

# Cross Sectional Study of Depression in Patients following a Stroke: A Neurologist's Perspective.

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## ABSTRACT

**Background:** Stroke is one of the leading causes of mortality and morbidity in today's world. With early intervention and improvements in critical care the mortality from stroke is decreasing. Today there are more chances of a patient surviving after a stroke than it was 2 decades ago. But this downward shift in mortality has caused increased prevalence of patients surviving with considerable neurodeficits and cognitive dysfunction. These patients are at increased risk of developing depression which may directly affect the recovery process. Yet the depression in post-stroke patient is rarely recognised and treated. Many a times such patients remain bed-ridden, neglected depressed and only a small number of these patients are treated for depression. Some of this has to do with the fact that there are not many randomised controlled trials dealing with this aspect. Gradually with increasing survival of the patients with stroke data is becoming available suggesting that the treatment of depression in post-stroke patient have a positive effect on recovery of these patients. We conducted this study to identify the prevalence and severity of depression in post stroke patients and to assess its relationship with demographic variables and stroke characteristics. **Methods:** This was a cross sectional study comprising of 52 patients selected on the basis of pre-defined inclusion criteria and was carried out in Department of Neurology of a tertiary care medical institute situated in an urban area. All patients attending follow up stroke OPDS having a history of stroke confirmed on imaging (Computed tomographic, MRI or MR angiography) were included in this study. Dependent variable of our study was depression while independent variables were demographic and clinical factors such as age, gender, marital status, financial status, residence status, education level and the clinical variables were stroke type, side and site of stroke. All the patients were interviewed using the preformed questionnaire specifically designed for this study. The data was tabulated and analysed. SPSS Statistics version 2.0 was used to analyze the collected data. **Results:** Forty four patients with stroke out of 52 (85%) met the criteria for depression. out of which 40 were males and 12 were females with a M: F ratio being 1:0.3. Demographic variables and stroke types (hemorrhagic versus thromboembolic) were not significantly associated with post stroke depression. A peculiar finding we encountered was infarcts in the middle cerebral artery territory were significantly associated with depression. Majority of the patients (87 %) had ischaemic stroke and most common location was found to be left hemisphere (60%). Most common territory was found to be left middle cerebral artery territory which was affected in 50% of the patients. 81% patients were found to be having illness since more than 6 months. Depression was more common in male patients of more than 45 years of age. There was a significant association between the post stroke depression and left middle cerebral artery infarction. **Conclusion:** These results highlighted the need to investigate, diagnose and treat post-stroke depression. From a neurologist's point of view it is important to recognize the symptoms of depression so that a psychiatric opinion can be sought.

**Keywords:** Stroke, Focal Deficit, Cognitive Dysfunction, Depression.

## INTRODUCTION

Stroke is defined as a clinical syndrome consisting of rapidly developing clinical signs of focal (or global in case of coma) disturbance of cerebral function lasting more than 24 hours or leading to death with

no apparent cause other than a vascular origin.<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 half second an incident of stroke occurs.<sup>[2]</sup> High blood pressure is the major risk factor in stroke which causes more than 80% of stroke cases (12.7 million) worldwide. The risk factors for stroke include increasing age, hypertension, diabetes mellitus,

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history of intermittent claudication, smoking, congestive heart failure, arrhythmias left ventricular hypertrophy. Smoking, hypertension and diabetes are most important modifiable risk factors for stroke.<sup>[3]</sup>

In developing countries like that of India the incidence of stroke is increasing exponentially. More than 50% cases of stroke occur in developing countries and these countries have surpassed the rate of developed countries by 20% during the period from the year 2000 to 2008. Stroke is associated with morbidity and mortality in a significant proportion of patients.<sup>[4]</sup> It is one of the leading causes of death in the individuals who are in their sixth or seventh decade. As far as morbidity is concerned it is one of the leading causes of disability in developed as well as developing world. As the medical facilities become more widely available there is increased survival of patients with stroke, but the patients who survive a massive stroke are likely to have residual paralysis, neurodeficits and many of them are expected to be bed ridden for prolonged period of time leading to complications such as bedsores, thromboembolism and osteoporosis etc.<sup>[5]</sup> Thromboembolism causing ischemic infarction is the most common etiological cause of stroke. Approximately 15% patients suffer hemorrhagic stroke in which is due to rupture of a blood vessel supplying various parts of brain.<sup>[6]</sup> In minority of the patients stroke is secondary to factors such as ruptured berry aneurysm, post-viral angiopathy, cerebral autosomal dominant arteriopathy, leukoencephalopathy and the amyloid angiopathies.<sup>[7]</sup> Majority of the patients are expected to survive first month after stroke. Survival rate decreases subsequently up to 70-75% up to 1 year after stroke. Many of the surviving patients suffer from long term disability and neurodeficits.<sup>[8]</sup>

The neuropsychiatric disorders associated with stroke may include depression, anxiety disorders, panic attacks, cognitive dysfunction, mania, psychosis and fatigue. Many studies have confirmed increased incidence of mood disorders such as depression in patients with stroke.<sup>[9]</sup> Various studies have reported different rates of post-stroke depression ranging from 25-60%. This large variation in range of depression associated with stroke reported by different studies may be due to variation in population characteristics being studied, difference in study designs, different inclusion and exclusion criteria, stage of stroke, clinical features and age of the patients. Post stroke depression is divided into major depression and minor depression. Patients with major depression following a stroke are at increased risk of developing cognitive impairment while those with minor depression are less likely to develop significant cognitive impairment.<sup>[10]</sup>

It is of extreme importance from a neurologist's point of view to study various aspects of post-stroke depression because neurologists are first responders

in cases of stroke. A neurologist may be of critical value in management of these patients as an early diagnosis of these symptoms may be helpful in seeking an early psychiatric consultation which will help in fast recovery and prevent long term complications associated with various neuropsychiatric disorders associated with stroke.

## MATERIALS AND METHODS

This was a cross sectional study comprising of 52 patients selected on the basis of pre-defined inclusion criteria. Those patients having any of the exclusion criteria were excluded from the study. The study was carried out over a period of 6 months in the Neurology Department of a tertiary care medical college situated in an urban area. The consent of patients to participate in study was sought and they were also assured about confidentiality of the information. Only those patients who have given informed consent were included in this study. All the patients were interviewed using the preformed questionnaire specifically designed for this study. All patients attending follow up stroke OPDS having a history of stroke confirmed on imaging (Computed tomographic, MRI or MR angiography) were included in this study. Dependent variable of our study was depression while independent variables were demographic and clinical factors such as age, gender, marital status, financial status, residence status, education level and the clinical variables were 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 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 seven 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 was used to measure the level of depression of patients with stroke. The cognitive impairment was assessed using Mini Mental Status Examination (MMSE). The data was tabulated and analyzed. SPSS Statistics version 2.0 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 and demographic variables and stroke characteristics.

### Inclusion Criteria

1. Stroke confirmed on the basis of Imaging.
2. Age more than 18 years.

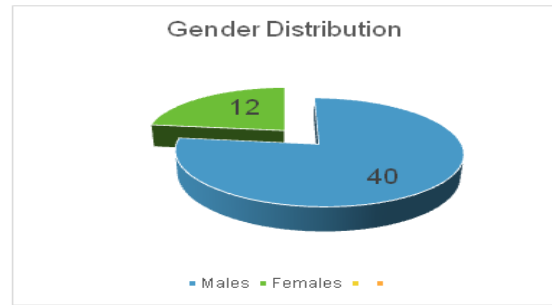
**Exclusion Criteria**

1. Age less than 18 years
2. Those patients who refused consent
3. Patients with severe co-morbid conditions like malignant disease, renal failure or hepatic failure.
4. Past history of psychiatric illness before stroke.
5. History of substance abuse or dependence.
6. Prior history of dementia or aphasia.

**RESULTS**

The cross sectional study of post stroke depression conducted by us included a total of 52 patients out of

which 40 were males and 12 were females with a M: F ratio being 1:0.3.



**Figure 1: Gender Distribution of the studied cases.**

**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	69
	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

**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

Study of demographic characteristics of the patients showed that 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 were married (52% male and 17% female). The majority i.e. 29 patients had studied up to secondary (50% male and 6% female). Most of the patients belongs to low income group (<Rs.10000). 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 (67% male and 16% female) and 17% had no job.

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 31 patients had left hemisphere lesions (47% male and 13% female). Bilateral lesions were 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 (81%) had more than 6 months duration of illness (63% male and 18% female).

Seventy three percent of the patients with stroke belonged to >45 years of age. In the present study, out of 52 patients 35 (67%) were 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 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 4: Prevalence of Post Stroke Depression with respect to Socio Economic Variables**

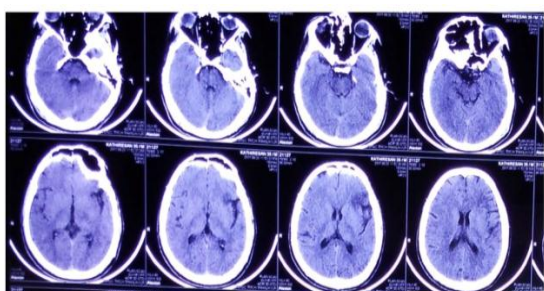
Variable	Categories	Depression				Total	%	p value
		Yes	%	No	%			
Education	Illiterate	11	21	0	0	11	21	1.578
	Primary	09	17	03	6	12	23	
	Secondary	24	46	05	10	29	56	
Occupation	Employed	37	71	06	12	43	83	1.018
	Unemployed	07	13	02	4	09	17	
Monthly Income	<10,000	38	73	08	15	46	88	0.987
	>10,000	06	12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

The prevalence of post stroke depression with respect to socio economic variables was studied. 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.

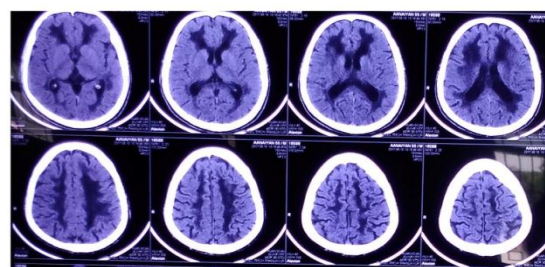
It was noted that most of the patients (86%) had suffered from ischemic type of stroke and among them 38 patients (73%) had depression features. Thirty one patients (60%) had stroke attack in the left side of the hemisphere. Twenty six patients (50%) had lesion in left middle cerebral artery infarction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

**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	



**Figure 2: Non contrast Enhanced CT (Axial Images) hypodensity in left fronto-temporal region s/o infarct in left MCA territory.**



**Figure 3: Axial CT images showing deep sulci, dilated ventricles and periventricular hypo-densities (Ischemic changes) s/o generalized cerebral atrophy. All these changes are s/o small vessel disease.**

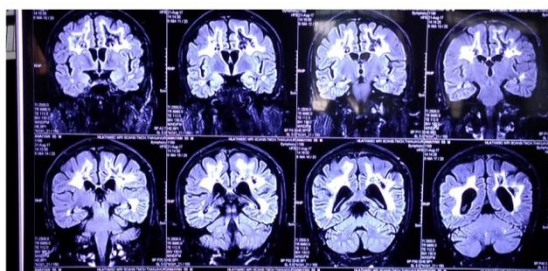


Figure 4: MRI coronal T1 weighted images showing hyperintensities in bilateral periventricular leukoaraiosis (grade 3) suggestive of small vessel disease.

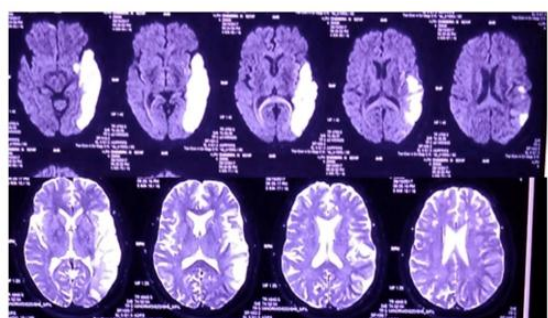


Figure 5: MRI Axial Images showing hyperintensity (FLAIR sequence) and restricted diffusion pattern (in DWI) s/o acute infarct involving left middle cerebral artery area.

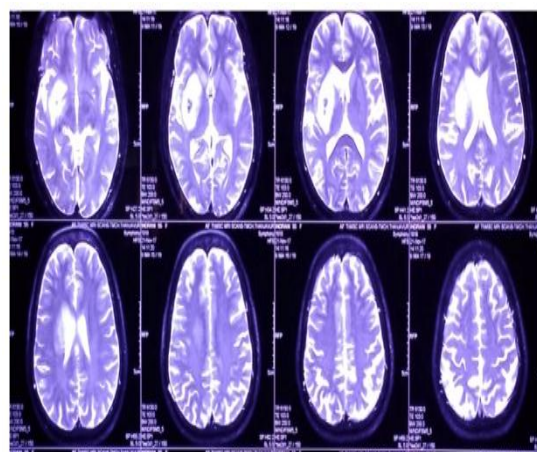


Figure 6: MRI T2 axial images showing hyperintensity with centrehypointense lesion in the right capsuloganglionic region with diffusion restriction suggestive of right capsuloganglionic infarct with hemorrhagic transformation.

Out of the studied cases severe depression was found in 67% cases followed by minimal depression, moderate depression and mild depression which was seen in 15%, 13% and 4% respectively. Severe depression being the most common form of depression was a very significant finding seen in our patients.

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	

The study of levels of cognitive impairment among patients with stroke showed that 37 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.

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	

## DISCUSSION

One of the first authors to study the incidence of depression in post-Stroke patients include Folstein et al who examined 30 patients (20 cases and 10 controls) for functional disabilities (Activities of Daily Living) and for psychiatric symptoms. The authors used the Hamilton Rating Scale, the Visual Analogue Mood Scale, the Present State Exam, and the Mini-Mental State Exam for neuropsychiatric assessment of the patients. They found that more of stroke patients than control patients were depressed (45% versus 10%). They further found that Patients with right hemisphere stroke were particularly

vulnerable and displayed a syndrome of irritability, loss of interest, and difficulty in concentration, in addition to depression of mood (70% of right hemisphere stroke patients versus 0% left hemisphere stroke patients and 0% control patients). They finally concluded that mood disorder was a more specific complication of stroke than simply a response to the motor disability. The authors suggested that a controlled trial of antidepressant medication was indicated for patients with post stroke depression.<sup>[11]</sup>

While studying age as the risk factor for depression we found that age more than 45 years was significantly associated with increased incidence of

depression after stroke. This aspect is one of the most controversial aspects of post-stroke depression because of the contradicting outcomes in various studies. This may have to do with complex association between age and post stroke depression which could be dependent upon multiple confounding factors. While many studies found positive relationship between increase age and post stroke depression.<sup>[12]</sup> Others suggest positive relation between post stroke depression and young age group. Interestingly some studies found no relationship whatsoever in age and Post Stroke Depression.<sup>[13]</sup>

In our study male gender was found to be associated with increased incidence of post-stroke depression. One of the plausible reasons for higher incidence of depression in context of our patients was that most of the men were bread-earners of their homes. Disability and handicap associated with stroke was responsible for collapse of financial structure of home. There are conflicting reports from various studies about which gender is affected more by post-stroke depression like Marie Eriksson et al in their study of cohort of stroke patients found that Male sex, young age and severe stroke were associated with significant post-stroke depression and an increased risk of attempted suicide after stroke. The risk was highest during the first 2 years after stroke.<sup>[14]</sup> The other authors like Alajbegovic et al reported post-stroke depression to be more common in females.<sup>[15]</sup> Lastly the difference in the nature of depression is reported by Paradiso S who in his study found that in men major depression was associated with greater impairment in activities of daily living, and greater severity of depression was associated with greater impairment in daily activities and social functioning while in women, greater severity of depression was associated with prior diagnosis of psychiatric disorder and cognitive impairment. However in context of developing world the studies favor the incidence of depression to be more in male stroke survivors.<sup>[16]</sup>

The study of stroke characteristics revealed that there was a significant association between post stroke depression and left middle cerebral artery infarction. This aspect also once again is marred with conflicting reports from various studies. Meyer et al in their study postulated that depression may be the effect of the combined insult or injury to brain affecting mainly the left frontal lobe as well as other lobar convexities.<sup>[17]</sup> This proposition may explain the increased incidence of post stroke depression in patients having involvement of left side of brain (Left MCA infarct).<sup>[18]</sup> On the other hand Provinciali L et al questioned this assumption of relationship between cerebral lesion location and depression. They proposed that diffuse subcortical involvement may be more commonly associated with post-stroke depression.<sup>[19]</sup> These differences on the subject of Location of stroke and its association with post

stroke depression could be due to the methodological differences among study settings like sample size, differences in inclusion criteria and various methods of diagnosing depression.<sup>[20]</sup>

## CONCLUSION

Depression is a common occurrence after stroke. The identification and management of post-stroke depression is crucial for the recovery of a patient. With advances in neurology and critical care there is an increased survival after stroke which means there would be more individuals having potential to develop depression. As first responders neurologists must be aware of this entity. Early identification of depressive symptoms by treating neurologist may result in early psychiatric consultation and institution of appropriate treatment at an early stage.

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