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## The Influence of Age Advancement and of Comorbidities on the Functional Capacity of Patients After the Incident of Ischemic Stroke

### Wpływ zaawansowania wieku i chorób współistniejących na sprawność funkcjonalną chorych po incydencie udaru niedokrwiennego mózgu

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#### Abstract

**Introduction.** The occurrence of ischemic strokes, particularly with people over 65 years of age, results from the presence of comorbidities that may adversely affect both the early and late prognosis as well as functional capacities of patients.

**Aim.** The aim of the study was to evaluate the efficiency regarding basic daily activities performed by patients after the incident of the ischemic stroke, depending on the advancement of their age and the on the presence of comorbidities.

**Material and Methods.** The study was carried out among 65 patients hospitalised due to the ischemic stroke in the neurology ward of the Provincial Hospital in Płock. The analysis of the functional capacity of patients, with the use of the Barthel Scale Questionnaire, was performed twice: on the first day of their hospitalisation and on the day of discharge from the hospital ward.

**Results.** The functional capacity of the patients within the period of hospitalization after the incident of ischemic stroke was improving as a result of treatment, rehabilitation and care. However, both on the day of admission to the ward, as well as at discharge, the patients aged over 65 had the lowest scores on the Barthel Scale Questionnaire. The presence of comorbidities, particularly among older respondents, contributed to the deterioration of patients' functional capacity.

**Conclusions.** 1). Patients after the incident of ischemic stroke, despite the improvement regarding their functional capacity, require assistance in the performance of daily activities. 2). Age advancement contributes to the reduction of the functional capacity of respondents after the incident of ischemic stroke. 3). Comorbidities of the incident of ischemic stroke as well as the prior episode of stroke significantly contribute to the decrease of the functional capacity of respondents. (JNPN 2015;4(3):102–108)

**Key Words:** stroke, functional capacity, risk factors

#### Streszczenie

**Wstęp.** Występowanie udarów niedokrwiennych mózgu, szczególnie wśród osób po 65 roku życia, wynika z obecności chorób współistniejących, które mogą wpływać negatywnie na rokowanie wczesne i odległe oraz sprawność funkcjonalną pacjentów.

**Cel.** Celem badań była ocena sprawności w podstawowych czynnościach dnia codziennego pacjentów po incydencie udaru niedokrwiennego mózgu, w zależności od zaawansowania wieku i obecności chorób współistniejących.

**Materiał i metody.** Badania zostały przeprowadzone wśród 65 chorych, hospitalizowanych z powodu udaru niedokrwiennego mózgu w oddziale neurologicznym Wojewódzkiego Szpitala Zespołowego w Płocku. Analizę sprawności funkcjonalnej pacjentów przy wykorzystaniu skali Barthel przeprowadzono dwukrotnie: w pierwszej dobie hospitalizacji oraz w dniu wypisu z oddziału.

**Wyniki.** Sprawność funkcjonalna pacjentów w okresie hospitalizacji po incydencie udaru niedokrwiennego mózgu w efekcie podjętego leczenia, usprawniania i sprawowanej opieki podlegała poprawie. Jednak zarówno w dniu przyjęcia do oddziału, jak i w dniu wypisu, badani po 65 roku życia uzyskali najniższe wyniki w skali Barthel. Obecność chorób współistniejących, szczególnie w grupie badanych w starszym wieku, wpływała na pogorszenie sprawności funkcjonalnej chorych.

**Wnioski.** 1). Pacjenci po incydencie udaru niedokrwiennego mózgu pomimo poprawy w zakresie sprawności funkcjonalnej wymagają pomocy w czynnościach dnia codziennego. 2). Zaawansowanie wieku wpływa na obniżenie sprawności czynnościowej badanych po incydencie udaru niedokrwiennego mózgu. 3). Choroby współistniejące z incydem udaru niedokrwiennego mózgu oraz przebyty w przeszłości epizod udaru mózgu istotnie wpływają na obniżenie sprawności czynnościowej badanych. (PNN 2015;4(3):102–108)

**Słowa kluczowe:** udar mózgu, sprawność funkcjonalna, czynniki ryzyka

## Introduction

According to the estimates made by the World Stroke Organization, every sixth inhabitant of the globe will experience in their lives the brain stroke. In turn, approximately 8% of patients will experience a re-incident stroke within a year. Currently, it is the third leading reason for death in the adult population and the major causative factor of disability, additionally increased by problems resulting from the phenomenon of aging societies. Therefore, it should be therefore that the diseases of the central nervous system, of vascular background will significantly shape the contemporary image of benefits in the health care system [1-3].

Ischemic stroke is a syndrome caused by closing or narrowing of intracerebral vessels or of those supplying blood to the brain. Often, it is also the effect of hemodynamic disorders resulting in a slowdown of cerebral blood flow. It is the most common form of cerebral circulation disorders (approximately 85% of cases) apart from hemorrhagic stroke (approximately 15% of cases) [4].

There are two groups distinguished among the stroke risk factors: non-modifiable and modifiable. The first group includes: age, gender, race, genetic and ethnic factors, as well as an experienced incident of stroke. The most important modifiable factors include: hypertension, atherosclerosis, atrial fibrillation, myocardial infarction with thrombosis, valvular heart defects, diabetes, dyslipidemias, coagulation disorders, carotid stenosis and vascular anomalies, the deficiency of healthy behaviors and their consequences (alcohol abuse, tobacco smoking, lack of physical inactivity, obesity) [5,6]. Traditional risk factors for vascular diseases are responsible for 50-60% of the population risk of ischemic brain disease form. The reason for approximately 30% of strokes remains still unclear, and may also result from the genetic predisposition [7]. Age is the strongest risk factor for the brain stroke, since after the age of 55 the incidence doubles with each subsequent decade of life [6].

The research shows that approximately 15% - 30% of patients after the aforementioned vascular incident remain disabled forever. On the other hand, approximately 20% of the patients three months after the stroke require institutional support [8]. Early and late consequences of stroke, the need for long-term care, rehabilitation for the purpose of regaining the optimal autonomy and functional capacity of the patient constitute a significant medical, social and economic problem.

The aim of the study was to evaluate the efficiency in the basic activities of daily living of patients after the

incident of ischemic stroke, depending on the advancement of their age and on the presence of comorbidities. The analysis of the functional status of patients was carried out twice: on the first day of hospitalisation and at discharge from the hospital ward.

## Material and Methods

The research was carried out among 65 patients hospitalised due to acute ischemic stroke in the neurological ward of the Provincial Hospital in Plock. Consent for the implementation of the research procedure was obtained from the patients, the hospital authorities and the Bioethics Committee.

The research tool was the Barthel Scale Questionnaire, which was preceded by a metrics containing socio-demographic data of respondents. The Barthel Scale Questionnaire is used to assess capacity referring to the performance of basic activities. The points ranging from 0 to 100, determine the degree of the respondent's independence regarding self-service operations, sphincter control and mobility. The number of points depends on the degree of disability and on the dependence on others. According to the interpretation of the results from the scale, the patients were divided into three groups. Minor deficits and relatively good functional status ('the patient's condition - light') referred to the patients who scored 86-100 points. On the other hand, moderately-hard functional capacity impairment was confirmed by the test result ranging from 21 to 85 points. Whereas, the respondents who scored 0-20 points, were characterized by a very hard impairment of independence and ability to perform basic self-service activities [9].

The study of the functional status of patients was carried out twice: on the first day of hospitalization due to symptoms of ischemic stroke and on the day of the discharge from the hospital ward.

The group of respondents consisted of 36 men - 55.38% and 29 women - 44.62% of respondents. The most numerous group included patients over 75 years of age (50.77% - 33 patients). The age of 17 patients - (26.15%) ranged from 65 to 74 years and the age of 15 respondents (23.08%) ranged from 45 to 64 years. More than a half of the respondents were married (53.85% - 35 people), whereas 35.38% of the respondents (23 patients) were widowers and widows. In turn, 7.69% of the respondents (5 people) were divorced. The smallest group included unmarried patients (3.08% - 2 respondents). Among the respondents, the largest group consisted of

patients with primary education (49.23% - 32 people). 32.31% of patients (21 respondents) had vocational education. Whereas 16.92% of patients (11 respondents) had secondary education, and only 1 person (1.54%) – higher education. More than a half of respondents lived in the country (58.46% - 38 patients) and the remaining group (41.54% - 27 patients) lived in the city.

The clinical status of the group consisting of 65 patients during the period of hospitalization varied also due to the presence of comorbidities. The analysis of the data showed that 40.00% of the respondents (26 persons) had cardio – vascular problems, 30.77% of the respondents (20 persons) had diabetes. In turn, 12.31% of the patients (8 persons) had already experienced the incident of stroke, whereas 16.92% of the patients (11 respondents) did not confirm the disease in the interview.

### Statistical Analysis

In order to investigate the statistical relationship between the analyzed features, the  $\chi^2$  test and Statistica 8.0 package by Soft Company Stat were used. The value of 5% of the conclusion error risk was adopted. The probability value of  $p < 0.05$  was considered statistically significant.

## Results

Table 1 presents the assessment of the functional capacity of respondents after the ischemic stroke according to the Barthel Scale Questionnaire. On admission to hospital vast majority of respondents showed a very severe condition (63.1% - 41 patients), whereas on the day of discharge from hospital such a situation concerned only 16.9% of the respondents (11 patients). In contrast, assessment of 29.2% of the patients (19 respondents) on the first day of hospitalization ranged from 21 to 85 points. (medium-hard condition). On the day of discharge from hospital this situation related to 72.3% of patients (47 persons). The result of 86-100 points (light condition) on the first day of hospitalization was scored only by 7.7% of patients (5 respondents) and on the day of discharge by 10.8% of patients (7 respondents).

Table 1. Assessment of the functional capacity of the respondents after the ischemic stroke according to the Barthel Scale Questionnaire

Assessment of patients according to the Barthel Scale Questionnaire	On the day of admission to hospital		On the day of discharge from hospital	
	n	%	n	%
86-100 points patient's condition „light”	5	7.7%	7	10.8%
21-85 points patient's condition „medium-hard”	19	29.2%	47	72.3%
0-20 points patient's condition „very hard”	41	63.1%	11	16.9%

Table 2 includes an analysis of the capacity of the respondents after prior ischemic stroke in various everyday activities. The average number of points in the Barthel Scale Questionnaire scored by the respondents on the first day of hospitalization ranged  $25.85 \pm 5.4$  (median: 100.0; range: 0 - 100 points). Therefore, this confirms moderately-severe impairment of their functional impairment efficiency. The functional status of patients, however, was subject to a systematic improvement within the period of their hospitalisation as on the day of discharge the respondents obtained an average 61.08 points in the Barthel Scale Questionnaire. On the first day of hospitalisation, the patients reported the greatest difficulty in washing and bathing the whole body (on average 0.31 points) as well as in climbing and going down the stairs (on average 0.62 points). However, they best coped with self-sitting down and with moving from bed to chair and back (on average 6.38 points). On the last day of their hospitalisation, despite the improvement in the overall capacity, washing and bathing the whole body (1.69 points on average) as well as using the stairs (2.54 points on average) gave the patients most trouble. To the greatest extent it was possible to observe again the improvement of patients' efficiency in sitting down and moving from bed to chair and back (average 14.31 points).

Table 2. Assessment of respondents' abilities in the performance of everyday activities according to the Barthel Scale Questionnaire on the days of admission and discharge from hospital

Assessment of the patients according to the Barthel Scale Questionnaire	Admission	Discharge
	average points	average points
Eating meals	4.23	7.54
Moving from bed to chair and back, sitting down	6.38	14.31
Maintaining personal hygiene	1.92	4.00
Using toilet	1.92	4.92
Washing, bathing the whole body	0.31	1.69
Moving on flat surfaces	1.54	8.15
Climbing and going down the stairs	0.62	2.54
Dressing and undressing	3.15	5.92
Controlling stool / sphincter	2.92	6.08
Controlling incontinence / urinary sphincter	2.85	5.92
Average points in total	2.85	61.08

Table 3 presents the scope of functional capacity of the respondents according to the Barthel Scale Questionnaire, depending on their age, on the first day of hospitalization associated with the incident of ischemic stroke. A statistically significant relationship has been found between the age of respondents and their functional capacity evaluation assessed on the first day of their stay in hospital. By far, the largest percentage of patients aged 65-74 years (64.71% - 11 people) and over 75 years of

age (75.76% - 25 people) have been classified as patients with very serious deficit of functional capacity. However, no patient aged over 75 was included in the group of respondents in 'light condition' whereas this category included patients aged 45-64 (26.67% - 4 persons). The average level of functional capacity deficits concerned mostly respondents from the youngest age group (40.00% - 6 persons).

Table 3. Functional capacity of the respondents according to the Barthel Scale Questionnaire depending on their age on the day of admission to the hospital ward

Age of respondents	Patient's condition „light”		Patient's condition „medium hard”		Patient's condition „very hard”		Overall
	n=5	%	n=19	%	n=41	%	
45-64 years	4	26.67%	6	40.00%	5	33.33%	15
65-74 years	1	5.88%	5	29.41%	11	64.71%	17
≥ 75 years	0	0.00%	8	24.24%	25	75.76%	33
Significance $\chi^2$				13.46			65

Table 4 presents the range of functional efficiency of the respondents according to the Barthel Index Questionnaire, depending on their age, on the last day of their hospitalization associated with the incident of ischemic stroke. No statistically significant correlation has been found between the age of the respondents and their functional capacity evaluation assessed on the last day of their stay in hospital. However, on the day of discharge the largest group of respondents included in the category of patients with serious deficits in functional efficiency was at the age of 64-74 years (17.65% - 3 persons) and over 75 years (18.18% - 6 persons). By far, the respondents most often left hospital with moderate disorders in terms of independence and efficiency in everyday functioning. This group of patients mostly included patients aged 64-74 years (76.47% - 13 persons) and over 75 years (78.79% - 26 persons). In contrast, minor deficits in functional efficiency were most often observed in patients from the youngest age category 45-64 years (33.33% - 5 persons).

Table 4. Functional capacity of the respondents according to the Barthel Scale Questionnaire depending on their age on the day of discharge from the hospital ward

Age of respondents	Patient's condition „light”		Patient's condition „medium hard”		Patient's condition „very hard”		Overall
	n=7	%	n=47	%	n=11	%	
45-64 years	5	33.33%	8	53.33%	2	13.33%	15
65-74 years	1	5.88%	13	76.47%	3	17.65%	17
≥ 75 years	1	3.03%	26	78.79%	6	18.18%	33
Significance $\chi^2$				10.43			65

Table 5 presents the scope of the functional capacity of the respondents according to the Barthel Scale Questionnaire depending on the presence of comorbidities, on the first day of hospitalisation associated with the incident of ischemic stroke. Comorbidities significantly affect the evaluation of the patients' efficiency in the performance of everyday activities, assessed on the first day of their stay in hospital. Very serious deficits of independence in the performance of everyday activities regarded the respondents having problems with the cardio - vascular system (88.46% of the patients - 23 persons) as well as 70.00% of the respondents (14 persons) suffering from diabetes. In turn, the capacity of the patients who had already experienced the stroke, contributed to the classification of the majority of patients (75.00% of the respondents - 6 persons) to the group being in, 'moderately-hard' efficiency condition. Lack of comorbidities in the interview had no effect on the fact that the deficits of the functional capacity of the respondents in connection with the incident of the ischemic stroke were mostly at the moderately-hard level (45.45% of the patients - 5 persons).

Table 5. Functional capacity of the respondents according to the Barthel Scale Questionnaire depending on the comorbidities on the day of admission to the hospital ward

Comorbidities	Patient's condition „light”		Patient's condition „medium hard”		Patient's condition „very hard”		Overall
	n=5	%	n=19	%	n=41	%	
Diseases of the cardiovascular system	0	0.00%	3	11.54%	23	88.46%	26
Diabetes	1	5.00%	5	25.00%	14	70.00%	20
Prior stroke	0	0.00%	6	75.00%	2	25.00%	8
None	4	36.36%	5	45.45%	2	18.18%	11
Significance $\chi^2$				32.35			65

Table 6 shows the extent of the functional capacity of the respondents according to the Barthel Index Questionnaire, depending on the presence of comorbidities on the last day of hospitalization associated with the incident of the ischemic stroke. The presence of comorbidities significantly affects the evaluation of the patients' efficiency in the performance of everyday activities, assessed on the last day of their stay in hospital. Patients suffering from additional health problems were most often classified to the group of respondents in 'medium heavy condition'. This situation referred to all respondents after prior stroke (100.00% - 8 persons), 80.00% of patients (16 persons) with diabetes and to the vast majority of patients with problems associated with the cardio - vascular system (69.23% - 18 persons). On the other hand, patients with comorbidities of the cardio - vascular system had significantly more serious deficiencies related to the functional capacity (26.92% - 7 persons).

Tabela 6. Functional capacity of the respondents according to the Barthel Scale Questionnaire depending on the comorbidities on the day of discharge from the hospital ward

Comorbidities	Patient's condition „light”		Patient's condition „medium hard”		Patient's condition „very hard”		Overall
	n=7	%	n=47	%	n=11	%	
Diseases of the cardiovascular system	1	3.85%	18	69.23%	7	26.92%	26
Diabetes	1	5.00%	16	80.00%	3	15.00%	20
Prior stroke	0	0.00%	8	100.00%	0	0.00%	8
None	5	45.45%	5	45.45%	1	9.09%	11
Significance $\chi^2$			20.40				65

## Discussion

According to the research performed, the functional capacity of patients during the period of hospitalisation after the incident of the ischemic stroke, as a result of the undertaken treatment, rehabilitation and care was subject to improvement. In particular, this applied to basic activities such as sitting down, moving from bed to chair. Smaller progress related to the activities which require the assistance of another person as they were associated with the involvement of a larger group of muscles, use of excessive force, as in the case of bath. Similar results were obtained by Rynkiewicz, Rogulska, Czernicki [9] and Trochimiuk and Kochanowski [10] as well as by Jaracz and Kozubski [11], who analysed changes in functional capacity of patients at early stages after a stroke.

Age is one of the very important, non-modifiable risk factors for stroke. This risk (regardless of the type of disorder) increases exponentially with age advancement. The possibility of the occurrence of stroke in the adult population is doubled with every decade and affects as many as 5% of people over 65 years of age [6,12]. One should be aware of the presence of co-morbidities associated with the advancement of age of an individual and simultaneously increasing the risk of vascular diseases of the central nervous system. The analysis of the dynamics of the incidence of the first stroke in one's life in the world, over the last few decades, has indicated the favorable downward trend observed since 1945. Due to demographic changes in the world, and therefore in Europe, inhibition of this trend is expected. The main reason for this is the increase of the percentage of people aged over 65. It is assumed that by 2050 the number of this population in the European Union will have increased up to 35%. As a result, it is assumed that the number of strokes will rise approximately to 1.5 million in 2025. The forecasts assume that Poland will be the fastest aging country in Europe with a strong phenomenon of the double aging population. According to the Central Statistical Office

data, the percentage of people aged 80 and older in 2013 represented less than 4% of the total population whereas in 2050 it will amount up to 10.4%. This demographic situation may significantly affect both the incidence and mortality due to strokes [13-15].

It was stated in the results presented in our study that the advancement of age of the patients who underwent hospitalization in connection with the incident of ischemic stroke, affected the deterioration of their functional capacity. Both on admission to the hospital ward as well as at discharge respondents aged over 65 and particularly those over 75 obtained the lowest scores according to the Barthel Scale Questionnaire. Similar results were obtained by Wawrzyniak S. and Wawrzyniak K. indicating greater disability in elderly patients after the incident of stroke on both the first and last day of their hospitalization [16]. Bartoszek and co-authors in their studies showed that there was a correlation between age and the level of self-service capacity of patients hospitalized in the neurology ward. Among the respondents, the lowest level of capacity was obtained by patients aged over 64 [17].

The occurrence of strokes particularly among people aged over 65 results from the presence of comorbidities that may adversely affect both the early and late prognosis as well as functional abilities of patients.

The most significant pharmacologically modifiable risk factors of stroke include hypertension, heart disease, diabetes, dyslipidemias, coagulation disorders. On the other hand, carotid artery stenosis and vascular anomalies are subject to surgical treatment [6]. The studies have shown that hypertension quadruples the risk of stroke. Another recognised factor is solid (over 70%) atherosclerotic carotid artery stenosis [18]. Atrial fibrillation in turn, increases the risk of the ischemic stroke 5-7 times whereas heart diseases predisposing to embolism - even several times [19]. The studies have shown a tendency of increasing the frequency of the incidence of ischemic stroke in a situation of a lowered HDL cholesterol level, and increasing concentration of triglycerides. The risk of vascular disorders in the central nervous system is increased by 6-25% per 1 mmol / l of the increased total cholesterol, and twice in the case of diabetes [18,20]. Schmidt and co-authors have indicated that the risk of the reoccurrence of stroke within the period of 7 years after the first episode, takes place in 28% of patients, a second relapse within the same period relates to 3% of patients and the third one to 0.6% of patients [21].

According to the results of our studies, included in the paper the presence of comorbidities, particularly in the group of older respondents, contributed to the deterioration of functional capacity of patients after the incident ischemic stroke. Both on admission to the hospital ward as well as at discharge the respondents burdened with a history of chronic disease obtained low scores on the Barthel Scale Questionnaire. Similar test results have been obtained by Bartoszek, A. et al [17] previously cited. Based on the results of their research, Wawrzyniak S.,

K. Wawrzyniak emphasised that the deterioration of the self-service efficiency of the elder patients in the course of ischemic stroke is associated with the presence of comorbidities [16].

## Conclusions

The analysis of the results of our research and literature allowed the following conclusions:

1. Patients after the incident of the ischemic stroke, despite the improvement in the functional capacity require assistance in everyday activities.
2. The advancement of age reduces the functional efficiency of the respondents after the incident of the ischemic stroke.
3. Comorbidities of the incident of the ischemic stroke and the episode of the stroke experienced in the past significantly contribute to the decrease of the functional efficiency of the respondents.

## Implications for Nursing Practice

Intensive treatment and rehabilitation of patients after the incident of the ischemic stroke aim at improving their functional capacity. However, many patients, particularly the elderly, will still require assistance in the performance of daily activities. It is therefore necessary to design long-term, systematic nursing-care and rehabilitation actions. Bearing in mind the risk factors of the disease it necessary to prepare, implement and evaluate preventive actions promoting healthy lifestyle.

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