Dementia and depression after stroke

Otępienie i depresja po udarze mózgu

Mariola Wodzińska [1(A,E,F)], Agnieszka Doryńska [2(C,D,F)], Beata Stach 3(B,E), Aleksandra Bober [1(B,E)], Wojciech Kurzydło [4(B,F)], Joanna Szkarłat [1(B,E)], Agnieszka Koczera [1(B)], Agnieszka Szotek [1(B)], Andrzej Pająk [2(A,C,D)]

[1] Neurological Rehabilitation Department, Krzeszowice Rehabilitation Center, Poland
[2] Department of Epidemiology and Population Studies, Institute of Public Health, Jagiellonian University Medical College, Poland
[3] Department of Physiotherapy, Jagiellonian University Medical College, Poland
[4] Clinic of Rehabilitation, Faculty of Health Sciences, Jagiellonian University Medical College, Poland

Key words
post-stroke dementia, post-stroke depression, stroke, rehabilitation

Abstract
Introduction: In addition to physical impairment, post-stroke patients also display emotional and cognitive disorders, e.g., depression and dementia, which may result from a stroke or occur independently of it. Because these disorders affect treatment outcome, the risk of a subsequent stroke, and mortality, they should be taken into account during rehabilitation.
Aim: The aim of this study was to assess the prevalence of depression and dementia among post-stroke patients and to assess the correlation between these disorders and sociodemographic and clinical characteristics.
Material and methods: Retrospective analysis of medical documentation of 124 post-stroke patients hospitalised in a neurological rehabilitation ward from 1 January 2012 to 31 July 2013 was conducted. Depression and dementia were diagnosed by psychologists using the Mini-Mental State Examination, Short Test of Mental State, Hamilton Rating Scale for Depression, and Beck Depression Inventory.
Results: a total of 46% of post-stroke patients rehabilitated in the Krzeszowice Rehabilitation Centre were diagnosed with dementia, and 39% were diagnosed with depression. Persons aged over 65 years had a higher chance of dementia compared to younger persons (OR=5.91, 95%CI: 2.52–13.89). Aphasia correlated with a five times higher chance of dementia (OR=5.74, 95%CI: 1.93–17.11). Sex, education, and other analysed clinical and sociodemographic characteristics did not correlate with dementia. No correlation was found between depression and dementia, age, sex, education, number of inhabitants, the type, location and number of strokes, time since stroke, hypertension, diabetes, or aphasia.
Conclusions: Dementia and depression were diagnosed in a group of post-stroke patients. Dementia was more prevalent among persons aged over 65 years and persons with aphasia. Because depression and dementia increase the risk of a subsequent stroke and mortality in post-stroke patients, both disorders should be diagnosed and treated early to prevent their effects.

Słowa kluczowe
otępienie poudarowe, depresja poudarowa, udar, rehabilitacja

Streszczenie
Wstęp: U pacjentów po udarze mózgu usprawnianych w Oddziałach Rehabilitacji oprócz niepełnosprawności fizycznej występują zaburzenia emocjonalne i poznawcze. Mogą one być wynikiem udaru, ale mogą również występować bez związku z udarem. Bez względu na etiologię i mechanizm powstawania wymagają uwzględnienia w pracy z pacjentem, gdyż wpływają na proces usprawniania, ryzyko kolejnego udaru oraz na umieralność. Cel: Ocena częstości występowania depresji i otępienia w grupie pacjentów po udarze mózgu, a także związku ich występowania z cechami socjo-demograficznymi i klinicznymi.
Materiał i metody: Dokonano przeglądu dokumentacji pacjentów. Przeanalizowano dokumentację 124 pacjentów w wieku od 37 do 91 lat wypisanych z Oddziału Rehabilitacji Neurologicznej w okresie od 01.01.2012 do 31.07.2013. Obecność otępienia i depresji stwierdzano na podstawie klinicznej diagnozy postawionej przez psychologów posiłkujących się testami: Mini-Mental State Examination (MMSE) i Krótkim Testem Stanu Psychicznego (KTSP) oraz skalą Hamiltona i skalą Becka.

The individual division on this paper was as follows: a – research work project; B – data collection; C – statistical analysis; D – data interpretation; E – manuscript compilation; F – publication search

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Wyniki: Otępienie stwierdzano u 46% pacjentów po udarze mózgu usprawnianych w Oddziale Rehabilitacji Neurologicznej Ośrodka Rehabilitacji Narządu Ruchu „Krzeszowice", a depresję u blisko 39%. U osób w wieku powyżej 65 lat stwierdzono większą szansę wystąpienia otępienia w porównaniu do osób młodszych (OR=5,91; 95%CI: 2,52-13,89). Występowanie afazji było związane z pięciokrotnie większą szansą wystąpienia otępienia (OR=5,74; 95%CI: 1,93-17,11). Płeć, wykształcenie oraz pozostałe czynniki kliniczne i socjo-demograficzne nie były związane z występowaniem otępienia. Nie stwierdzono związku pomiędzy występowaniem depresji a otępieniem, wiekiem, płcią, wykształceniem, liczbą współmieszkańców, typem udaru, lokalizacją udaru, liczbą udarów, czasem od udaru, nadciśnieniem tętniczym, cukrzycą oraz afazją.
Wnioski: Depresja i otępienie towarzyszą niepełnosprawności po udarze mózgu. Otępienie częściej występuje u osób powyżej 65 roku życia oraz u pacjentów z afazją. Ponieważ depresja i otępienie zwiększają ryzyko kolejnego udaru mózgu oraz u osób na nie cierpiących stwierdza się wyższą śmiertelność w porównaniu do pacjentów bez tych schorzeń, powinno się je wcześnie wykrywać i leczyć aby zapobiegać ich skutkom.

INTRODUCTION

Depression and dementia are the most common mental disorders among persons aged over 65 years.[1] Depression is the most frequent psychiatric complication following a stroke, occurring in approximately one-third of stroke patients[2]. Depression hampers treatment and rehabilitation of neurological disorders, and limits independent functioning in stroke patients. Mortality following a stroke is greater among patients with depression than among patient without depression[3]. Furthermore, depression occurring before the age of 65 years quadruples the risk of a stroke[4].

Researchers differ in opinion with respect to the etiology and development mechanism of depression. Some underline the crucial role of the biological mechanism, while others point to the role of psychosocial factors. Robinson et al.[5] showed in 1975 that depression results from disruptions to sympathetic transmission in the right hemisphere of the brain. On the other hand, a study in 1984 emphasised the role of damage to the left frontal region[6]. a study by Carson et al.[7] from 2000 did not confirm any correlation between the location of the stroke and the occurrence of depression.

In 2005, Hackett and Anderson[2] conducted a meta-analysis of 20 studies with 18,000 persons with depression and found that the risk of post-stroke depression (PSD) correlated with lack of physical fitness, stroke intensity, cognitive disorders, and social factors (loneliness and lack of social support). On the other hand, meta-analysis found no correlation between PSD and the age at which the stroke occurred, sex, education, co-occurrence of diabetes, medical history of the stroke, or type of stroke. Hackett and Anderson pointed out that the studies included in the meta-analysis had numerous flaws in terms of exclusion criteria (patients with a history of depression and patients who had difficulties with communication due to aphasia or dementia were excluded), time at which depression symptoms were assessed (the earliest assessment took place three weeks after the stroke, and the latest assessment took place 12 months after it), and the choice of variables included into multi-factor analyses (e.g., variables that did not show any correlation with depression in single-factor analyses but did so in other studies)[8].

A multicentre study in Italy showed that risk factors for PSD comprised a history of depression, a history of stroke, severe disability, and being a woman[9]. Neither the type and location of the stroke nor cognitive disorders correlated with the occurrence of PSD. a study in Finland observed a minor effect of cognitive disorders on the occurrence of PSD. Consequently, it seems that assessing and recognising PSD factors requires further research[10].

Identifying PSD factors could help prevent it or provide early treatment. The fact that depression constitutes a risk factor for the re-occurrence of a stroke and that it negatively affects the length and quality of life in stroke patients supports the hypothesis that earlier diagnosis and treatment of depression can prove benefitial[11].

Another mental disorder frequently occurring in post-stroke patients is dementia. According to ICD-10, *dementia* is a group of symptoms caused by chronic and progressive brain disorders. These symptoms comprise: memory, thinking, orientation, understanding, counting and language use disorders, and decreased learning and evaluation abilities[12]. *Post-stroke dementia* refers to any type of dementia appearing after a stroke, regardless of its cause. Post-stroke dementia occurs in approximately 30% of stroke patients[13]. It is estimated that half of the post-stroke dementia cases is vascular dementia, and over 40% is Alzheimer's disease[14,15]. Research has shown that dementia correlates with a three times greater risk of another stroke and two times greater risk of death[14,16]. Furthermore, dementia increases the patient's dependency on others in everyday activity[17].

Research shows that the number of post-stroke dementia cases is rising, and is predicted to rise due to population ageing and decreased mortality rate of patients. Consequently, the demand for care and rehabilitation of post-stroke patients will increase[17]. Risk factors for post-stroke dementia comprise old age, low education, a history of cognitive disorders, severe stroke, diabetes, left-hemisphere stroke, and hypercholesterolaemia. Women are at greater risk of post-stroke dementia than men[14,18–20].

Klimkowicz-Mrowiec et al.[21] showed that post-stroke dementia occurred in 22.6% of patients at the Stroke Unit in the Department of Neurology of the University Hospital in Krakow, and correlated independently with age, diabetes, and neurological disorders present at the time of admission to hospital. This study aims to help determine the prevalence of post-stroke dementia and its risk factors among Polish patients.

AIM OF THE STUDY

The aim of this study was to assess the prevalence of depression and dementia, and to determine the correlation between these two disorders and sociodemographic and clinical characteristics of stroke patients who underwent rehabilitation in the Neurological Rehabilitation Department of the Krzeszowice Rehabilitation Center.

The following research questions were posed:

1. Does the occurrence of dementia correlate with sociodemographic characteristics?
2. Does the occurrence of depression correlate with sociodemographic characteristics?
3. Does the occurrence of dementia correlate with clinical characteristics?
4. Does the occurrence of depression correlate with clinical characteristics?

MATERIAL AND METHODS

All stroke patients hospitalised in the Neurological Rehabilitation Department between 1 January 2012 and 31 July 2013 qualified for the study. Medical documentation of 124 patients aged between 37 years and 91 years was analysed. Data concerning the type and location of the stroke were complete for all patients. The presence of dementia and depression was determined based on clinical diagnosis performed by psychologists who used the following tests and scales: the Mini-Mental State Examination (MMSE), the Short Test of Mental Status (STMS), the Hamilton Rating Scale for Depression (HRSD), and the Beck Depression Inventory (BDI).

The correlation between dementia and depression and the assessed variables was determined using the $\chi 2$ test and single-factor and multifactor logistic regression analysis. a statistical significance level of $\alpha = .05$ was used. The results were presented as percentages and quotients of chances with 95% confidence intervals. Data analysis was conducted using the Stata 12.1 software package.

RESULTS

Data concerning dementia were available for 124 persons (94 men and 30 women). Data concerning depression were available for only 72 persons (52 men and 20 women), as the patients were tested for depression later than for dementia. Mean age of patients tested for dementia was 66.2 years (SD=10.02) for all 124 persons, 65.7 years (SD=10.11) for men and 67.1 years (SD=9.58) for women. Mean age among the group of patients tested for depression was 64.8 years (SD=9.38) for all 72 persons, 64.5 years (SD=10.63) for men and 65.1 years (SD=8.23) for women. Table 1 shows an overview of the group. Dementia was found in 57 of the 124 study participants (46.0%). a majority of study participants had primary education (66.9%). a total of 108 persons (87.1%) had an ischaemic stroke and 16 persons (12.9%) had a haemorrhagic stroke. Data concerning the location of the stroke were available for 119 (96.0%) persons, most of which (51.3%) had a stroke in the right hemisphere. Twenty persons (16.1%) have had more than one stroke. Eighty-five persons (69.1%) were admitted to the rehabilitation centre within 30 days of being discharged from stroke treatment wards. Eighty-nine persons (71.8%) had hypertension, 30 persons (24.2%) had diabetes, and 26 persons (21.0%) had aphasia.

In the group of 72 persons tested for depression, dementia was found in 29 (40.3%) and depression was found in 28 (38.9%). a majority of the group (68.1%) had primary education. Only one person (1.4%) lived alone. Sixty-two persons (86.1%) had an ischaemic stroke, and 10 persons (13.9%) had a haemorrhagic stroke. Data on stroke location were available for 69 persons, most of which (52.2%) had a stroke in the right hemisphere. Nine persons have had more than one stroke. Eighty-five persons (69.1%) were admitted to the rehabilitation centre within 30 days after being discharged from the stroke treatment ward. Hypertension was found in 54 persons (75.0%), diabetes was found in 21 persons (29.2%), and aphasia was found in 16 (22.2%) persons.

Table 2 shows the occurrence of dementia and depression according to age, sex, education, number of persons living with the patient, the type, side and number of strokes, time since last stroke, and the presence of hypertension, diabetes, and aphasia.

Dementia occurred more frequently among the older group than among the younger group (66.7% and 26.6%, respectively; $p<.001$). Persons with aphasia showed dementia more

Table 1

Characteristics of study participants

	Persons tested for dementia n=124	Persons tested for depression n=72
Characteristic	**n (%)**	**n (%)**
Age over 65 years	60 (48.4)	34 (47.2)
Female sex	30 (24.2)	20 (27.8)
Dementia	57 (46.0)	29 (40.3)
Depression*	28 (22.6)	28 (38.9)
Secondary or higher education	41 (33.1)	23 (31.9)
Living alone	7 (5.7)	1 (1.4)
Haemorrhagic stroke	16 (12.9)	10 (13.9)
Left-sided stroke	58 (48.7)	33 (47.8)
Past stroke	20 (16.1)	9 (12.5)
Over 30 days since stroke	38 (30.9)	24 (33.3)
Hypertension	89 (71.8)	54 (75.0)
Diabetes	30 (24.2)	21 (29.2)
Aphasia	26 (21.0)	16 (22.2)

* data on depression prevalence in persons with dementia were available for 72 persons

frequently than persons without aphasia (69.2% and 39.8%; p=.007). No correlation was found between dementia and sex, education, number of persons living with the patient, the type, location and number of strokes, time since last stroke, hypertension, or diabetes.

No correlation was found between depression and sex, education, number of persons living with the patient, the type, location, and number of strokes, time since last stroke, hypertension, or aphasia. Furthermore, no correlation was found between the occurrence of dementia and depression among study participants.

Single-factor logistic regression analysis showed that persons aged over 65 years had a five-times greater chance of suffering from dementia compared to persons from the younger age group (OR=5.53; 95%CI: 2.56–11.96). Persons with aphasia had an over three-times greater chance of suffering from dementia (OR=3.40; 95%CI: 1.35–8.59). Single-factor logistic regression analysis found no correlation between the occurrence of depression and the analysed characteristics.

Table 3 shows odds ratio values for the occurrence of dementia, taking into account confounders. Once sex, education, and aphasia were taken into account, persons aged over 65 years had an almost six-times greater chance of suffering from dementia than persons from the younger age group (OR=5.91; 95%CI: 2.52–3.89). Once age, sex, and education were taken into account, the presence of aphasia correlated with an almost six-times greater chance of suffering from dementia (OR=5.74; 95%CI: 1.93–17.11). Once age and aphasia were taken into account, sex and education did not show a significant correlation with the occurrence of dementia.

Multifactor logistic regression analysis among persons tested for depression did not yield different results from single-factor analysis.

DISCUSSION

Dementia was found in 46.0% of stroke patients, and depression was found in 38.9% stroke patients. Age of over 65 years and aphasia correlated with a high prevalence of dementia. Study participants showed no correlation between the occurrence of depression and sociodemographic characteristics, or between occurrence of depression and clinical characteristics.

The prevalence of depression was lower than in a study by Whyte and Mulsant[22], which found that the prevalence of depression equalled 27% up to two weeks after a stroke, 37% up to six months after it, 16% up to a year after it, and 21% up to two years after it. The prevalence of depression three months after a stroke was estimated at approximately 27.3%.[23] According to current epidemiological data, depression occurs in 30–40% of acutely and sub-acutely ill patients and in 50% of patients three

Table 2

Prevalence of dementia and depression according to sociodemographic and clinical characteristics

		Prevalence of dementia n=124		Prevalence of depression n=72	
		n (%)	p	n (%)	p
Age group	≤65	17 (26.6)	<0.001	15 (39.5)	0.914
	>65	40 (66.7)		13 (38.2)	
Sex	male	40 (42.6)	0.177	18 (34.6)	0.230
	female	17 (56.7)		10 (50.0)	
Education	primary	43 (51.8)	0.063	17 (34.7)	0.287
	secondary or higher	14 (34.2)		11 (47.8)	
Number of persons living with the participant	0	1 (14.3)	0.083	1 (100.0)	0.207
	1 or more	56 (47.9)		27 (38.0)	
Type of stroke	ischaemic	50 (46.3)	0.849	26 (41.9)	0.187
	haemorrhagic	7 (43.8)		2 (20.0)	
Side of stroke	right	32 (52.5)	0.112	12 (33.3)	0.303
	left	22 (37.9)		15 (45.5)	
Number of strokes	1	47 (45.2)	0.693	25 (39.7)	0.715
	2 or more	10 (50.0)		3 (33.3)	
Time since stroke	up to 30 days	37 (43.5)	0.506	21 (43.8)	0.231
	over 30 days	19 (50.0)		7 (29.2)	
Hypertension	present	15 (42.9)	0.663	7 (38.9)	1.000
	not present	42 (47.2)		21 (38.9)	
Diabetes	not present	41 (43.6)	0.353	22 (43.1)	0.249
	present	16 (53.3)		6 (28.6)	
Aphasia	not present	39 (39.8)	0.007	21 (37.5)	0.651
	present	18 (69.2)		7 (43.8)	

Table 3.

Correlation between the prevalence of dementia and sociodemographic and clinical characteristics

Characteristic		OR	95% CI
Age group	≤65	1.00	
	>65	5.91	2.52–13.89
Sex	male	1.00	
	female	1.81	0.68–4.81
Education	primary	1.00	
	secondary or higher	0.54	0.21–1.36
Aphasia	not present	1.00	
	present	5.74	1.93–17.11

months after a stroke[24]. The differences in data concerning the prevalence of PSD between this study and studies by other authors may, however, stem from different research methods[25].

A study in China found a correlation between the risk of PSD 14 days after a stroke and being a woman, a history of depression, and disability[23]. Furthermore, a study in Warsaw found that patients who showed PSD symptoms had low education and low income, suffered from a severe stroke, and reported problems in everyday functioning[26]. This study found no significant correlation between PSD and sociodemographic characteristics or clinical characteristics. This may be partially attributed to a small number of participants and low statistical power of the sample. Researchers point out that studies on PSD are methodologically inconsistent due to a large number of different scales used to assess the condition[11]. In this study, the presence of depression was determined based on clinical diagnosis made by experienced psychologists using HRSD and BDI. Furthermore, other studies take into account the effect of depression symptoms occurring before a stroke on the risk of the stroke itself and the development of PSD symptoms[27]. The interpretation of results obtained in this study was limited in that the study did not test whether depression occurred before the stroke or whether it was caused by it.

As with depression, this study found dementia to occur much more frequently than in other studies. For instance, a study conducted at the Stroke Unit at the Department of Neurology of the University Hospital in Krakow determined that dementia occurred in 22.6% of patients[21]. Meta-analysis of studies on PSD estimated dementia prevalence at approximately 30%[17]. Patel et al.[28] found that dementia occurred in 39% of stroke patients. Differences in the obtained results may be related to different characteristics of the study participants (age and time after which the study took place following a stroke) and to different diagnostic methodologies for dementia (cognitive, psychiatric, and neurological assessments)[17, 29].

Excluding patients with aphasia from dementia tests may result in an underestimation of dementia prevalence[17]. Patients with aphasia may not show dementia symptoms, but may perform worse in dementia tests due to their limited ability to understand and communicate information. In this study, patients with aphasia were tested for dementia, and a correlation was found between the occurrence of dementia and aphasia.

This study confirmed the correlation between age and dementia. Dementia occurred more frequently among persons aged over 65 years than in younger persons. This result is consistent with a meta-analysis by Leys et al.[17], in which age also constituted a determinant of dementia. The CASCADE study conducted among persons aged over 65 years showed that the prevalence of cognitive disorders increased with age[30]. This study found no correlation between dementia and depression.

CONCLUSIONS

Dementia and depression occur in stroke patients. Dementia is more frequent in persons aged over 65 years and in persons with aphasia. Because depression and dementia constitute risk factors for the re-occurrence of a stroke, and because persons with depression or dementia display higher mortality than persons without these disorders, both depression and dementia should be diagnosed and treated early to prevent their effects.

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Address for correspondence

Mariola Wodzińska MD
ul. Pietrusińskiego 10E, 30-321 Kraków
kom.+48 695 240 986
e-mail: mariolawodzinska@interia.pl