
ORIGINAL PAPER

DELIRIUM AFTER STROKE

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ABSTRACT

Aim: To determine the frequency of delirium in patients with acute stroke.

Patients and methods: We assessed delirium prospectively in a sample of 233 consecutive patients with an acute (≤ 4 days) stroke using the Delirium Rating Scale R-98 and the Diagnostic and Statistical Manual of Mental Disorders - Fourth Edition criteria for delirium.

Results: Delirium was diagnosed in 59 (25.3%) patients. Patients with delirium were older comparing to those without delirium (70.0 ± 11.3 vs. 64.7 ± 10.4 years of age; $p=0.001$). Delirium was significantly more frequent in hemorrhagic comparing to the ischemic type of stroke (41.6% vs. 22.3%, $p=0.02$). In patients with the ischemic stroke, the delirium was more frequent among those with right hemispheric lesion (26.2% vs. 20.5%, $p=0.0006$); however, in hemorrhagic stroke delirium was more frequent in patients with left hemispheric lesion (42.9% vs. 27.8%, $p=0.002$). Delirium was also more frequent in patients with ischemic stroke in the anterior than posterior cerebral circulation territory (22.7% vs. 5.6%, $p=0.0001$).

Conclusion: Delirium develops in approximately one quarter of patients in the acute phase of stroke. Possible factors which predispose the occurrence of delirium are ages over 65 years, hemorrhagic stroke, ischemic stroke in anterior cerebral circulation, lesion of right hemisphere in ischemic stroke and left hemisphere in hemorrhagic stroke.

Key words: *delirium, ischemic stroke, hemorrhagic stroke*

INTRODUCTION

Delirium represents etiological nonspecific organic cerebral syndrome attributive to simultaneous disorder of consciousness and attention, perception, thinking, psychomotor behavior, the sense of sleep-awake rhythm which can occur after the stroke.¹ Numerous studies have shown that delirium is induced by causes which decrease the level of acetylcholine inside the brain. Generally speaking any toxic-metabolic disorder which strikes the brain metabolism can cause the delirium.² In patients with acute stroke delirium conditions are temporary and they do fluctuate.³ The ma-

jority of patients are recovered within four weeks or less. If treatment is causal, the recovery is faster.

The aim of this study was to determine frequency of delirium in patients with acute phase of stroke in relation to age, stroke type and localization.

PATIENTS AND METHODS

In the prospective study which has been conducted at the Department of Neurology, the University Clinical Center Tuzla, in the period from November 2005 to April 2006, delirium frequency after the acute stroke has been analyzed. During this period 561 patients

Table 1. Delirium frequency according to the age

Age	Delirium		Without delirium		Total	
	N	%	N	%	N	%
≥ 65	44	31.9*	94	68.1	138	100
< 65	15	15.8	80	84.2	95	100
Total	59	25.3	174	74.7	233	100
Mean (±SD)	70.0 ± 11.3**		64.7 ± 10.4		66.0 ± 10.9	

SD – Standard deviation; * χ^2 test- $p=0.008$, ** t -test $p=0.001$

with first-ever stroke have been hospitalized. The inclusion criteria in the studied group patients were:

- (a) diagnosis of cerebral infarct,
- (b) intracerebral hemorrhage or subarachnoidal hemorrhage (SAH) confirmed by computed tomography (CT),
- (c) neuropsychiatric assessment performed within four days after the brain stroke onset and
- (d) Glasgow coma score >5.

Patients with Glasgow Coma Score ≤5 on the day of neuropsychiatric examination have been excluded from the study, as well as the patients with the recurrent stroke, epileptic seizures at onset of stroke, all types of aphasia, early stage of dementia, delirium caused by abuse of alcohol and other psychoactive substances. The information about pre-existing dementia and alcohol or drug abuse was collected during history taken from family members and previous medical records. The presence of delirium was assessed according the Delirium Rating Scale R-98 and the Diagnostic and Statistical Manual of Mental Disorders - Fourth Edition criteria for delirium.⁴ Delirium Rating Scale R-98 (DRS-R-98)⁵ is observation scale of thirteen parts:

- Sleep-awake rhythm disorder* - part 1,
- Perception and hallucination disorders* - part 2,
- Imagination* - part 3,
- Excitement tendencies* - part 4,
- Language* - part 5,
- Thinking process disorders* - part 6,
- Anxiety* - part 7,
- Motor brakeage* - part 8,
- Orientation* - part 9,
- Concentration* - part 10,
- Short-term memory* - part 11,
- Long-term memory* - part 12 and
- Space orientation capabilities* - part 13.

Beside these 13 items another three facultative diagnostic items have been used as a help in distinguishing of delirium from other disorders for diagnostic and scientific purposes: chronological start of symptoms, variability of symptoms and physical dis-

orders. Delirium has been diagnosed in those patients who had more than 16 points on DRS-R-98, and if they met the criteria for delirium according to the Diagnostic and Statistical Manual of Mental Disorders - Fourth Edition. Neuropsychological assessment by DRS R-98 and DSM IV criteria for delirium was made during the first 24 hours of hospitalization by one of the authors of this research. The final neuropsychological assessment was performed during the third or fourth day of hospitalization by two of the authors in this study and none of them did the first assessment. All authors of this study are neuropsychiatrists who had training in both neurology and psychiatry. Neuropsychological assessment for delirium was done according to the DRS R-98 scale by one examiner, and second by DSM IV and another independent examiner. To diagnose delirium patients had to meet the criteria according to both assessments.

Computed tomography of the brain was performed in patients with clinical signs of stroke during the first 48 hours of hospitalization. If first CT was negative, the control CT was done after 24 hours. CT was interpreted by radiologist without informing him about our research. Type and localization of lesion was determinate according to the CT. Stroke, according to the type, have been classified on:

- (a) hemorrhagic (intracerebral hemorrhage and subarachnoidal hemorrhage) and
- (b) ischemic stroke (according to the TOAST classification).⁶

According to the localization, ischemic strokes were divided into strokes in anterior or posterior cerebral circulation territory, and right or left hemispheric, while the hemorrhagic strokes were divided according to the cerebral hemisphere.

We used statistical applicative software MedCalc (9.2.0.0.) for the analysis of obtained results, with the use of standard statistical parameters: means, student's t -test and Chi-square test. A value of $p<0.05$ was considered as statistically significant.

The study protocol has been approved by Hospital Ethical Committee.

Table 2. Delirium frequency according to the type and localization of stroke

Variables	N	Delirium	Without delirium	p-value (X ² test)
Type of stroke				
Ischemic	197	44	153	0.02
Hemorrhagic	36	15	21	
Hemisphere – IS				
Left	44	9	35	0.0006
Right	65	17	48	
Bilateral	88	18	70	
Hemisphere – HS*				
Left	7	3	4	0.002
Right	18	5	13	
Bilateral	1	1	-	
Cerebral circulation territory – IS				
Anterior circulation	154	35	119	0.0001
Posterior circulation	18	1	17	
Anterior-posterior circulation	25	8	17	

* patients with subarachnoidal hemorrhage were not included; IS- ischemic stroke; HS – haemorrhagic stroke

RESULTS

Out of 561 consecutive patients with acute stroke, 233 have matched the inclusion criteria. Of these 233 patients 197 (84.5%) had an ischemic stroke, and 36 (15.5%) hemorrhagic (26 with intracerebral and 10 subarachnoidal hemorrhage). Delirium was diagnosed in 59 (25.3%) patients. Patients with delirium were older comparing to those without delirium (70.0 ± 11.3 vs. 64.7 ± 10.4 years of age, $p=0.001$). Delirium was more frequent in patients older than 65 years (31.9% vs. 15.8%, $p=0.008$) (Table 1).

Among 59 patients with delirium 25 (42.4%) were men and 34 (57.6%) women, 44 had ischemic stroke (IS), 9 patients had intracerebral and 6 patients subarachnoidal hemorrhage. Delirium was significantly more frequent in hemorrhagic (HS) comparing to the ischemic type of stroke (41.6% vs. 22.3%, $p=0.02$). In patients with the ischemic stroke, the delirium was considerably more frequent among those with right hemispheric lesion (26.2% vs. 20.5%, $p=0.0006$); however, in hemorrhagic stroke delirium was more frequent in patients with left hemispheric lesion (42.9% vs. 27.8%, $p=0.002$). Delirium was also more frequent in patients with ischemic stroke in the anterior than posterior cerebral circulation territory (22.7% vs. 5.6%, $p=0.0001$) (Table 2).

DISCUSSION

Delirium is a frequent neuropsychological disorder in acute phase of stroke, although there are few systematic studies about this topic and they are mainly conducted in the general medicine and surgical geriatric population.⁷ Previous studies about delirium occurrence after the stroke have shown different results regarding the frequency (range of 15-48%), and these differences were probably due to the different methodology.⁸⁻¹⁵

The main limitations of our study are 1) database of neuropsychological status before stroke was done according to the history of patients, not by a specific test, 2) control computed tomography was not performed in all patients. In our study, we tried the maximum to avoid the influence of other factors as a primary caused of delirium. Therefore we did not include patients with the recurrent stroke, epileptic seizures at onset of stroke, all types of aphasia, early stage of dementia, delirium caused by abuse of alcohol and other psychoactive substances. Patients with delirium were placed in the Stroke Unit under constant supervision.

In the study of Sheng et al delirium frequency of 25% was determined in the first three days after the stroke in older patients, which is almost identical to our result.¹² The study of Caeiro et al indicates the

delirium frequency of 13%.¹¹ Increased frequency of delirium after hemorrhagic stroke (50%) is also noted by Gustafson et al, but without the data about the side of lesion.⁸ Increased frequency of delirium in acute phase of stroke in patients older than 65 years of age reported Caeiro et al which was similar to our result.¹¹ In the same study the higher frequency rate of delirium in acute phase of ischemic stroke was noted in the lesion of right hemisphere (16%). The age-related loss of cholinergic reserve and the focal loss of acetylcholine in the nucleus basal of Meynert may be the reasons why delirium is more common in older individuals.¹⁶

The study of Rahkonen et al showed that among 51 previously healthy persons, the stroke was the most important etiological factor for delirium in 25% of cases, and 30% of those patients had long term treatment or died within one year.¹³ Frequency of delirium in the acute phase of stroke in our study (25.3%) is similar to the above mentioned studies. The additional characteristic of delirium in our study is that delirium is more frequent in patients with ischemic lesions in the anterior cerebral circulation. On the other hand, patients with intracerebral hemorrhage in the left hemisphere have significantly higher frequency of delirium compared with right hemispheric lesions. Hospitalized patients with delirium have high risk of early complications, longer hospitalization, higher costs of treatment and increased needs for further follow-up and monitoring, even after discharge from hospital and after the end of acute phase of stroke.

Most papers dealing with the occurrence delirium after stroke utilized DSM IV Edition Criteria for Delirium. However, the most reliable data on delirium incidence and its impact on the outcome of acute phase of stroke were gained if Delirium Rating Scale was used as an additional assessment tool. This methodological approach was used by Ferro et al as well as in our study.⁷

CONCLUSION

Delirium develops in approximately one quarter of patients in the acute phase of stroke. Possible factors which predispose the occurrence of delirium are ages over 65 years, hemorrhagic stroke, ischemic stroke in anterior cerebral circulation, lesion of right hemisphere in ischemic stroke and left hemisphere in hemorrhagic stroke.

REFERENCES

1. Sinanović O. *Delirium as a neuropsychological problem* [Delirijum kao neuropsihološki problem]. In: Sinanović O, Smajlović Dž et al (eds.) *Basics of neuropsychology and behavioral neurology* [Osnove neuropsihologije i neurologije ponašanja]. Tuzla: Univerzitet u Tuzli, 2005; 207-13.
2. World Health Organization. *International Statistical Classification of Diseases and Related Health Problems*, 10th revision. Geneva, Switzerland: World Health Organization, 1992; 240-1.
3. Cumings J. *Neuropsychiatry*. In: Simpson MG (ed). *Psychiatric disorders*. New York: Impact Communications Inc 1995; 109-36.
4. American Psychiatric Association. *Delirium, Dementia and Amnesic and Other Cognitive Disorders. Diagnostic and Statistical Manual of Mental Disorders*, 4th Edition, Text Reviewed. Washington. DC, American Psychiatric press, 2002; pp 153-80.
5. Trzepacz PT, Baker RW, Greenhouse J. A symptom rating scale for delirium. *J Psychiatry Res* 1998; 23: 89-97.
6. Fure B, Wyller TB, Thommessen B. TOAST criteria applied in acute ischemic stroke. *Acta Neurol Scand* 2005; 112: 254-8.
7. Ferro JM, Caeiro L, Vardelho A. Delirium in acute stroke. *Curr Opin Neurol* 2002; 15: 51-5.
8. Gustafson Y, Olsson T, Eriksson S, Asplund K, Bucht G. Acute confusional states (delirium) in stroke patients. *Cerebrovasc Dis* 1991; 1: 257-64.
9. Gustafson Y, Olsson T, Asplund K, Hägg E. Acute confusional state (delirium) soon after stroke is associated with hypercortisolism. *Cerebrovasc Dis* 1993; 3: 33-8.
10. Hénon H, Lebert F, Durieu I, Godefroy O, Lucas C, Pasquier F, Leys D. Confusional state in stroke. Relation to preexisting dementia, patient characteristics, and outcome. *Stroke* 1991; 30: 773-9.
11. Caeiro L, Ferro JM, Albuquerque R, Figueira ML. Delirium in the first days of acute stroke. *J Neurol* 2004; 250(2): 171-8.
12. Sheng AZ, Shen Q, Cordato D, Zhang YY, Yin C, Daniel K. Delirium within Three Days of stroke in a Cohort of Elderly Patients. *J Am Geriatr Soc* 2006; 54: 1192-8.
13. Rahkonen T, Makela H, Paanila S, Eloniemi-Sulkava U, Paanila S, Halonen P, Sivenius J, Sulkava R. Delirium in elderly people without severe predisposing disorders; etiology and 1-year prognosis discharge. *Int Psychogeriatr* 2000; 12: 473-81.
14. Dostović Z. *Frequency of delirium in the acute phase of the stroke*. [Učestalost delirijuma u akutnoj fazi moždanog udara]. In: Sinanović O, Škobić H, (eds.) *Proceedings of the Second Congress of Neurologists of Bosnia and Herzegovina* [Zbornik radova Drugog kongresa neurologa Bosne i Hercegovine]. Mostar: Udruženje neurologa u Bosni i Hercegovini; 2006; str. 369.
15. Oldenbeuving A, Kort P, Jansen B, Kappelle J, Roks G. A pilot study of rivastigmine in treatment of delirium after stroke. *BMC Neurology* 2008; 8: 34.
16. Tune LE, Egeli S. Acetylcholine and delirium. *Dement Geriatr Cogn Disord* 1999; 10: 342-4.