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Post-stroke depression: frequency, risk factors, and impact on quality of life among 103 stroke patients—hospital-based study

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Abstract

Background: Post-stroke depression (PSD) has worse functional outcomes and quality of life. Despite the extensive literature on this topic, there is no agreement on the frequency or risk factors for post-stroke depression.

Objectives: To establish the frequency and risk factors of post-stroke depression and its impact on quality of life.

Patients and methods: One hundred three stroke patients were recruited from the out-patient clinic of Qena University Hospital who satisfied the WHO definition for stroke, together with a control group of 50 age- and sex-matched healthy volunteers. A complete history, neurological examination, and CT brain were obtained for each patient. DSM-IV TR criteria were used for diagnosis of depressive disorders which was scored with the Hamilton depression rating scale (HAM-D); Barthel Index (BI), and quality of life were also measured.

Results: Thirty-eight (36.9%) stroke patients had PSD which was significantly higher than in the normal population (control group 12%). Statistically significant risk factors for PSD included low educational level, low socioeconomic status, smoking, and post-stroke functional impairment. Post-stroke depression has an impact on quality of life.

Conclusion: Post-stroke depression is a relatively common complication of stroke and can affect the quality of life. Low educational level and socioeconomic status, as well as smoking and functional impairments, were considered as risk factors for the occurrence of post-stroke depression. Early detection of predictors of post-stroke depression may improve the outcome of stroke and prevent the psychiatric consequences.

Keywords: Depression, Stroke, Hospital-based study, Hamilton depression scale, Barthel Index scale, Quality of life, MMSE, DSM-IV-TR

Introduction

Stroke is an important neurological problem and a leading cause of death in clinical practice. Among survivors, over half have significant physical disabilities and/or psychiatric complications, the most common of which is post-stroke depression (PSD). In 2017, stroke made up

the third-leading cause of disability-adjusted life-years (DALYs) worldwide [1]. The prevalence of stroke in a study conducted in our community (Qena governorate) was 922 in 100,000 [2]. Martin Roth was the first to study the association between depression and stroke [3]. Later, Folstein reported that depression was more common in stroke patients than in patients with a similar level of motor disability caused by orthopedic problems [4]. Various reports have shown a significant association between depression and quality of life in stroke survivors [5, 6]. The double burden of stroke and depression has

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been considered the main leading cause to total years lost to disability based on the global burden of disease report [1]. A reciprocal relationship between the severity of initially diagnosed PSD and stroke recovery outcome has been noted in many studies [7, 8], with increased mortality rates [9–11], and improved survival and quality of life with antidepressant medications and psychoeducation [12–16]. Across the literature, there is great variability of PSD frequency; two recent Nigerian studies have found PSD at 22.9% and 42.9%, respectively [17, 18], and another Tanzanian study found PSD to be 30% [19]. In a recent systematic review of post-stroke depression in the Middle East and North Africa reported that the prevalence ranged from 17 to 73% [20].

In fact, the previous studies showed that the frequency of PSD is influenced by patient's selection, socioeconomic state, educational level, severity of stroke, location of the lesion, study design, time of assessment after stroke, and the associated risk factors.

Unfortunately, PSD is often underdiagnosed and underreported, in part because cognitive problems after stroke can confound the symptoms of depression and make the diagnosis of depression difficult. Despite increased interest in the socioeconomic aspects of chronic medical conditions in developing countries, there is little information about PSD in Egypt. To address this point, our study is aimed to estimate the frequency of PSD, associated risk factors, and impact on quality of life (QoL) among stroke patients in Qena University Hospital (upper Egypt).

Patients and methods

In this cross-sectional study, we recruited 103 (out of 180) patients with stroke from the neurology outpatient clinic of Qena University Hospital from September 2014 to August 2015; they were compared with a group of 50 age- and sex-matched healthy control subjects that were recruited from 2nd-degree relatives of patients. Qena is one of the southern governorates of Egypt. Inclusion criteria included patients diagnosed with stroke according to the WHO definition as a syndrome of rapidly developing clinical signs of focal or global disturbance of cerebral function, with symptoms lasting 24 h or longer with no apparent cause other than of vascular origin [21], and stroke diagnosis was confirmed by computerizing tomography of the brain (CT scan) The duration of stroke was the time passed since the onset of stroke to the time of examination (ranging from the onset of stroke up to 2 years). They were 18 years or older; alert; oriented with persons, time, and place; had no problems in communication; willing to participate in the study; and able to give written informed consent.

Stroke patients were classified according to the side of the lesion to right and left hemisphere and according to the location of the lesion to frontal and non-frontal as

the frontal region has the greatest vulnerability to post-stroke mood disorder [22].

Exclusion criteria included individuals who were unable to communicate due to a disturbed level of consciousness. Severe global dysphasia was excluded on the bases of clinical assessment that interferes with patients' life and communication. Severe cognitive impairment (as assessed by Mini-Mental State Examination [MMSE] which was used to exclude patients with score < 18 for literate and < 16 for illiterate subjects [23, 24]) as cognitive problems after stroke can confound the symptoms of depression and make the diagnosis of depression difficult, and severe hearing or visual impairment that affect the communication and assessment of depression. Severe medical complications (renal or liver failure as these are confounding factors associated with depression) were also excluded. Neither the patient nor controls were on antidepressant medications.

Structured Clinical Interview for DSM-IV-Clinician Version (SCID-CV) [25] the Arabic version [26] was used for the diagnosis of depression and exclusion of other psychiatric comorbidities in patients and controls. It contains seven diagnostic modules for axis I disorders.

Socioeconomic status was assessed with an appropriate Arabic validated scale, as it was classified into low, middle, and high socioeconomic status based on the subject score [27]. It consists of 4 dimensions: parents' level of education, parents' occupation, total family monthly income, and lifestyle of the family. Each item was given a score of 1. According to the total score, the socioeconomic level was divided into three categories: high (85–100%), moderate (60–84%), and low (< 60%).

The residence of each patient or control subject is classified as a rural or urban resident according to the geographical distribution of rural (from the village) and urban (from city) areas location in Qena governorate. Clinical characteristics and risk factors were recorded for each patient. Hamilton depression rating scale (HAM-D) [28] was used to measure the severity of depressive symptoms according to the subject score as follows: 0–7 = normal, 8–13 = mild depression, 14–18 = moderate depression, 19–22 = severe depression, and > 23 = very severe depression. The World Health Organization Quality of Life (WHOQOL)-BREF [29] and Barthel Index (BI) [30] were used to measure quality of life and functional status of stroke patients.

All participants provided an informed written consent. The local Ethical Committee of Assiut University Hospital approved the study.

Statistical analysis

The data were analyzed using the Statistical Package for Social Science (SPSS Inc., 2008, 233 South Wacker Drive, Chicago, IL, USA) version 17.0 software.

The sampled population was divided into diagnostic groups of depressed and non-depressed individuals. The chi-square test was used to find the significance of study parameters on categorical variables, while the Mann-Whitney *U* test was used to analyze continuous variables (they were not normally distributed) between the two groups. The *P* value was set at 0.05. Independent predictors of depression were determined by binary logistic regression. A *P* value of less than 0.05 was considered significant.

Results

A significantly higher relative frequency of depression was detected among stroke patients compared with the control group ($P < 0.001$). Thirty-eight patients (36.9%) had depression, of whom 22 (21.4%) had major and 16 (15.5%) patients had minor depressive disorder; 6 out of 50 (12%) individuals in the control group had depression (Table 1). Patients also had a significantly higher HAM-D score (8.6 ± 5.8) than the control group (5.2 ± 4.2) ($P < 0.001$). Post-stroke depression was significantly associated with low educational level, low socioeconomic status, and smoking, while age, gender, residence, marital, and job status were not significantly different between depressed and non-depressed stroke patients (Table 2). There were no significant differences between depressed and non-depressed stroke patients in symptoms of hypertension, cardiac disease, or diabetes mellitus. In addition, there was no significant association with a past psychiatric history of depression or family history of depression in first-degree relatives (Table 3).

There were no significant relationships between the various stroke indices and PSD except for functional impairment (measured according to Barthel Index scale), which was significantly higher in the patients with post-stroke depression (Table 4). Physical, psychological, and environmental QOL assessed by WHOQOL-BREF questionnaire was significantly worse among stroke patients with depression than in stroke patients without depression (Table 5).

Discussion

The main findings of the present study were the relatively high frequency of PSD of 36.9%, low educational level, low socioeconomic status, smoking, and functional impairment as measured by BI scale and were all considered risk factors associated with PSD, while other risk factors had no relationship with PST. PSD has a worse impact on physical, psychological, and environmental QOL

Two possibilities for the occurrence of PSD are the following: firstly, PSD is a result of damage of a certain brain region and presumably subsequent changes in neurotransmitters such as serotonin and dopamine, and

secondly, it may be a psychological reaction to the disabilities sequelae resulting from a stroke that affects the quality of life.

The prevalence of PSD has been summarized in numerous individual studies and meta-analyses and was estimated to be in the range of 20 to 65% [31]. Another two meta-analyses estimated the prevalence at 29% (20,293 patients) in 43 studies over a period of 5 years post-stroke [32] and 31% (25,488 patients) in 61 prospective studies over 5 years post-stroke [33]. In the current study, depression was diagnosed in about 37% of patients. Differences in prevalence estimates are probably related to the variation in the clinical presentation of stroke and the difficulty of evaluating depression in many cases [34] or to the use of different measures and diagnostic criteria for diagnosis [35]. Another factor related to the difference in the frequency of PSD is the small sample size as local studies with sample sizes of less than 100 patients for PSD reported a prevalence of 30% or less. It is possible that the small samples were not sufficient to give the studies the required power to address the hypothesis, which may be responsible for the lower prevalence reported.

Most (21.4%) of our patients had major depressive disorders (MDD) while 15.5% had a minor depressive disorder. This is similar to figures of 19.9% and 12.6% from Mitchell and colleagues [36].

Gender and age did not reveal any significant association with PSD despite the fact that depressive disorders are more prevalent among females in the general population. This is consistent with two previous systematic reviews: De Ryck and colleagues [31] reported that gender was not a risk factor for PSD in 13 out of 21 studies, while age was not a predictor in 16 studies. A similar conclusion was reached by Kutlubaev and Hackett [37] reviewing 23 studies that included 18,374 stroke patients from 23 studies. However, not all studies find the same relationship with aging. There was a high prevalence among older stroke patients in a study carried out in Jordan [38], while there was increased prevalence among younger stroke patients in other studies [39, 40].

We found that the lower the educational level, the higher the prevalence of PSD, a finding that is consistent with numerous previous studies [39, 41–43]. This may be due to defective coping strategies and a less consistent premorbid support system in less educated subjects. The significant association of PSD with smoking was also consistent with previous findings [38, 44], which may be explained by deficient vitamin D in smokers according to Ren and colleagues [44] and the superadded dysphoric effect of sudden nicotine abstinence, withdrawal mood symptoms, and craving.

The absence of a significant association between PSD and hypertension, diabetes, or cardiac disease was partly

Table 1 Demographic, socioeconomic, medical, and psychiatric risk factors in stroke patients and control subjects

Characteristic	Stroke patients, number = 103	Control, number = 50	P value
Sex			0.650
Male	62 (60.2)	32 (64)	
Female	41 (39.8)	18 (36)	
Age in years			
Mean \pm SD (years)	61.2 \pm 14.7	59 \pm 13.3	0.861
Residence			0.281
Urban	40 (38.8)	24 (48)	
Rural	63 (61.2)	26 (52)	
Marital status			0.046
Single	9 (8.7)	7 (14)	
Married	69 (67)	39 (78)	
Divorced/widowed	25 (24.3)	4 (8)	
Education			0.380
Literate	77 (74.8)	34 (68)	
Illiterate	26 (25.2)	16 (32)	
Socioeconomic status (SES)			0.538
Low	38 (36.9)	23 (46)	
Middle	59 (57.3)	25 (50)	
High	6 (5.8)	2 (4)	
Employment (occupation)			0.336
Employed	39 (37.9)	23 (46)	
Unemployed	64 (62.1)	27 (54)	
Special habits (in males)			0.570
Smoker males	33/62 (53.2%)	19/32 (59.4)	
Non-smoker males	29/62 (46.8%)	13/32 (40.6)	
Diabetes			0.022
Yes	24 (23.3)	4 (8)	
No	79 (76.7)	46 (92)	
Hypertension			0.021
Yes	29 (28.2)	7 (14)	
No	74 (71.8)	43 (86)	
Cardiac			0.071
Yes	17 (16.5)	3 (6)	
No	86 (83.5)	47 (94)	
Past psychiatric history of depression	19 (18.4)	5 (10)	0.098
Family history of depression in first-degree relatives	10 (9.7)	4 (8)	0.964
Depressed	38 (36.9)	6 (12%)	0.001
Non-depressed	65 (63.1)	44 (88)	
Major depressive disorder	22 (21.4)	4 (8)	0.039
Minor depression	16 (15.5)	2 (4)	0.039

consistent with some previous reports [31, 37, 45] which found that hypertension and hyperlipidemia were not associated with PSD, while diabetes mellitus was identified as a predictor. Contrary to the present findings, a past

history of depression [31, 37] and family history of depression were also significantly correlated to PSD [36].

In the current study, PSD was more common in those with more severe post-stroke functional impairments as

Table 2 Demographic and socioeconomic data for post-stroke depression

Characteristic	Non-depressed stroke patients, N = 65 (63.1%)	Depressed stroke patients, N = 38 (36.9%)	P value
Age in years			
Mean ± SD (years)	61.2 ± 15	61.1 ± 14.4	0.853
Gender, n (%)			
Male	40 (61.5%)	22 (57.9%)	0.877
Female	25 (38.5%)	16 (42.1%)	
Residence, n (%)			
Urban	25 (38.5%)	15 (39.5%)	0.920
Rural	40 (61.5%)	23 (60.5%)	
Marital status			
Single	6 (9.2%)	3 (7.9%)	0.921
Married	44 (67.7%)	25 (65.8%)	
Divorced/widowed	15 (23.1%)	10 (26.3%)	
Education			
Literate	54 (83.1%)	23 (60.5%)	0.021
Illiterate	11 (16.9%)	15 (39.5%)	
Socioeconomic status (SES)			
Low	13 (20%)	25 (65.8%)	< 0.001
Middle	47 (72.3%)	12 (31.6%)	
High	5 (7.7%)	1 (2.6%)	
Job status			
Work	25 (38.5%)	14 (36.8%)	0.869
Non-worker or retired	40 (61.5%)	24 (63.2%)	

measured by the Barthel Index that is in line with Schöttke and colleagues [46]. Thus, the burden of functional impairment of stroke can increase the risk of PSD, which then leads to further impairment like increased disability, reduced social activities, delayed recovery,

failure to return to work, and longer institutional care and so affect quality of life.

In the present study, there was no significant relationship between the duration since onset of stroke and the frequency of PSD. Previous studies reported an increased

Table 3 Comorbid medical and psychiatric illness and post-stroke depression

		Stroke patients		P value
		Non-depressed, N = 65 (63.1%)	Depressed, N = 38 (36.9%)	
Diabetes mellitus	Not diabetic	51 (78.5%)	28 (73.7%)	0.580
	Diabetic	14 (21.5%)	10 (26.3%)	
Hypertension	Not hypertensive	46 (70.8%)	29 (76.8%)	0.542
	Hypertensive	19 (29.2%)	9 (23.7%)	
Cardiac disease	Not cardiac	55 (84.6%)	31 (81.6%)	0.689
	Cardiac	10 (9.7%)	7 (6.8%)	
Smoking	Males, smoker	18 (45%)	15 (68.2%)	0.04
	Males, non-smoker	22 (55%)	7 (31.8%)	
Past history of depression	Negative	53 (81.5%)	31 (81.6%)	0.996
	Positive	12 (18.5%)	7 (18.4%)	
Family history of depression	Negative	59 (90.8%)	34 (89.5%)	0.830
	Positive	6 (9.2%)	4 (10.5%)	

Table 4 Stroke indices and post-stroke depression

Characteristic	Non-depressed stroke patients, N = 65 (63.1%)	Depressed stroke patients, N = 38 (36.9%)	P value
Duration since onset in months, number (%)			0.588
≤ 3 months	22 (33.8%)	18 (47.4%)	
> 3–6 months	12 (18.5%)	5 (13.2%)	
> 6–12 months	9 (13.8%)	4 (10.5%)	
> 12 months to ≤ 2 years	22 (33.8%)	11 (28.9%)	
Type of stroke			0.898
Ischemic stroke	52 (80%)	30 (78.9%)	
Hemorrhagic stroke	13 (20%)	8 (21.1%)	
Lateralization of lesion			0.418
Right hemisphere	34 (52.3%)	23 (60.5%)	
Left hemisphere	31 (47.7%)	15 (39.5%)	
Brain lobe involvement			0.216
Frontal lobe lesion	18 (27.7%)	15 (39.5%)	
Non-frontal lesion	47 (72.3%)	23 (60.5%)	
Functional impairment according to Barthel Index score (BI):			0.0001
Totally dependent B.I (0–20)	2 (3.1%)	7 (18.4%)	
Severely dependent B.I (25–50)	8 (12.3%)	20 (52.6%)	
Moderately dependent B.I (55–75)	24 (36.9%)	7 (18.4%)	
Slightly dependent B.I (80–95)	30 (46.2%)	4 (10.5%)	
Nondependent B.I (100)	1 (1.5%)	0 (0%)	

frequency of depression early after stroke [38, 47]. However, since this recovered gradually with improvement of physical symptoms and restoration of a normal quality of life, it seems likely that it is quality of life rather than the time after stroke that determines the severity of PSD [48]. In confirmation of our findings, the type of stroke (ischemic vs. hemorrhagic) was not found to be a predictor in many studies [31, 37].

The relationship between PSD and lesion location is a matter of some debate. In the present study, there was no significant relationship between PSD and lesion location consisting with Nickel and Thomalla meta-analysis, 2017 [49], and Wei and colleagues, [50] as they concluded that there is no clear pattern as to the association of stroke lesion location and PSD. However, few reports found a significant correlation with left frontal and left

basal ganglionic lesions and/or the proximity of the ischemic lesion to the frontal pole [51]. Others find this correlation with the right hemisphere especially the frontal lobe [40, 52]. The absence of a relationship between lesion location and PSD could be largely due to exclusion criteria used in the present study as we excluded patients with severe aphasia (left hemispheric affection), and patients with cognitive impairment that makes difficult communication with the patient and affects the assessment of depression which is one of our limitation of the study.

Limitation of the study

Main limitations of this study are the relatively small sample size and the highly selective patient criteria, which may be required for accurate determination of

Table 5 Quality of life and state of functioning among stroke patients groups (with versus without depression)

Score of quality of life (QOL) domain	Stroke patients without depression	Stroke patients with depression	P value
Physical domain mean ± SD	53.5 ± 15.3	27 ± 9.7	< 0.001
Psychological domain mean ± SD	62.2 ± 8.4	41.84 ± 15.6	< 0.001
Social domain mean ± SD	55.2 ± 15.3	50.3 ± 13.5	0.465
Environmental domain mean ± SD	46.4 ± 15.2	33.95 ± 14	0.045
Overall QOL score mean ± SD	57.1 ± 10	38.68 ± 8.1	< 0.001

depression, but it limits the interpretation of the frequency of PSD; lack of MRI study in some cases to measure brain lesion; and follow-up of these patients on antidepressant medication.

Conclusion

PSD is a frequent complication of stroke and can affect the quality of life. Low educational level and socioeconomic status, as well as smoking and functional status of stroke, were predictors for the development of PSD. PSD has a worse impact on the quality of life. A comprehensive evaluation and management of PSD improves the outcome of stroke. Further studies that involve the best treatment approaches for such patients are urgently required.

Abbreviations

PSD: Post-stroke depression; WHO: World Health Organization; DALYs: Disability-adjusted life-years; DSM-IV-TR: Diagnostic and statistical manual of mental disorders 4th edition revised; HAM-D: Hamilton depression rating scale; BI: Barthel Index; QoL: Quality of life; MMSE: Mini-Mental State Examination; WHOQOL-BREF questionnaire: The World Health Organization Quality of Life; MDD: Major depressive disorders

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Authors' contributions

EMK, TD, AF, and AG contributed to the study concept and design, acquisition of the data, drafting and revision of the report, statistical analyses, and interpretation of the data. AFZ, TD, and AG contributed to case recruitments, acquisition of the data, and statistical analyses. EMK, AFZ, and AG contributed to the editing of this report. All authors read and approved the final manuscript.

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Availability of data and materials

The data supporting the results reported in the article is already saved and available on request at any time.

Ethics approval and consent to participate

An informed consent was obtained from all the patients before participating in the study. The protocol was approved in January 2014 by the South Valley Medical School Ethical Review Board and all participants or relatives gave written informed consent before participation in the study. The confidentiality of the patients' information was maintained during all the steps of the study.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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