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NDT-Bobath Method in Normalization of Muscle Tone in Post-Stroke Patients

Metoda NDT-Bobath w normalizacji napięcia mięśniowego u pacjentów po udarze mózgu

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Abstract

Background. Ischaemic stroke is responsible for 80–85% of strokes. There is great interest in finding effective methods of rehabilitation for post-stroke patients.
Objectives. The aim of this study was to assess the results of rehabilitation carried out in the normalization of upper limb muscle tonus in patients, estimated on the Ashworth Scale for Grading Spasticity.
Material and Methods. The examined group consisted of 60 patients after ischaemic stroke. 10 sessions of NDT-Bobath therapy were provided within 2 weeks (ten days of therapy). Patient examinations using the Ashworth Scale for Grading Spasticity were done twice: the first time on admission and the second after the last session of the therapy to assess rehabilitation effects.
Results. Among the patients involved in the study, the results measured on the Ashworth Scale (where possible) were as follows: recovery in 16 cases (26.67%), relapse in 1 case (1.67%), no measurable changes (or change within the same grade of the scale) in 8 cases (13.33%).
Conclusions. Statistically significant changes were observed in the health status of the patients. These changes, in the area of muscle tone, were favorable and reflected in the outcomes of the assessment using the Ashworth Scale for Grading Spasticity (**Adv Clin Exp Med 2012, 21, 4, 513–517**).

Key words: rehabilitation, ischaemic stroke, NDT-Bobath, Ashworth Scale, muscle tone, upper limb.

Streszczenie

Wprowadzenie. Udar niedokrwienny odpowiada za 80–85% udarów mózgu. Istnieje konieczność poszukiwania i badania nowych, skuteczniejszych form rehabilitacji poudarowej.
Cel pracy. Ocena wyników rehabilitacji prowadzonej w celu normalizacji napięcia mięśniowego w kończynie górnej ocenianego za pomocą Skali Ashwortha.
Materiał i metody. Badaną grupę stanowiło 60 chorych leczonych na oddziale rehabilitacji i ambulatoryjnie. Stopień napięcia mięśniowego był mierzony za pomocą Skali Ashwortha 2-krotnie: przy przyjęciu na rehabilitację oraz po 2 tygodniach rehabilitacji w celu oceny jej wyników.
Wyniki. Wyniki pomiarów za pomocą Skali Ashwortha były następujące: w 16 przypadkach (26,67%) stwierdzono poprawę (26,67%), w jednym przypadku (1,67%) stwierdzono pogorszenie, a brak mierzalnych zmian (lub zmianę tego samego stopnia Skali Ashowortha) – w 8 przypadkach (13,33%).
Wnioski. Zaobserwowano statystycznie istotne zmiany w stanie zdrowia pacjentów. Zmiany napięcia mięśniowego były korzystne i odzwierciedlone w wynikach badań za pomocą Skali Ashwortha (**Adv Clin Exp Med 2012, 21, 4, 513–517**).

Słowa kluczowe: rehabilitacja, udar niedokrwienny, NDT-Bobath, Skala Ashwortha, napięcie mięśniowe, kończyna górna.

Stroke has been defined in the *MeSH* database [1] since 2000 as "a group of pathological conditions characterized by sudden, non-convulsive loss of neurological function due to brain ischemia or intracranial hemorrhages. Stroke is classified by the type of tissue necrosis, such as the anatomic location, vasculature involved, etiology, age of the affected individual, and hemorrhagic vs.

non-hemorrhagic nature". According to the most popular Polish definition, popularized by Prof. Członkowska, stroke is a clinical syndrome characterized by sudden onset of focal symptoms or general disturbances in brain functioning, maintained for more than 24 hours (if not causing death) with only vascular causes [2–6]. According to epidemiologic studies, the annual number of people suffering from a stroke is estimated worldwide to be 15 million, including 5 million deaths each year. The incidence of stroke in Poland is reported to vary between 125/100,000 and 175/100,000. The total number of stroke cases in Poland is estimated to be 70,000 per year [2–6]. It has been established that among all stroke cases:

– ischaemic stroke constitutes 80–85%,

– hemorrhagic stroke constitutes 10–12%,

– subarachnoid hemorrhage (SAH) constitutes 5–7% [2–6].

Effects of a stroke can include: sudden weakness, numbness of face, arm or leg, most often on one side of the body, difficulty speaking (or understanding speech), difficulty seeing with one or both eyes, difficulty walking, increased or decreased muscle tone, loss of balance or coordination, headache, fainting or unconsciousness. The effect of a stroke depends mainly on the injured area of the brain and severity of the lesion.

It is estimated, that 60% of patients after stroke suffer from motor deficits, and 50% of them suffer from a limited independence because of it, needs help/care of another person in daily living or is unable to work and/or participate in community life [7, 8]. In this way, stroke has become a significant medical, social and financial problem. There is great interest in looking for a more effective method of post-stroke patient rehabilitation. The aim of this study was to assess the results of post-stroke rehabilitation based on the NDT-Bobath method for adults in the normalization of muscle tonus in the upper limbs. Muscle tonus was estimated using the Ashworth Scale for Grading Spasticity [9–11]. This scale is well known and widely used both in clinical practice and in scientific research. The reliability of the scale using Kendall's tau correlation = 0.89–0.99 [12].

The NDT-Bobath method for adults is one of the leading methods in post-stroke rehabilitation [13–18]. Its beginning was in the 1940s, but achieved worldwide popularity in adult rehabilitation following the book "Adult hemiplegia: evaluation and treatment", written by Berta Bobath [19]. The first part of the name is an abbreviation for Neurodevelopmental Treatment. The second part derives from the name of the method's authors, Karel and Berta Bobath. In the United States the method is better known as the NDT method and in Europe as the Bobath method. To avoid misunderstandings, the double-barreled name NDT-Bobath is often used. The NDT-Bobath method is well known in Poland, but mainly in the area of treatment of children with CNS disorders. All around the world, it is successfully used in the therapy of adults with neurological disorders too. The method is not a set of exercises but a whole concept, which contains analysis of level of disability, assessment of functional deficits and their causes. The uniqueness of the method lies in attempts to integrate both sides of the body, affected and unaffected. Particular attention is paid to "direct" therapy – to stimulate use of the affected side. A fundamental role is played by the plasticity of the brain. It is this ability of CNS to restore the brain to a normal state after damage and to modify its own structure and functions. NDT-Bobath therapists should be very good at the analysis of normal physiological human movement, so it is necessary for them to have extensive knowledge in the areas of anatomy, neurophysiology, neurology and biomechanics. A problem solving approach, analysis leading from the cause to the goals of the therapy and ways to achieve it makes it possible to plan the intervention. One of the effects of CNS damage is often increased/decreased muscle tone, influencing the motor possibilities of the patient. Rehabilitation using the NDT-Bobath method can be an effective way to solve patients' problems in this area. Despite wide use of NDT-Bobath, there is a lack of studies in the area of outcomes of post-stroke rehabilitation using the NDT-Bobath method [20–24] including spasticity therapy [25, 26].

Material and Methods

The study involved 60 patients following ischaemic stroke, made up of 30 females and 30 males, 30 left-side paresis and 30 right-side paresis. Study groups were established on the basis of the criteria described. Inclusion criteria were as follows: age above 18 years, time after CVA – from 6 weeks to 3 years, diagnosis: ischaemic stroke. Inclusion of the patients was confirmed by medical records in each case. The patients' profiles are presented in Table 1.

Patients were treated according to the guidelines of the method by therapist experienced in the NDT-Bobath method for adults with the following international certificates:

– International Bobath Instructor Training Association (IBITA) recognized Basic Course "Assessment and Treatment of Adults with Hemiplegia – The Bobath Concept" – (110 hours),

– IBITA recognized Advanced Course "Assess-

Table 1. Patients' overall profile

Tabela 1. Charakterystyka badanych chorych

	Patients (Pacjenci) (n = 60)
Side of paresis (Strona niedowładu)	
left (L)	30 (50%)
right (P)	30 (50%)
Sex (Płeć)	
females (K)	30 (50%)
males (M)	30 (50%)
Age – years (Wiek– lata)	
min	42
max	86
mean	65.7
Time after cerebrovascular accident (CVA) (Czas po incydencie udarowym)	
6 weeks – 6 months	20 (33.33%)
> 6 months – 1 year	13 (21.67%)
> 1–2 years	14 (23.33%)
> 2–3 years	13 (21.67%)

ment and Treatment of Adults with Neurological Conditions – The Bobath Concept" (35 hours),

– additionally (earlier) European Bobath Tutors Association (EBTA) recognized "NDT-Bobath Basic Course in the Assessment and Treatment of Children" (400 hours).

10 sessions of the NDT-Bobath therapy were provided over 2 weeks (10 days of the therapy). Two weeks is a standardized period of outpatient rehabilitation in Poland. Each session lasted 30 minutes. Examination using the Ashworth Scale for Grading Spasticity (Table 2) was done twice, the first time upon admission and the second time after the last session of the therapy (where possible because of the patients' health status).

The study was accepted by the appropriate Bioethical Committee. The subjects gave written informed consent before entering the study, in accordance with the recommendations of the Bioethical Committee, acting on the rules of Good Clinical Practice and the Helsinki Declaration.

The results were statistically analyzed using a Wilcoxon's test.

Statistical analysis of the data was performed using Statistica software.

Results

The results are presented in Tables 3–4. This study has focused on the determination of changes observed as a result of the therapy conducted according to the NDT-Bobath method in a group of patients after ischaemic stroke in the area of muscle tone. This element is one of the most often impaired as a result of stroke. There were statistically significant changes reflecting recovery as the result of the therapy using the NDT-Bobath method. Observed changes reflect a recovery in the area of muscle tone. Among 60 patients (100%) involved in the study, the results measured with the Ashworth Scale were as follows:

– recovery in 16 cases (26.67%),

– relapse in 1 case (1.67%),

– no measurable changes (or change within the same grade of the Ashworth Scale) in 8 cases (13.33%).

Thirty-five patients (58.33%) had normal muscle tone upon admission. They were assessed as grade 0 on the Ashworth Scale. Because of this result, recovery in these patients (i.e. decrease in spasticity) was not accessible.

Table 2. Skala Ashwortha (ang. Ashworth Scale for grading spasticity) [12]. The Ashworth scale is one of the most widely used methods of measuring spasticity, due in a large part to the simplicity and reproducible method. Spasticity is assessed by the therapist by passive range of motion (ROM) in elbow flexion or extension. During examination, the patient is lying back

Tabela 2. Test pomiaru napięcia mięśniowego – Skala Ashwortha [12]

Grade (Stopień)	Description (Opis)
0	no increase in muscle tone
1	slight increase in muscle tone, manifested by a catch and release or by minimal resistance at the end of the range of motion when the affected part(s) is moved in flexion or extension
2	more marked increase in muscle tone through most of the ROM, but affected part(s) easily moved
3	considerable increase in muscle tone, passive movement difficult
4	affected part(s) rigid in flexion or extension
Result (Wynik)	

Table 3. Results of study for all patients

Tabela 3. Wyniki badań dla całej grupy

Result of Ashworth Scale for grading spasticity [grades] (Wynik Skali Ashwortha [pkt])	Number of patients in the examination (Liczba chorych w badaniu)	
	first	second
0	36	41
1	9	9
2	7	5
3	6	5
4	2	0
Total (Razem)	60	60

In all cases with recovery, this level of recovery was 1 grade. The greatest number of recoveries was observed from grade 1 to grade 0 on the Ashworth Scale. It implicates the conclusion that, in the area of muscle tension normalization, the NDT-Bobath method is most efficient in cases of mid-range increased muscle tension. In cases of increased muscle tension, it has been lowered using the described therapy. The difference in the results of the first and second examination is statistically significant (Wilcoxon's test: $p = 0.001$).

Discussion

Unfortunately, there is a lack of studies using the NDT-Bobath method for adults to compare the outcomes of this study. There is a need to provide further studies in the area as independent sources of knowledge necessary to estimate the effectiveness of the NDT-Bobath method for adults in the normalization of muscle tone in post-stroke patients. What is widely discussed [20, 23] as one of the criteria of the study should be an extensive knowledge by the therapists of the NDT-Bobath method for adults, confirmed with international certificates and several years of experience in the method after courses. There is a strong belief [20, 23] that only the outcomes of the therapy provided by such experts can be comparable. Unfortunately, the number of certificated medical specialists in this area is still low, despite increases each year.

In conclusion, as a result of therapy using the NDT-Bobath method, statistically significant changes have been observed in the health status of patients. These changes, in the area of muscle tone, were favorable and reflected the outcomes of the assessment using the Ashworth Scale for grading spasticity.

Planned further direction of this study is the assessment of the most favorable results of the therapy which were achieved, with regard to prognostic signs in the patients' sex, age, side of paresis and time from CVA.

Table 4. Results of patients who achieved recovery (n = 16)

Tabela 4. Wyniki pacjentów, którzy osiągnęli poprawę (n = 16)

Grade of recovery [grades] (Stopień poprawy [pkt])	Level of recovery [grades] (Wielkość poprawy [pkt])	Number of patients with recovery (Liczba pacjentów, którzy osiągnęli poprawę)	Percentage with reference to number of patients with recovery [%] (Udział procentowy w stosunku do całkowitej liczby pacjentów, którzy osiągnęli poprawę [%])
1 –> 0	1	6	37.5
2 –> 1	1	5	31.25
3 –> 3	1	3	18.75
4 –> 3	1	2	12.5

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