Characteristics of Stroke in Young Adults in Tuzla Canton, Bosnia and Herzegovina

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A B S T R A C T

The aim of the study was to analyze stroke in young adults in Tuzla Canton, Bosnia and Herzegovina. From January 2001 to December 2005, 3864 patients with first-ever stroke were admitted at the Department of Neurology Tuzla. A retrospective analysis of risk factors, stroke types, severity and one month outcome in all young adults (18–45 years of age) with first-ever stroke was carried out. Out of total, there were 154 (4%) young adults with stroke. Mean age was 38.8±5.7 years and 47% were women. The leading risk factors were smoking (56%) and hypertension (45%). Subarachnoid hemorrhage (SAH) was more frequent in young adults compared with older patients (>45 years of age) (22% vs. 3.5%, p< 0.0001), intracerebral hemorrhage (ICH) was similar in both groups (16.9% vs. 15.8%, p=0.7), but ischemic stroke (IS) was predominant stroke type in the older group (61% vs. 74%, p=0.0004). Young adults had more frequent lacunar stroke (26.6% vs. 16.1%, p=0.01) and stroke due to other etiology (8.5% vs. 1.8%, p=0.0004) than stroke patients over 45 years of age. Stroke severity at admission was lower in young adults than in older patients (p<0.0001), as well as mortality at one month (11% vs. 30%, p<0.0001). Favorable outcome (modified Rankin Scale ≤2) had 71% of young adults compared with only 53% of patients in the older group (p=0.0003). Stroke in young adults in Tuzla Canton is rare. Risk factors profile, stroke types, severity and outcome at one month in young adults are different from those in older patients.

Key words*: stroke, young adults*

Introduction

Despite considerable improvement in primary prevention, diagnostic workup and therapy, stroke is on the second or third place on a mortality list, and all projections indicate that this will remain in the year 2020. Furthermore, stroke is a leading cause of disability.

Stroke in young adults is rare but can be devastating for the affected individuals and their families**.** Its frequency is different from study to study. The incidence of stroke in the young has been the topic in many studies[1–3], but, accurate information about the incidence of stroke and its major subtypes in young adults have been reached in the studies with neuroimaging protocol. Causes of ischemic stroke in young adults are diverse, but undetermined etiology is common in majority of studies. Generally, the young adults with stroke have better chances of surviving and recovery than older stroke victims[1]. However, the majority of survivors have different *sequelae* that impair their quality of life.

According our knowledge, there is no information about stroke in young adults in post-war period in Bosnia and Herzegovina. The aim of this study was to analyze some characteristics of first-ever stroke in young adults in Tuzla Canton, Bosnia and Herzegovina.

Patients and Methods

From January 2001 to December 2005, 3864 patients with first-ever stroke were admitted at the Department of Neurology Tuzla, Bosnia and Herzegovina. A retrospective analysis of risk factors, stroke types, severity and one month outcome in all young adults (18–45 years of age) with first-ever stroke was carried out. The first--ever stroke in young adults treated at our Department was the only inclusion criteria, while recurrent stroke was the exclusion criteria.

Chart review was used to determine patients' medical and neurological histories, findings from general and neurological examinations, blood tests, neuroimaging and vascular studies. The following stroke risk factors were assessed: sex, hypertension (defined by preadmission history and medical records), heart disease (angina pectoris, cardiomiopathy, hypertensive heart diseases and heart rhythm disorders), atrial fibrillation (considered as a separate risk factor), diabetes mellitus (diagnosed according to the National Institutes of Health[4]), dyslipidemia (defined as the total serum cholesterol higher than 5.0 mmol/L, low density lipoprotein (LDL) higher than 3.0 mmol/L and triglycerides higher than 2.0 mmol/L), current cigarette smoking (if they smoked at least 10 cigarettes per day during the past six months[5]), and alcohol overuse (100 g alcohol per day during the past two months, and/or acute alcohol intoxication 24 hours before the onset of disease[6]).

The severity of the neurological deficit on admission was assessed using the Scandinavian Stroke Scale[7].

Routine laboratory tests (with the exception of the blood lipids level wich was performed in only 50% of the elderly stroke patients), electrocardiogram (ECG) and computed tomography (CT) were done in nearly all the patients. In young stroke patients control CT or magnetic resonance imaging (MRI) was performed in 78 patients (51%). Carotid and transcranial ultrasound were done in two third of young stroke patients, and in the cases with vascular abnormalities catheter or CT angiography was performed additionally (55 patients or 36%). All young stroke patients were examined by specialist in internal medicine, transthoracic echocardiography was done in 61 patients (40%), and transesophageal echocardiography only for strictly selected cases. Immunological testing (antinuclear and antiphospholipid antibodies) was done in 107 of the young stroke patients (69%).

Stroke was confirmed by CT scan and etiology of ischemic stroke was made according to the TOAST criteria[8]. Outcome at 1st month after stroke onset included information on vital status and handicap (modified Rankin Scale, mRS)[9].

This study was approved by the Ethical Committee of the University Clinical Centre Tuzla.

Statistical analyses

For statistical analyses we used statistical applicative software »Med Calc« v. 9.2.0.0. Continuous and categorical data between two groups were analyzed using Student's t-test and χ^2 (Chi-square) test where appropriate. Values of $p < 0.05$ were considered statistically significant.

Results

Out of total, there were 154 (4%) young adults with stroke. Mean age was 38.8±5.7 years and 47% were women. Current smoking and hypertension were the most frequent risk factors among young adult stroke pa-

tients, while atrial fibrillation and diabetes were rare. In general, stroke risk profile was different in young adults and older stroke patients (Table 1). Stroke severity at admission was significantly lower among young adults with stroke.

Table 2 shows the distribution of stroke types among young adults. Subarachnoid hemorrhage was more frequent in young adults compared with older patients (>45 years of age) (22.1% *vs*. 3.5%, p<0.0001), intracerebral hemorrhage (ICH) was similar in both groups (16.9% *vs*. 15.8%, p=0.7), but ischemic stroke (IS) was predominant stroke type in the older group (61% *vs*. 73.8%, p=0.0004). A comparison of the distribution of etiological types of ischemic stroke showed the difference between young adults and older stroke patients. Young adults had more frequent lacunar stroke (26.6% *vs*. 16.1%, p=0.01) and stroke due to other etiology (8.5% *vs*. 1.8%, p=0.0004), and less frequent atherotrombotic (14.9 *vs*. 28.7, p= 0.002) and cardioembolic stroke (9.6% *vs*. 19.2%, p=0.01) than stroke patients over 45 years of age.

One month outcome was different between two analyzed groups. Mortality rate was significantly lower in young adults (17/154, 11% *vs*. 1127/3710, 30%; p<0.0001), and favorable outcome at one month (mRS≤2) achieved significantly higher number young adults than older stroke patients (75/106, 71% *vs*. 1305/2479, 53%, p= 0.0004).

Mortality rates and functional outcome at one month are shown in Figure 1. In the young adults with stroke, ICH had the highest mortality (23%), followed with SAH (12%) and ischemic stroke (7.5%). The clinical one month outcome was favorable in more than two-thirds of young patients with cerebral infarct (42/94), and in less than half of patients with ICH (11/26). Unfavorable outcome (mRS 3–5) had nearly 25% of ischemic young stroke patients, 30% of patients with SAH and 35% with ICH.
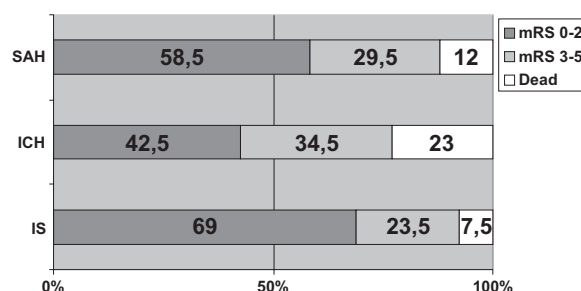

Fig. 1. Outcome of first-ever stroke in young adults at one month. IS – ischemic stroke; ICH – intracerebral hemorrhage; SAH – subarachnoid hemorrhage; mRS – modified Rankin Scale.

Discussion

Frequency of first-ever stroke in young adults is different from country to country and it is ranged between <5% and 30%[1–3,10,11]. The prevalence of stroke in young adults in our region is low (4%), but it is similar with some studies from Europe[10,12].

Our study showed some differences in risk factors profile between young adults with first-ever acute stroke and older patients (Table 1). Smoking and hypertension were the leading risk factors among young adults in our study and it is similar with findings of Rasura et al.[2]. Furthermore, in the study of our neighbors from Serbia the most frequent risk factors among young stroke patients were smoking (37%) and hypertension (35%)[12]. In the study of Khan[13], hypertension was the leading risk factor (40%), and other risk factors were represented in higher percentage than in our study (diabetes mellitus 32.5%, hypercholesterolemia 27.5%). In the recent Finnish study with 1008 young ischemic stroke patients the most frequent risk factors were dyslipidemia, smoking and hypertension[14]. In our country, unfortunately, smoking is still very popular habit among young people. The reason for this is a lack of awareness about the harmful effects of smoking. In addition, our country has no law passed to prohibit smoking in enclosed public spaces and facilities. Another interesting finding in our study is much lower prevalence of dyslipidemia in the older group of stroke patients comparing with other studies. Namely, at the time when we performed the study blood lipid level in older patients was not a part of routine laboratory tests.

Leno at al.[15] and Marini et al.[10] reported that intracerebral and subarachnoid hemorrhage were more frequent stroke types in the young. In our series we found out that subarachnoid hemorrhage was also more frequent in young adults comparing with older patients, but the prevalence of intracerebral hemorrhage was similar in both groups (Table 2). The cumulative proportion of subarachnoid and intracerebral hemorrhage in our young patients, although high (39%), was within the range found in previous studies (33.5% to 58%)[16–18].

In our study young adults had more frequent lacunar stroke and stroke due to other etiology, and less frequent atherothrombotic and cardioembolic stroke than stroke patients over 45 years of age. Compared with previous reports (Table 3), regarding ischemic stroke type in young adults, we found out that cardioembolic stroke and stroke due to other etiology was much less common in our series than in other studies. However, lacunar stroke and stroke of undetermined etiology was more common among our young adults than in other studies in Europe, Asia and the United States. We think that the main reason for such a difference in distribution of ischemic stroke types is extent of diagnostic evaluation, and this was a limitation of our study. Unfortunately, we are not able to perform

TABLE 1
GENERAL CHARACTERISTICS AND RISK FACTORS IN YOUNG ADULTS WITH STROKE

Variable	Young adults (N=154) N (%)	Older patients (N=3710) N (%)	p
Women	72 (46.8)	1973 (53.2)	0.1
Hypertension	69 (44.8)	2796 (75.4)	<0.0001
Heart disease	22 (14.3)	1593 (42.9)	<0.0001
Atrial fibrillation	2 (1.3)	599 (16.1)	<0.0001
Diabetes mellitus	6 (3.9)	909 (24.5)	<0.0001
Current smoking	86 (55.8)	1052 (28.4)	<0.0001
Alcohol overuse	11 (7.1)	328 (8.8)	0.4
Dyslipidemia	19 (12.3)	407 (11.0)	0.5
Scandinavian Stroke Scale, X±SD	37.5±18.5	29.1±16.6	<0.0001

X – mean, SD – standard deviation

TABLE 2
STROKE SUBTYPES IN YOUNG ADULTS

Stroke subtype	Young adults (N=154) N (%)	Older patients (N=3710) N (%)	p
Ischemic stroke	94 (61.0)	2993 (80.7)	0.0004
– atherothrombotic	14 (14.9)	859 (28.7)	0.002
– cardioembolic	9 (9.6)	575 (19.2)	0.01
– lacunar stroke	25 (26.6)	482 (16.1)	0.01
– other etiology	8 (8.5)	53 (1.8)	0.0004
– undetermined	38 (40.4)	1024 (34.2)	0.2
ICH	26 (16.9)	587 (15.8)	0.7
SAH	34 (22.1)	130 (3.5)	<0.0001

ICH – intracerebral hemorrhage, SAH – subarachnoid hemorrhage

TABLE 3
DISTRIBUTION OF ISCHEMIC STROKE SUBTYPES (%) IN YOUNG ADULTS IN DIFFERENT COUNTRIES

Country	ATH	CE	LS	OE	UE
USA[16]	16	14	3	44	23
Saudi Arabian[17]	12.9	17.1	24.3	30.0	15.7
Taiwan[18]	7.9	19.5	22.4	24.5	25.7
Switzerland[1]	4.0	24.0	9.0	30.0	33.0
Italy[2]	12.0	34.0	2.5	28.0	24.0
Spain[3]	21.0	17.0	17.0	9.0	36.0
Serbia[12]	7.9	19.5	22.4	24.5	25.7
B&H, present study	14.9	9.6	26.6	8.5	40.4

B&H – Bosnia and Herzegovina, ATH – atherothormbotic stroke, CE – cardioembolic stroke, LS – lacunar stroke, OE – other etiology, UE – undetermined etiology

some specific tests to diagnose protein C and S deficiency, Fabry disease, mitochondrial diseases etc. Therefore, we had the highest proportion of young stroke patients with stroke of undetermined etiology.

One month case-fatality rate in young adults (11%) was nearly one third of that reported in older patients (30.4%). Identical case-fatality rate in young adults was found in the study of Marini et al.[10], while Jacobs et al.[19] reported one month stroke mortality in young adults of 17%. In our study the best prognosis one month after the first-ever stroke had young adults with ischemic stroke. They had the lowest mortality rate (7.5%) and the highest proportion (69%) of good recovery (mRS≤2) (Figure 1). On the other hand, young adults with ICH had the highest one month mortality rate (23%) and the lowest proportion of patients with favorable outcome (42.5%). In the Italian study[10] patients with SAH had the highest proportion of good recovery (60%), patients with ICH had the highest mortality (44%), and patients with ischemic stroke had the highest proportion of severe disability (47%). In the Western Norway 80% of young ischemic stroke patients had favorable one month outcome, and 30-day case fatality rate was only 3.4%[20].

The main limitation of our study was its retrospective nature, because not all patients received complete exami-

nations and some information might have been lost. Furthermore, after the war in Bosnia and Herzegovina official stroke register has not been formed in our region and our data was based on hospital register only. Additionally, this study started just couple years after the war, when the human, capacity and technical resources at our Department were limited and »Stroke Unit« was not established.

Conclusion

Stroke in young adults in Tuzla Canton is rare, with equal sex distribution. Risk factors profile, stroke subtypes, severity and one month outcome in young adults are different from those in older patients. More than one third of young adults have intracerebral or subarachnoid hemorrhage, and stroke of undetermined etiology is the most common type of ischemic stroke. In the future, a larger battery of examinations is indicated to define the etiology of stroke in young adults. We believe that the findings in this study warrant further trials in order to obtain more precise information about stroke in young adults in whole Bosnia and Herzegovina.

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ZNAČAJKE MOŽDANOG UDARA U MLADIH ODRASLIH U TUZLANSKOJ ŽUPANIJI, BOSNA I HERCEGOVINA

SAŽETAK

Cilj ove studije je bio analizirati moždani udar u mladih odraslih u Tuzlanskoj županiji, Bosna i Hercegovina. U Klinici za neurologiju Tuzla je, od siječnja 2001. do prosinca 2005. godine, hospitalizirano 3864 bolesnika sa prvim moždanim udarom. Mi smo analizirali čimbenike rizika, tipove moždanog udara, težinu i ishod nakon prvog mjeseca kod svih mladih odraslih (životna dob 18-45 godina). Od ukupnog broja bolesnika sa prvim moždanim udarom, mladih odraslih je bilo 154 (4%). Srednja životna dob je iznosila 38,8±5,7 godina, a žena je bilo 47%. Vodeći čimbenici rizika su bili pušenje (56%) i hipertenzija (45%). Subarahnoidalna hemoragija je bila češća u grupi mladih odraslih u odnosu na starije bolesnike (>45 godina) (22% naspram 3,5%, p<0,0001), intracerebralno krvarenje je bilo približne učestalosti u obje grupe (16,9% naspram 15,8%, p=0,7), dok je ishemički moždani udar bio predominantan u grupi starijih bolesnika (61% naspram 74%, p=0,0004). Mladi odrasli su značajno češće imali lakunarni (26,6% naspram 16.1%, p=0,01) i moždani udar druge poznate etiologije (8,5% naspram 1.8%, p=0,0004). Težina moždanog udara pri prijemu je bila manja u mladih odraslih nego u starijih bolesnika (p<0,0001), kao i mortalitet unutar prvog mjeseca (11% naspram 30%, p<0,0001). Povoljan ishod (modificirana Rankin skala ≤2) je imao 71% mladih odraslih u poređenju sa svega 53% u bolesnika starije dobi (p=0,0003). Moždani udar u mladih odraslih u Tuzlanskoj županiji je rijedak. Profil čimbenika rizika, tipova, ozbiljnosti i ishoda moždanog udara nakon prvog mjeseca u mladih odraslih se razlikuje u poređenju sa starijim bolesnicima.