

Udar mózgu problemem współczesnej cywilizacji – analiza postępowania fizykalnego

Stroke as a civilisation-scale problem – physical treatment analysis

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Streszczenie:

Wstęp. Udar mózgu to jedna z najczęściej występujących postaci uszkodzenia ośrodkowego układu nerwowego. Każdego roku w Polsce na udar mózgu zapada około 60 tys. ludzi. Zaburzenia powstałe w wyniku udaru wymagają wdrożenia długotrwałej opieki i rehabilitacji. Głównym celem postępowania fizjoterapeutycznego jest przywrócenie choremu samodzielności w codziennym funkcjonowaniu oraz poprawa jakości życia pacjenta.

Cel pracy. Celem pracy była ocena wpływu postępowania fizjoterapeutycznego na stan funkcjonalny i jakość życia chorych po udarze mózgu. **Materiał i metody.** Badania przeprowadzono u 30 chorych po udarze mózgu (24 po udarze niedokrwiennym i 6 po udarze krwotocznym) przebywających na Pododdziale Rehabilitacji Neurologicznej Szpitala Specjalistycznego św. Łukasza w Końskich. W trakcie 8 tygodni pobytu na oddziale pacjenci poddawani byli intensywnemu leczeniu usprawniającemu. Badanie wykonywane było dwukrotnie, a mianowicie w dniu przyjęcia pacjenta na oddział oraz w dniu jego wypisu. Obejmowało wypełnienie ankiety uwzględniającej ocenę jakości życia w skali od 1 do 10 pkt., ocenę stanu funkcjonalnego przy użyciu Wskaźnika Barthel oraz ocenę stopnia spastyczności mięśni kończyny górnej i dolnej zmodyfikowaną skalą Ashworth. Wynik oceny stanu funkcjonalnego porównano w zależności od charakteru udaru, czasu od momentu wystąpienia udaru do rozpoczęcia rehabilitacji oraz liczby chorób współistniejących. Ocenie poddano także wpływ kompleksowego usprawniania na ocenę niezależności w codziennym funkcjonowaniu po zakończonym postępowaniu oraz zbadano wpływ usprawniania na stopień spastyczności i korzystanie z przedmiotów zaopatrzenia ortopedycznego. **Wyniki i wnioski.** U wszystkich badanych doszło do poprawy stanu funkcjonalnego. Lepsze wyniki końcowe uzyskali pacjenci po udarze niedokrwiennym oraz zmagający się z mniejszą liczbą chorób współistniejących. Efekty postępowania były lepsze u tych, którzy wcześniej po wystąpieniu udaru podjęli rehabilitację. Ocena jakości życia była znacząco wyższa, aniżeli przed rehabilitacją. Nastąpiło istotne obniżenie stopnia spastyczności, a znaczącej poprawie uległo korzystanie przez pacjentów z przedmiotów zaopatrzenia ortopedycznego.

Słowa kluczowe:

udar mózgu, leczenie, fizjoterapia

Abstract

Introduction. Stroke is one of the most common forms of damage to the central nervous system. In Poland, approximately 60,000 people suffer from stroke every year. Disorders resulting from stroke require the implementation of long-term care and rehabilitation. The main objective of physiotherapy is to restore patient independence in daily living and improve the quality of life of the patient. **Aim of study.** The aim of the study was to evaluate the effect of physiotherapy on the functional status and quality of life of patients after stroke. **Material and Methods.** The study comprised 30 patients after stroke (24 patients after ischemic stroke and 6 patients after hemorrhagic stroke) staying at the neurological rehabilitation ward in the St. Luke Specialist Hospital in Końskie. During 8 weeks of hospitalization, the patients underwent intensive rehabilitation. They were examined twice, namely on admission and on the day of discharge. The examination included completing a questionnaire assessing the quality of life on a scale of 1 to 10 points, an assessment of the functional status using the Barthel Index and an assessment of muscle spasticity of the upper and lower limb with the modified Ashworth scale. The results of functional status assessment were compared according to the type of stroke, time from stroke to rehabilitation and the number of concomitant diseases. Moreover, the effect of the comprehensive rehabilitation on the assessment of independence in daily living was studied after treatment, as was the influence of rehabilitation on the degree of spasticity and the use of orthopedic aids. **Results and Conclusion.** The functional status improved in all patients. Better final results were obtained in patients after ischemic stroke and suffering from fewer comorbidities. The results were better in those whose rehabilitation commenced earlier. The quality of life was significantly higher than before rehabilitation. The degree of spasticity was significantly reduced and the use of orthopaedic aids was improved.

Key words:

stroke, treatment, physiotherapy

Introduction

Stroke resulting from vascular failure in the central nervous system poses a considerable therapeutic, social and economic problem. It is dangerous not only for the health but also the life of a patient. In Poland, approximately 60,000 people suffer from stroke every year, compared to 2.5 million new cases annually in Europe [1, 2]. Worldwide, 4.6 million people die of stroke annually, including 3.2 million deaths in the developing countries and 1.2 million in the developed countries [1, 2].

The incidence of stroke in Poland is at the average European level and reaches 177 per 100,000 people in men and 125 per 100,000 people in women. Between the age of 55 and 64, the incidence increases to 300 per 100,000 people. The mortality rate in Poland is among the highest in Europe, reaching 106.4 per 100,000 people in men and 78.7 per 100,000 people in women [1, 2, 3].

According to the Central Statistical Office, the number of people after stroke living in Poland is over 400,000, 300,000 of whom have permanent disability (78.4%) and only 8.4% are professionally active.

80% of strokes are caused by ischaemia, 10% by intracerebral haemorrhage, 6% by subarachnoid haemorrhage and 4% are cases of unknown aetiology [4, 5, 6, 7, 8]. Clinical signs of stroke result from a decreased cerebral blood flow (under 20-30ml/100g/min) [9, 10].

Ischaemia results in changes both on the cellular and molecular level, leading to neuronal cell death.

The presence of blood in the brain tissue causes the migration of inflammatory cells, mainly lymphocytes and plasma and mast cells. At the site of haemorrhage, immune responses lead to the development of immune complexes.

Clinical presentation of stroke

The clinical presentation of stroke differs depending on the location and extent of the lesion, the pathomechanism or the general condition of the patient. The sequelae of stroke may be divided into focal and global.

The most common are motor and coordination symptoms (hemiparesis, difficulty swallowing – dysphagia, speech disorders – dysarthria, cerebellar symptoms, such as disturbed balance, coordination and body posture) and cognitive impairment (aphasia, agnosia, sensory disturbances, intellectual impairment). A relatively fast, sensitive and specific examination used in order to exclude intracerebral haemorrhage is computed tomography (CT). First signs and symptoms occur after approx. 6-12 hours and result mainly from cytotoxic oedema. Haemorrhage is clearly visible as a hyperdense focus, usually accompanied by a hypodense oedematous area.

Magnetic resonance imaging (MRI) is more sensitive compared to CT; it shows ischaemic lesions as early as after 3-6 hours.

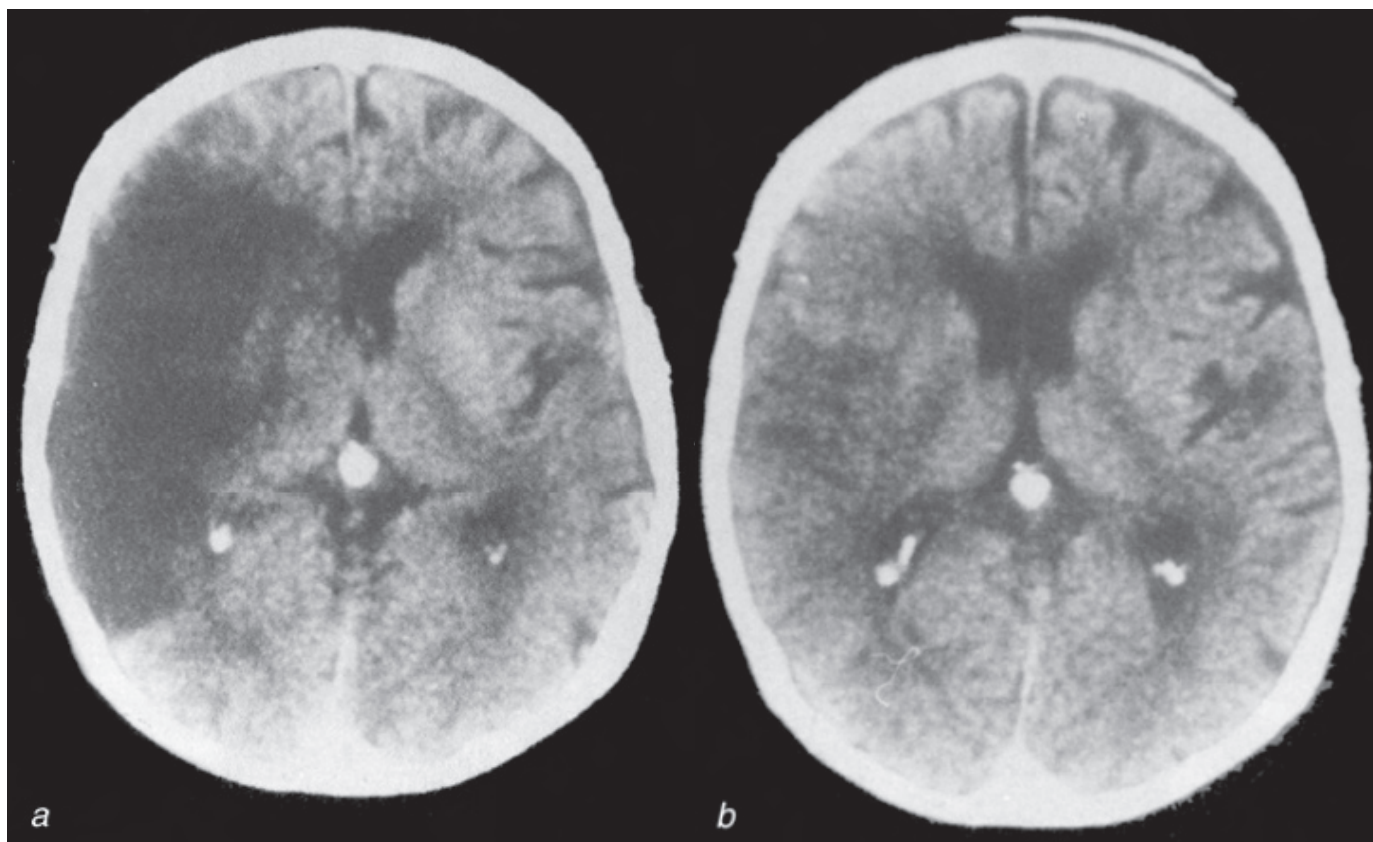


Fig. 1. Ischaemic stroke – CT scan (a – 20 hours after stroke; b – 2 hours after stroke)

Another imaging technique used in the diagnostic work-up is angiography, which visualizes blood vessels after the administration of a contrast agent. Traditional angiography is often replaced by digital subtraction angiography (DSA), which uses considerably lower amounts of radiation and contrast agents.

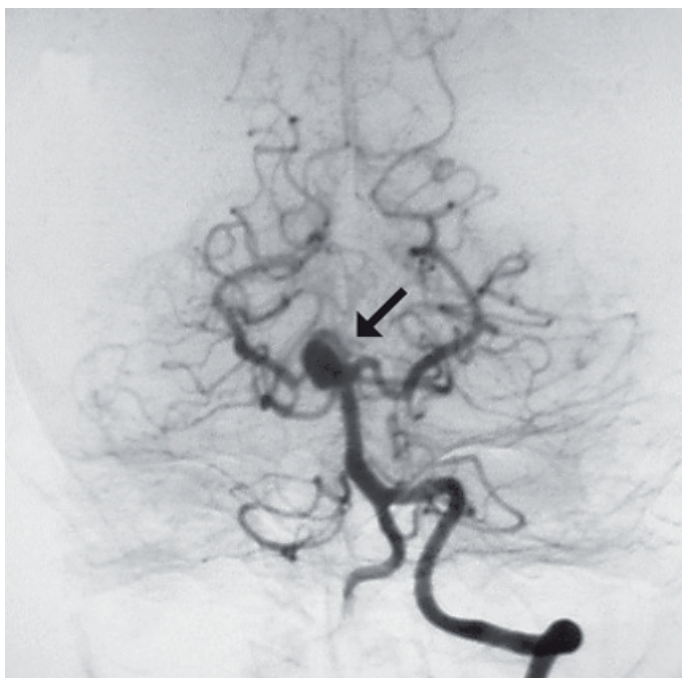


Fig. 2. Basilar artery aneurysm (DSA)

Physical therapy and rehabilitation

A person after stroke has to face various problems. As many as 50% of stroke patients suffer from balance and coordination disturbances. 75% of stroke patients have difficulty during locomotion and nearly 40% suffer from falls in the first year after stroke. Spasticity limits muscle function and disturbs muscle growth and tone.

Most common forms of physical therapy used after stroke are electrotherapy, heat therapy and magnetic field therapy [15, 17].

Neuromuscular electrical stimulation (NMES) is aimed at increasing muscle strength, activating muscles and improving sensory awareness. The treatment of spasticity utilises Hufschmidt's method and tonolysis. Both methods are aimed at restoring the appropriate physiological balance between flexors and extensors through the reflex mechanism of reciprocal innervation.

Numerous scientific studies have confirmed the effectiveness of low frequency magnetic fields in the treatment of stroke patients. The effect of the magnetic fields facilitates the regeneration of the nervous tissue, stimulates the processes of neural branching and differentiation and influences the higher brain functions.

Kinesiotherapy

The intensity of kinesiotherapy depends on the stage of treatment [11, 14, 16, 17, 19].

The early stage of rehabilitation is closely associated with intensive medical and nursing care and its main goal is to prevent abnormal stereotypical movement patterns and respiratory complications, decubitus ulcers, contractures, urinary tract infections and deep vein thrombosis [12, 13].

The second stage is aimed at treating spasticity, preventing contractures, adapting to new conditions of life and improving the quality of life.

Specialist methods usually used in the treatment of patients after stroke include Proprioceptive Neuromuscular Facilitation (PNF), the NDT Bobath method, constraint-induced movement therapy (CIMT) and the Brunnström method [16, 19, 20, 23, 25].

Methods of assessing the condition of patients

Nowadays, the most common methods of objective evaluation allowing for measuring clinical phenomena and changes taking place during treatment and rehabilitation are clinimetric scales [22, 23, 24]. There are three main groups of such scales: injury scales, functional assessment scales and quality of life scales.

Injury scales are used in the acute phase and allow mainly for the assessment of brain function impairment, control of treatment results and determining short-term objectives. The American National Institutes of Health Stroke Scale (NIHSS), the Canadian Neurological Scale (CNS), the Scandinavian Stroke Scale (SSS) and the European Stroke Scale (ESS) are the most well-known injury scales.

Functional assessment scales allow for the evaluation of the degree of independence and determining the patient's needs with respect to orthopaedic aids or care. Changes in the functional status of patients are usually assessed with the Barthel Index, the Functional Independence Measure (FIM) scale (its Polish modification is called the Repty Functional Index), the Rankin Scale measuring the degree of disability and the Brunnström test for the assessment of gait as well as the mobility of paretic limbs.

Gait and balance are assessed with functional tests such as the Up & Go test, the walking test, the two scales' test or the balance test.

The degree of spasticity may be measured with the numerical 5-point Ashworth scale. Scales assessing the quality of life reflect subjective well-being of the patients and the level of satisfaction with life. The patient's mental state and attitude towards the disability is also measured. The most popular scales assessing the quality of life include the Short Form Health Survey (SF-36), EuroQol-5D, SIP 136 or its modification SA-SIP 30 and QLI.

Aim of study

The aim of the study was to evaluate the effect of physiotherapy on the functional status and quality of life of patients after stroke.

Material and Methods

Problems and study hypotheses:

1. Does the assessment of the functional status after physiotherapy depend on the type of stroke, time between stroke and the start of rehabilitation or the number of comorbidities?
2. Does comprehensive physiotherapy influence the status of the patients, including the degree of spasticity, independence in daily living, quality of life and the use of orthopaedic aids?

Characteristics of the study group

The study group included 30 patients (12 women and 18 men) after stroke staying at the Department of General Rehabilitation with the Neurological Rehabilitation Ward of the St. Luke Specialist Hospital in Końskie. 24 patients had suffered from ischemic stroke and 6 patients (20%) had had haemorrhagic stroke. The study was conducted between May 2014 and March 2015. The patients stayed at the department for 8 weeks. They were examined twice: on admission and on the day of discharge. The examination consisted of two parts. The first part was the completion of a questionnaire consisting of 26 questions, taking into consideration also the assessment of the quality of life on a scale of 1 to 10 points. The second part of the test involved the assessment of the functional status of the patients with the Barthel Index and the evaluation of spasticity in the limb muscles with the modified Ashworth scale.

The inclusion criteria were: stroke (haemorrhagic or ischaemic) in the previous 12 months and the presence of hemiparesis.

The results were statistically analysed and presented with the use of means, standard deviation, medians and minimum and maximum values. Student's t test for dependent samples was used for the assessment of the functional status with the Barthel Index, evaluation of the degree of spasticity of the limb muscles with the modified Ashworth scale and assessment of the quality of life before and after rehabilitation. The significance level was set at $p < 0.05$. A chi-squared test was used in order to assess the correlation between the functional status after treatment and the type of stroke, time between stroke and the start of rehabilitation and the number of comorbidities. The correlation between the level of independence in daily living and comprehensive rehabilitation was similarly calculated.

Study results

The study comprised 30 subjects, including 12 women (40%) and 18 men (60%). Most of the patients were aged 51-60 years (12 patients, 40%) and 10 patients were aged 61-70 years (33.33%). Those over the age of 70 constituted 16.67% of the group and 3 patients (10%) were aged 41-50 years. The mean age was 61.7 ± 8.92 years. More than 53% of the participants (16 patients) lived in villages and 46% lived in cities (14 patients). 80% of our participants (9 women and 15 men) had ischaemic stroke and 20% (3 women and 3 men) had haemorrhagic stroke. In nearly 47% of the participants (8 women and 6 men), the time between stroke and the start of rehabilitation was 1-2 months; in 10 patients (33.33%) it was under 1 month. In 16.7% of the patients (2 women and 3 men) the rehabilitation commenced between the 2nd and 4th month after stroke and only 1 person (3.3%) started rehabilitation between the 4th and 6th month.

Table 1. Concomitant diseases

	Number of patients		
	Women	Men	Total
diabetes	3	7	10
hypertension	6	12	18
atherosclerosis	4	4	8
atrial fibrillation	0	3	3
obesity	2	4	6
ischaemic heart disease	2	3	5
none	3	2	5

Only 4 participants (13.3%) had suffered from a stroke before. 24 patients (10 women and 14 men) complain of gait disturbances. 21 patients have balance, coordination and body posture disturbances. Left-sided paralysis or paresis is present in 5 women and 12 men while right-sided paralysis or paresis was reported by 13 patients (7 women and 6 men). 16 patients suffer from sensory disturbances, 14 complain of impaired memory and orientation and 13 have vision problems. 5 patients suffer from speech disorders such as dysarthria or aphasia. 4 patients have urinary or faecal incontinence. Difficulty swallowing was found only in 1 female and 1 male study participant.

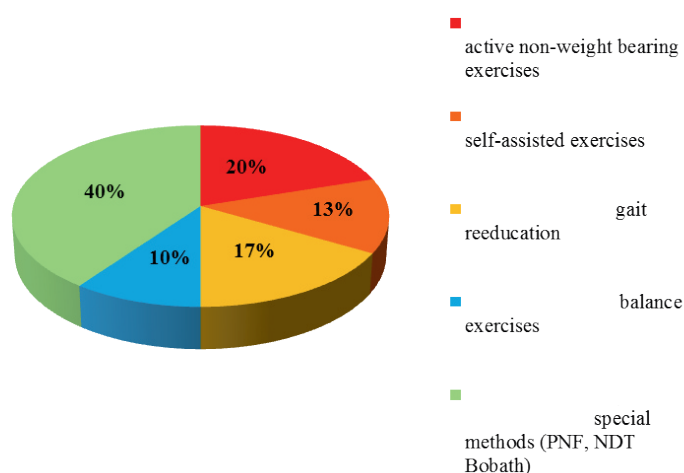


Fig. 3. Kinesiotherapeutic procedures during rehabilitation

Kinesiotherapeutic procedures used during rehabilitation were: electrotherapy (tonolysis), TENS and cryotherapy. 50% of the participants reported a considerable decrease in spasticity after treatment.

The functional status of the patients was assessed with the Barthel Index on admission and on the day of discharge. Before treatment, the mean value of the index was 9.4 points. After treatment, its value increased by 5.63 points and was 15.03.

Table 2. Assessment of functional status according to Barthel Index – statistical data

	Assessment of functional status according to Barthel Index	
	before rehabilitation	after rehabilitation
Mean value	9.4	15.03
Standard deviation	2.24	2.77
Difference in mean values	5.63	
Variance	5.01	7.69
Pearson's correlation	0.66	
p value in Student's t test	< 0.001	

The functional status was also assessed with the Barthel Index separately in those after haemorrhagic and ischaemic stroke. The assessment of the functional status was significantly higher after rehabilitation in both groups of patients.

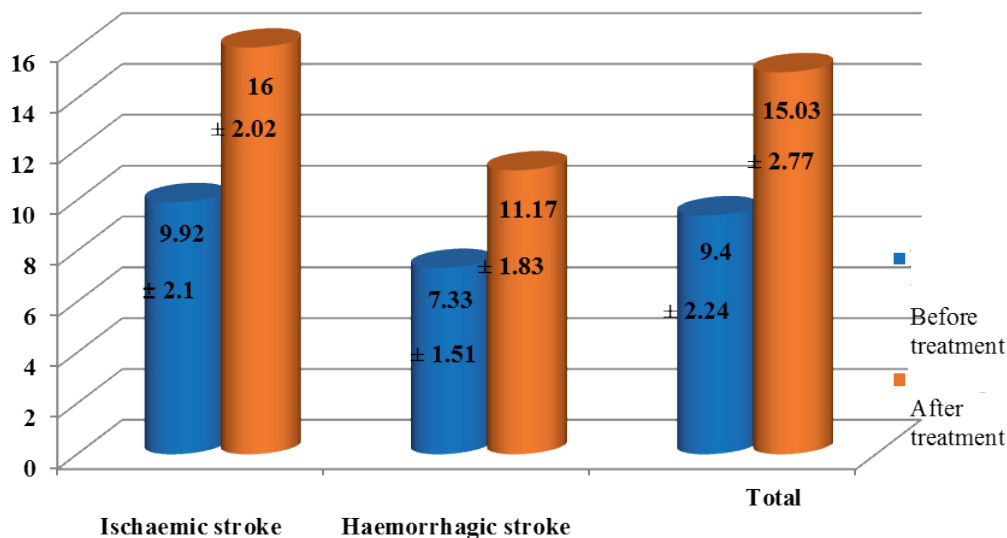


Fig. 4. Assessment of functional status according to Barthel Index before and after treatment

The spasticity in the limb muscles was measured with the modified Ashworth scale twice, on admission and on the day of discharge. The mean value of spasticity decreased after treatment from 1.63 to 1.28 in the upper limb muscles and from 1.69 to 1.33 in the lower limb muscles. An analysis with Student's t test for dependent samples confirmed a statistically significant improvement ($p < 0.001$).

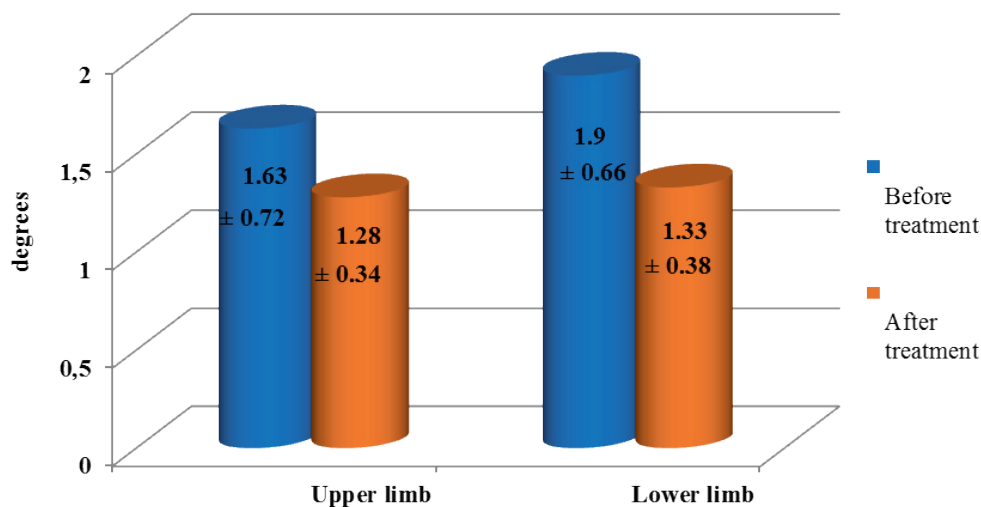


Fig. 5. Assessment of degree of muscle spasticity in limbs in Ashworth scale before and after treatment

The patients were asked to assess their quality of life twice, before and after treatment, using a 10-point scale where 1 meant dramatically low quality of life and 10 reflected exceptionally high quality of life.

In the general assessment, the mean quality of life before treatment was 3.77 points and increased after treatment to 6.1 points ($p < 0.001$).

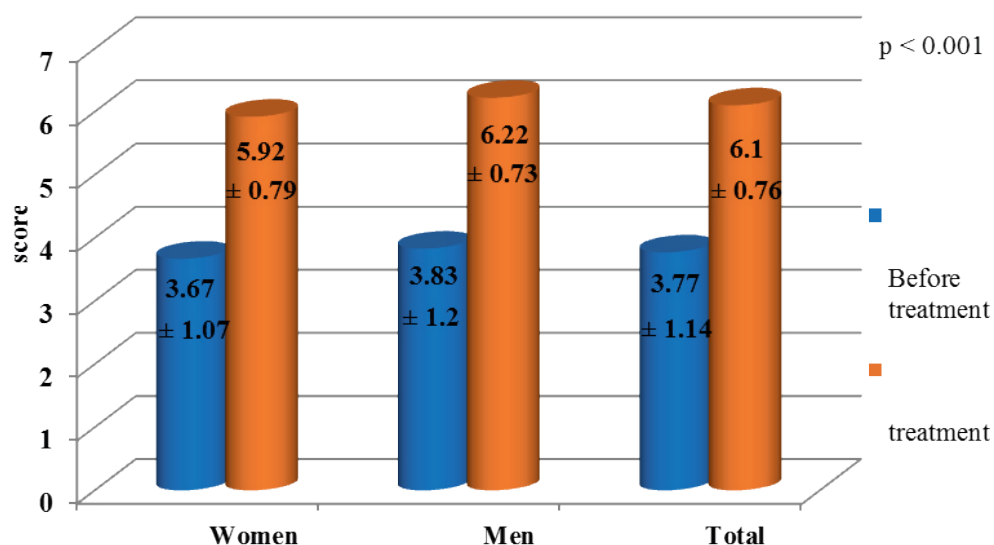


Fig. 6. Assessment of quality of life in numerical 10-point scale before and after treatment

The results were also assessed with respect to the presence of correlations between the functional status after treatment and the type of stroke, time between stroke and the start of rehabilitation and the number of comorbidities. The assessment used a chi-squared independence test and the strength of the correlation was calculated on the basis of Pearson's contingency coefficient C. The significance level of the test was set at $p < 0.05$.

Table 3. Assessment of correlation between functional status after treatment and type of stroke.

Type of stroke	Increase in score after surgery measured in Barthel Index				Σ
	0-2 pts	3-5 pts	6-8 pts	≥9 pts	
ischaemic stroke	1	6	13	4	24
haemorrhagic stroke	2	4	0	0	6
Σ	3	10	13	4	30

$$\chi^2 = 10.33; df=3; C=0.51; p=0.013 < 0.05$$

Table 4. Assessment of correlation between functional status after treatment and time between stroke and start of rehabilitation.

Time after stroke	Increase in score after surgery measured in Barthel Index				Σ
	0-2 pts	3-5 pts	6-8 pts	≥ 9 pts	
< 1 mc/month	0	1	5	4	10
1 - 2 mc/months	0	6	8	0	14
2 - 4 mc/months	2	3	0	0	5
4 - 6 mc /months	1	0	0	0	1
Σ	3	10	13	4	30

$$\chi^2 = 29.73; df=9; C=0.7; p=0.0005 < 0.001$$

The study showed that there is a statistically significant correlation between the assessment of the functional status and the time between stroke and the start of rehabilitation. A contingency coefficient of 0.7 indicates a very strong correlation between the variables. Moreover, an analysis showed the presence of a correlation between the functional status after treatment and the number of comorbidities.

$$\chi^2 = 22.25; df=9; C=0.65; p=0.008 < 0.01$$

A contingency coefficient of 0.65 shows a strong correlation between the variables. Patients with fewer comorbidities achieved better results.

Results

- 1) The assessment of the functional status after rehabilitation significantly improved both in the patients after ischaemic and haemorrhagic stroke. The final assessment depends on the type of stroke as those after ischaemic stroke achieved better therapeutic outcomes.
- 2) The assessment of the functional status after treatment depends on the time between stroke and the start of rehabilitation. The shorter the time, the better the results. The assessment also depends on the number of concomitant diseases. The higher the number of comorbidities, the lower the final functional assessment.
- 3) According to the patients, the most effective kinesiotherapeutic methods were individual exercises based on neurophysiological methods while the most effective physical therapy procedures were cryotherapy and electrotherapy.
- 4) The physical therapy procedures facilitated a significant reduction in limb spasticity.
- 5) The rehabilitation contributed to an increase in the number of patients who do not require orthopaedic aids.

- 6) The quality of life increased significantly after rehabilitation both in women and men.

Discussion

Stroke has become an ever-increasing clinical and social problem. Physical therapy and rehabilitation are the basis for the treatment and prevention and constitute an inherent part of the therapy. Treatment outcomes depend on numerous factors. Studies have shown better results in patients after ischaemic stroke and with fewer comorbidities. Early rehabilitation also had a significant influence on the final outcomes.

Rynkiewicz et al. assessed changes in the functional status of patients in the early period after stroke twice, before and after rehabilitation. The authors used the Rankin Scale, the Barthel Index and the FIM. The results were compared with respect to the existence of a correlation between the age, gender, paretic side and the presence of aphasia. The study showed a considerable improvement in the functional status of the patients. Better results were achieved in the patients with right-sided paresis without aphasia; the age and gender did not have a significant influence on the final outcomes [22].

An assessment of daily life activities depending on the subtype of ischaemic stroke and early rehabilitation was also conducted by Pasek et al. who studied 85 patients within 3 months after stroke. The functional status was assessed with the Repty Functional Index, Rivermead Mobility Index and Sodrting Motor Evaluation Scale. The quality of life was studied in part with the Frenchay Activities Index. The study showed a statistically significant improvement in the functional status and an increase in the quality of life in the majority of the patients. Early rehabilitation had a significant influence on the final outcomes [21].

Physical therapy used in the patients contributed to a significant decrease in the degree of spasticity in the limbs and a reduction of the previous symptoms.

In their study, Wolny et al. assessed the effect of PNF on the degree of spasticity in patients after stroke. The subjects were divided into two groups. The first group received rehabilitation with traditional methods and the second underwent PNF. The degree of spasticity was assessed on the basis of the modified Ashworth scale. The study showed significantly better outcomes in the second group, which was treated with the neurophysiological method [24].

In another study, Wolny et al. analysed the effects of rehabilitation of patients after stroke with various physiotherapeutic methods. The subjects were divided into three groups. The first group underwent traditional rehabilitation, the second was treated with PNF and the third one underwent PNF and tension mobilisation of the paretic upper limb. The best rehabilitation outcomes with respect to locomotion and self-care were obtained in the groups treated with PNF [23].

Similarly, the study by Nadina, who used the NDT Bobath method during rehabilitation, showed decreased spasticity in the Ashworth scale and improved function of the upper limb in the Barthel scale both in patients in the 3rd and 6th month after stroke [18].

The effectiveness of physiotherapy in patients after ischaemic stroke was also studied by Hawrylak et al. The authors observed the range of motion in the joints of the upper and lower limbs and measured the circumferences after the use of a comprehensive rehabilitation program combining kinesiotherapy, physical therapy and massage. The treatment resulted in improved mobility in the joints

as well as increased circumferences due to muscle mass gain [24]. The rehabilitation used in the subjects contributed also to an increase in the number of patients who did not require orthopaedic aids. The effects of the physiotherapy confirm the important role played by rehabilitation, which helps restore the desired functional as well as mental, social and professional status of the patient.

Conclusions

1. Intensive systematic rehabilitation of patients after stroke introduced as early as possible results in measurable therapeutic outcomes.
2. The functional status of the patients and the quality of their lives considerably improve after physical treatment.
3. The best results of physiotherapy are obtained in patients after ischaemic stroke, with fewer comorbidities and shorter time between the stroke and the start of rehabilitation.
4. Appropriately selected kinesiotherapy and physiotherapy contribute to a significant reduction in the degree of spasticity, higher muscle strength, increased range of motion in the joints of the limbs and decreased pain.
5. Physiotherapy allows the patients to put away or reduce the number of orthopaedic aids.

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