show any significant difference in waist circumference or BMI between female stroke patients and controls. For abdominal obesity, waist-to-hip ratio is a good indicator and it is an independent risk factor for ischemic stroke[11]. Abdominal obesity is a better measure of obesity and predictor of stroke risk than BMI because BMI can be decreased in smokers or in elderly people where a high stroke risk still clearly exists[13]. Subclinical carotid disease can be detected using carotid ultrasound techniques, IMT, carotid arterial stiffness (CAS) as well as resistance index (RI)

and pulsatility index (PI)[14]. The increase in IMT by one millimeter has been associated with subclinical atherosclerosis, so IMT can be a valuable indicator of atherosclerosis in younger population where carotid atherosclerotic plaques are not frequent[15]. In obese people, IMT is increased and it is strongly associated with high levels of serum lipids, blood glucose, serum inflammatory markers and 'silent' brain infarcts[16]. In obese people, HDL cholesterol does not have protective function. Also, in obese persons adhesive molecule blood levels are increased and in significant positive correlation with BMI and waist to hip ratio increase[17]. Waist circumference and BMI are good measures for estimation of metabolic syndrome risk in persons with normal body weight or in overweight persons[18]. Based on these facts and on the results of our pilot study, we find it necessary to extend our ongoing study to the correlation of stroke and obesity, IMT, metabolic syndrome, serum lipid levels and inflammatory markers in young adults.

Conclusion

The results of our pilot study showed that waist circumference was significantly greater in young male stroke patients than in male control group. We found no significant difference in BMI between controls and young stroke patients. In females, we found no significant difference between young stroke patients and controls in either abdominal circumference or BMI. Our results and results of previous studies point to a preliminary conclusion that the risk of stroke could be associated with abdominal obesity in young male stroke patients and that BMI was not a good measure of obesity in this group. This pilot study and collection of patient data will be continued. Additional study of other risk factors in young stroke patients with obesity is being planned, aiming to define the role of obesity as an isolated risk factor for stroke in younger population.

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Sažetak

POVEZANOST DEBLJINE I CEREBROVASKULARNE BOLESTI U MLAĐIH ODRASLIH

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Debljina se smatra nezavisnim čimbenikom rizika za moždani udar. Kod pretilih ljudi također su prisutni i ostali čimbenici rizika za moždani udar poput arterijske hipertenzije, hiperlipidemije, ishemijske bolesti srca i opstruktivne apneje u snu. Cilj ovoga istraživanja bio je utvrditi prisutnost debljine uz ostale rizične čimbenike za moždani udar u odraslih bolesnika mlađe životne dobi s ishemijskim moždanim udarom. Provedeno je probno istraživanje koje je uključivalo bolesnike s ishemijskim moždanim udarom u dobi od 18 do 55 godina. Uza standardnu dijagnostičku obradu svim bolesnicima je izmjerena tjelesna visina, težina te opseg struka. Istraživanje je uključilo 50 bolesnika, 23 žene i 27 muškaraca. Prosječa dob muške skupine je bila 39,8±10,5 godina, a ženske 41,6±7,7 godina. U kontrolnoj skupini prosječni opseg struka u muškaraca je bio 94,9±5,8 cm, a u muških bolesnika s moždanim udarom 102,6±9,8cm. Nije nađena statistički značajna razlika u opsegu struka između kontrolne skupine i ženskih bolesnika kao niti za indeks tjelesne mase između bilo koje skupine. Abdominalna debljna može se smatrati značajnim čimbenikom rizika za ishemijski moždani udar u mlađih muškaraca.

Ključne riječi: *Pretilost – komplikacije; Moždana ishemija – etiologija; Moždana ishemija – patologija; Indeks tjelesne mase*