

## Prevalence and Severity of Post Stroke Depression and its Relation with Demographic and Stroke Characteristics

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**Abstract:** The World Health Organization has highlighted the emergence of non-communicable chronic diseases, including stroke, in developing countries. As a cause of death, stroke ranks fourth in India. Stroke is the foremost cause of neuropsychiatric disorder, including Post Stroke Depression (PSD) which is a very common disorder. The objectives of this study were to identify the prevalence and severity of depression in patients with stroke and to assess its relationship with demographic variables and stroke characteristics. It was a cross sectional study and was conducted at the Neurology Out Patient Department of Thanjavur Medical College Hospital, Thanjavur, Tamil Nadu. Screening for depression was carried out for patients with stroke (N=52), who visited the Neurology Out Patient Department of the Thanjavur Medical College Hospital, Thanjavur, Tamil Nadu using the ICD 10 criteria. The severity of depression was assessed with Beck Depression Inventory II and the level of cognitive impairment was measured using Mini Mental Status Examination (MMSE). Data was collected using the self structured proforma which contained demographic and stroke related variables. Analysis was carried out to determine the relationship between post stroke depression with demographic variables and stroke characteristics. Chi Square was computed to find out the association between variables. SPSS 20 version was used to perform statistical analysis. Forty four patients with stroke out of 52 (85%) met the criteria for depression. Demographic variables and ischemic stroke type were not significantly associated with post stroke depression. There was significant association between post stroke depression and left middle cerebral artery infarction. These results highlighted the need to investigate, diagnose and treat PSD, which is a risk factor for morbidity and mortality after stroke.

**Keywords:** Stroke, post stroke depression, left middle cerebral artery infarction

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### I. Introduction

Stroke as per the definition given by the World Health Organization is “a rapidly developed clinical signs of focal or global disturbance of cerebral function, lasting for more than 24 hours or until death, with no apparent cause other than of vascular origin. Stroke is caused by the interruption of the blood supply to the brain, usually because a blood vessel bursts or is blocked by a clot. This cuts off the supply of oxygen and nutrients, causing damage to the brain tissue”<sup>1</sup>. As per an estimate of WHO every year about 15 million of world population suffers from stroke out of which around 33% (5 million) die and 33% become disabled permanently. Globally on every 10th second, a life is taken by stroke and on every ½ second an incident of stroke occurs. High blood pressure is the major risk factor in stroke which causes more than 80% of stroke cases (12.7 million) worldwide. Other risk factors of stroke are smoking, atrial fibrillation, heart failure and heart attack <sup>1,2</sup>.

In developing countries burden of stroke is rising rapidly. They borne about 66% of total stroke burden and rate of stroke in these countries has surpassed the rate of developed countries by 20% during the period from the year 2000 to 2008 <sup>3</sup>. In terms of mortality and morbidity due to stroke globally, stroke found to be the leading reason of death in people of age group of 60 years and above and is the 5th leading cause of death among people of age group 15-59 years<sup>4</sup>. In terms of disability as per the Lancet 28 Nov 2009 issue, stroke is found to be the leading cause worldwide and in developing countries it is the 2nd leading cause of disability.

Around four fifth (> 80%) of stroke cases are caused by ischemic brain infarction<sup>5</sup>. Ischemic stroke is due to obstruction in a blood vessel supplying blood to brain. This blockage in blood vessel could be caused due to blood clot in the vessel or due to hardening of blood vessel supplying blood to the brain because of accumulation of fat in vessel walls. Remaining one fifth (13 % ) of stroke cases are due to hemorrhagic stroke, which is less frequent and occur due to breakage or burst of a blood vessel which leads to the bleeding. Accumulation of blood compresses surrounding brain tissues creating deprivation of oxygen and nutrients to the

surrounding tissues. This type carries higher risk of death<sup>6</sup>. In first month after stroke about 80 to 90 % ischemic stroke patients stay alive while survival rate drops to 67-80% in one year after stroke<sup>7</sup>. Rate of stroke mortality is greater than that of other chronic diseases if all put together (AIDS, TB and Malaria) worldwide<sup>8</sup>. Major revival occurs within first three months after stroke while long term disability often remains for a longer period<sup>3</sup>.

## **Depression**

According to WHO definition “Depression is a common mental disorder characterized by sadness, loss of interest in activities and by decreased energy. It is differentiated from normal mood changes by the extent of its severity, the symptoms and the duration of the disorder”. Identifiable depression prevalence is 5-10% of the populace at any given point of time which requires psychological intervention. Risk of developing depression in female during a lifetime is 10-20% which is somewhat higher than male<sup>9-11</sup>.

Post stroke depression is divided into two major types: Major Depression and Minor Depression. Major depression is the outcome of left anterior lesion location of stroke. Risk of developing cognitive impairment is high among patients suffering from major depression. Minor or dysthymic depression is the outcome of posterior brain injury. Chance of developing cognitive impairment in 2nd type of depression is insignificant whereas major depression is related with high functional impairment<sup>12-16</sup>. Study of Post Stroke Depression (PSD) is of vital importance to avoid long term adverse consequences of post stroke depression. Through early study of PSD, patients could be helped out at an early stage and long term critical complications could be avoided.

## **Post Stroke Depression and its prevalence**

Stroke is significantly associated with high rate of mortality and morbidity. Although a decreasing trend could be observed in mortality rate from stroke especially in western societies rate of morbidity is still very high. According to an estimate about one third of the post stroke patients suffer from substantial depressive symptoms<sup>17</sup>. WHO has predicted cerebrovascular disease as the second highest cause of disability worldwide by 2020. Different studies on prevalence of Post Stroke Depression (PSD) report different frequencies and results vary considerably across studies. The prevalence as reported in different studies ranges from 9% to 60%.

This large variation in range of depression reported by different studies could be attributed to variation in population characteristics being studied, different assessment measures/ study designs used, definition of depression, time of assessment and clinical characteristics. Stroke progression could be taken as an important risk factor in development of Post Stroke Depression (PSD) as comparatively less depression is observed in first ever stroke patient as compared to the patients having recurrent stroke history<sup>18-20</sup>.

## **Stroke Characteristics:**

### **Lesion Location**

Historically the association of post stroke depression and left hemisphere lesion location was documented by some of the researches followed by the series of studies which endorse this finding and reinforce the hypothesis that left hemisphere lesion plays an important role in creation of post stroke depression<sup>21</sup>. Severe depression after stroke was found associated with left anterior cerebral lesion while less severity of post stroke depression was found in left posterior lesion<sup>14</sup>. Further, no significant association was found between the post stroke depression and left cortical and sub cortical lesions<sup>22</sup>. The researchers who belong to the second group of thoughts, in contrast, found no relationship between the lesion location and post stroke depression<sup>23</sup> as in a systematic review a study has found no significant association between lesion location and depression after pooling the data of primary studies<sup>24</sup>. Further, the third group of thoughts studies found association of depression with right hemisphere lesion location<sup>25</sup>.

This wide divergence among different research findings on the subject of Lesion location association with post stroke depression could be attributed to the methodological differences among study setting e.g minimal sample size, sample selection criteria, study site, different tools used to measure depression, time passed since stroke. Importance of time elapsed since stroke and study settings in association of depression with lesion location were also proved by researchers. The involvement of left lesion location in development of depression was found only in acute depression in the first week after stroke. Post stroke depression was found associated with left hemisphere lesion location in hospital inpatients studies early after stroke while right hemisphere lesion location and post stroke depression were found associated in community based population studies within six months after stroke<sup>26</sup>.

## **II. Materials and Method**

Totally 52 patients were selected to serve as sample in the study who fulfilled the inclusion criteria. This study was carried out at Neurology Out Patient Department of Thanjavur Medical College Hospital, Thanjavur from 1 July, 2017 to 30 September, 2017 with the help of Neurologist and Psychiatrist. The consent

of patients to participate in study was sought and they were also assured about confidentiality of the information.

Afterwards, we conducted the interviews of the patients using the questionnaire devised for this study, during follow-up visits of the patients with stroke to the Neurology Out Patient Department. Questionnaire based interviews were conducted during the OPD timing (from 08: 00 a.m to 2:00 p.m) in week days.

Dependent variable of our study was depression while independent variables were all demographic and clinical factors such as age, gender, marital status, financial status, residence status, education level and the clinical variables including stroke type, side and site of stroke.

The main instrument used for data collection was a self structured proforma. It was designed from ICD 10 to assess depressive symptoms. Every patient was evaluated against the list of 9 predefined depressive symptoms (as per the criteria of ICD 10) and those patients were identified as depressed who were having at least four or more of the symptoms out of seven and one of those must include either depressed mood or loss of interest/ pleasure. The other symptoms were: decrease in weight, decrease in appetite, insomnia, psychomotor agitation or retardation, fatigue, diminished concentration or decision making, feeling of guilt and suicidal ideation. Beck Depression Inventory II (BDI II) was used to measure the level of depression of patients with stroke. The cognitive impairment was assessed using Mini Mental Status Examination (MMSE).

### Statistical Analysis

SPSS Statistics version 20 was used to analyze the collected data. Description of categorical variables like age, sex, marital status, socio-economic status, stroke lesion and depression, were presented as numbers. Analysis was computed to determine the relationship between post stroke depression with demographic variables and stroke characteristics. Test like Pearson Chi Square test at 5% significant level was performed.

### III. Results

**Table 1:** Demographic characteristic of patients with stroke

Variable		Male	%	Female	%	Total	%
Age	<45 years	07	13	05	10	12	23
	>45 years	27	52	13	25	40	77
Marital Status	Single	06	11	02	4	08	15
	Married	27	52	09	17	36	70
	Divorced / Widow	01	2	07	13	08	15
Residence	Urban	03	6	01	2	04	8
	Rural	32	61	16	31	48	92
Occupation	Employed	35	67	08	16	43	83
	Unemployed	01	2	08	15	09	17
Education	Illiterate	09	17	02	4	11	21
	Primary	07	13	05	10	12	23
	Secondary	26	50	03	6	29	56
Monthly Income	<Rs.10,000	31	60	15	28	46	88
	>Rs.10,000	05	10	01	2	06	12

Demographic characteristics of the sample are provided in Table 1. Out of 52 patients 65% were male and 35% female. Majority of the patients belongs to more than 45 years age group (77%) and out of them 52% were male and 25% were female. Most of the patients 36 were married (52% male and 17% female). The majority i.e. 29 patients had studied upto secondary (50% male and 6% female). Most of the patients belongs to low income group (<Rs.10000) 46 patients (60% male and 28% female). According to residence status 48 patients (62% male and 28% female) hailed from rural area while just 8% were living in urban localities. In the present study, totally 43 patients were employed (mostly agricultural laborers) (67% male and 16% female) and 17% had no job.

**Table 2:** Stroke Characteristics of patients with stroke

Variable		Male	%	Female	%	Total	%
Stroke type	Ischemic	31	60	14	27	45	87
	Hemorrhagic	04	8	03	5	07	13
Location of stroke	Right Hemisphere	07	13	10	19	17	32
	Left Hemisphere	24	47	07	13	31	60
	B/L	04	8	00	0	04	8
Left side lesion	Left ACA	02	4	00	0	02	4
	Left MCA	21	40	05	10	26	50
	Left PCA	01	2	02	4	03	6
Duration of Illness	<6 month	02	4	08	15	10	19
	>6 month	33	63	09	18	42	81

Stroke characteristics of the sample are provided in Table-2. Out of total 52 patients 87% (60% male and 27% female) had Ischemic stroke whereas 13% patients (8% male and 5% female) had hemorrhagic stroke. The right hemisphere lesion location account for 17 patients (13% male and 19% female) and it was astonishing that 31 patients had left hemisphere lesion location (47% male and 13% female) and bi-lateral lesion found in 4 patients (only 8% male). It was alarming to note that when we consider the left side lesion alone 26 patients (majority 40 % male and 10% female) had lesions in middle cerebral artery. Most of the patients i.e. 81% had more than 6 months duration of illness (63% male and 18% female).

**Table 3:** Prevalence of Post Stroke Depression with respect to demography

Variable	Categories	Depression				Total		p value
		Yes	%	No	%		%	
Age	<45 years	08	15	06	12	14	27	0.527
	>45 years	36	69	02	4	38	73	
Gender	Male	30	57	05	10	35	67	1.287
	Female	14	27	03	6	17	33	
Residence	Urban	04	8	0	0	04	8	0.916
	Rural	40	77	08	15	48	92	
Marital Status	Single	06	11	01	2	07	14	0.077
	Married	29	55	05	10	34	65	
	Divorced / Widow	09	17	02	4	11	21	

Table 3 showed the prevalence of post stroke depression with respect to demography. Seventy three percent of the patients with stroke belongs to >45 years of age. In the present study, out of 52 patients 35 (67%) are male patients and majority hailed from rural population. Sixty five percent of the sample got married. There was no significant difference found between the post stroke depression and demographic variables.

**Table 4:** Prevalence of Post Stroke Depression with respect to Socio Economic Variables

Variable	Categories	Depression				Total		p value
		Yes	%	No	%		%	
Education	Illiterate	11	21	0	0	11	21	1.578
	Primary	09	17	03	6	12	23	
	Secondary	24	46	05	10	29	56	
Occupation	Employed	37	71	06	12	43	83	1.018
	Unemployed	07	13	02	4	09	17	
Monthly Income	<10,000	38	73	08	15	46	88	0.987
	>10,000	06	12	0	0	06	12	

In Table 4 the prevalence of post stroke depression with respect to socio economic variables was presented. Majority of them (29 patients) had secondary school education and among them 24 patients (46%) had depressive features. Forty three patients (83%) were employed and among them 37 patients (71%) had depression features. Forty six patients (88%) had monthly income less than Rs. 10000 per month and in that 38 patients (73%) of the patients had depressive features. There was no significant difference was found between the post stroke depression and socio economic variables.

**Table 5:** Stroke Characteristics of Sample with and without Depression

Variable	Categories	Depression				Total		p value
		Yes	%	No	%		%	
Stroke type	Ischemic	38	73	07	13	45	86	1.037
	Hemorrhagic	06	11	01	2	07	13	
Location of stroke	Right Hemisphere	14	27	03	6	17	33	0.978
	Left Hemisphere	26	50	05	10	31	60	
	B/L	04	8	0	0	04	8	
Left Side Lesion	Left ACA	02	4	0	0	02	4	0.041*
	Left MCA	22	42	04	8	26	50	
	Left PCA	02	4	01	2	03	6	
Duration of Illness	<6 months	13	25	02	4	15	29	0.894
	>6 months	31	60	06	11	37	71	

\*Significant

From Table 5 it was noted that most of the patients, totally 45 patients (86%) had suffered from ischemic type of stroke and among them 38 patients (73%) had depression features. Thirty one patients (60%) had stroke attack in the left side of the hemisphere. Twenty six patients (50%) had lesion in left middle cerebral artery infarction and among them 22 patients (42%) had depressive features. There is a significant association between the post stroke depression and left middle cerebral artery. Thirty seven patients (71%) had more than 6 months duration of illness and among them 31 patients (60%) had depressive features.

**Table 6:** Levels of Depression among patients with Stroke (Beck Depression Inventory II)

Levels of Depression	Male	%	Female	%	Total	%	p value
Minimal depression	05	10	03	5	08	15	2.184
Mild depression	01	2	01	2	02	4	
Moderate depression	04	8	03	5	07	13	
Severe depression	25	48	10	19	35	67	

From Table 6 it was found that there was no significant difference between the levels of depression and patients with stroke but it was very shocking to note that the majority of patients i.e. 35 patients had Severe depression (67%) among them 48% male and 19% female.

**Table 7:** Levels of Cognitive impairment among patients with Stroke according to National Institute for Health and Care Excellence (NICE) classification

Levels	Male	%	Female	%	Total	%	p value
Normal	02	4	02	4	04	8	1.897
Mild cognitive impairment	06	11	05	10	11	21	
Moderate cognitive impairment	27	52	10	19	37	71	

Table 7 represents the levels of cognitive impairment among patients with stroke. Thirty seven patients (71%) had moderate cognitive impairment and among them 52% were male and 19% female. There was no significant difference found between the levels of cognitive impairment and patients with stroke.

#### IV. Discussion

We examined the prevalence and severity of post stroke depression and its relation with sociodemographic and stroke characteristics enrolled from a tertiary care set-up. Our major finding was the significant association between post stroke depression and left middle cerebral artery infarction.

##### Demographic factors:

Post stroke depression was found mostly in male sex in this study. This is in accordance with the study by Hackett and Anderson conducted in (2005)<sup>16</sup>. One reason for high depression among working age group of male might be that physical disability as compared to female or another reason for higher depression in men was attributed to their less coping abilities as compared to women.

##### Stroke characteristics:

Significant association was found between stroke localization and post stroke depression in the study and this finding is in line with many other studies<sup>23</sup>. In a systematic review a study has found significant association between lesion location and depression after pooling the data of 24 primary studies. However, some studies agree with this finding and report significance of left side lesion location in causing post stroke depression<sup>14</sup> and some other in contrast to this report significance of right lesion location in causing post stroke depression. This wide divergence among different study findings on the subject of lesion location association with post stroke depression could be attributed to the methodological differences among study settings e.g sample size, sample selection criteria, study site and different tools used to measure depression. Our study finding corroborates with an earlier study which reported high depression among patients having ischemic stroke in the left hemisphere as compare to those having it in the right hemisphere<sup>18</sup>.

#### V. Conclusion

Depression is a common psychiatric disorder after stroke. The occurrence of PSD observed in this study more than six months after stroke was 60%. Demographic variables are not significantly associated with post stroke depression. Patients having Ischemic stroke are at higher risk of developing depression after stroke. Side of stroke was predominantly high in left hemisphere and site of lesion was mostly found in left side middle cerebral artery. There was a significant association between post stroke depression and left middle cerebral artery infarction. These findings highlighted the necessity to investigate, diagnose and treat PSD, which is a risk factor for morbidity and mortality of patients after stroke.

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