Predictors of depressive symptoms in patients with stroke – a three-month follow-up

Predyktory objawów depresyjnych u pacjentów po udarze mózgu – obserwacja trzymiesięczna

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Abstract

Background and purpose: Depression is one of the most common post-stroke complications, which could impair rehabilitation outcome and quality of life, and could also increase mortality after stroke. The aim of the present study was to assess the association between demographic, socioeconomic and clinical (stroke risk factors, type of stroke, location of vascular lesion, cognitive functions) factors on the presence and severity of post-stroke depressive symptoms in patients after first ever stroke as well as on their social functioning.

Material and methods: A prospective, cohort study with a three-month observation period was performed in seven centres. Severity of depressive symptoms was assessed with the help of a short, 15-item version of the Geriatric Depression Scale (GDS), 3 months after stroke onset.

Results: On the basis of GDS (GDS ≤ 5 points or > 5 points) patients were allocated to a group without ($n = 160$) or with symptoms suggestive of depression ($n = 82$). The study groups did not differ with respect to age, sex or place of residence. Univariate logistic regression analysis showed

Streszczenie

Wstęp i cel pracy: Depresja jest jednym z najczęstszych powikłań udaru mózgu, które znacząco wpływa zarówno na postęp rehabilitacji po udarze, jakość życia pacjentów, jak i umieralność. Celem badania była ocena wpływu czynników demograficznych oraz klinicznych związanych z udarem (czynniki ryzyka udaru mózgu, typ udaru, lokalizacja ogniska naczyniopochodnego, nasilenie deficytu neurologicznego, funkcje poznawcze) na występowanie i nasilenie objawów depresyjnych u pacjentów po pierwszym w życiu udarze mózgu. Oceniano również funkcjonowanie społeczne pacjentów po udarze mózgu w zależności od nasilenia objawów depresyjnych.

Materiał i metody: Prospektywne, kohortowe badanie z 3-miesięcznym okresem obserwacji prowadzono w 7 ośrodkach. Nasilenie objawów depresyjnych po 3 miesiącach od udaru oceniano w 15-punktowej wersji Geriatrycznej Skali Depresji (*Geriatric Depression Scale* – GDS).

Wyniki: Na podstawie wyników uzyskanych w skali GDS (GDS ≤ 5 lub > 5 punktów) wyodrębniono grupę pacjentów bez depresji ($n = 160$) i z objawami sugerującymi de-

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that independent predictors for the presence of symptoms suggestive of depression at 3 months after stroke were: low level of education, low income, greater severity of stroke, worse functional status, self-reported problems with daily-living activities and need of help in daily living activities. More than 60% of patients with depressive symptoms limited their social contacts. Patients with depressive symptoms were unsatisfied with their relations with life partners and friends.

Conclusions: Our study showed a complex aetiology of post-stroke depressive symptoms with an important role of socioeconomic factors. Depressive symptoms after stroke worsen existing health, social and economic problems, and cause social isolation of patients.

Key words: stroke, depressive symptoms, Geriatric Depression Scale, social functioning.

presję (*n* = 82). Chorzy z obu grup nie różnili się pod względem wieku, płci i miejsca zamieszkania. Znaczącymi predyktorami występowania nasilonych objawów depresyjnych u pacjentów po udarze mózgu były: niższy poziom wykształcenia, niższe dochody, gorszy stan neurologiczny i funkcjonalny oraz trudności w życiu codziennym i potrzeba pomocy. Ponad 60% pacjentów z objawami depresyjnymi ograniczyło po udarze kontakty społeczne. Chorzy z objawami sugerującymi depresję oceniali gorzej swoje kontakty z rodziną i przyjaciółmi.

Wnioski: Badanie pokazuje złożoność przyczyn występowania objawów depresyjnych po udarze mózgu, wśród których istotną rolę odgrywają również czynniki społeczno-ekonomiczne. Występowanie objawów depresyjnych po udarze mózgu powoduje dodatkowo narastanie istniejących problemów oraz izolację społeczną chorych.

Słowa kluczowe: udar mózgu, objawy depresyjne, Geriatryczna Skala Depresji, funkcjonowanie społeczne.

Introduction

Depressive symptoms are a common consequence of stroke. The prevalence of depression or depressive mood after stroke (post-stroke depression – PSD) has been reported to range from 25% to 79% [1-3], with a pooled estimate of 33% [4]. Although depression is recognized as an important complication of stroke, which worsens outcome and quality of life [5], there is uncertainty regarding its aetiology, risk factors and management [6].

Previous studies analyzing different potential risk factors for PSD and post-stroke depressive symptoms showed that depression after stroke occurs more frequently in women [1,4,7-9], men [10], and older patients [11,12]. Others have pointed to the role of lesion location in the left hemisphere, but most later studies have not been able to replicate these findings [3,13-15]. Other identified factors include personal history of depression [16], disability [17] and cognitive impairment [18-21], living alone [19,22], living in an institution [11,23,24], social isolation [24], lack of social support [25] and social distress [19]. In general, it is thought that socialization is protective of mood disorders, and low social support is associated with depression, although the role of social parameters has not been adequately proved.

Identification of risk factors of depressive symptoms after stroke may improve detection of post-stroke depression and provide appropriate interventions resulting in improved outcomes.

Given the above, the aim of the present study was two-fold. First, we decided to assess possible predictors of depressive symptomatology after stroke. Second, in order to replicate and extend the previous reports [4,6], we aimed to analyze the possible relationship between depressive symptoms and clinical (stroke risk factors, type of stroke, location of vascular lesion, cognitive functions), psychological (previous depressive episodes) and general demographic factors. We also assessed patients' social functioning after stroke.

Material and methods

This prospective, cohort study included consecutive patients with their first ever stroke admitted to one of seven neurological departments participating in the project.

The diagnosis of stroke was established on the basis of clinical symptoms according to WHO criteria, and computed tomography (CT). The protocol for the study was reviewed and approved by the Ethics Committee on Human Studies at the Institute of Psychiatry and Neurology, Warsaw (10/2007). Exclusion criteria were: pre-stroke dementia, psychosis, confusion, and severe aphasia making the patient unable to cooperate. Each participant read and signed an informed consent form.

The assessment was completed three months after stroke onset by trained physicians. A structured questionnaire included questions on age, gender, weight, height, marital status, educational level, employment,

living conditions as well as detailed questions on social functioning, frequency of social contacts, etc. (see Tables 1-3). Medical records were reviewed to establish the number of concomitant medical conditions (e.g. hypertension, atrial fibrillation, diabetes) and medications taken. All the patients were asked to self-assess their health status. Stroke characteristics were recorded using Oxfordshire Stroke Classification [26], side of lesion from the CT report, and side of weakness. The National Institutes of Health Stroke Scale (NIHSS) was used to assess the severity of neurological deficit [27], the Rankin Scale (mRS) for measuring overall outcome [28], and the Barthel Index (BI) to measure functional status [29]. Cognitive functioning was evaluated using the Mini-

Mental State Examination (MMSE) [30]. Aphasia was assessed with the help of Boston Diagnostic Aphasia Examination (BDAE) [31].

Depressive symptomatology was assessed by using a 15-item version of the Geriatric Depression Scale (GDS) [32,33]. We used 5 points on the GDS as a criterion for severity of depressive symptoms (GDS > 5 points), and on that basis (GDS ≤ 5 points or GDS > 5 points) patients were allocated to the group with or without depressive symptoms [32].

A cross-sectional analysis was conducted to identify factors associated with depressive symptoms at 3 months after stroke onset. Descriptive statistics were used to summarize the data. We used χ^2 test for analysis of

Table 1. Comparison of basic sociodemographic and clinical factors in groups of patients with stroke and Geriatric Depression Scale (GDS) score > 5 or ≤ 5 at 3 months after stroke onset

Variable	GDS at 3 months after stroke		P-value
	GDS > 5	GDS ≤ 5	
Mean age, years (mean)	66.1 ± 12.0	65.2 ± 13.7	0.92
Sex, women/men ratio (% of women)	40/42 (48.8%)	67/93 (41.9%)	0.37
Vascular risk factors, n (mean ± SD)	2.4 ± 1.2	2.1 ± 1.2	0.11
hypertension, %	86%	81%	0.36
diabetes, %	32%	23.6%	0.21
atrial fibrillation, %	18%	11.5%	0.30
ischaemic heart disease, %	39.7%	35.8%	0.54
hyperlipidaemia, %	58.1%	54.8%	0.75
Active smoking before stroke onset (>10 cigarettes/day)	41%	32.1%	0.19
Alcohol drinking (% of patients drinking no more than 1 time per month no more than 2 units)	57.7%	50%	0.38
Previous depressive episodes, %	9.8%	7.4%	0.70
NIHSS score (at stroke onset)	5.7 ± 4.5	4.5 ± 3.2	0.11
NIHSS score (3 months after stroke onset)	2.5 ± 2.4	1.7 ± 1.9	0.007
Barthel Index (3 months after stroke onset)	17.6 ± 3.5	19.2 ± 2.3	0.00000
Modified Rankin Scale (3 months after stroke onset)	1.8 ± 1.2	1.2 ± 1.0	0.0003
Aphasia severity at stroke onset (% of patients with scores < 4 in BDAE)	20%	15.3%	0.46
Aphasia severity 3 months after stroke onset (% of patients with scores < 4 in BDAE)	10.2%	8.5%	0.85
MMSE (3 months after stroke onset)	25.7 ± 3.8	27.0 ± 3.4	0.008
Location of vascular lesion, % of left-sided strokes	74%	75.6%	0.92
Aetiology, % of haemorrhagic strokes	9.6%	9.7%	0.84
Clinical stroke syndromes:			
TACI, %	12.3%	4%	0.08
PACI, %	41.5%	46%	0.61
LACI, %	30.77%	27.1%	0.72
POCI, %	27.12%	17.8%	0.79

SD – standard deviation, NIHSS – National Institutes of Health Stroke Scale, BDAE – Boston Diagnostic Aphasia Examination, MMSE – Mini-Mental State Examination, TACI – total anterior circulation infarct, PACI – partial anterior circulation infarct, LACI – lacunar infarct, POCI – posterior circulation infarct

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Table 2. Sociodemographic characteristics of study groups

Variable	GDS at 3 months after stroke		P-value
	GDS > 5	GDS ≤ 5	
Education, primary school/minimum secondary school (% of patients with primary school)	32/50 (40%)	38/122 (24%)	0.02
Life partner, yes/no	33/49	46/114	0.09
Employment (% of retired/unable to work before stroke)	88.5%	81.2%	0.40
Place of residence (% of those living at home)	95%	95.6%	0.93
Income per person (< 700 PLN/≥ 700 PLN)	30/76	36/151	0.02

GDS – Geriatric Depression Scale

Table 3. Self-assessment of frequency and satisfaction with social contacts with family and friends in groups with (GDS > 5) and without (GDS ≤ 5) significant depressive symptoms

Variable	GDS at 3 months after stroke		P-value
	GDS > 5	GDS ≤ 5	
Assessment of relations with family members (% of positive assessments)	84.3%	90.8%	0.03
Satisfaction with frequency of contacts with family members (% of positive assessments)	75.0%	91.6%	0.0004
Frequency of contacts with friends (% of occasional or rare)	51.0%	30.4%	0.002
Satisfaction with frequency of contacts with friends (% of positive assessments)	49.4%	79.1%	0.0000
Percentage of patients who reduced their social contacts after stroke	66.2%	31.4%	0.0000

GDS – Geriatric Depression Scale

nominal variables and t-test or Mann-Whitney U-test for continuous variables. Univariate logistic regression modelling was used to identify predictors of depressive symptoms 3 months after stroke. Variables that were statistically different at $P < 0.05$ were considered for inclusion in a regression model. All statistical analyses were performed with the aid of the Statistica 5.0 software package (StatSoft, Tulsa, OK, USA).

Results

Two hundred and seventy-eight patients were included in the study. During 3-month follow-up 3 patients died, 17 still have severe aphasia making them unable to cooperate, 10 patients refused to participate in the follow-up, and another 6 were excluded after the initial screening because of lack of GDS data. Thus, during the time of the study data regarding depressive symptoms were available for 242 patients. On the basis of GDS scores (see Methods section) they were allocated to the group without symptoms suggestive of depression (GDS ≤ 5; $n = 160$) or with depressive symptoms (GDS > 5; $n = 82$).

Sociodemographic and clinical characteristics of these groups are shown in Table 1. The two groups did not differ with respect to age, sex, number of vascular risk factors, or location and type of stroke lesion (ischaemic, haemorrhagic). Study groups differ significantly in terms of severity of neurological deficit and functional status at 3 months after stroke. Patients with more severe depressive symptoms also complained of more severe stroke, and correspondingly, they showed worse functional status 3 months after stroke as assessed by the Barthel Index. They also self-assessed their health status as worse than non-depressed patients.

Regarding socioeconomic parameters, the two groups differed significantly in level of education – patients with less severe depressive symptoms more frequently were better educated ($p = 0.02$), and had higher income per person per month (Table 2).

Patients with more pronounced symptoms suggestive of depression more frequently were disabled (% of patients declaring need for help: 61.1% vs. 37.1% in the group with more and less severe depressive symptoms, respectively; $\chi^2 = 37.1, p < 0.001$) and needed help in daily living activities (82.7% vs. 43.7% of patients with symptoms suggestive of depression and patients without such symptoms, respectively; $\chi^2 = 18.3, p < 0.001$). Severity of depressive symptoms influenced self-assessment of patients' contacts with family members and friends. Patients with GDS > 5 assessed their contacts with family and friends as not satisfactory,

and most of them limited their social contacts after stroke (Table 3).

GDS scores at 3 months after stroke were not significantly correlated with age, gender, employment, location of the lesion, NIHSS scores in the acute phase of stroke and 3 months after stroke, or severity of aphasia. Significant correlations were found between GDS scores and level of education ($R = -0.17$, $p = 0.006$), income ($R = -0.14$, $p = 0.03$), functional status as assessed with Barthel Index ($R = -0.25$, $p = 0.00005$ and $R = -0.38$, $p = 0.00000$ for acute phase and 3 months after stroke, respectively), and Rankin Scale ($R = -0.20$, $p = 0.001$ and $R = -0.26$, $p = 0.00008$ for acute phase and 3 months after stroke, respectively). Moreover, a negative correlation was found between GDS scores and MMSE scores ($R = -0.20$, $p = 0.002$). Depressive symptoms were also significantly correlated with patients' assessments of their health status ($R = -0.26$, $p = 0.00005$) and contacts with family and friends (relation with family members: $R = -0.21$, $p = 0.005$; satisfaction from contacts with family: $R = -0.30$, $p = 0.000003$; satisfaction from contacts with friends: $R = -0.34$, $p = 0.0006$). We also found a significant correlation between reduction of social activity and severity of depressive symptoms ($R = 0.37$; $p = 0.00000$).

The regression analysis is summarized in Table 4. Because clinical variables such as NIHSS, Barthel Index and Rankin Scale in the acute phase and after 3 months were intercorrelated, we decided to include in the analysis only NIHSS in the acute phase as baseline neurological status and Barthel Index at 3 months as a measure of functional status. Univariate logistic regression analysis showed that significant independent predictors of a greater likelihood of depressive symptoms at 3 months after stroke were: low level of education, lower income, higher severity of stroke at baseline, worse functional status 3 months after stroke and need of help in daily living activities.

Discussion

The prevalence of symptoms suggestive of depression at 3 months after stroke in our study (33.8%) is similar to the pooled estimate derived from previous reports included in the meta-analysis of Hackett et al. [4]. In other studies analyzing prevalence of depressed mood at 3 months after stroke its frequency ranged from 14% in a Swedish study [9] to 47% in the Finnstroke Study [23]. Such differences probably derived from different criteria for post-stroke depression used in the mentioned studies: single simple question in the study by Eriksson [9] and Beck Depression Inventory score equal to or above 10 in the Finnstroke Study [23]. We decided to use the Polish version of the 15-item Geriatric Depression Scale, whose high reliability and concurrent validity against other measures of depression have been reported for various populations [33-36]. The Polish version of the GDS has been validated recently in a group of non-psychiatric patients [33]. We dichotomized patients from the cohort into two groups: without symptoms suggestive of depression (GDS ≤ 5) and with such symptoms (GDS > 5) [32]. Similarly, in the Örebro Stroke Study the same cut-off score in the GDS was used and 37% of patients exceeded the cut-off for symptoms suggestive of depression. When DSM-IV criteria were used, 27% of patients in this study had a minor or major depression [24]. In the New Zealand study by Hosking et al. [20] (30-item GDS), depressed mood at 3 months after stroke was noted in 39% of patients.

In our study age was not predictive for symptoms suggestive of depression (GDS > 5) at 3 months post-stroke. Most studies (4 from 17) included in the review by Hackett and Anderson [15] also failed to identify age as a significant risk factor for PSD. Both the Finnstroke Study [23] and the OCSP study [18] found that older age could predict PSD. On the other hand, younger age increased risk for PSD in the studies

Table 4. Results of univariate logistic regression analysis for sociodemographic and clinical variables

Variable	Odds ratio	95% confidence interval	P-value
Education (primary school/min. secondary school)	2.1	1.2-3.8	0.01
Income per person (< 700 PLN/≥ 700 PLN)	2.1	1.2-3.8	0.03
NIHSS score at stroke onset	4.1	1.2-14.2	0.19
Barthel Index (3 months after stroke onset)	4.6	1.9-10.8	0.00006
Problems in daily living activities after stroke	19.6	7.52-51.1	0.00000
Need of help in daily living activities	3.4	1.95-6.0	0.00003

NIHSS – National Institutes of Health Stroke Scale

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by Eriksson *et al*. [9] and Verdelho *et al*. [21]. It has been suggested that younger age may be associated with PSD among men rather than women [37].

Female gender has been shown to be associated with increased risk of PSD [1,7,9,12,15,17,23,38]. Also in the general population, women are more likely than men to experience depressive mood [39]. In our cohort, both groups with and without symptoms suggestive of depression had a similar proportion of women, so we did not include this parameter in the regression analysis. Similarly, many other studies on post-stroke survivors also did not find any association between PSD and gender [11,20,22,40]. From predictors identified in previous studies, reported previous depressive episodes and location of stroke lesion were not significant predictors for symptoms suggestive of depression in the present study [3].

In the present cohort study, severity of stroke and functional status at 3 months post-stroke were predictive for presence of symptoms suggestive of depression. Similarly to our observation, severity of stroke was associated with PSD, either when assessed in the acute phase or 3 months after stroke [3]. Our results provide further support for the well-known relationship between dependence in the Barthel Index and depressed mood after stroke [11,12,17,23]. An important predictor for depressive symptoms in our study was also self-assessed functional status and need of help in daily living activities. It can be hypothesized that disruption in normal activities also results in poorer mental health outcomes [41].

Patients with post-stroke depressive symptoms were more cognitively impaired. Our finding is in agreement with the results of many previous studies, where a correlation between PSD and cognitive impairment was found [2,3,11,17,20]. Contrary to previous studies [22,42,43], we did not observe differences between the number of aphasic patients in both groups, and we did not analyze the predictive value of aphasia for PSD. However, the number of aphasic patients in this study was relatively low, because of exclusion of patients with severe aphasia unable to communicate, who were unable to answer questions included in the GDS.

In the present study, we found that predictive for symptoms suggestive of depression at 3 months after stroke were some socioeconomic parameters, such as lower level of education. Lower education predicted post-stroke depressive symptoms, contrary to a previous report by Paolucci *et al*. [44], where PSD occurred more frequently in patients with higher education level. In our study, education level was correlated with MMSE at 3 months post-stroke, but it did not correlate with income, so both parameters – education level and income – were included in the univariate analysis. Education can affect health outcome in different ways: by making an individual more able to process information and thus more health conscious, and also through economic factors and psychosocial factors, such as family relations. The predictive value of lower income for depressive symptoms, observed in our study, may have resulted from fear of the future, self-perceived loss of autonomy, and also difficulties with access to long-term rehabilitation. In the previous studies low socioeconomic level has been shown to have [37, 45] or not to have [46] predictive value for PSD.

In our study we observed that depressive symptoms significantly influenced patients' self-perceived frequency and quality of relations with family members and friends. High level of social functioning was related to lower risk for PSD in a previous study by Shimoda and Robinson [47]. Conversely, Gottlieb *et al*. [2] observed that high rather than low level of social support was associated with PSD. It is difficult to properly define social support and its role in PSD. Some depressed patients may feel more helpless, need more help and support from their family members, and assess these contacts as inadequate. On the other hand, depressive symptoms may increase the risk of social isolation and adverse health behaviours, and reduce patients' motivation and capacity to participate in rehabilitation [41,48]. In our study more than 66% of depressed patients reduced their social contacts, compared to 34% in the non-depressed group.

Our study has some limitations: we assessed depressive symptoms with GDS, which is a self-report scale, so we need to exclude patients with communication problems. We also did not assess severity of depressive symptoms during the acute phase of stroke. It should be borne in mind, however, that depressive mood detected within the first several days after stroke onset as well as at different time points after stroke may result from pre-stroke depression and/or from somatic, psychological, and social aspects of stroke, which are difficult to differentiate without pre-stroke assessment.

Conclusions

1. The results of the present study are consistent with a large body of evidence indicating that post-stoke depressive symptoms and PSD are related to severity of stroke and post-stroke physical impairment [3].

2. We also found that low level of education and low income are predictive for symptoms suggestive of depression.

3. Further studies regarding social functioning of stroke survivors are needed, especially in the light of the positive impact of social support on stroke outcomes.

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Disclosure

Authors report no conflict of interest.

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