

Survey of prevalence and correlates of depressive symptoms, anxiety symptoms, stress symptoms and symptoms of Post-Traumatic Stress Disorder among stroke patients in a tertiary care hospital in Sri Lanka

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Abstract

Background

Neuropsychiatric symptoms, such as depression, anxiety, and PTSD, are common complications following a stroke, negatively impacting recovery and outcomes. Although post-stroke depression has been researched in Sri Lankan patients, there has been limited focus on anxiety and PTSD. This study aims to address this knowledge gap.

Aim

This research seeks to determine the prevalence of depression, anxiety, stress, and PTSD among post-stroke patients at Colombo North Teaching Hospital and Ragama Rehabilitation Hospital and to explore the interrelationships among these symptoms.

Method

A cross-sectional descriptive study was conducted with 285 participants who experienced either ischemic or hemorrhagic stroke within the past one month to two years. Neuropsychiatric symptoms were evaluated using the Depression Anxiety Stress Scale (DASS-21) and the Post-Traumatic Stress Symptom Scale – Self Report (PSS-SR).

Results

The study revealed a high prevalence of depression

(53%), anxiety (52%), stress (58%), and PTSD (34%) among participants, significantly exceeding general population rates ($p < 0.001$). Correlations were noted between these symptoms and various factors: depression was associated with the female gender ($p = 0.004$), poor family support ($p = 0.002$), and high disability ($p = 0.011$); anxiety correlated with female gender ($p = 0.001$), recent stroke onset ($p = 0.0002$), and tobacco use disorder ($p = 0.01$); stress was linked to female gender ($p = 0.001$), lower education ($p = 0.034$), lack of a partner ($p = 0.004$), and tobacco use ($p = 0.009$); PTSD correlated with poor family support ($p = 0.023$), higher education ($p = 0.015$), employment at stroke onset ($p = 0.004$), hemorrhagic stroke ($p = 0.023$), and severe disability ($p = 0.0003$).

Conclusions

This study highlights a significant prevalence of non-cognitive neuropsychiatric symptoms in Sri Lankan post-stroke patients. Regular evaluation by medical professionals trained in liaison psychiatry is recommended to improve patient care and outcomes.

Keywords: stroke, prevalence, depression, anxiety, PTSD

SL J Psychiatry 2024; 15(2): 37-45

Introduction

Epidemiological studies suggest strokes can be considered the second most common cause of mortality after heart disease (1). According to the World Health Organization (WHO), there are more than 15 million new cases of strokes which occur worldwide each year (2). Of these, 5 million die, and another 5 million are left permanently disabled (2). As a result, stroke is probably the most frequent cause of severe disability in the

community which causes most of the victims disabled in the productive years of their lives (3).

The impact of a cerebrovascular event on an individual can be enormous and it has a significantly debilitating effect on the physical, psychological and social wellbeing of the person and the family (4). Neuropsychiatric manifestations of the stroke may be attributable directly to the brain damage sustained or can be a representation

of the individual's reaction to the handicaps imposed on him. In either event, the patient's personality and life situation can have a profound effect on overall adjustment to the disability (3).

Commonly identified neuropsychiatric manifestations of strokes are depression, cognitive impairment, personality change and emotionalism (5). Most of the previous studies have focused on identifying the prevalence and correlations of the above conditions in post-stroke patients. However, studies by Castillo et al. and Lepavueri et al. showed that post-stroke anxiety symptoms also play a crucial role in the symptom burden of patients where they have identified that more than 25% of post-stroke patients have features of generalized anxiety disorder (6).

Anxiety symptoms following a cerebrovascular event occur in about 24% of patients and are a debilitating condition associated with poorer health-related quality of life (7). Despite the high prevalence of post-stroke anxiety, it is an understudied area in comparison to other neuropsychiatric manifestations of strokes (8). There are no published studies that could be traced on the prevention of post-stroke anxiety disorders and evidence-based therapies for the treatment of the condition (9). This may be due to a lack of data regarding risk factors and associations. The development of effective therapies for the condition depends on a better understanding of its associations which could provide targets for treatment (10).

More recent studies have focused on the possibility of the presence of post-traumatic stress disorder (PTSD) among post-stroke patients. Traditionally external traumas such as assaults, torture and road traffic accidents are considered as the focus for PTSD and most of the research related to PTSD is done relating to external events (11). There has been growing evidence that PTSD can also occur as a result of an internal event such as an acute cerebrovascular event (11). Strokes also have most features of an acute traumatic event such as sudden onset, unexpected and potentially life-threatening (12). Studies have shown that the prevalence of PTSD symptoms in post-stroke patients can be as high as 23% (11).

According to a study done by Thashi Chang et al in the year 2015, it has been shown that the prevalence of strokes in Sri Lanka is 10 per 1000 (13). Though studies have been done to identify neuropsychiatric manifestations of strokes such as post-stroke depression in Sri Lankan patients, less emphasis has been given to anxiety disorders and PTSD.

As proper treatment of psychiatric comorbidities in post-stroke patients plays a crucial part in prognosis, it is

important to identify all the possible psychiatric sequelae and implement a comprehensive monitoring system to detect them (14). Research on the epidemiology of neuropsychiatric manifestations of strokes which are done on the local population is important to identify disease burden and their correlations. The absence of these data causes serious implications for patient management, especially at the screening level.

There is a scarcity of the number of studies done on anxiety disorders and PTSD in post-stroke patients. Though some studies have been done regarding post-stroke depression in Sri Lanka, there are no studies on anxiety disorders and PTSD (15).

This study aims to investigate the prevalence of non-cognitive neuropsychiatric sequelae, including anxiety, depression, stress, and post-traumatic stress disorder (PTSD), among post-stroke patients in Sri Lanka. Specifically, the study will determine the prevalence of these conditions in post-stroke patients attending neurology clinics and rehabilitation hospitals. Additionally, the study will explore the correlations between these neuropsychiatric sequelae and other psychiatric conditions, as well as with sociodemographic factors.

Methodology

Study design and setting

This study employed a descriptive cross-sectional design to investigate the prevalence of anxiety, depression, and post-traumatic stress disorder (PTSD) among post-stroke patients in Sri Lanka. Data were collected from patients attending a neurology clinic at Colombo North Teaching Hospital (CNTH) and undergoing rehabilitation at Ragama Rehabilitation Hospital (RRH).

Study population

The study included adult individuals (≥ 18 years) who had experienced an ischemic or hemorrhagic stroke within the past 1-24 months. Patients were excluded if they had a history of psychiatric disorders, marked dysphasia or cognitive impairment, delirium, severe personality changes, severe mood disturbances or psychotic symptoms, or difficulty communicating in Sinhala or English.

Study sample

A convenience sampling method was used to recruit eligible and consenting patients until the target sample size was reached. The sample size was calculated using the formula for calculating a population proportion with absolute precision, based on a prevalence of anxiety

disorders following stroke of 24% as reported in previous literature. A total of 281 participants were included in the study.

Study instruments

Data were collected using self-administered questionnaires:

- **Socio-demographic questionnaire:** Collected basic information about the participants.
- **Depression, Anxiety, and Stress Scale (DASS):** Measured depression, anxiety, and stress.
- **Post-traumatic Stress Symptom Scale – Self Report (PSS-SR):** Assessed symptoms of PTSD.

Data collection

Patients were invited to participate in the study during their clinic visits or ward stays. Informed consent was obtained, and questionnaires were administered in the participants' preferred language. For patients with reading or writing difficulties, the questionnaires were read aloud, and responses were documented by the investigators.

Data analysis

Data analysis was done using Statistical Package for the Social Sciences (SPSS) version 20. Correlation coefficients were calculated to measure the strength and direction of relationships between adherence and other variables.

Ethical considerations

Ethical approval was obtained from the Ethics Review Committee of the Faculty of Medicine, University of Kelaniya, Ragama. Informed consent was obtained from all participants, and their privacy and confidentiality were maintained throughout the study.

Results

A total of 285 patients with a history of stroke who were under the care of the Neurology Clinic at CNTH and RRH, Sri Lanka participated in the study. Most of the patients were from the Gampaha district which is the second most populace district in the country.

Clinical variables

Established risk factors of stroke such as male gender, advanced age, alcohol consumption and smoking were

high in the study sample. 83% of the participants have had an ischaemic stroke and 17% have had a haemorrhagic stroke. 69% of them had previous vascular risk factors such as diabetes, hypertension and ischaemic heart diseases. Alcohol use (57%) and tobacco dependence (45%) were high among male post-stroke patients before the stroke.

Prevalence of neuropsychiatric symptoms

The study revealed that 53.4% (n=152) of stroke patients exhibited depressive symptoms, a rate significantly higher than that observed in the general population during the COVID-19 pandemic ($\chi^2(1, N=285) = 48.72, p = 0.001$). Similarly, 53.4% (n=152) of patients experienced anxiety symptoms, which were also significantly elevated compared to the general population during the COVID-19 outbreak ($\chi^2(1, N=285) = 59.2, p = 0.001$). Furthermore, 35.1% (n=100) of patients showed symptoms of Post-Traumatic Stress Disorder (PTSD), a prevalence significantly higher than that of the general population in South Asia ($\chi^2(1, N=285) = 63.26, p = 0.001$). Lastly, 58.6% (n=167) of patients reported stress symptoms, which were significantly more prevalent than in the general population during the COVID-19 outbreak ($\chi^2(1, N=285) = 105.8, p = 0.001$).

Associations between neuropsychiatric symptoms and the corresponding variables

Anxiety symptoms were significantly higher among female patients ($\chi^2(1, N=285) = 11.25, p = 0.001$), smokers ($\chi^2(1, N=279) = 6.58, p = 0.01$), and those who had experienced a stroke within the past six months ($\chi^2(1, N=285) = 13.49, p = 0.0002$). PTSD symptoms were significantly elevated in individuals with poor family support ($\chi^2(1, N=282) = 5.16, p = 0.023$), higher education ($\chi^2(1, N=282) = 5.877, p = 0.015$), hemorrhagic stroke ($\chi^2(1, N=243) = 5.139, p = 0.023$), high levels of disability ($\chi^2(1, N=278) = 21.21, p = 0.0003$), low Barthel index ($\chi^2(1, N=281) = 17.14, p = 0.000$), and those unemployed after the stroke ($\chi^2(1, N=279) = 5.62, p = 0.018$). Depressive symptoms were significantly more prevalent in individuals with poor family support ($\chi^2(1, N=282) = 9.34, p = 0.002$), high levels of disability ($\chi^2(1, N=278) = 6.45, p = 0.011$), low Barthel index ($\chi^2(1, N=281) = 4.58, p = 0.032$), and among female patients ($\chi^2(1, N=285) = 8.14, p = 0.004$). Stress symptoms were significantly associated with female gender ($\chi^2(1, N=285) = 10.94, p = 0.001$), not living with a spouse ($\chi^2(1, N=285) = 10.94, p = 0.001$), not owning a house ($\chi^2(1, N=281) = 15.24, p = 0.0001$), and low education levels ($\chi^2(1, N=282) = 4.47, p = 0.034$).

Table 1. Sociodemographic characteristics of the study population

Variable		N(%)
Gender	Male Female	190 (66.7%) 95 (33.3%)
Age Group	Less than 40 41 - 60 61 - 75	21 (7.4%) 145 (50.9%) 119 (41.8%)
Marital Status	Single Married and living with a partner Married and widowed Married and separated	4 (1.4%) 245 (87.2%) 20 (7.0%) 12 (4.2%)
Parent Status	No children Have dependent children Have independent children	11 (3.9%) 132 (46.6%) 140 (49.5%)
Main Caregiver	Spouse Children Siblings Other relation Care home	218 (76.5%) 40 (14.0%) 12 (4.5%) 7 (2.5%) 7 (2.5%)
Perceived Quality of Care	Good Average Poor	211 (74.8%) 67 (23.8%) 4 (1.4%)
Residence Status	Own house Rented house Care home	230 (81.9%) 24 (8.5%) 27 (9.6%)
Educational Level	No formal education Primary - Grade 5 Grade 6 - Grade 11 O/L pass A/L pass Degree holder	8 (2.8%) 27 (9.6%) 82 (29.1%) 96 (34.0%) 61 (21.6%) 8 (2.8%)
Occupation Status Before Stroke	Never occupied Occupied until the stroke Previously occupied but not at the time of stroke	43 (15.2%) 193 (68.4%) 46 (16.3%)
Occupation Status After Stroke	Occupied Not occupied	31 (11.2%) 248 (88.8%)
Income Before Stroke	No income Less than 10,000 10,000 - 25,000 25,000 - 50,000 50,000 - 100,000 More than 100,000	47 (16.5%) 21 (7.4%) 40 (14.0%) 133 (47.0%) 32 (11.6%) 10 (3.5%)
Income After Stroke	No income Less than 10,000 10,000 - 25,000 25,000 - 50,000 50,000 - 100,000 More than 100,000	194 (68.4%) 27 (9.5%) 16 (5.6%) 41 (14.4%) 5 (1.8%) 1 (0.4%)

Table 2. Clinical variables of the study population

Variable		N(%)
Type of Stroke	Ischaemic stroke Haemorrhagic stroke	202 (82.7%) 42 (17.3%)
Post-stroke Duration (Months)	1 - 3 4 - 12 13 - 24	52 (18.2%) 106 (37.2%) 127 (44.6%)
Vascular Risk Factors	Present (DM, HT, IHD) No vascular risk factors	195 (69.4%) 85 (30.6%)
Alcohol Use (Before Stroke)	Yes No	109 (38.3%) 173 (61.7%)
Alcohol Use (After Stroke)	Yes No	16 (5.6%) 268 (94.4%)
Tobacco Use (Before Stroke)	Yes No	88 (31.5%) 191 (68.5%)
Tobacco Use (After Stroke)	Yes No	13 (4.6%) 268 (95.4%)
Perceived Disability	No disability Mild disability Severe disability	11 (4%) 109 (39.2%) 158 (56.8%)
Perceived Improvement	Excellent Good Average Poor	13 (4.6%) 68 (24.3%) 154 (55%) 45 (16.1%)
Barthel Index	21 - 60 61 - 90 91 - 100	133 (47.3%) 134 (47.7%) 14 (5%)

Table 3. Prevalence of neuropsychiatric symptoms

Category	Sub-category	Frequency	Percentage
Prevalence of Depressive Symptoms	No	133	46.6%
	Yes	152	53.4%
Prevalence of Anxiety Symptoms	No	136	47.7%
	Yes	149	52.3%
Prevalence of PTSD Symptoms	No	187	65.6%
	Yes	98	34.4%
Prevalence of Stress Symptoms	No	120	42.1%
	Yes	165	57.9%

Table 4. Associations between neuropsychiatric symptoms and the corresponding variables				
Variable	Neuropsychiatric Symptoms	Chi-square (χ^2)	p-value	Significant Association
Age	Depressive symptoms	2.38	0.304	No
	Anxiety symptoms	4.62	0.09	No
	Stress symptoms	5.80	0.055	No
	PTSD symptoms	0.586	0.746	No
Gender	Depressive symptoms	8.14	0.004	Yes (higher in females)
	Anxiety symptoms	11.25	0.001	Yes (higher in females)
	Stress symptoms	10.94	0.001	Yes (higher in females)
	PTSD symptoms	0.381	0.537	No
Marital Status	Depressive symptoms	0.001	0.975	No
	Anxiety symptoms	0.034	0.855	No
	Stress symptoms	8.46	0.004	Yes (higher in separated/ not living together)
	PTSD symptoms	1.44	0.229	No
Family Support	Depressive symptoms	9.34	0.002	Yes (higher with poor family support)
	Anxiety symptoms	0.058	0.809	No
	Stress symptoms	2.006	0.157	No
	PTSD symptoms	5.16	0.023	Yes (higher with poor family support)
Residence	Depressive symptoms	0.311	0.577	No
	Anxiety symptoms	2.726	0.099	No
	Stress symptoms	15.24	0.0001	Yes (higher in those without their own house)
	PTSD symptoms	1.26	0.260	No
Education	Depressive symptoms	0.311	0.577	No
	Anxiety symptoms	2.726	0.099	No
	Stress symptoms	4.47	0.034	Yes (higher in low education)
	PTSD symptoms	5.877	0.015	Yes (higher in high education)
Occupation (Before Stroke)	Depressive symptoms	2.74	0.098	No
	Anxiety symptoms	0.789	0.375	No
	Stress symptoms	0.809	0.368	No
	PTSD symptoms	8.142	0.004	Yes (higher in employed before stroke)
Occupation (After Stroke)	Depressive symptoms	1.33	0.249	No
	Anxiety symptoms	0.010	0.919	No
	Stress symptoms	0.884	0.347	No
	PTSD symptoms	5.62	0.018	Yes (higher in unemployed post-stroke)
Type of Stroke	Depressive symptoms	0.005	0.944	No
	Anxiety symptoms	0.016	0.898	No
	Stress symptoms	0.227	0.634	No
	PTSD symptoms	5.139	0.023	Yes (higher in haemorrhagic stroke)

(Continued)

Variable	Neuropsychiatric Symptoms	Chi-square (χ^2)	p-value	Significant Association
Duration of Stroke	Depressive symptoms	3.06	0.080	No
	Anxiety symptoms	13.49	0.0002	Yes (higher in 1-6 months)
	Stress symptoms	1.77	0.182	No
	PTSD symptoms	1.22	0.299	No
Pre-existing Physical Illness	Depressive symptoms	2.19	0.139	No
	Anxiety symptoms	0.409	0.522	No
	Stress symptoms	0.77	0.380	No
	PTSD symptoms	3.507	0.061	No
Alcohol Use	Depressive symptoms	0.586	0.444	No
	Anxiety symptoms	0.058	0.810	No
	Stress symptoms	0.001	0.979	No
	PTSD symptoms	1.345	0.246	No
Tobacco Use	Depressive symptoms	0.621	0.431	No
	Anxiety symptoms	6.58	0.01	Yes (higher in tobacco users)
	Stress symptoms	6.81	0.009	Yes (higher in tobacco users)
	PTSD symptoms	0.221	0.639	No
Disability (Perceived by Patient)	Depressive symptoms	6.45	0.011	Yes (higher in severe disability)
	Anxiety symptoms	0.305	0.581	No
	Stress symptoms	2.70	0.100	No
	PTSD symptoms	21.21	0.0003	Yes (higher in severe disability)
Barthel Index	Depressive symptoms	4.58	0.032	Yes (higher with a low Barthel Index)
	Anxiety symptoms	0.010	0.920	No
	Stress symptoms	2.95	0.085	No
	PTSD symptoms	17.14	0.000	Yes (higher with a low Barthel Index)

Discussion

The study was conducted to identify the prevalence and correlations of non-cognitive neuropsychiatric symptoms (depression, anxiety, stress and PTSD) of stroke among post-stroke patients who were under follow-up at CNTH and RRH. Though there are previous studies which assessed the prevalence of post-stroke depression in Sri Lankan patients, this is the first study that investigates the prevalence of anxiety, stress and PTSD in post-stroke patients in Sri Lanka (15).

The study findings suggest depressive symptoms (53%), anxiety symptoms (52%), stress symptoms (57%) and PTSD symptoms (35%) were significantly higher among the study population compared to the general population. Data collection for the study was done from March to August 2021 which is the period where the

COVID-19 outbreak highly affected the country. The COVID-19 pandemic had a significant negative impact on the mental health of all, and the study findings showed enhanced levels of distress among patients as expected (16). Hence, the study population was compared with a meta-analysis done by Nader Salari et al which analyzed the depression, anxiety and stress symptoms in the general population during the COVID-19 pandemic (17). According to the meta-analysis, the prevalence of stress, anxiety, and depression, in the general population was 29.6, 31.9 and 33.7% respectively during the early stage of the COVID pandemic which was significantly higher compared to non-pandemic values. Compared to these values, the prevalence of depression (χ^2 -48.72p-value-0.000), anxiety (χ^2 -59.2p-value-0.000) and stress (χ^2 -105.8p-value-0.000) were significantly high among participants of our study.

In a similar study by Schotke et al. (2015), post-stroke depression and anxiety were reported at 31.1% and 20.4%, respectively (18). A Sri Lankan study in 2015 showed 28% prevalence of depression (15). In comparison, the current study found significantly higher rates of post-stroke depression ($\chi^2=28.97$, $p=0.000$) and anxiety ($\chi^2=62.49$, $p=0.000$), likely due to limited recovery opportunities during the COVID-19 pandemic.

An Australian study on spinal cord injury patients reported depression, anxiety, and stress prevalence rates of 37%, 30%, and 25%, respectively, while an Indian study on chronic kidney disease patients found rates of 22.9%, 19.2%, and 28.2% (19,20). In comparison, stroke patients in this study exhibited significantly higher neuropsychiatric symptoms: depression ($\chi^2=48.72$, $p=0.000$), anxiety ($\chi^2=48.72$, $p=0.000$), and stress ($\chi^2=48.72$, $p=0.000$).

Post-stroke patients are biologically, psychologically, and socially more vulnerable to neuropsychiatric symptoms, such as depression, anxiety, and stress, compared to the general population (30). Though cognitive impairment is a significant factor in the development of these symptoms, the condition is multifactorial (3). Some studies link the anatomical location of stroke lesions, particularly in the left frontal cortex and basal ganglia, with increased severity of post-stroke depression, although this association has not been consistently replicated (21,22). Neurochemical changes, such as alterations in the monoamine pathway and immune system interactions, are also implicated in the onset of symptoms (23). While our study did not assess neuroimaging, neurological deficits, or biochemical findings, future research should include these factors to enhance understanding and management of neuropsychiatric symptoms in post-stroke patients in Sri Lanka.

The prevalence of PTSD symptoms in the study sample was 35.1%. According to a systematic review done in the year 2020, which analyzed the prevalence of mental disorders in the general population in South Asian countries, the prevalence of PTSD was 17.2% (24). Compared to these findings, the prevalence of PTSD in the study sample was significantly high ($\chi^2=63.26$, $p\text{-value}=0.000$) among participants of our study. Traditionally external traumas are considered as the focus for PTSD and most of the research related to PTSD is done relating to external events. However, there is a growing set of evidence that suggests PTSD can occur as a result of internal incidents such as myocardial infarction or a cerebrovascular accident which fulfil the DSM-5 definition of trauma (25,26).

A meta-analysis by Edmondson et al. reported a 23% prevalence of PTSD in post-stroke patients, significantly lower than the rate found in our study ($\chi^2=17.77$, $p=0.000$) (48). A German study on transient ischemic attack patients showed a 29% PTSD prevalence, which was

not significantly different from our findings ($\chi^2=2.111$, $p=0.146$) (27). Factors like negative cognitive appraisals, maladaptive coping strategies, alexithymia, and avoidance, which were heightened during the COVID-19 pandemic, may explain the higher PTSD prevalence (28). Additionally, the elevated levels of depression, anxiety, and stress in our population could contribute to the increased PTSD rates.

Given the high prevalence of neuropsychiatric symptoms among Sri Lankan post-stroke patients, it is crucial to implement regular screening and integrate mental health professionals into stroke care teams. Training for medical staff in recognizing these symptoms and the establishment of dedicated psychiatric services are recommended. Special attention should be given to optimizing patient mental health during pandemics, with strategies including continuous rehabilitation, psychotherapeutic measures, and caregiver support.

Future research should encompass a national scope, larger sample sizes, diverse language groups, and prospective designs to further elucidate the impact of neuropsychiatric disorders in post-stroke patients and address existing study limitations.

Limitations

The generalizability of the study can be limited due to its focus on Gampaha district patients, exclusion of non-Sinhala/English speakers, pandemic-related psychological effects, and potential response bias from investigator assistance.

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