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# Factors Influencing Depression In Patients Of Cerebrovascular Accidents-A Study

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## ABSTRACT

**Background:** Post Stroke Depression (PSD) is one of the most frequent Neuropsychiatric consequences of stroke. It affects almost 29%-70% of Stroke Survivors (SS). There is paucity of research data in determining the risk factors and especially severity and association of depression with site of lesion location in Indian community.

**Aim and Objectives:** To determine factors associated with PSD and association between Socio-demographic profiles, Stroke symptoms, Site of lesion with depression.

**Materials and Methods:** It's a cross-sectional study including participants from the outpatients section of Department of Neurology at Prathima Institute of Medical Sciences. A predetermined sample size of 60 patients with CVA patients was enrolled in the study and their socio demographic details are collected along with administering Beck's Depression Inventory for Depression. Neuro-imaging provided information on lesion location. Collected data was analysed using SPSS version 19 and using descriptive and inferential statistics.

**Results:** In this study 18 out of 60 subjects with stroke were diagnosed with PSD. Risk factors found to be mainly associated with PSD are lack of family support, Joint family types, Stroke with Aphasia, Cranial Nerve involvement and Motor System weakness whereas, Substance use is found to be a protective factor. Significant numbers of subjects were found to have left-anterior-sub-cortical lesions associated with PSD.

**Conclusion:** This study highlights the variables which are to be considered in the recognition of PSD for Neurologists and Mental health care workers for early intervention and a better outcome in view of stroke recovery.

**KEYWORDS:** Post Stroke Depression, Stroke Survivors, Risk factors, Lesion location, Aphasia

## INTRODUCTION

Post Stroke Depression (PSD) is among the most frequent Neuropsychiatric sequelae of stroke.[1]It affects almost 29%-70% of Stroke Survivors(SS).[2, 3]The World Health Organization (WHO) defines stroke as the rapid development of clinical signs of local or global cerebral dysfunction with symptoms lasting at least 24 hours or leading to death with no apparent cause other than the vascular origin.[4]Stroke is a disorder affecting both neurological and psychological domains leading to immobility & cognitive impairments.[1, 5]

A review article considering 50 years of research in the field of stroke has projected data stating that7-15.7% of stroke survivors remained completely disabled, one-third developed PSD and overall Disability Adjusted Life Years (DALYs) lost due to stroke were 795.57 per 100,000 person-years (730.43 in men and 552.86 in women) in India. The disability in stroke survivors with depression was 15% higher when compared to those without depression which could be due to reduced participation in rehabilitation program. [1] SS of female gender and with neuropsychiatric disturbances had poor functional outcome, while education correlated with better outcome.[6]

Various researches done all over the world have reported PSD being associated with educational level, socioeconomic status, smoking, age, gender, residence, marital, and job status but are not in similar consensus between them.[2, 3] Hence, determining the risk factors and relationship between lesion location and PSD may help us in early detection and aid in reducing the DALYs.

There is paucity of research data in determining the risk factors, severity and association of depression with site of lesion location in Indian community. Hence, this study was

done to understand factors affecting PSD in stroke survivors.

**AIM AND OBJECTIVES:**

To study post stroke depression and the factors associated with it**.**

**OBJECTIVES OF THE STUDY:**

1) To determine the socio demographic profile, marital status, type of family, habits, duration of illness and depression in patient with Cerebro-Vascular Accident (CVA).

2) To determine the symptoms of CVA, site of lesion.

3) To determine association between Socio-demographic profiles, marital status, type of family, habits, duration of illness the symptoms of CVA and site of lesion with depression.

**MATERIALS AND METHODS:**

It's a cross-sectional study including every $10^{th}$ CVA patient visiting the outpatients section of Department of Neurology at Prathima Institute of Medical Sciences. A predetermined sample size of 60 patients with CVA patients was enrolled in the study. Ethical clearance was obtained from institution ethics committee and Informed consent was obtained from the participants.

**INCLUSION CRITERIA**

1) Patients with the diagnosis of CVA made by a neurologist both clinically and with CT scan.

2) Subjects diagnosed CVA 1 month before and not more than a year post CVA.

3) The presence of at least one informant with the patient.

4) The patient should be conscious and co-operative.

5) Age of the patients between 15 and 65 yrs.

**EXCLUSION CRITERION:**

1) Patients with past history of any Psychiatric illness.

2) Patients who didn't give informed consent.

**DEVELOPMENT AND DESCRIPTION OF TOOL:**

Each patient was screened and then was examined in detail with data recorded on an intake proforma. These consisted of Socio-demographic profile, marital status, type of family, habits, history of present illness, history of past medical and psychiatric illness, duration of illness, symptoms of CVA, detailed neurological examination, CT scan findings, site of lesion and other important investigations. The following tools were administered after selection.

**BECK'S DEPRESSION INVENTORY:**

The Beck Depression Inventory was first created by Dr. Aaron T. Beck in 1962. It is a 21 item self-report inventory; it is among the most widely used instruments for measuring the severity of depression. There are three versions of BDI among which, the original version of BDI was published in 1961, the revised version BDI-1A in 1978, and the latest version BDI-II was published in 1996. The current version of questionnaire is designed for individuals aged 13 and over and is composed of items related to features of depression such as hopelessness, irritability and cognitions like guilt or feelings of being punished. They are also accompanied by physical symptoms like fatigue, weight loss, and lack of interest in sex. The re-test reliability was ranged from 0.73 to 0.96 and the internal consistency was assessed to be 0.9. Scores of each question are added to obtain the total score ranging from zero to 63. A total score of one to ten is considered normal,11-16 Mild mood disturbance,17-20 Borderline clinical depression, 21-30 Moderate depression,31-40 Severe depression, over 40 Extreme depression. [7]

**PRESUMPTIVE STRESSFUL LIFE EVENTS SCALE (PSLE SCALE):**

PSLE scale by Singh et al. 1984, which covered 51 life events, was administered independently to the patient in a pattern of semi structured interview. Life events that occurred in the past 12 months were included in the study. Taking the local and cultural factors into account this inventory was developed and standardization was done in our country. Hence, it has more relevance and applicability.

**CT SCAN ANALYSIS [8] :**

Computed Tomography (CT), more commonly known as a CAT scan, is a diagnostic imaging test. Like X-Ray machines, Computed tomography also produces multiple images or pictures of the interiors of the body. The major advantage of CT scanning is, it is non-invasive, painless, and accurate procedure as well as its ability to scan bone, soft tissue, and blood vessels at the same time. In a case of emergency, they can reveal internal injuries and bleeding, for a quick diagnosis. CT scanning is a cost-effective imaging tool for a wide range of clinical problems. Sensitivity to movement is less in CT compared to MRI. An implanted medical device of any kind will not prevent you from having a CT scan, a contrasting feature to MRI. Radiation does not remain in a patient's body after a CT scan. CT can be performed safely in pregnant women but other imaging exams not involving radiation, such as ultrasound or MRI, are preferred. It has a weight limit of 450 pounds for the table to move.

A replication of the methodology reported by Robinson and colleagues was undertaken. (2) Lesions traced on the digitalized CT scans were used to generate AP ratio, which was determined by dividing the distance of the most anterior border of the lesion from the frontal pole with the overall anterior-posterior (AP) length of the cerebral hemisphere on the same slice. An AP ratio intra-rater and inter-rater reliability was 0.98 and 0.85, respectively, with use of intra-class correlation. Lesions are classified into 4 groups in relation to the Antero-Posterior diameter, namely, Anterior, Posterior, Extended and Intermediate as demonstrated in **Figure 1**.

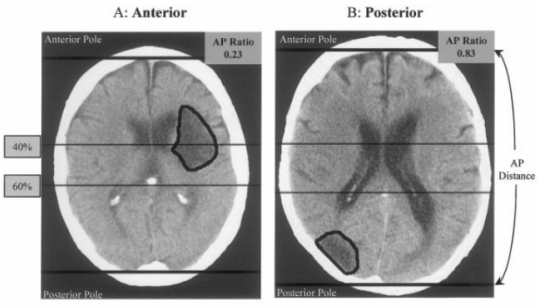


**Figure 1: Classification of lesions with CT Analysis(A)**

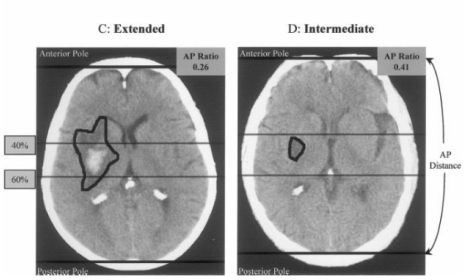


**Figure 2: Classification of lesions with CT Analysis(B)**

The anterior location of the lesion was defined as the mean distance of the anterior border of the infarct from the frontal pole averaged over all slices. This measurement was expressed as AP distance, a percentage of the greatest distance between the anterior and posterior poles of the brain. "Anterior" lesions were defined as those in which the anterior border was less than 40% of the Antero-Posterior distance. Lesions were defined as "Posterior" if their anterior border was posterior to 40% of the A-P distance. Lesions were again subdivided into Cortical and Sub-cortical depending on their depth. Each of these methods described has been employed in previous studies on psychiatric morbidity after stroke.

**PLAN FOR DATA ANALYSIS:**

The data obtained was analyzed with SPSS software version 19 in terms of achieving the objective of the study by using descriptive and inferential statistics.

## RESULTS

A profile of socio-demographic data of 60 patients among which 41 were males with 10 in between the age group 46-50 and a total of 19 females with 6 in between the age group 51-55. The P Value was 0.22 implying no statistically significant difference in age and gender distribution.Table 1

In this study 36 participants belonged to low socioeconomic status (SES) out of which 13 had PSD. Majority of the low socioeconomic participants in the sample are having PSD compared to middle and high socioeconomic Classification of lesions with CT Analysis status with PSD indicating significant (P value <0.001) association between low socioeconomic status and PSD. Out of the total 19 participants who had family history of depression 8 had PSD and out of 41 without family history only 10 had PSD with a P value of 0.16 hence, there was no association between family history of depression and PSD. All the participants were married. Majority of the participants living alone had PSD comparing to them who are living with spouse and living with children had PSD indicating those participants living alone had higher association (P value <0.001) with PSD. PSD was found in 14 out of 39 belonging to joint family and only 4 out of 21 belonging to nuclear family with a significant p value of <0.001 implying association between joint family and PSD.**Table 2**

A total of 18 participants were suffering with PSD out of which 17 had an onset within 2 months of onset of stroke with a p value of 0.23. There was no association between PSD and duration of stroke.Table 3

10 out of 30 participants with substance had PSD compared to only 8 participants with habits had PSD. The P value was 0.007 instigating an association between habits and PSDTable 4.

In our study 14 out of 43 with hemiplegia had PSD and only 4 out of 14 with hemiparesis had PSD. The P Value was 0.89 indicating no association between PSD and presenting illness. 7 out of 9 participants with Aphasia had PSD and shown significant association between them with a P value 0.001. An association was found between cranial nerve involvement and PSD from our study where 11 out of 25 participants with cranial nerve involvement had PSD with a

| | | SEX | | P VALUE | CHI SQUARE |
|---|---|---|---|---|---|
| | | MALE | FEMALE | | |
| AGE | ≤40 | 4(6.7%) | 0(0%) | 0.2234 | 2.9970 |
| | 41-45 | 4(6.7%) | 4(6.7%) | | |
| | 46-50 | 10(16.7%) | 2(3.3%) | | |
| | 51-55 | 9(15%) | 6(10%) | | |
| | 56-60 | 7(11.7%) | 4(6.7%) | | |
| | 61-65 | 7(11.7%) | 3(5%) | | |

**Table 1: Demographic Details Of Stroke Patients**

| | | PSD | | TOTAL | P VALUE | CHI SQUARE |
|---|---|---|---|---|---|---|
| | | PRESENT | ABSENT | | | |
| SOCIO ECONOMIC STATUS | LOW | 13(21.7%) | 23(38.3%) | 36(60%) | <0.001 | 34.74 |
| | MEDIUM | 4(6.7%) | 16(26.6%) | 20(33.3%) | | |
| | HIGH | 1(1.7%) | 3(5.0%) | 4(6.7%) | | |
| FAMILY HISTORY OF DEPRESSION | PRESENT | 8(13.3%) | 11(18.3%) | 19(31.7%) | 0.163 | 1.940 |
| | ABSENT | 10(16.7%) | 31(51.7%) | 41(68.3%) | | |
| MARITAL STATUS | MARRIED | 18(30%) | 42(70%) | 60(100%) | 0.0014 | |
| LIVING STATUS | LIVING ALONE | 8(13.4%) | 2(3.3%) | 10(16.7%) | <0.001 | 29.28 |
| | WITH SPOUSE | 6(10%) | 26(43.3%) | 32(53.3%) | | |
| | WITH CHILDREN | 4(6.7%) | 14(23.3%) | 18(30%) | | |
| FAMILY TYPE | JOINT | 14(23.3%) | 25(41.7%) | 39(65%) | <0.001 | 32.74 |
| | NUCLEAR | 4(6.7%) | 17(28.3%) | 21(35%) | | |

**Table 2: Demographic Details Of PSD Among Stroke Patients**

| | | PSD | | TOTAL | P VALUE | CHI SQUARE |
|---|---|---|---|---|---|---|
| | | PRESENT | ABSENT | | | |
| DURATION | 1 MONTH | 3(5%) | 16(26.7%) | 19(31.7%) | 0.22704 | 2.96 |
| | 1.5 MONTHS | 7(11.6%) | 10(16.7%) | 17(28.3%) | | |
| | 2 MONTHS | 7(11.6%) | 13(21.7%) | 20(33.3%) | | |
| | 3 MONTHS | 1(1.7%) | 2(3.3%) | 3(5%) | | |
| | 6-12 MONTHS | 0(0%) | 1(1.7%) | 1(1.7%) | | |

**Table 3: Duration Since Stroke**

| | | PSD | | TOTAL | P VALUE | CHI SQUARE |
|---|---|---|---|---|---|---|
| | | PRESENT | ABSENT | | | |
| HABITS | NO HABITS | 10(16.7%) | 20(33.3%) | 30(50%) | 0.007 | 9.844 |
| | ALCOHOL | 4(6.7%) | 9(15%) | 13(21.7%) | | |
| | SMOKING | 1(1.6%) | 7(11.7%) | 8(13.3%) | | |
| | GUTKHA | 1(1.6%) | 3(5%) | 4(6.7%) | | |
| | BOTH SMOKING & ALCOHOL | 2(3.3%) | 3(5%) | 5(8.3%) | | |

**Table 4: Habits In Stroke Patients**

| | | PSD | | TOTAL | P VALUE | CHI SQUARE |
|---|---|---|---|---|---|---|
| | | PRESENT | ABSENT | | | |
| PRESENT ILLNESS | HEMIPARESIS | 4(6.7%) | 10(16.7%) | 14(23.3%) | 0.89 | 0.0177 |
| | HEMIPLEGIA | 14(23.3%) | 29(48.3%) | 43(71.7%) | | |
| | OTHERS | 0(0%) | 3(5%) | 3(5%) | | |
| APHASIA | PRESENT | 7(11.7%) | 2(3.3%) | 9(15%) | 0.001 | 10.53 |
| | ABSENT | 11(18.3%) | 40(66.7%) | 51(85%) | | |
| CRANIAL NERVE INVOLVEMENT | PRESENT | 11(18.3%) | 14(23.4%) | 25(41.7%) | <0.001 | 16.7 |
| | ABSENT | 7(11.7%) | 28(46.6%) | 35(58.3%) | | |
| MOTOR SYSTEM INVOLVEMENT | 0/5 | 3(5.1%) | 2(3.3%) | 5(8.4%) | 0.0005 | 11.81 |
| | 1/5 | 7(11.9%) | 11(18.6%) | 18(30.5%) | | |
| | 2/5 | 4(6.8%) | 16(27.1%) | 20(33.9%) | | |
| | 3/5 | 4(6.8%) | 13(22%) | 17(28.8%) | | |
| SENSORY SYSTEM | NOT INVOLVED | 18(30%) | 42(70%) | 60(100%) | 0.0019 | 9.6 |

**Table 5: Stroke Symptoms Associated With PSD**

P value of <0.001. All the 18 participants had muscle power less than 3 on motor system examination where 4 out of 17 had 3/5 power, 4 out of 20 had 2/5 power, 7 out of 18 had 1/5 power and 3 out of 5 had 0/5 power showing a directly proportional relationship of PSD with severity of motor weakness with a significant P value of 0.0005. Association with sensory system could not be elicited as none of the subjects had sensory impairment Table 5.

A statistically significant finding (p value <0.001) show that PSD exists in 17 out of 31 participants with left hemisphere lesions indicating an association of left hemisphere lesions with PSD. In this study 15 out of 21 participants with sub-cortical lesions had PSD with a P value of <0.001 showing significant association of PSD with sub cortical lesions. 15 out of 23 subjects with anterior lesions had PSD with a P value of <0.001 implying a significant association of PSD with Anterior lesions of strokeTable 6.

| DEPRESSION SEVERITY | NO. OF PARTICIPANTS |
|---|---|
| Borderline | 4(6.6%) |
| Moderate | 12(20%) |
| Severe | 2(3.3%) |

**Table 7: Depression Severity (BDI Scores)**

With respect to BDI scores out of 18 with depression 4 had borderline, 12 had moderate and 2 had severe levels of depressionTable 7.

## DISCUSSION

The present study was done to evaluate the factors associated with PSD in a tertiary care hospital in semi-urban area. According to this study 30% participants had PSD. A

| | | PSD | | TOTAL | P VALUE | CHI SQUARE |
|---|---|---|---|---|---|---|
| | | PRESENT | ABSENT | | | |
| RIGHT/LEFT | RIGHT | 1(1.7%) | 28(46.6%) | 29(48.3%) | <0.001 | 47.26 |
| | LEFT | 17(28.3%) | 14(23.3%) | 31(51.7%) | | |
| CORTICAL/SUB-CORTICAL | CORTICAL | 3(5%) | 36(60%) | 39(65%) | <0.001 | 38.14 |
| | SUBCORTICAL | 15(25%) | 6(10%) | 21(35%) | | |
| ANT/POST | ANTERIOR | 15(25%) | 8(13.3%) | 23(38.3%) | <0.001 | 36.65 |
| | POSTERIOR | 3(5%) | 34(56.7%) | 37(61.7%) | | |

**Table 6: Association Of Lesion Location With PSD**

review article done on PSD in South Asian region had shown prevalence ranging from 31.89% — 41.06%. Another review done by Robinson et al. had shown a prevalence of 31%-52% indicating discrepancy that could be explained by variation in geographical location and life style habit(2)

In our study 86.6% of the study sample belonged to age group 41-65 which was not far off with 78.8% in the study done by Ankita V patel [9, 10]whereas, only 58% of the participants belonged to this age group in another study done by Rajashekaran P. Majority of the study sample with PSD was from lower and middle Socio-economic Status which was in accordance with a study done by Rajashekaran P were all the participants belonged to middle Socio-economic Status. [11] Among the participants significant number of them who were living alone had PSD compared to living with spouse and living with children indicating those participants living alone had higher association with Post Stroke Depression. A study done by Ramasubbu had also shown depressed patients were living alone. [12]When comparing family types our study found depression to be more in joint family type whereas a study done in Gujarat on 52 participants had projected an association between nuclear family and PSD. This difference could be explained by changing trends in ability to handle interpersonal relationships in stressful situations [10]. Our study found 28.3% of the patients had depression within 2 months from the stroke which was similar to a study done by Ramasubbu et al. [12]with depression in 26% after 10 days from the stroke onset. But, some studies done in acute settings such by Caeiro et al witnessed 46% prevalence of depression within 4 days [13]stating that PSD was more prevalent in acute settings. This difference can be explained by immediate reaction to the illness which later on fades away due to adaptive skills. Study done by Litton et al [14] found no association between alcohol, tobacco habits with PSD whereas in current study it was found that use of substance had negative association with PSD. This difference could be explained by the culturally accepted behavior to consume substance with peers and relatives during stressful situations that can serve as a coping mechanism in reducing psychiatric sequel.

Out of the study sample, PSD was present in only few participants with Hemiplegia and Hemiparesis indicating that PSD was not significantly associated with the type of presenting illness. Majority of the participants with Cranial nerve involvement are having PSD, a novel finding in this study implying a need for more data into this aspect to substantiate any association between them. More than half the participants with Aphasia are having PSD, a finding similar to the study done by Lincoln NB et al. [15]This could be substantiated by difficulty in communication affecting the quality of life directly and lesion in left hemisphere being responsible for aphasia. [16]All the participants in this study with PSD had reported weakness in motor component ($\leq$3/5) leading to gait disturbances. In another multi-centric study done on 1806 participants total weakness score was significantly higher in depressed participants. This association can be explained by few studies which reported that gait disturbance was significantly associated with poor QOL [17, 18]and fear of falling (FoF) evinced significantly greater levels of depressive symptoms. [19]None of the study participants reported sensory disturbances and hence could not establish its association with PSD. This discrepancy could be because of the likelihood of approaching the hospital at earliest when there was weakness rather than paraesthesia.

In present study sample 28.3% of participants with left hemispheric lesion were suffering with PSD and only 1.7% of participants with right hemispheric lesion had PSD showing a significant association of PSD with left sided lesion. These findings were in line with studies done in Mangalore and Puducherry. [11, 14]Clinical and experimental studies in healthy participants indicate that the right hemisphere was more involved with emotions and left hemisphere enables in balancing these emotional reactions. Therefore, it could be implied incidence and severity of PSD is significantly higher in patients with lesions of the left hemisphere. [16]Robinson et al. in a series of studies found depression to be more commonly associated with left lesions than right and anterior more than posterior, that is left anterior is most common. This was similar to current study where majority

of participants with anterior lesion had PSD. Based on this finding it can be hypothesized that in at least some stroke survivors, depression was caused by structured lesion in the brain and was not secondary to physical deficit only. Many recent studies did not comment on whether the lesion is anterior or posterior. In present study out of 21 patients with sub-cortical lesion, 15 had depression but out of 39 patients with cortical lesions 36 didn't have depression. [20] In a bird view of this study most of the PSD sufferers were having left anterior sub-cortical lesions. In the current study 20% of participants with PSD were having moderate levels of depression. A meta-analysis of 111 studies showed that the location of lesion was significantly associated with the severity of depressive symptoms in the first 6 months following stroke. [21]

This study has some limitations mainly being a cross-sectional study and sequence of severity of depression following various time intervals could not be measured. Small sample size and not assessing association with stroke severity and disability also add to the limitations.

## CONCLUSION

Post Stroke Depression (PSD) is among the most frequent Neuro-psychiatric sequel of stroke. In an effort to fill the paucity of research data on PSD we found the prevalence of PSD is 30% and predominantly in lower socioeconomic group of the study sample. PSD was mainly associated with lack of family support, Joint family types, Stroke with Aphasia, Cranial Nerve involvement and Motor System weakness whereas, Substance use is found to be a protective factor in our study. Statistically significant numbers of subjects were found to have left anterior sub-cortical lesions associated with PSD which accounts for organic basis of PSD. This study highlights the variables which are to be considered in the recognition of PSD for Neurologists and Mental health care workers for early intervention and a better outcome in view of stroke recovery.

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