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Evaluation of Post Stroke Dementia in Different Types of Stroke Patients

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Abstract

Background: Post-stroke dementia is defined as any dementia occurring after stroke, and includes vascular dementia (VaD), degenerative dementia (mostly Alzheimer's disease, AD) and mixed dementia (coexistence of vascular and degenerative changes). We aimed to evaluate the patients of stroke developing this vascular cognitive impairment event by this study. **Objective:** The purpose of the present study was to evaluate post stroke dementia (PSD) after different types of strokes and to find out the determinants of dementia in stroke patients. **Methodology:** This cross-sectional study was conducted in Stroke clinic (OPD) and inpatient Department of Neurology at Bangladesh Medical University (BMU), Dhaka Bangladesh from December 2014 to June 2015. Cases were examined by Bengali version of MMSE for evidence of dementia. Severity and risk factors of dementia (PSD) was assessed with types of stroke, location of stroke, duration of stroke etc. **Results:** A total number of 80 cases were selected. Mean age of stroke patients was 61.0 ± 11.42 years. Male (n-62) out number's female (n-18) with a ratio of 3.44:1. Among 80 patients 34 (42.5%) were smoker, 22(27.5%) were diabetic and 48(60.0%) were hypertensive. Our data confirmed that a quarter, 20(25.0%) of total 80 patients become demented 3 months after stroke; most of them were in severe stage. High blood pressure, diabetes, dyslipidemia, heart disease and recurrent stroke were associated with PSD. PSD was also observed more with left sided lesions. **Conclusion:** In conclusion, post stroke dementia (PSD) events occurred after different types of strokes. *[Journal of National Institute of Neurosciences Bangladesh, July 2025;11(2):98-103]*

Keywords: Stroke; dementia; diabetes; hypertension; post stroke dementia (PSD)

Introduction

According to the World Health Organization, stroke is a sudden neurological deficit of vascular origin. It is a serious pathology with a serious impact on the functional and vital prognosis[1]. In a population of 1 million inhabitants, 2400 patients will have a stroke every year, of whom fewer than 50.0% will be independent 1 year later[2]. Post-stroke dementia is defined as any dementia occurring after stroke, and includes vascular dementia (VaD), degenerative dementia (mostly Alzheimer's disease, AD) and mixed dementia (coexistence of vascular and degenerative changes). A huge increase in prevalence and burden of PSD is likely to happen[3] because of the decline in mortality after stroke[4] and ageing of populations. Dementia related to vascular disorders, first described as "arteriosclerotic dementia"[5], was later replaced by terms like "multi-infarct dementia (MID)"[6], post-stroke dementia (PSD)[7], "vascular dementia (VaD)"[8] and recently by "vascular cognitive impairment" (VCI)[9,10,11].

Vascular cognitive disorder (VCD)[12] is a global diagnostic category encompassing all these disorders. In community-based studies with adjustment for age, the prevalence of dementia in people with a history of stroke

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is about 30.0% i.e. 3·5 to 5·8 times higher than in those who have not had stroke[13,14]. The risk of PSD and its severity are not influenced by the type of stroke (ischemic or hemorrhagic)[15,16,17]. In the New York study, dementia diagnosed 3 months after stroke was associated with a three times greater increased risk of stroke recurrence (relative risk: 2·71; 95.0% CI 1·36 to 5·42)[18]. In patients with pre-existing dementia, mortality rates are two to five times higher[19,20]. Patient-related variables associated with an increased risk of PSD are increasing age, low education level, pre-stroke cognitive decline without dementia, high blood pressure[21], diabetes mellitus[22], atrial fibrillation, myocardial infarction[23], epileptic seizures, sepsis, cardiac arrhythmias, congestive heart failure, silent cerebral infarcts, global and medial-temporal-lobe atrophy, and white-matter changes. PSD might be the result of vascular lesions, Alzheimer pathology, white-matter changes, or combinations of these. We assessed the patients with history of stroke at least 3 months back attending inpatient department or stroke clinic at OPD for evidence of dementia by the Bengali version of Mini-Mental State Examination (MMSE) that has been translated and validated by a technical committee for development of MMSE in Bangladesh[24]. Patients with scores of 24 or lower on the MMSE were considered demented. The purpose of the present study was to evaluate post stroke dementia (PSD) after different types of strokes and to find out the determinants of dementia in stroke patients.

Methodology

Study Settings and Population: This cross-sectional descriptive study was carried out in adult patients attending stroke clinic (OPD) or inpatient department of the Neurology, Bangladesh Medical University (BMU). All patients clinically diagnosed with 1st or recurrent stroke (Ischemic or hemorrhagic) presented with at least 3 months after stroke were taken as sample by purposive sampling. Exclusion criteria for cases were having any other form of dementia, severe psychiatric disorders and advanced medical conditions. After taking informed written consent, the suspected cases of ischemic and hemorrhagic stroke were identified based on history, clinical examination and findings of cranial CT scan or MRI of brain.

Study Procedure: The following demographic variables like age, sex, occupation, educational status, detailed clinical variables like present focal neurological deficit, history of recurrent stroke, hypertension, diabetes mellitus, dyslipidemia, coronary artery disease, family history stroke or dementia, smoking, alcohol consumption, dietary history and others were assessed. Examination findings including hemiparesis/ monopoiesis (MRC grading of muscle power), dysphasia, plantar response, pulse, BP, carotid bruit, cardiac murmur were noted. Common Investigational variables like blood sugar, fasting lipid profile, serum creatinine, ECG, Chest X-ray, echocardiogram, serum vitamin B-12, and related investigations were also done. All data was collected in a structured questionnaire. Total 83 cases were included in the study. 3 cases were dropped out due to severe cognitive impairment. So, 80 cases were finally selected. These patients were examined by Bengali version of MMSE for evidence of dementia[23]. Dementia severity was categorized with the score 21 to 24(mild), 10 to 20(moderate) and <10(severe). Risk factors of dementia (PSD) were assessed with types of stroke, location of stroke, duration of stroke, 1st or recurrent strokes etc. Data was collected in a pre-designed questionnaire. Since all data were categorical so we summarized them by using cross table. For comparison between groups with various variables, we measured the number and percentage. Patients were divided into 2 groups according to the diagnosis of dementia.

Statistical Analysis: All demographic, clinical, and complementary data at least 3 months after stroke were compared between these 2 groups. The 2-tailed Student t test for quantitative variables and the Chi squire (x2) test for categorical variables were used. All the univariate analyses were performed after adjusting for age. The odds ratios (ORs) and 95.0% CIs were estimated by the regression coefficients.

Ethical Consideration: All procedures of the present study were carried out in accordance with the principles for human investigations (i.e., Helsinki Declaration 2013) and also with the ethical guidelines of the Institutional research ethics. Formal ethics approval was granted by the local ethics committee. Participants in the study were informed about the procedure and purpose of the study and confidentiality of information provided. All participants consented willingly to be a part of the study during the data collection periods. All data were collected anonymously and were analyzed using the coding system.

Results

The study shows that, among 80 patients, 6 patients belonged to age group 41 to 50, 37 patients in 51 to 60, 25 in 61 to 70, 12 in > 70-year group. Maximum 46.25% (n-37) patients were in age group 51 to 60. Minimum age was 50 and maximum was 74 years, with

a mean of 61 ± 11.42 years (Table 1).

Table 1: Distribution of the respondents by age (n = 80)

Age Group	Frequency	Percent
18 to 40 years	0	0.0
41 to 50 years	6	7.5
51 to 60 years	37	46.25
61 to 70 years	25	31.25
>70 years	12	15
Total	**80**	**100**

Among the respondents, 62 (77.0%) were male and 18 (23.0%) were female, 34(42.5%) were smoker and 46(57.5%) were non-smoker, 48(60.0%) are hypertensive and 32(40.0%) are normotensive and 22(27.5%) had diabetes mellitus and 58 (72.5%) were non- diabetic (Table 2).

Table 2: Sociodemographic and clinical characteristics of the respondents (n=80)

Variables	Frequency	Percent
Gender		
• Male	62	77.0
• Female	18	23.0
• Male: Female	3.44: 1	3.44: 1
Smoking status		
• Smoker	34	42.5
• Non-smoker	46	57.5
Hypertension		
• Present	48	60.0
• Absent	32	40.0
Diabetes mellitus		
• Present	22	27.5
• Absent	58	72.5

Almost a quarter, 20(25.0%) cases were demented and 60(75.0%) were nondemented. In the 20 demented patients, 6(30.0%) having mild dementia, 6(30.0%) moderately and 8 (40.0%) were severely demented. out of 20 demented patients, 16(80.0%) had ischemic, 3(15.0%) hemorrhagic and 1(5.0%) mixed stroke whereas in nondementia group it was 53(88.33%), 5(8.33%) and 2(3.33%) respectively (Table 3).

Table 3: Distribution of respondents by stroke type (n=80)

Type of stroke	Demented	Nondemented
Ischemic	16 (80.0%)	53(88.3%)
Haemorrhagic	3(15.0%)	5(8.3%)
Ischemic with haemorragic transformation	1(5.0%)	2(3.3%)
Total	**20**	**60**

Vascular risk factors were assessed to see the relation with dementia. Except smoking (OR 0.6), all other factors like Hypertension (OR 1.3), Diabetes (OR 1.2), IHD (OR 2.9), Dyslipidemia (OR 1.4) showed significant relationship with occurrence of dementia. Recurrent strokes (OR 2.2) were more related with PSD than single ever stroke (Table 4).

Table 4: Vascular risk factors in demented and nondemented cases (n=80)

Vascular risk factors	Demented	Nondemented	OR (95.0% CI) *
Hypertension	14 (70.0%)	34(56.7%)	1.3(0.6 to 2.4)
Diabetes	6(30.0%)	16(26.7%)	1.2(0.6 to 2.5)
Smoking	7(35.0%)	27(45.0%)	0.6(0.3 to 1.1)
Heart disease	2(10.0%)	7(11.7%)	2.9(1.2 to 6.7)
Dyslipidemia	11(55.0%)	32(53.3%)	1.4(0.4 to 4.6)
Recurrent stroke	5(25.0%)	11(18.3%)	2.2(0.9 to 5.2)

Severity of dementia in ischemic and hemorrhagic groups were also assessed. It shows, out of 20 demented patients, 8(50.0%) of ischemic stroke patients developed severe dementia whereas in hemorrhagic stroke 2(50.0%) in each developed mild and moderate dementia (Table 5).

Table 5: Distribution of severity of dementia in relation to type of stroke (n=20):

Type of Stroke	Severity of Dementia		
	Mild	Moderate	Severe
Ischaemic	4(25.0%)	4(25.0%)	8(50.0%)
Hemorrhagic	2(50.0%)	2(50.0%)	0(0.0%)

In the dementia groups, left versus right and cortical versus subcortical stroke were assessed. Left sided strokes outnumbers right sided stroke and in left hemispheric stroke, cortical lesion 7(63.64%) outnumbers subcortical lesion 4(36.36%) (Table 6).

Table 6: Distribution of dementia respondents by structure involved (n=20):

Structure Involved	Hemisphere	
	Right	Left
Cortical (n=12)	5(55.6%)	7(63.6%)
Sub cortical(n=8)	4(44.4%)	4(36.4%)
Total	**9(100.0%)**	**11(100.0%)**

Discussion

Post-stroke dementia has been defined as any dementia occurring after stroke, and includes vascular dementia

(VaD), degenerative dementia mostly Alzheimer's disease, AD and mixed dementia coexistence of vascular and degenerative changes. This cross-sectional study was carried out with an aim to evaluate post stroke dementia (PSD) after different types of strokes. In this study, it was observed that the mean age of stroke patients was 61 ± 11.42 years. Most of the cases belonged to 5th and 6th decade. There was a study of prevalence of dementia estimated with six commonly used classification systems in 1879 patients. Their patients were of age 65 years or older[25]. So, it is evident that both stroke and dementia events after stroke are age dependent mostly after 60 years of age. This study shows that male patients (n-62) out number's female (n-18) with a ratio of 3.44:1. Stroke is a male predominant disease as shown in different studies in Bangladesh[26,27]. They found M: F, 2.75:1 and 2.53:1 respectively. It is well established that high blood pressure can increase the risk of stroke and heart disease and decrease life expectancy.

Many studies including the Framingham, the Kungsholmen, and the Honolulu-Asia Aging studies have implicated impaired cognitive function to hypertension in geriatric patients[28-31]. In the present study 48(60.0%) patients were hypertensive which correlates with previous studies. Again, the previous two studies showed in their series of patients having hypertension 58.6% and 65.0% respecectively[25-26]. Diabetes or hyperglycemia have been associated with worse cognitive performance after stroke, but most assessments of these markers are confounded by the fact that these might both occur in response to stroke in the acute phase or might be present in the setting of a larger stroke. Additionally, data on hyperglycemia are conflicting. Our study shows 22(27.5%) patients had diabetes which was consistent with similar study in this country which showed diabetes as a risk factor in 32.1% and 21.0% respectively[25-26]. Among 80 cases 16(20.0%) cases had family history of stroke and only 2(2.5%) cases had family history of dementia reflecting that stroke runs more in family than dementia. Previous reports from several research groups indicate that post stroke dementia (PSD) is a frequent finding, ranging from 25.0% cases32 to 41.0% cases[20] of cases. The proportion of stroke patients with PSD depends mainly on the age range, length of follow-up, and diagnostic criteria. We recruited a good number of different stroke cases who attended stroke clinic (OPD) or inpatient department of Neurology at least 3 months after the stroke event. To avoid further bias, all strokes listed in our registry were included in the series, without excluding hemorrhagic or recurrent stroke; we excluded only transient ischemic attacks, subarachnoid hemorrhage, and nonspontaneous causes of stroke. We also carefully examined the existence of previous dementia, and we used the DSM-IV criteria of dementia as the more conservative[24].

Our data confirmed that a quarter (25.0%) of patients become demented 3 months after stroke; most of them demonstrated at severe stage. The frequency of dementia (25.0%) is very similar and very close to the frequency reported by others (26.3%)[31] and (31.8%)[33] who also followed up their samples of ischemic stroke patients for 3 months. Among the demented patients (n=20), 6(30.0%), 6(30.0%) and 8(40.0%) had mild, moderate and severe dementia respectively reflecting most of the cases presenting in severe stage of dementia. Previous and present studies agree on the evidence that PSD is not solely due to cerebrovascular lesions. PSD seems to be unrelated to stroke features, such as location, and extent in our study. But Ischemic stroke 16(80.0%) clearly causing more dementia than hemorrhagic stroke 4 (20.0%) in our study. The limited influence of well-established vascular risk factors on PSD is also remarkable. High blood pressure, diabetes, heart disease, and recurrent stroke are associated with PSD in our sample. Hypertension34, diabetes[32,35], smoking[22] and myocardial infarction[22,32] were found to predict PSD in some studies but not in others. Previous stroke has been more consistently found in PSD[31,32,33,34] which was also observed in our study.

The study compares left vs. right sided lesion. There were not significant differences between anterior, middle, and posterior territories or between left and right carotid vs. vertebrobasilar territories) in these two groups. But among the demented group(n=20), left sided lesion 11(55.0%) are more than the right one. In some series of ischemic strokes[32,36] left sided lesions (present in 36.0% to 47.0%) were associated with PSD; although we found the same proportion of left sided lesions (55.0%), this finding is not confirmed in the present study, possibly because we included both ischemic and hemorrhagic cases and excluded few aphasic patients.

There are few limitations of this study. The duration of this study was short. The study was conducted in one hospital in one region; hence it may not represent the whole population. Although sample size was calculated statistically, this was small in relation to huge number of populations.

Conclusion

This study demonstrates that post stroke dementia (PSD) is a less frequently occurring event (in 25.0% cases) after stroke. Ischemic stroke (80.0%) was found to cause more dementia than hemorrhagic stroke and most (40.0%) of them were presented at severe stage. There are no significant differences between right and left hemisphere stroke. But left sided cortical lesion (63.64%) has more dementic effects than sub-cortical (36.36%) lesions. This PSD is not determined by a single factor; several factors combine to exceed the critical threshold for normal cognition. In this study the vascular risk factors like hypertension, cardiac diseases (IHD), diabetes, dyslipidemia and recurrence of stroke are found to be associated with stroke and PSD. Our study was done in a single hospital in Dhaka city. So, it doesn't reflect the picture of the whole nation. Therefore, broad-based studies involving multiple hospitals/ institutions of different parts of the country would be done. Research should now focus on the delineation of the concept of post stroke cognitive decline without dementia, which could be a preliminary stage of PSD, and be much more common in practice. Finally, epidemiological studies are also necessary to assess the evolution over time of the burden of PSD at the community level, to have a better knowledge of the need in terms of resources and its progression over time.

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Data Availability
The datasets generated and analyzed during this study are not publicly available due to patient confidentiality and institutional data protection policies. However, anonymized data may be made available from the corresponding author upon reasonable request, subject to approval by the institutional ethics committee.

Ethics Approval and Consent to Participate
Ethical approval for the study was obtained from the Institutional Review Board. As this was a prospective study the written informed consent was obtained from all study participants. All methods were performed in accordance with the relevant guidelines and regulations.

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