| RESEARCH PAPER |

Risk Factors for Post-Stroke Depression: A Comparative Study

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Abstract

Background: Post-stroke depression (PSD) is one of the common emotional disorders associated with increased morbidity, mortality and strongest predictors for poor quality of life among stroke survivors.

Aims: To find out the frequency and risk factors for PSD.

Methods: A cross-sectional analytical study conducted from July 2020 to June 2021 comparing stroke patients with and without depression, whoever was attending for follow up of three to twelve months' post-stroke duration. The cases were divided into two groups: depression and non-depression according to DSM-V criteria for major depressive disorder. Disability was measured using modified Rankin scale (score 0 complete recovery, 5 worst). Logistic regression was performed to identify risk factors for depression.

Results: A total of 258 stroke cases were recruited and 95 (36.8%) had depression. Mean (SD) age of depressed and non-depressed cases were 57.97(12.64) and 58.1(15.1) years respectively. Logistic regression indicated that ischemic stroke [OR 2.03, 95% CI (1.00-4.11), p= 0.049], disability [OR 4.69, 95% CI (1.09 - 20.16), p = 0.038] and left cerebral hemisphere lesion [OR 4.86, 95% CI (1.19-15.95), p= 0.011] were the important risk factors for post stroke depression.

Conclusions: In this study, we observed that nearly one-third stroke survivors had depression. Ischemic stroke type, having disability and left cerebral hemisphere lesion had strongest associations for the development of this depression. Future studies should explore the relationship for targeted prevention and treatment strategies.

Key words: Post-stroke depression, risk factors, stroke

Introduction:

Stroke is an important neurological disease and a leading cause of death in clinical practice.[1,31] Among survivors, over half have significant physical disabilities and/or psychiatric complications in worldwide.[1,28] Of them, majority experience impairments of daily functioning work capacity heading to increase their families' economic and caregiving burdens.[48] Post-stroke depression (PSD) is one of the most common emotional disorders for poor quality of life.[2,28] Depression can happen at any time following a stroke from soon afterwards to several months later. It can be mild to severe and may last from a few weeks to over a year.[51] Its etiopathogenesis is still uncertain, complex, multi-factorial in origin and a combination of biological and psychosocial mechanisms. Brain damage caused by stroke, disrupt in amine pathways, neural circuits involved in mood regulation, the size and location of the lesion.[4,6,51] Although some authors advocated the location of cerebral lesion as the most important factors in determining post-stroke depression.[1,3-6] Other studies failed to confirm this relationship.[2,7-9] Someone propose that depression is caused by dysfunctional psychosocial adjustment following the stroke.[51] Previous studies have reported prevalence rates that have ranged from 11% to 75% depending upon patient selection and criteria used. Approximately one-third of persons will experience clinically significant depression at some point following a stroke.[1,6,10,12] PSD is associated with diminished recovery, including less functional gain in activities of daily living, even when adjusting for other important covariates, including stroke type and severity.[5-11] Like with depression that occurs after myocardial infarction, PSD is also associated with increased risk for subsequent cardiovascular events, mortality, and healthcare utilization.[13-15] Unfortunately, PSD is often underdiagnosed and underreported, because of cognitive problems after stroke can confound the

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symptoms of depression diagnosis difficult.[1] Multiple studies[16-18] have documented the accuracy of various depression screening tools in stroke survivors. The prevalence of disability among stroke survivors is between 35–54%.[3,6] Disability after stroke has also been implicated in the etiology of post stroke depression.[7,10,11] However, some studies found only weak association between post-stroke depression and disability.[4,12] Despite a plethora of research on the risk factors of PSD in past decades, evidence is still lacking at the clinical level.[19,20] There is little information about PSD in Bangladesh. Due to significant sociocultural differences, findings from western/eastern populations could not be extrapolated to the subcontinental region. To address this point, our study aimed is to estimate the frequency of PSD and associated risk factors in a tertiary teaching and research center of Bangladesh.

Materials and Methods

A cross-sectional, analytical study that was conducted at the Department of Neurology, Shaheed Suhrawardy Medical College Hospital (ShSMCH), in Dhaka, Bangladesh from July 2020 to June 2021. Stroke patients, whoever were attending rehabilitation program for follow up were screened for enrolment. Patients with a first-ever, single, supra-tentorial stroke of three to twelve months' post-stroke duration, age 18 years and above, wiling to comply with study procedure were included. Patients with recurrent stroke, transient ischemic attack (TIA), unconscious, too ill to participate because of stroke severity, severe aphasia, or severe cognitive impairments, past history of psychiatric disorders, current antidepressant medication and substance abuse were excluded. Brain steam stroke, cerebellar stroke, subarachnoid hemorrhage and arterio-venous malformation (AVM) hemorrhage were also excluded. CT scan of head and or MRI/MRA of brain were used to confirm diagnosis, site localization and to assess vascular territory. Using standardized templates, we characterized territory of internal carotid as anterior and vertebra-basilar as posterior circulation. Study objectives were explained to the participant/legal guardian in easily understandable local language, then informed written consent was taken prior to data collection.

The patients fulfilling the inclusion criteria were evaluated for diagnosis of major depressive disorder done a neurologist based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-V).[45]

Disability was assessed using modified Rankin scale (score 0 complete recovery, 5 worst).[46,47] The interview was conducted in local language and assessments were made in English by the investigators. Sociodemographic and clinical information was obtained in a pre-designed data sheet. Tobacco consumption was established according to the WHO as: non-smoker, ex-smoker and current smoker and employed was established currently or was employed in last one year. A subject was considered diabetic, hypertensive and ischemic heart disease (IHD), when treatment records were available or receiving treatment for these conditions. Socio-economic condition was assessed by subjective statement of monthly total family income in BDT (<20,000-lower, 20,000 to 50,000 middle and >50,000 upper).

Statistical analysis:

The data were analyzed using SPSS version 23.00. Continuous variables were expressed as mean ± standard deviation and were evaluated by unpaired Student's t test. Similarly, categorical variables were expressed as percentage of the total and were evaluated by chi-square test to measure the level of significance. We calculated odds ratio between two groups (A=depression, B=non-depression) and their corresponding 95% confidence limits for categorical variables were determined by logistic regression. The association between various explanatory variables and depression was assessed by univariate logistic regression in the first step. A p-value <0.05 was considered statistically significant. Variables showing statistically significant association on univariate analysis were included in the multivariate logistic regression analysis, to identify the independent predictors of depression.

Result:

In this study, we recruited 258 stroke cases and 95 (36.8%) had depression. Mean (SD) age of depressed and non-depressed were 57.97(12.64) and 58.1(15.1) years respectively. Male were predominated both the groups (77.9% vs 66.9%) and majority were un-employed (70.5% vs. 82.2%,). There was no significant difference in frequency of residence, education, smoking, diabetes, hypertension and coronary heart disease (Table I). Anterior circulation (89.4% vs 84.2%) as well as ischemic stroke (74.7% vs 87.2%) was found more in groups and 30.62% (79/258) were complete recovery (stage 0) but only 6.58% were found in stage five (Table II).

Table I: Socio-demographic characteristics of the study population (N=258)

	Group		p value*
	Group A (depression, n=95)	Group B (non-depression, n=163)	
Gender			
Male	74 (77.9)	109 (66.9) #	
Female	21 (22.1)	54 (33.1)	0.042
Age (Groups)			
≤60	53 (55.8)	97 (59.5)	
>60	42(44.2)	66(40.5)	0.347
Marital Status			
Married	73(76.8)	123 (75.5)	
Other than married	22 (23.2)	40 (24.5)	0.921
Employment status			
Employee	28 (29.5)	29 (17.8)	
Un-employee	67 (70.5)	134 (82.2)	0.029
Residence			
Urban	53(55.8)	88 (54.0)	
Rural	42 (44.2)	75 (46.0)	0.880
Education			
Illiterate	26(32.5)	54(33.13)	
Literate	69(67.5)	109(66.87)	0.370
Smoking status (only in Male)			
Smoker	45 (39.5)	69 (60.5)	
Non-smoker	29 (42.0)	40 (58.0)	0. 733
Diabetes mellitus			
Present	29 (30.5)	51 (31.3)	0.995
Absent	66 (69.5)	112 (68.7)	
Hypertension			
Present	79 (83.2)	127 (77.9)	0.394
Absent	16 (16.8)	36 (22.1)	
Coronary heart disease (CHD)			
Present	22 (23.2)	51 (31.3)	0.209
Absent	73 (76.8)	112 (68.7)	
Age (mean)	57.97(12.64)	58.1(15.1)##	0.936**

*Chi square test was done to measure the level of significance except **where Unpaired t test was done to measure the level of significance

#Figure within parenthesis denoted corresponding column percentage except## where Mean (SD)

Table II: Clinical presentation of the study population (N=258)

	Group		p value*
	Group A (depression, n=95)	Group B (non-depression, n=163)	
Vascular territory			
Anterior circulation	84 (89.4)	137 (84.2) #	0.05
Posterior circulation	11 (10.6)	26 (15.8)	
Stroke type			
Ischemic	71 (74.7)	136 (87.2)	0.019
Hemorrhagic	24 (25.3)	20 (12.8)	
Disability (mRS)			
Stage 0	15 (15.7)	64 (39.2)	<0.001
Stage 1	07 (7.4)	37 (22.7)	
Stage 2	22 (23.5)	31 (19.1)	
Stage 3	18 (18.8)	15 (9.2)	
Stage 4	21(22.1)	11 (6.7)	
Stage 5	12 (12.5)	05 (3.1)	
Side of cerebral hemisphere lesion			
Left	70 (73.68)	64 (39.26)	<0.001
Right	25 (26.32)	99 (60.74)	

*Chi square test was done to measure the level of significance
#Figure within parenthesis denoted corresponding column percentage

Univariate analysis shows, female [OR 1.75, 95%CI (1.07 -3.13); p =0.042], un-employment [OR 1.93, 95%CI (1.06 – 3.51); p = 0.031], anterior circulation stroke [OR 1.15, 95%CI (1.29 - 2.39); p =0.048], ischemic stroke [OR 2.3, 95%CI(1.19 - 4.44); p= 0.013], disability [OR 3.45, 95%CI(1.56 - 12.61); p<0.001] and left cerebral hemisphere lesion [OR 4.33, 95%CI (1.91 – 14.10); p<0.001] were significant association with post stroke depression (Table III).

Table III: Socio-demographic and clinical factors associated with post stroke depression (N=258)

Variables	Unadjusted OR	95% CI	p value
Gender			
Male [Ref.]	1		
Female	1.746	1.073 - 3.131	0.042
Employment status			
Employed [ref]	1		
Un- employed	1.931	1.064 -3.506	0.031
Site of circulation			
Posterior [ref]	1		
Anterior	1.148	1.289 - 2.395	0.048
Stroke type			
Hemorrhagic [ref]	1		
Ischemic	2.299	1.189 - 4.444	0.013
Disability			
No (stage 0) [ref]	1		
Yes (stage 1 to 5)	3.631	1.564 -12.608	<0.001
Side of cerebral hemisphere lesion			
Right [ref]	1		
Left	4.331	1.902 - 14.102	<0.001

Significant variables that found univariate analysis, were entered logistic regression model, we found, ischemic stroke [OR 2.03, 95% CI (1.00-4.11), p= 0.049], disability [OR 4.69, 95% CI (1.09 - 20.16), p = 0.038] and left cerebral hemisphere lesion [OR 4.86, 95% CI (1.19-15.95), p= 0.011] were the major factors for depression (Table IV).

Table IV: Logistic regression for associations of post-stroke depression

Variables	Adjusted OR (95% CI)	p value
Stroke type		
Hemorrhagic [(ref)]	1	
Ischemic	2.031 (1.004-4.109)	0.049
Disability		
No [(ref)]	1	
Yes	4.686 (1.089 - 12.160)	0.038
Side of cerebral hemisphere lesion		
Right [(ref)]	1	
Left	4.856 (1.190-15.950)	0.011

Discussion:

The frequency of PSD in this study was 36.8% which consistent with previous studies.[6,28,31,52] The difference in prevalence rate as compared to others[7,21-30,50] might be due to the sample characteristics, since this study was confined to patients who were referred for rehabilitation. Previous studies have shown advancing age as a risk factor for the development of depression,[20-24] but we did not find any difference. Post-stroke depression in the aged may have a biological basis, with reduced neuro-transmitters relating to mood and emotion.

Demographic variables are important determinants of PSD.[28,51] Similarly, in our study, the determinants of depression in univariate analysis, female gender and un-employment were signification but marital status, living situation were not. This reflects the sociodemographic profile of a developing country, where there is lower per capita expenditure on health. The majority of the earlier studies[21-23,29,50] had reported female gender as being an important risk factor for PSD. The absence of a significant association between PSD and smoking, hypertension, diabetes, or ischemic heart disease was partly consistent with some previous reports.[25-28,52] Although they were established risk factors for development of stroke but they were not reported as risk factors for development of PSD.[1]

Multivariate logistic regression model, we found ischemic stroke, disability and left cerebral hemisphere lesion were the independent factors for depression. In confirmation of our findings, the type of stroke (ischemic vs. hemorrhagic) was found to be a predictor in many studies[30-32,53] but others did not have.[25,26,28] The relationship between PSD and lesion location is a matter of some debate. In the present study, there was significant relationship between PSD and left cerebral lesion location. Similar findings were found in the different study.[33-37,49,50] However, few reports[38-41] found no significant correlation. PSD was more common in those with more severe post-stroke functional impairments as measured by the modified Rankin scale. Our findings support others.[1,22,28,29,31,34,42-44,49] Thus, the burden of functional impairment of stroke can increase the risk of PSD, which then leads to further impairment like increased disability.

Limitations:

It was a single center; cross-sectional study. Relatively small sample size and highly selective patients enrolled. Severity of depression was not evaluated using any scales. The final limitation was lack of MRI study in some cases to measure brain lesion.

Conclusions:

PSD was present in more than one-third of the stroke survivors. Ischemic stroke type, having disability and left cerebral hemisphere lesion were predictors for the development of PSD. This highlights the need for ongoing clinical monitoring of patients depressed after stroke. But using larger sample sizes, multicenter, randomized design would help for further elucidate these issues and to target prevention and treatment strategies.

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