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# Post-stroke patients: frequency and effectiveness of rehabilitation and speech therapy

Abstract: The study presented here was conducted on post-stroke patients in the years 2014–2017. Data was collected using a survey questionnaire based on single-choice questions, Barthel ADL Index and the modified Rankin Scale (mRS). As many as 128 out of 135 respondents (94.8%) were referred for further treatment after initial rehabilitation. Of these, 33.6% did not continue their rehabilitation. Most of the remaining ones chose outpatient (32.9%) or inpatient rehabilitation in a hospital (29.4%). After the second examination of the physical condition of the patients, improvement was noted in those who participated in long-term rehabilitation. This feeling was also declared by the patients

themselves. Out of all respondents, 92 people suffered from speech disorders, of which only 21.7% participated in speech therapy, and in this group 90% noticed a significant improvement in verbal communication. A small percentage of patients with aphasia recognize and follow speech therapy recommendations. Patients and their carers should be informed in more detail about the benefits of rehabilitation and speech therapy.

Keywords: stroke, aphasia, rehabilitation, speech therapy

## Pacjenci poudarowi – częstotliwość i skuteczność rehabilitacji i terapii logopedycznej

Streszczenie: Prezentowane badania dotyczące pacjentów po przebytym udarze mózgu przeprowadzono w latach 2014–2017. Dane zebrano za pomocą kwestionariusza ankiety opartego na pytaniach jednokrotnego wyboru, skali Barthel (Barthel ADL Index) i zmodyfikowanej skali Rankina (mRS). Aż 128 ze 135 badanych (94,8%) po wstępnej rehabilitacji skierowano na dalsze leczenie. Spośród nich 33,6% nie kontynuowało rehabilitacji. Większość pozostałych wybrała rehabilitację ambulatoryjną (32,9%) lub stacjonarną w szpitalu (29,4%). Po drugim zbadaniu fizycznej kondycji pacjentów zauważono poprawę stanu tych, którzy uczestniczyli w długotrwałej rehabilitacji. Takie odczucie deklarowali też sami pacjenci. Spośród wszystkich badanych 92 osoby cierpiały na zaburzenia mowy, z tego tylko 21,7% korzystało z pomocy logopedycznej, a w tej grupie 90% zauważyło znaczącą poprawę w komunikacji werbalnej. Niewielki odsetek pacjentów z afazją uznaje i stosuje zalecenia logopedyczne. Należy bardziej szczegółowo informować pacjentów i ich opiekunów o korzyściach płynących z rehabilitacji i terapii logopedycznej.

Słowa kluczowe: udar mózgu, afazja, rehabilitacja, terapia logopedyczna

The World Health Organization (WHO) identified stroke as one of the leading causes of premature death and disability worldwide. It is characterised by an abrupt dysfunction of the brain activity that can be focal or generalized. Its symptoms persist longer than 24 hours or causing death, and it has no other causes than vascular ones (Stępień, 2014; World Health Organization, 2001). In the United States, nearly 795,000 people undergo stroke each year, while 610,000 of these cases are primary attacks and 185,000 are recurrent attacks. The percentage of deaths caused by stroke was 11.8% in 2015, which made it the second leading global cause of death (American Heart Association, 2017). In Poland, 60,000 patients experience first or recurrent stroke each year. The incidence of the symptoms is approximately 171/100,000 in men and 93/100,000 in women. The age-adjusted mortality rate for stroke as an underlying cause is 40% in men and 44% in women; more patients die from intracerebral haemorrhage (60%) than from ischemic stroke (38%) (Sarti, Stegmayr & Tolonen, 2003; Grabowska-Fudula, Jaracz & Górna, 2010).

Among patients who experienced stroke, 44–75% are disabled (Rankin ≥3) (Hankey & Warlow, 1999). The decreased quality of life and self-dependence among stroke survivors is mainly caused by disabilities such as paralysis, speech disorders and cognitive impairments. Between 15 to 30% of patients exhibit a

significant level of disability (Schwamm et al., 2005). The primary goal of post-stroke rehabilitation is to minimise the impairment, improve coordination and psychical activity, and restore lost functions or stabilise those that cannot be restored. The European Stroke Initiative (EUSI) recommends to continue rehabilitation after discharging a patient during the first year after stroke and to increase the duration and intensity of rehabilitation if needed (European Stroke Organisation, 2008).

The aim of this study was to evaluate frequency and effectiveness of motor and speech rehabilitation of participating post-stroke patients.

## Methods

### Study population

The prospective study was conducted among the stroke patients who had been admitted to the Department of Neurological Rehabilitation of the Medical University of Silesia in Katowice, Poland, between 2014 and 2017. All of them have gone through early rehabilitation after stroke (8 weeks) in the Department of Neurological Rehabilitation.

### Selection criteria

The inclusion criteria were as follows:
- A consent for participation in the study
- Hospitalization due to an ischemic stroke or intracerebral haemorrhage between 2014 and 2017 at Neurorehabilitation Department of the Medical University of Silesia in Katowice, Poland.

The exclusion criteria were as follows:
- Craniocerebral injury leading to intracerebral haemorrhage
- Neurodegenerative disorders diagnosed prior to the first stroke incident
- Death less than one year after hospitalization

### Methodology

Patients were evaluated twice – during the discharge from Neurorehabilitation Department and after long-term rehabilitation, at least one year after discharge.

At that time, phone survey were conducted with patients themselves or with caregivers, in case of patients' severe clinical condition.

### Questionnaire

The tool used in this study was a single-answer type questionnaire. It included information regarding age, gender, type of stroke (ischemic or intracerebral haemorrhage), place of residence, presence of rehabilitation used by the patient and its type (stationary, ambulatory or both), neurologopedic treatment, patient's general condition and willingness of participation in the hospital rehabilitation (Appendix 1).

### Physical condition

Physical condition was assessed twice: during the discharge from Neurorehabilitation Department and during the telephone survey. The functionality status was established using the modified Rankin Scale (mRS) and the Barthel Index of Activities of Daily Living (Barthel ADL Index). Modified Rankin Scale is a six-point scale with values ranging between 0–5; a score of 0 indicates total independence, while a score of 5 corresponds with severe disability (Banks & Marotta, 2007). Barthel ADL Index objectively evaluates self-maintenance and mobility of the patient. The index consists of ten questions analysing bowel and bladder control, grooming, mobility and transfer, toilet use, dressing, feeding, bathing and stair climbing (Mahoney & Barthel, 1965). Each item is rated between 0 and 2 points. Total possible score values range frame 0 to 20 with lower scores indicating increased disability (Collin, Wade, Davies & Horne, 1988). In our study, we determined the score of 14 points as a borderline between severe and mild incapacity.

### Ethical aspect

During hospitalization, all the patients had given a consent for examination and for the telephone re-evaluation of their physical condition. The ethical approval was not necessary for preparation of this article, but the study was conducted according to the principles of the Declaration of Helsinki, while all participants submitted Written Informed Consent documents.

### Statistical Analysis

Descriptive statistics were used to present sociodemographic characteristics. In order to investigate whether there were statistical differences between the physical condition of patients between the groups, the Mann Whitney U test was performed in each time point. In order to determine if there were any differences between the patients' physical condition before and after rehabilitation, the Wilcoxon signed-rank test was used. Statistical analyses also included a repeated-measure analysis of variance (ANOVA) and Friedman ANOVA when the data did not meet the assumption of normality (tested with Shapiro-Wilk test). When significant ANOVA effects emerged, the results were further explored with Bonferroni *post-hoc* test. Chi-square tests were conducted to discover whether there were differences in the percentage of patients who did or did not declare physical and speech improvement. Differences and associations were considered significant for $p < 0.05$. Data analysis was performed using Statistica 13.1, StatSoft Polska Sp. z.o.o.

## Results

### Profile of participants

Between 2014 and 2017, 135 patients were selected, based on the inclusion and exclusion criteria. The group consisted of 60 men and 75 women; the mean age was 69.8 years (SD ± 12.9). In the course of study, patients' relatives informed about death of the 35 participants (25.9%). The exact patients' characteristics and the results of psychical condition tests during the discharge from Neurorehabilitation Department are presented in Table 1.

Table 1. Clinical profile of participants

| Variables | Mean ± SD* | Frequency (n = 135) | Percentage (%) |
|---|---|---|---|
| Age | 69.8 ± 12.9 | | |
| Gender | | | |
| Male | | 75 | 55.6 |
| Female | | 60 | 44.4 |
| Time since stroke | | | |
| Less than a year | | 32 | 23.7 |
| 1–2 years | | 29 | 21.5 |
| 2–3 years | | 28 | 20.7 |
| More than 3 years | | 46 | 34.1 |

Table 1 (cont.)

| | | | |
|---|---|---|---|
| Type of stroke | | | |
| Ischaemic | | 112 | 83 |
| Hemorrhagic | | 23 | 17 |
| Speech disorders | | | |
| Yes | | 92 | 68 |
| No | | 43 | 32 |
| Physical condition | | | |
| modified Rankin Scale (0–5) | 3.35 ± 1.16 | | |
| 0–2 | | 33 | 24.4 |
| 3 | | 37 | 27.4 |
| 4 | | 41 | 30.4 |
| 5 | | 24 | 17.8 |
| Barthel ADL Index (0–20) | 10.64 ± 6.24 | | |
| < 14 | | 78 | 57.8 |
| ≥ 14 | | 57 | 42.2 |

* SD – standard deviation.

Source: Own study.

## Place of residence

Among all interviewees, the vast majority stayed at home with their families (n = 121; 89.6%). From that group, 65 (53.7%) were evaluated as disabled according to the Barthel ADL Index (< 14 points). Fourteen patients (10.4%) stayed at nursing homes and these patients presented more severe physical condition than those at home. Mean Barthel ADL Index for nursing homes patients was 6.21 during discharge, and for those in their family home – 11.16 (p = 0.0034). During the examination, the Barthel ADL Index for nursing homes residents was 5.13, while for patients staying with their families – 13.86 (p = 0.0009).

## Presence and type of rehabilitation

In a group of 135 patients after early rehabilitation, 128 received a recommendation for further rehabilitation (Barthel ADL Index < 20, mRS > 0). During the examination, 43 of them (33.6%) admitted that they did not continue their rehabilitation at all. At the time of hospital discharge, according to the functionality tests, the patients who had not undergone rehabilitation were in the comparable physical condition to the patients who had decided to continue rehabilitation.

In patients who underwent at least 1 year of rehabilitation (n = 85; 66.4%), the group consisted of 48 women and 37 men. Rehabilitation users usually decided to choose ambulatory rehabilitation (28; 32.9%) and stationary rehabilitation at

the hospital (25; 29.4%). Only 21 stroke patients (24.7%) attended both stationary and ambulatory rehabilitation. The rest of interviewees (11; 12.9%) reported that they underwent rehabilitation at home, using their own exercise schedule (without professional care).

There was a correlation between the type of rehabilitation and physical condition of the patients. The members of the group that decided on the stationary rehabilitation were in more severe condition, than those who chose ambulatory rehabilitation (Barthel: stationary 7.88, ambulatory 11.89; p = 0.0289).

## Improvement of physical condition

The second evaluation of patients' physical condition revealed that it significantly improved after long-term rehabilitation (Barthel: 11.73 vs. 12.58, p = 0.0175). That improvement was pronounced more frequently in comparison with patients who had not undergone any rehabilitation whatsoever. Motor improvement depended on the type of rehabilitation that patients had chosen – the most effective one was association of stationary and ambulatory rehabilitation (Barthel: 12.53 vs. 14.63, p = 0.0280), and the least effective was rehabilitation at home, without professional help (statistically insignificant, p = 0.8658). The results of physical condition tests before and after rehabilitation are presented in Table 2.

Table 2. Comparison of physical condition between rehabilitation users and patients who didn't use rehabilitation

| | n | Barthel 1 | Barthel 2 | p |
|---|---|---|---|---|
| Patients who used rehabilitation | 66 | 11.73 | 12.58 | 0.0175 |
| Patients who didn't use rehabilitation | 27 | 12.56 | 13.00 | 0.2367 |
| | n | Rankin 1 | Rankin 2 | p |
| Patients who used rehabilitation | 66 | 3.30 | 3.10 | 0.1692 |
| Patients who didn't use rehabilitation | 27 | 2.96 | 3.07 | 0.8647 |

Source: Own study.

## Subjective health assessment

The majority of patients after long-term rehabilitation admitted that their physical condition has significantly improved (41; 62.1%; p = 0.0111). In comparison, among patients who did not undergo rehabilitation, only 9 (33.3%) noticed health improvement.

### Speech therapy

There were 92 patients with speech disorders and all of them had received a recommendation for speech therapy after discharge from the rehabilitation department. Among them, 72 admitted that they did not undergo speech therapy sessions, whilst only 20 (21.7%) reported that they were under the supervision of a speech therapist (at least 1 year).

The patients who underwent speech therapy were in better general physical condition than the patients who did not (mRS: 2.0 vs. 3.27; $p = 0.0017$; Barthel: 16.41 vs. 12.52; $p = 0.0042$). In 20 speech therapy users, 18 (90%; $p < 0.001$) declared significant improvement in their speech communication. In comparison, among group of patients who did not use speech therapy, the improvement affected only 31.9% of patients.

## Discussion

Our research showed that up to 89.6% of post-stroke patients stay at home under the supervision of their families, while 53.7% of them are disabled and require 24-hour care. The studies from all over the world proved that the families with stroke survivors are facing formidable challenges and taking care of their disabled relatives influences both their professional and private life. Additionally, they are not appropriately prepared for dealing with disabled patients (Firoz, Islam, Rumana & Faruqui, 2017; Olivier, Phillips & Roy, 2018). A minor percentage of stroke patients reside in the nursing homes. The question is whether this situation arises from the decisions of their families or the limited access to the nursing homes in Poland.

Movement therapy as a physiotherapeutic approach is proven to be an efficient tool for improving patients' quality of life and abilities to perform everyday activities (Marcolino et al., 2020; Klimkiewicz et al., 2018; Wang, Zhang & Langhammer, 2014). It also improves the survival of patients affected by a stroke, as it diminishes the risk of complications due to immobilisation, such as bedsores, pneumonia, and venous thromboembolic disease. It prevents the development of pseudostroke syndrome which manifests itself in the deepening of the paresis and spasticity without the presence of a second stroke (Piskorz, Wójcik, Iłzecka & Kozak-Putowska, 2014).

A randomized controlled trial carried in order to determine the adherence to exercises performed by patients in their homes revealed good outcome in lessening disabilities caused by a stroke (Gunnes et al., 2019). The intervention of

monthly coaching by a trained physiotherapist, which was a standard practice in our case, was an important factor in that research. Therefore, our finding is that home based exercises, performed by patients without the assistance of qualified physicians, display no significant changes in their condition measured by the Barthel ADL Index and mRS, which may be linked to the insufficient education of these patients. For instance, a Norwegian prospective cohort study from 2018 revealed that only 12% of patients got advice on physical activity during their one-year medical consultation follow-up period (Pedersen, Petursson & Hetlevik, 2018). In this setting, we assert that further efforts should be considered to provide essential information and encourage both patients and caregivers before discharge and during the process of rehabilitation. For instance, in his review Dobkin suggests the inclusion of behavioural self-management strategies in the neurologic rehabilitation trials and routine clinical care, which may constitute an improved approach to this particular issue (Dobkin, 2016).

One of the rehabilitation possibilities is a 4-week inpatient stationary rehabilitation that provides complex care and multiple rehabilitation variants. It should be considered the most adequate option for patients with disabilities. Unfortunately, our research demonstrated that patients rarely decide to use that option and, what is more, their knowledge in this field is very limited. Therefore, such a situation creates a challenge not only for the physicians, but also for the healthcare in general to fully inform the patients and their families about further treatment possibilities.

In our study, the functionality status was established using the mRS and Barthel ADL Index. According to the results, the crucial point was to determine whether patients' mean score changes were clinically important or not. In our study, the mean difference between patients' physical condition before and after rehabilitation was 0.85 points. By comparison, patients who did not undergo rehabilitation achieved only 0.44-point improvement and this difference was statistically significant. However, a statistically significant difference does not necessarily impose a clinically relevant change, which is the major point of the rehabilitation. According to other studies, the minimal threshold of clinically important difference in stroke patients is 1,85–2 points as measured with the Barthel ADL Index (Cherney, Patterson & Raymer, 2011; Hsieh et al., 2007). These findings suggest that the improvement in the physical condition of our patients was not clinically relevant. However, the vast majority of patients noticed the effectiveness of long-term rehabilitation. Assumedly, the mental benefits of the rehabilitation should hence be considered equally important as the clinical ones.

Aphasia is one of the most disabling symptoms in stroke patients which significantly hinders the recovery and return to professional and social life. In our study, we exhibited that only a minor percentage of patients with aphasia (21.7%) comply with the recommendation of speech therapy after being discharged from

the Neurorehabilitation Unit. The patients who did not participate in speech therapy often complained about the insufficient access to speech therapists, the cost of speech therapy and poor general condition of patients. As indicated in our research, the patients who underwent speech therapy were in better physical condition than those who did not (mRS: 2.0 vs. 3.27; p = 0.0017; Barthel: 16.41 vs. 12.52; p = 0.0042). We assume that patients in worse general condition do not consider speech therapy as equally necessary to motor rehabilitation and neglect this part of treatment. These findings are alarming since speech therapy after stroke is both recommended and efficacious, according to the results of multiple meta-analyses (Quinn, Langhorne & Stott, 2011; Bhogal, Teasell & Speechley, 2003; Robey, 1998. When it is given with adequate intensity and lasts for an appropriate period of time, it may result in significant improvement of language capabilities and quality of life in general. The results of the randomized, multicentre FCET2EC trial (From controlled experimental trial to = 2 everyday communication) showed that even in patients with chronic (≥ 6 months of duration) aphasia after stroke, three weeks of intensive speech and language therapy resulted in the significant improvement of language skills (Breitenstein et al., 2017).

**Clinical implications**

In the light of the presented study results, in order to reach the best effects of comprehensive stroke care, significantly better information about benefits of rehabilitation and speech therapy programmes should be provided to the patients and their caregivers. Furthermore, the proper access to rehabilitation service is mandatory to reach those goals.

**Conflict of interest**

The authors declare no conflict of interest.

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# APPENDIX 1

**COMMUNITY CARE OF POST-STROKE PATIENTS – QUESTIONNAIRE**

**I. PERSONAL DATA**

NAME: AGE:

SURNAME: SEX: M F

**II. INFORMATIONS ABOUT STROKE**

DATE OF STROKE:

TYPE OF STROKE: ischaemic hemorrhagic

LOCALIZATION: right hemisphere left hemisphere

PARESIS: right-sided left-sided none

SPEECH DISORDER: aphasia dysarthria aphasia and dysarthria none

**III. INFORMATIONS ABOUT PATIENT**

PLACE OF RESIDENCE: home / nursing home / others……..

THROMBOTIC PROPHYLAXIS: yes / no / not applicable

SECOND STROKE: yes / no

REHABILITATION: yes / no / does not require

TYPE OF REHABILITATION: stationary / outpatient / stationary and outpatient / practice at home (without professional help) / not applicable

SUBJECTIVE ASSESSMENT OF HEALTH: improvement / unchanged / deterioration

PROFESSIONAL SPEECH THERAPY: yes / no / not applicable

SUBJECTIVE ASSESSMENT OF SPEECH COMMUNICATION: improvement/ unchanged/ deterioration/ not applicable

WILLINGNESS OF USING STATIONARY REHABILITATION: yes, and I use / yes, but I didn't know about that possibility / no

**IV. BARTHEL SCALE – SCORE**

DISCHARGE: NOW:

**V. RANKIN SCALE – SCORE**

DISCHARGE: NOW: