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High Burden of Stroke Risk Factors in Developing Country: the Case Study of Bosnia-Herzegovina

Marija Bender¹, Edin Jusufovic², Vesna Railic³, Sima Kelava⁴, Selma Tinjak⁵, Damir Dzevdetbegovic⁶, Dario Mot⁷, Mensuda Tresnjo⁸, Sandra Lakicevic¹, Natasa Pejanovic-Skobic¹, Osman Sinanovic²

¹University Clinical Hospital Mostar, Herzegovina-Neretva Canton, Bosnia and Herzegovina

²University Clinical Hospital Tuzla, Tuzla Canton, Bosnia and Herzegovina

³General Hospital Brčko, District Brčko, Bosnia and Herzegovina

⁴County Hospital „Fra Mihovila Sučića", Herzeg-Bosnian Canton, Bosnia and Herzegovina

⁵County Hospital „Dr. Safet Mujić", Herzegovina-Neretva Canton, Bosnia and Herzegovina

⁶General Hospital „Dr. Mustafa Beganović", Tuzla Canton, Bosnia and Herzegovina

⁷County Hospital Orašje, Posavina Canton, Bosnia and Herzegovina

⁸General Hospital Konjic, Herzegovina-Neretva Canton, Bosnia and Herzegovina

Corresponding author:
Marija Bender, MD. University Clinical Hospital Mostar, Herzegovina-Neretva Canton, Bosnia and Herzegovina. Mob.: 0036763044104. E-mail: marijabender@yahoo.com,

ABSTRACT

Introduction: The burden of stroke has been increasing worldwide, especially in developing countries. Very few data regarding epidemiology of stroke are available in Bosnia and Herzegovina (BH). **Patients and methods:** We undertook a retrospective hospital-based study in all hospitals existing in five cantons and one district of BH. The patients were recruited between January 1st, 2014, and December 31st, 2014, and only first-ever-in-lifetime strokes (FES) were included for evaluation. **Results:** A FES was diagnosed in 1479 patients (age 71.83 ± 11.703 years) during the study period. FES occurred in 709 men (47.9%; age 69.64 ±12.002 years) and 770 women (52.1%; age 73.85± 11.051 years). Stroke was categorized into ischemic stroke (IS), primary intracerebral hemorrhage (PICH), subarachnoid hemorrhage (SAH) and cerebral venous thrombosis (CVT), which was diagnosed in 84%, 12,2%, 3,4% and 0,4% cases respectively. Early 28-day case-fatality was 18.5 % for all patients and both sexes combined. Short-term case-fatality was significantly greater in women (P=0.007). Among all patients with FES, 87% had hypertension, 35% diabetes mellitus, 39% hypercholesterolemia and almost 25 % atrial fibrillation. **Discussion:** This is the first study that provides us with information on epidemiology of stroke in BH. More than 90% of patients had one or more modifiable risk factors and the number would be even higher if we included smoking. The early stroke case-fatality was lower than that observed in other low- to middle-income countries. **Conclusion:** All modifiable stroke risk factors, especially high blood pressure, should be understood as a major public health problem in BH and efforts should be focused on the primary prevention of stroke. Our emphasis is on the designing of a stroke register in BH for a better health planning.

Keywords: Bosnia and Herzegovina, stroke, case-fatality, epidemiology, hospital-based.

1. INTRODUCTION

Stroke affects 33 million individuals worldwide every year and two-thirds of all strokes occur in developing countries (1, 2). The burden of stroke has been increasing worldwide, especially in developing countries (3, 4). Very few data regarding epidemiology of stroke are available in Bosnia and Herzegovina (BH), mainly because it is one of the rare countries in Europe that does not have official Stroke register (5-7). In order to describe stroke subtypes, risk factors and case fatality in BH, we preformed a retrospective hospital-based study in five cantons and in one district in BH.

2. SUBJECTS AND METHOD

We studied retrospectively stroke patients hospitalized between January 1st, 2014, and December 31st, 2014, in all hospitals existing in the study area. We used World Health Organization (WHO) definition of stroke: "rapidly developing clinical signs of focal (or global) disturbance of cerebral function, with symptoms lasting 24 hours or longer or leading to death, with no apparent cause other than of vascular origin". We categorized, based on clinical and cerebral imaging, stroke subtype as ischemic stroke (IS), primary intracerebral hemorrhage (PICH), subarachnoid hemorrhage (SAH) and cerebral venous thrombosis (CVT). Transient ischemic attacks were excluded. Stroke risk factors were identified, including hypertension, blood pressure (BP) ≥160/90 mmHg (or any treatment for high BP); diabetes mellitus, fasting glucose level 7 mmol/L or plasma glucose

11 mmol/L at any time of day (or if treated with insulin or with oral hypoglycemic agents); hypercholesterolemia, total cholesterol level ≥ 5.6 mmol/L; atrial fibrillation (ECG or Holter recordings). The stroke was considered non-fatal if the patient was alive 28 days after stroke onset. All data were extracted from the hospital patient's records.

3. STUDY AREA

Bosnia and Herzegovina is a country in Southeastern Europe, located on the Balkan peninsula. According to the World Bank, it was an upper middle-income country with Gross Domestic Product (GDP) of 7123 convertible marks (U.S. dollars 3958) in 2014. Life expectancy of population is 73.33 years for males and 79.55 for females (8). The entity of the FBH is divided into ten cantons and all of these cantons have their own cantonal governments, which is under the law of the Federation as a whole (9). This study was conducted in five cantons and in one district, which are presented in Table 1. We detected all hospitals existing in the study area: County Hospital Orašje in Orašje (Posavina Canton); General Hospital „Dr.Mustafa Beganović" in Gračanica and University Clinical Center Tuzla in Tuzla (Tuzla Canton); County Hospital „Dr. Safet Mujić" in Mostar, General Hospital Konjic in Konjic and University Clinical Hospital Mostar in Mostar (Herzegovina-Neretva Canton); County Hospital „Fra Mihovila Sučića" in Livno (Herzeg-Bosnian Canton); General Hospital Brčko in Brčko (District Brčko).

Statistical Analysis

SPSS software for Windows (version 20, SPSS Inc., Chicago, IL, USA) was used for the statistical analysis of the data. Chi-square test was used for the comparison between categorical variables. P < 0.050 was considered statistically significant.

4. RESULTS

Between January 1st, 2014, and December 31st, 2014, 1938 patients with stroke were hospitalized. Mean age was 72.20 (± 11.164 SD) years. Among all identified cases, 930 (48.0 %) occurred in males and 1008 (52.0%) in females. Among all hospitalized patients, 459 (23.7%) had a recurrent stroke. A FES was diagnosed in 1479 (76.3 %) patients (age 71.83 ± 11.703 years; range 19 to 97 years). FES occurred in 709 men (47.9 %; age 69.64 ±12.002 years) and 770 women (52.1%; age 73.85± 11.051 years). In FES, brain imaging was performed in 100% of patients and stroke was categorized into IS, PICH, SAH and CVT, which was diagnosed in 84%, 12.2%, 3.4% and 0.4% cases respectively. CVT were excluded from further analysis. Mean age for IS was 72,7 years; for PICH 70.,2 years and for SAH 58.2. Ischemic patients were significantly older than hemorrhagic ones (P=0.007). Median length of hospital stay for FES was 10.4 days (range 1 to 70 days). Risk factors are summarized in Table 2. Hypertension was the main risk factor, occurring in almost 87 % of patients. Early 28-day case-fatality was 18.5% for all patients and for

Canton	Area (km²)	Population
Posavina Canton	324.6	39178
Tuzla Canton	2,649.0	501340
Herzegovina-Neretva Canton	4,401.0	222745
West Herzegovina Canton	1,362.2	78568
Herzeg-Bosnian Canton	4,934.9	67777
District Brčko	493.0	75545
Total	14,164.7	985153

Table 1. Geographical Area of the Study and its Population

both sexes combined. Intracerebral hemorrhage at 36% had the overall highest fatality rate (P<0.001) (Table 3). Short-term case-fatality is significantly greater in women (P=0.007).

5. DISCUSSION

We preformed a retrospective hospital-based study in order to describe stroke subtypes, risk factors and 28-day case-fatality of stroke in different cantons of BH. The frequencies of IS, PICH and SAH in our study of 84%, 12.2% and 3.4%, respectively, are similar to those reported by EROS investigators (10).

The median age for FES was 72 years, which is only one year older than in other European countries and conflicts with the finding that average age of FEV incidence is 6 years younger in LMIC than in HIC (10, 11, 22). In BH, like in most studies, women got their first stroke on an average 4,2 years later than man (13).

Among all patients with FEV, 87% had hypertension, 35% diabetes mellitus, 39% hypercholesterolemia and almost 25% AF. Only 7 % patients did not have any modifiable risk factors and 65% had two or more. Our data clearly showed a high prevalence of these risk factors. That can be explained by assuming that large segment of BH population still lives in poverty and low socioeconomic status is associated with higher prevalence of vascular risk factors (14). Since most of these risk factors are preventable, our emphasis would be on better stroke prevention strategies.

The early stroke case-fatality (18.5%) is lower than that observed in other low- to middle-income countries (11, 12), but still higher than the goal set for 2015 (15%) in the Helsingborg Declaration 2006 (15). We found no differences in early case-fatality between hospitals and since early case fatality is an indicator of hospital performance, we can say that quality of care is the same in all hospitals (16). Our data show significant

Risk Factors	IS (n=1242)		PICH (n=181)		SAH (n=50)		Total (n=1473)	
	No.	%	No.	%	No.	%	No.	%
Hypertension	1090	87.8	160	88.4	30	60	1280	86.9
Diabetes mellitus	457	36.8	50	27.6	9	18	516	35.0
Atrial fibrillation	335	27	28	15.5	1	2	364	24.7
Hypercholesterolemia	520	41.9	47	26	8	16	574	39

Table 2. Risk Factors for Ischemic and Hemorrhagic Stroke IS indicates ischemic stroke; PICH primary intracerebral hemorrhage; SAH, subarachnoid hemorrhage

	Ischemic (n=1242)		PICH (n=181)		SAH (n=50)		P Value
	%(95%CI)	N	% (95%CI)	N	%(95% CI)	N	
Fatal	16.3 (14.2-18.7)	203	35.9 (27.9-45.4)	65	10,0 (3.6-22.1)	5	‹0.001

Table 3. Early (28-day) Fatal Stroke Outcomes of Patients with First-Ever Stroke, Stratified by Pathological Subtype. PICH indicates primary intracerebral hemorrhage; SAH, subarachnoid hemorrhage

sex differences, with higher 28-day case fatality in women than in men. Previous studies have reported conflicting findings with evidence of no sex differences (17, 18) or increased risk in women (5, 13, 19). Sex differences are still poorly understood, but it is likely that higher case fatality in women is connected with greater stroke severity in women, which is a strong predictor of short term outcome (17).

Considering that the study was retrospective, data were extracted from medical records and therefore there was a lack of data concerning etiology for ischemic strokes, history of smoking and other risk factors.

6. CONCLUSION

In conclusion, high burden of stroke in BH is related with a high rate of modifiable risk factors. More than 90% of patients had one or more modifiable risk factors and the number would be even higher if we included smoking. All modifiable stroke risk factors, especially high blood pressure, should be understood as a major public health problem in BH and efforts should be focused on the primary prevention of stroke. Our emphasis is on the designing of a stroke register in BH for a better health planning.

- **Author Contributions:** Bender Marija designed the draft of the study, participated in data collection and writing. Jusufovic Edin, Railic Vesna, Kelava Sima, Tinjak Selma, Dzevdetbegovic Damir, Mott Dario, Tresnjo Mensuda, Lakicevic Sandra and Pejanovic-Skobic Natasa participated in data collection. Sinanovic Osman designed the draft of the study.
- **Conflict of interests:** the authors declare no conflict of interest in this study.

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