

ISCHEMIC STROKE IN YOUNG ADULTS: A RETROSPECTIVE ANALYSIS

Vanja Bašić-Kes, Vesna Vargek-Solter and Vida Demarin

University Department of Neurology, Sestre milosrdnice University Hospital, Zagreb, Croatia

SUMMARY – The aim of the study was to evaluate the profile of ischemic stroke in young adults. Sixty-two cases of ischemic stroke in Croatian subjects aged 26 to 49 years were reviewed. Fifty of these had large infarctions and 12 had lacunar infarctions. The causes of large cerebral infarction were as follows: atherosclerosis 37% of women and 35% of men; cardiac embolism 5% of women and 26% of men; and uncertain causes 31% of women and 23% of men. Among men, the most prominent risk factors were smoking and drinking, whereas among women the leading risk factors were hypertension and hypercholesterolemia. Color Doppler Flow Imaging (CDFI) was pathologic in 48% of female and 33% of male patients.

Key words: *Cerebrovascular disorders – etiology; Cerebrovascular disorders – epidemiology; Young*

Introduction

Disorder of cerebral circulation is one of the major problems in the overall morbidity in the world¹. Recent data suggest that stroke in young adults is more frequent than previously reported. It is generally considered that cerebral vascular disease reaches its peak incidence in later decades of life. Stroke in the elderly reflects the development of cardiac or vascular disorders related to age². Stroke in young adults occurs before the expected age and tends to arouse interest because there is a feeling that the study of such a group may teach us more about strokes. The relative prevalence of stroke and its causes in young adults seems to vary among different ethnic groups and geographic areas. For instance, in some countries only 3%-5% of all strokes are found in patients younger than 45, whereas in others the incidence is as high as 19%-30%³.

The aim of this study was to evaluate the profile of ischemic stroke in young patients (aged 49 years or younger).

Subjects and Methods

This study retrospectively reviewed the records of all 15- to 49- year-old patients who were admitted to the University Department of Neurology, Sestre milosrdnice University Hospital in Zagreb, Croatia, from January 2002 till December 2003. The retrospective nature of the study was a limitation because not all patients received complete examination and some information might have been lost.

The relevant information obtained from patient records included data on patient age, sex, history of systemic arterial hypertension (blood pressure >160/90), diabetes mellitus (repeat blood glucose >7.7 mmol/L), cardiac disease, cigarette smoking (more than 20 cigarettes/day for at least two years), use of drugs and oral contraceptives, and migraine. The history of stroke as well as neurologic and general physical examination at admission were evaluated. Hypercholesterolemia was considered present if the fasting blood cholesterol level was >5.5 mmol/L at recruitment; and hypertriglyceridemia was considered present if fasting triglyceride levels were >2.2 mmol/L at recruitment.

The results of the following investigations performed in all patients were also reviewed: complete blood count, erythrocyte sedimentation rate (ESR), blood glucose (BG) and serum cholesterol, electrocardiogram (ECG), color

Correspondence to: *Vanja Bašić-Kes, M.D., Ph.D.*, University Department of Neurology, Sestre milosrdnice University Hospital, Vinogradska c. 29, HR-10000 Zagreb, Croatia
E-mail: vanjakes@net.hr

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Doppler flow imaging (CDFI), transcranial Doppler (TCD) and brain computed tomography (CT). Embolic infarction was defined as a stroke when cerebral infarction occurred in the presence of clinical data highly suggestive of embolism, such as an acute myocardial infarction in the previous 3 months; the presence of valvular heart disease; a history of paroxysmal tachyarrhythmias or bradyarrhythmias. Cerebral infarction was considered to be caused by atherosclerosis if occlusive, stenotic lesions or ulcerated plaques were found by angiography or ultrasound examination on the corresponding extra- or intracranial arteries. It was also suspected when the patient had long-standing arterial hypertension or diabetes mellitus, or was a heavy smoker, in the absence of another identifiable cause.

Results

There were 25 female and 37 male patients, mean age 37.2 (age range 22-49) years. The distribution of ischemic strokes as diagnosed by CT scan within different vascular territories are shown in Fig. 1. Fifty of them had large infarctions and 12 had lacunar infarctions. The main causes of large cerebral infarctions are shown in Fig. 2.

In the group of 37 male patients, embolism of cardiac origin was suspected in eight, atrial fibrillation in two, myocardial infarction in three patients, supraventricular extrasystole in one, and tachycardia in one patient. In the group of female patients, there was only one case of embolism of cardiac origin. In the group of men, 11 cases were probably caused by atherosclerosis. Significant arterial lesions were found by CDFI in all cases, whereas in the group of female patients they were only recorded in 5 cases. The causes classified as uncertain were found in 5 and 6 cases in the group of male and female patients, respectively. The probable causes of stroke are summarized in Fig. 2.

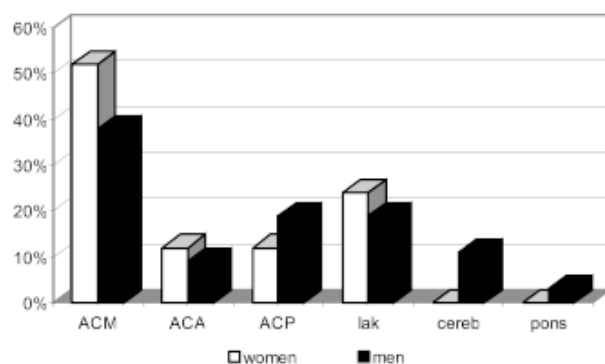


Fig. 1. Distribution of ischemic strokes as diagnosed by CT scan within different vascular territories.

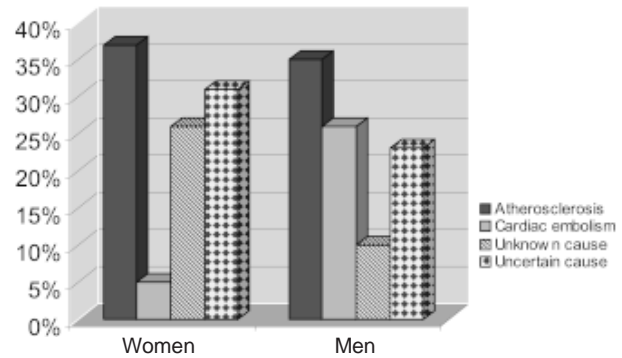


Fig. 2. Most likely causes of fifty large cerebral infarctions.

The main risk factors for stroke are presented in Table 1. Among men, the most prominent risk factors were smoking and drinking, while in the female group the leading risk factors were hypertension and hypercholesterolemia.

Noninvasive carotid flow studies revealed a large number of patients with occlusive cerebrovascular disease. In the female group CDFI was normal in 13 (52%) cases, tortuous artery was found in 6 (24%), 50%-60% stenosis of internal carotid artery in 4 (16%) cases, and subtotal stenosis with signs of vertebral artery hypoperfusion in one (4%) case. TCD was normal in 18 (72%) cases, generalized hypoperfusion was found in 4 (16%) and signs of vertebral artery hypoperfusion in 3 (12%) cases.

In the group of men CDFI was normal in 25 (68%) cases, occlusion of internal carotid artery was found in 7 (19%), subtotal stenosis of internal carotid artery in 2 (5%) cases, and occlusion of both internal carotid arteries along with subtotal stenosis of the right external carotid artery and stenosis of the left internal carotid artery in 7 (90%) cases. TCD was normal in 27 (73%) cases, hypoperfusion was found in 7 (19%), stenosis of medial cerebral artery in

Table 1. Distribution of risk factors according to Gender

Risk factor	Men (N=37)		Women (N=25)	
	n	%	n	%
Hypertension	14	38	9	36
Diabetes mellitus	5	14	2	8
Smoking	21	57	5	20
Drinking	21	57	1	4
Previous stroke	6	16	3	12
Hypercholesterolemia	15	40	9	36
Hypertriglyceridemia	8	22	3	12
Migraine	0	0	4	16

2 (5%) cases, and signs of vertebral artery hypoperfusion were recorded in one case.

Discussion

Stroke is an important cause of morbidity and mortality in young adults, especially in developing countries¹. Ischemic stroke in young adults has been considered a relatively rare event, with fewer than 5% of all cerebral ischemic infarctions occurring below the age of 45, although more than 30% have been reported³.

Ischemic stroke is well defined and its major characteristics are well known for older population. On the contrary, little is known about stroke in young persons. For this reason, the aim of the present study was to give the major characteristics of the ischemic stroke in young adults (aged below 49).

Atherosclerosis was implicated in 37% (women) and 35% (men) of the large cerebral infarctions in this series. This is higher than the data reported from other series¹. However, the mean age of our patients was higher. This confirms the fact that atherosclerosis is a less likely cause of cerebral infarction before age of 35 but rapidly becomes the dominant cause after this age^{4,5}.

The embolism of cardiac origin was implicated in 5% (women) and 26% (men) of the large cerebral infarctions. We found the embolism of cardiac origin to be more frequent in men than in women. In some studies, 33.6% of young patients (younger than 45) with cerebral infarction had cardiac pathology on echocardiography⁶.

The diagnosis of "uncertain" causes of cerebral infarction was involved in 32% of our cases, which is similar to other studies^{1,7}.

In our study, the distribution of risk factors was different when compared with other studies^{1,8}. We found hypertension in 38% of men and 36% of women.

Alcohol contributes to stroke in several ways, including induction of cardiac arrhythmias and cardiac wall abnormalities (which predispose to cerebral embolism), induction of hypertension, enhancement of platelet aggregation, activation of the clotting cascade, reduction of cerebral blood flow by stimulating cerebral vascular smooth muscle contraction, and alteration of cerebral metabolism^{2,8}. In our study, 57% of male and 4% of female patients were moderate to heavy alcohol drinkers. In some other studies, a history of excessive alcohol intake was obvious in 79% of males and 4% of females⁹.

Cerebral infarction is a potential complication of migraine headache¹⁰⁻¹². The incidence of migraine among

young patients with stroke varies little from that among the general population (approximately 15%-30%)¹³⁻¹⁵. In our series, 16% of female patients had a history of migraine. The mechanisms by which migraine may produce stroke include vasospasm and/or arteriopathy, embolism and platelet abnormalities¹³.

Noninvasive carotid flow studies revealed a large number of patients with occlusive cerebrovascular disease. In the female group we did not find any case of internal carotid artery occlusion, however, 7 (19%) such cases were found in the group of male patients. Four of them did not smoke or drink and their lipids were normal. Maybe in such cases we have to think about unusual forms of arthritis such as Takayasu's disease, fibromuscular dysplasia, autoimmune or infective vasculitides^{6,16,17}.

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Sažetak

ISHEMIJSKI MOŽDANI UDAR U MLADIH ODRASLIH OSOBA: RETROSPEKTIVNA ANALIZA

V. Bašić-Kes, V. Vargek-Solter i V. Demarin

Cilj istraživanja bio je utvrditi karakteristike ishemijskog moždanog udara u mladih osoba. U istraživanje je uključeno 62 bolesnika u dobi između 26 i 49 godina sa ishemijskim moždanim udarom. Uzroci ishemijskog moždanog udara bili su slijedeći: ateroskleroza u 37% žena i 35% muškaraca; kardioembolija u 5% žena i 26% muškaraca, a nesigurni uzroci u 31% žena i 23% muškaraca. Pedeset bolesnika imalo je ishemiju u opskrbnom području jedne ili više krvnih žila mozga, dok je njih 12 imalo lakunarnu ishemiju. Među muškarcima, najčešći rizični faktori bili su pušenje i alkoholizam, dok je među ženama, vodeći rizični faktor bila hipertenzija i hiperkolesterolemija. Kolor dopler je u 48% ženskih bolesnica bio patološki, a među muškarcima u 33% slučajeva.

Ključne riječi: *Cerebrovaskularne bolesti – etiologija; Cerebrovaskularne bolesti – epidemiologija; Mladi*