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INCIDENCE OF EPILEPTIC SEIZURES DURING AND AFTER STROKE IN A TEN-YEAR SURVEY AT DEPARTMENT OF NEUROLOGY, SARAJEVO UNIVERSITY HOSPITAL CENTER

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SUMMARY – Association between epilepsy and stroke has been known since 1864. The pathophysiological basis of epileptic seizures during and after stroke are molecular changes that occur in ischemia as primary events, and in hemorrhage as secondary events. The aim of the study was to determine the incidence of epileptic seizures during and after stroke, recorded over a 10-year period at the Department of Neurology, Sarajevo University Clinical Center. The study covered the period from January 1, 1989 till December 31, 1998. During the period, 7001 patients were treated at the Department. Cerebral thrombosis predominated (53.6%), whereas there were only 17.25% of patients with cerebral embolism, 21.96% with intracerebral hemorrhage, and 7.17% with subarachnoid hemorrhage. The incidence of symptomatic epileptic seizures for total patient sample according to years ranged from 0.75% to 6.67%. According to type of insult, the incidence of symptomatic epileptic seizures was 1.0%-3.37% for cerebral thrombosis, 1.22%-6.67% for cerebral embolism, 0.65%-4.05% for intracerebral hemorrhage, and 1.34%-4.34% for subarachnoid hemorrhage. Associated epileptic seizures, i.e. the seizures accompanying the onset of stroke, were not included in the study. Results of the study showed that there were 75 patients with symptomtic epileptic seizures (47 with late seizures and 28 with early seizures, or 1.998% of total patient sample) during the 10-year period of observation. There were 36 cases of cerebral embolism (23 and 13 in the group of late and early seizures, respectively; 2.980%), 30 cases of intracerebral hemorrhage (23 and seven with late and early seizures, respectively; 1.951%), and seven cases of subarachnoid hemorrhage (four with late and three with early seizures; 1.394%). According to stroke types and subtypes, hemorrhagic stroke was found to be a more common etiologic factor for the occurrence of early and late symptomatic epileptic seizures, whereas cerebral embolism in ischemic stroke was a more common cause of symptomatic epileptic seizures than cerebral thrombosis. During the study period, the years 1993, 1994 and 1995 were characterized by a small number of patients with symptomatic early and late epileptic seizures (9 in total). The incidence of early and late epileptic seizures in the sample of stroke patients during the study period ranged from 1.394% to 2.980%.

Key words: *Cerebrovascular disorders, complications; Epilepsy, etiology; Bosnia and Herzegovina*

Introduction

Cerebrovascular insult or stroke is a crisis of cerebrovascular circulation and central nervous system functions, but at the same time or as the consequence also a crisis of other systems, first of all of cardiovascular and respiratory systems. It is the clinical manifestation of cere-

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brovascular disease that is a longterm process lasting for years or decades. At the same time, it is the most severe neurologic disease of the third age[1], and the leading cause of mortality and disability in the adult population in Europe[2]. Clinical manifestation of cerebrovascular disease is most common in the second (age 25-64) and third (age ≥65) age groups. From the clinical viewpoint, cerebrovascular insult is a focal neurologic disjunction of the cerebral nervous system with acute onset, which is the consequence of a pathologic circulatory disorder[3]. Recent epidemiological studies have shown an increasing tendency of stroke in industrialized countries. These reports also show the rate of fatal outcome and morbidity to be on an increase[4]. The prognosis of stroke can be considered as survival prognosis, prognosis of the quality of recovery, or relapse prognosis. The mortality rate of hemorrhagic stroke and ischemic stroke has been reported to be 60% and 29%, respectively[5]. It is estimated that 60% of stroke patients suffer a high degree of disability and 20%-25% moderate disability; 50% of survivors are dependent on other people's help; and only 5%-15% can perform their daily activities by themselves. According to the results of the Framingham study, the consequences of stroke greatly vary, and can be divided into clinical sequels (various motor disturbances – unilateral or bilateral, lack of orientation, communication disturbance, vision impairment, sensitivity impairment, fecal and urinary incontinence) and consequences related to the quality of life and degree of disability (independent urination, feeding, dressing, taking bath, making bed, walking, etc.). Different types and subtypes of epileptic manifestations can also occur as a sequel of stroke.

The association between stroke and epilepsy has been known since 1864[6]. Epileptic seizures may occur as associated, early or late events. Associated seizures are epileptic manifestations with which a stroke begins, or which occur within the first 24 hours from the onset of stroke. Early seizures are those occurring in the acute stage of stroke (within 14 days of stroke onset), whereas those occurring after the time frame determining early seizures are classified into the group of late seizures. The time frame determining these seizures begins at 14 days from the onset of stroke, spanning five years thereafter. The pathophysiological basis of epileptic seizures during and after stroke includes molecular changes that occur as primary events in ischemic stroke, and as secondary events in hemorrhagic stroke[7]. The most common types of epileptic seizures during and after stroke are generalized epileptic seizures or partial epileptic seizures with or without generalization.

Patients and Methods

In this retrospective study, we used files of the Department of Neurology, Sarajevo University Clinical Center. Ten-year records of various divisions of the Department were examined: emergency neurology, general female and male neurology, and neurophysiology. Case history, final diagnosis, and data on early and late epileptic seizures during and after stroke were analyzed, with special reference to stroke classification for determination of stroke types and subtypes. The study spanned a 10-year period from January 1, 1989 till December 31, 1998. For each patient, a questionnaire with general, clinical, neuroradiologic, neurophysiologic and therapeutic data was used and served as a basis to determine stroke type and subtype, and early and late epileptic seizures. Upon data collection, statistical analysis was performed. Results are presented in Table 1 and Fig. 1.

Results

Analysis of 7001 case histories of patients treated at Sarajevo Department of Neurology during the 10-year study period showed that there were 3753 cases of cerebral thrombosis, 1208 cases of cerebral embolism, 1538 cases of intracerebral hemorrhage, and 502 cases of subarachnoid hemorrhage. Table 1 shows the incidence of symptomatic early and late epileptic seizures in the total number of stroke patients during the study period and according to years. The incidence of symptomatic epileptic seizures ranged from 0.75% to up to 6.67% in total patient sample. According to stroke types, the incidence of symptomatic epileptic seizures was as follows: 1.0%-3.37% for cerebral thrombosis; 1.22%-6.67% for cerebral embolism; 0.65%-4.05% for intracerebral hemorrhage; and 1.34%-4.34% for subarachnoid hemorrhage.

Discussion

Stroke is the most common cause of epileptic seizures in the adult population[8-10]. In differently designed studies, the incidence of epileptic seizures during and after stroke varies from 2%[11] to up to 28%[12]. In 1987, Olsen reported a 9% incidence of symptomatic epileptic seizures during and after stroke, and also cited other authors as follows: Aring and Morriet 6% (1969), Doge *et al.* 12.5% (1954), Louis and McDowell 7% (1967), Merqurdesen

Table 1. Number of early and late symptomatic epileptic seizures in total sample of stroke patients according to year of hospitalization

Year		Cerebral thrombosis	Cerebral embolism	Intracerebral hemorrhage	Subarachnoid hemorrhage	Total
1989	Total patient sample	380	60	117	67	624
	Epileptics – total	9	4	2	-	
	Late seizures	5	3	2	-	
	Early seizures	4	1	-	-	
	% of epileptics in total sample	2.37	6.67	1.71	-	
1990	Total patient sample	444	141	184	69	838
	Epileptics – total	10	6	7	3	
	Late seizures	5	3	3	2	
	Early seizures	5	3	4	1	
	% of epileptics in total sample	2.25	4.26	3.80	4.34	
1991	Total patient sample	411	150	175	62	798
	Epileptics – total	8	7	3	-	
	Late seizures	3	4	3	-	
	Early seizures	5	3	-	-	
	% of epileptics in total sample	1.95	4.67	1.71	-	
1992	Total patient sample	279	124	102	42	547
	Epileptics – total	5	7	2	1	
	Late seizures	4	4	2	1	
	Early seizures	1	3	-	-	
	% of epileptics in total sample	1.79	5.65	1.96	2.38	
1993	Total patient sample	178	55	123	23	379
	Epileptics – total	2	3	-	-	
	Late seizures	1	2	-	-	
	Early seizures	1	1	-	-	
	% of epileptics in total sample	1.12	5.45	-	-	
1994	Total patient sample	201	65	156	39	461
	Epileptics – total	2	-	-	1	
	Late seizures	2	-	-	-	
	Early seizures	-	-	-	1	
	% of epileptics in total sample	1.00	-	-	2.56	
1995	Total patient sample	271	105	133	25	534
	Epileptics – total	5	1	1	-	
	Late seizures	3	1	-	-	
	Early seizures	2	-	1	-	
	% of epileptics in total sample	1.71	0.95	0.75	-	
1996	Total patient sample	467	177	166	56	866
	Epileptics – total	8	4	3	-	
	Late seizures	5	3	-	-	
	Early seizures	3	1	3	-	
	% of epileptics in total sample	1.71	2.26	1.81	-	
1997	Total patient sample	499	167	209	59	934
	Epileptics – total	5	2	5	-	
	Late seizures	4	2	3	-	
	Early seizures	1	-	2	-	
	% of epileptics in total sample	1.00	1.20	2.97	-	

1998	Total patient sample	623	164	173	60	1020
	Epileptics – total	21	2	7	2	
	Late seizures	15	1	7	1	
	Early seizures	6	1	-	1	
	% of epileptics in total sample	3.37	1.22	4.05	3.33	
Total	Total patient sample	3753	1208	1538	502	7001
	Epileptics – total	75	36	30	7	
	Late seizures	47	23	23	4	
	Early seizures	28	13	7	3	
	% of epileptics in total sample	1.998	2.980	1.951	1.394	

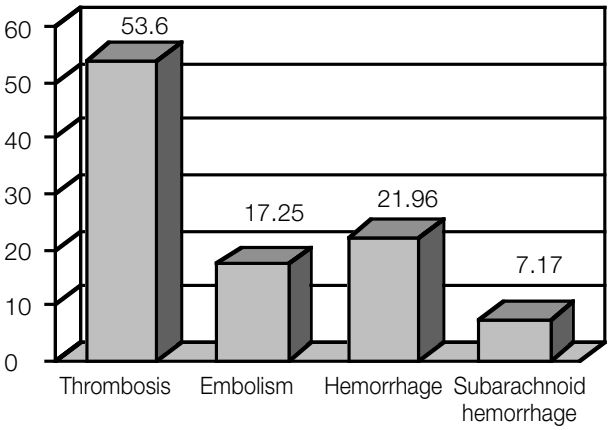

Fig. 1. Rate of early and late symptomatic epileptic seizures in total sample of stroke patients according to stroke type

6% (1969), Fentz 7% (1971), Holmes 13.8% (1980) and Black 10% (1983)[6]. Kilpatrick *et al.* report on the rate of 4.4%[9], Placentia on 5% in ischemic stroke and 28% in hemorrhagic stroke[12], Kotila and Waltimoto on 14% in ischemic stroke and 35% in hemorrhagic stroke[13], Heuts-Van Naak *et al.* on 9.5%[14], Arboix *et al.* on 2% in ischemic stroke and 4.2% in hemorrhagic stroke[11], and Burn *et al.* on 5%-11.5%[15].

Comparison of our results with those reported in the literature showed the incidence of symptomatic epileptic seizures in our total sample to be slightly lower for all stroke types and subtypes. Differences in the results could be explained by the retrospective design of our study, implying impossibility of patient follow-up, and the fact that our study did not include patients with preasymptomatic changes detectable on computed tomography of the brain as a previous ischemic or hemorrhagic stroke that could not be clinically observed but subsequently served as a pathophysiological basis for vascular precursor epilepsy in adults. In addition, the specific social and political circumstances during the war in Bosnia and Herzegovina (1992-1996) should be taken in consideration. According to stroke subtypes, the highest rate of symptomatic epileptic seizures was recorded in cerebral embolism, followed by subarachnoid hemorrhage and intracerebral hemorrhage, whereas cerebral thrombosis was associated with the lowest incidence of these seizures.

Conclusion

During the 10-year study period, the incidence of epileptic seizures in patients with various stroke types and subtypes ranged from 0.65% to 6.67% for particular years of the period. The overall incidence of epileptic seizures during the study period was highest for cerebral embolism, followed by intracerebral hemorrhage and subarachnoid hemorrhage. Cerebral thrombosis was the most common cause of stroke, but was associated with the lowest incidence of symptomatic early and late epileptic manifestations.

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Sažetak

INCIDENCIJA EPILEPTIČNIH NAPADAJA TIJEKOM I NAKON MOŽDANOG UDARA U DESETGODIŠNJEM RAZDOBLJU NA NEUROLOŠKOJ KLINICI KLINIČKOGA CENTRA UNIVERZITETA U SARAJEVU

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Veza između epilepsije i moždanog udara poznata je još od 1864. godine. Patofiziološka osnova epileptičnih napadaja tijekom i nakon moždanog udara su molekularne promjene koje u ishemiji nastaju primarno, a u hemoragiji sekundarno. Cilj ovoga rada bio je utvrditi incidenciju epileptičnih napadaja tijekom i nakon moždanog udara u desetgodišnjem razdoblju na Neurološkoj klinici Kliničkoga centra Univerziteta u Sarajevu. Obuhvaćeno je razdoblje od 1. siječnja 1989. do 31. prosinca 1998. godine, tijekom kojega je na Klinici liječen 7001 bolesnik. Najviše je bilo cerebralnih tromboza (53,65), potom cerebralnih embolija (17,25%), intracerebralnih hemoragija (21,96%) i subarahnoidnih hemoragija (7,17%). Incidencija simptomatskih epileptičnih napadaja u pojedinim godinama kretala se za ukupan uzorak od 0,75% do 6,67%. Prema tipovima inzulta incidencija je bila kako slijedi: za cerebralnu trombozu 1,0%-3,375%; za cerebralnu emboliju 1,22%-6,67%; za intracerebralnu hemoragiju 0,65%-4,05%; i za subarahnoidnu hemoragiju 1,34%-4,34%. U studiju nisu bili uključeni asocirani epileptični napadaji (napadaji kojima je započinjao moždani udar). Na temelju ispitivanja zaključeno je da je u desetgodišnjem razdoblju na Klinici bilo 75 bolesnika sa simptomatskim epileptičnim napadajima (47 bolesnika s kasnim napadajima i 28 bolesnika s ranim napadajima ili 1,998% od ukupnog uzorka naših bolesnika tijekom promatranog razdoblja). Bio je 36 bolesnika s cerebralnom embolijom (23 u skupini s kasnim napadajima i 13 u skupini s ranim napadajima; 2,980%), 30 bolesnika s intracerebralnom hemoragijom (23 u skupini s kasnim napadajima i 7 u skupini s ranim napadajima; 1,951%) i sedmoro bolesnika sa subarahnoidnim krvarenjem (4 u skupini s kasnim napadajima i 3 u skupini s ranim napadajima; 1,394%). Prema tipovima i podtipovima moždanog udara utvrđeno je da je hemoragijski moždani udar u našem kliničkom materijalu bio češći etiološki čimbenik za nastanak simptomatskih ranih i kasnih epileptičnih napadaja, dok se cerebralna embolija u ishemijskim inzultima i na našem materijalu pokazala kao češći razlog pojave simptomatskih epileptičnih napadaja u odnosu na cerebralnu trombozu. Tijekom promatranoga razdoblja mali je broj bolesnika sa simptomatskim ranim i kasnim epileptičnim napadajima (ukupno 9) zabilježen u godinama 1993., 1994. i 1995. Na temelju rezultata ovoga ispitivanja zaključeno je da se je incidencija epileptičnih napadaja u ukupnom uzorku bolesnika s moždanim udarom u desetgodišnjem razdoblju kretala od 1,394% do 2,980%.

Ključne riječi: *Cerebrovaskularne bolesti, komplikacije; Epilepsija, etiologija; Bosna i Hercegovina*