Turkish Journal of Cerebrovascular Diseases 2021; 27(1): 27-33
Turk J Cereb Vasc Dis
doi: 10.5505/tbdhd.2021.64426

Türk Beyin Damar Hastalıkları Dergisi 2021; 27(1): 27-33

ORIGINAL ARTICLE **ÖZGÜN ARAŞTIRMA**

INVESTIGATION OF EARLY TERM NEURODEVELOPMENTAL TREATMENT-BOBATH APPROACH RESULTS IN PATIENTS WITH STROKE

Gökhan YAZICI[1], Arzu GÜÇLÜ GÜNDÜZ[1], Hale Zeynep BATUR ÇAĞLAYAN[2], Çağla ÖZKUL[1], Melek VOLKAN YAZICI[3], Bijen NAZLIEL[2]

[1]Gazi University, Faculty of Health Sciences, Department of Physical Therapy and Rehabilitation, Ankara, TURKEY
[2]Gazi University, Faculty of Medicine, Department of Neurology, Ankara, TURKEY
[3]Yüksek İhtisas University, Faculty of Health Sciences, Department of Physical Therapy and Rehabilitation, Ankara, TURKEY

ABSTRACT

INTRODUCTION: Neurodevelopmental-Bobath (NDT-B) approach is a problem-solving method used in assessment and treatment of individuals with neurological conditions. The purpose of this study is to investigate the effects of NDT-B approach on functional recovery in patients with acute ischemic stroke.
METHODS: Thirty-nine patients with acute ischemic stroke were included in the study. The patients were randomly assigned to NDT-B (n: 21) and standard rehabilitation (SR) (n: 18) groups. The patients were evaluated with Stroke Rehabilitation Assessment of Movement Scale (STREAM), Trunk Impairment Scale (TIS), Berg Balance Scale (BBS) and Barthel Index (BI) before initiation of the rehabilitation program and before discharge. In the NDT-B group, the rehabilitation program was applied according to the Bobath method, five days per week, 60 minutes per session. In the SR group, exercises were applied according to the hospital routine.
RESULTS: NDT-B reduced hospitalization period (median 8 days vs. 11.5 days, p=0.02) and was more effective than SR in improving mobility and balance. When the treatment methods were compared, it was observed that lower extremity and basic mobility skills improved more in the NDT-B group. Significant improvements were achieved only in the NDT-B group in BBS. Improvements were observed in TIS and BI in both groups following treatment ($p < 0.05$). No complications were encountered during the study.
DISCUSSION AND CONCLUSION: Bobath rehabilitation is a task-oriented, multi-repetitive, 24-hour rehabilitation approach and due to these components it has direct impact on level of disability. Early initiation of rehabilitation programs and supporting rehabilitation with the Bobath approach may provide promising results.
Keywords: Acute, stroke, rehabilitation.

Address for Correspondence: Gökhan Yazıcı, PT, PhD. Gazi University Faculty of Health Sciences, Department of Physical Therapy and Rehabilitation, Ankara, Turkey.
Phone: +90 312 216 26 78 **E-mail:** gokhanyazici38@hotmail.com
Received: 13.02.2021 **Accepted:** 04.03.2021
ORCID IDs: Gökhan Yazıcı 0000-0002-9270-2290, Arzu Güçlü Gündüz 0000-0001-8464-1929, Hale Zeynep Batur Çağlayan 0000-0002-3279-1842, Çağla Özkul 0000-0001-9367-9910, Melek Volkan Yazıcı 0000-0001-9686-0571, Bijen Nazlıel 0000-0002-6148-3814.
Please cite this article as following: Yazıcı G, Güçlü Gündüz A, Batur Çağlayan HZ, Özkul Ç, Volkan Yazıcı M, Nazlıel B. Investigation of early term neurodevelopmental treatment-Bobath approach results in patients with stroke. Turkish Journal of Cerebrovascular Diseases 2021; 27(1): 27-33. doi: 10.5505/tbdhd.2021.64426

İNMELİ HASTALARDA ERKEN DÖNEM NÖROGELİŞİMSEL TEDAVİ-BOBATH YAKLAŞIMI SONUÇLARININ İNCELENMESİ

ÖZ

GİRİŞ ve AMAÇ: Nörogelişimsel-Bobath (NDT-B) yaklaşımı, nörolojik hastalığı olan bireylerin değerlendirilmesi ve tedavisinde kullanılan bir tedavi yöntemidir. Bu çalışmanın amacı; iskemik inmeli hastalara akut dönemde uygulanan Nörogelişimsel Tedavi-Bobath (NGT-B) yönteminin fonksiyonel iyileşme üzerine etkilerinin incelenmesidir.
YÖNTEM ve GEREÇLER: Çalışmaya otuz dokuz akut iskemik inmeli hasta dahil edildi. Hastalar randomize olarak NGT-B (n: 21) ve standart rehabilitasyon (SR) (n: 18) gruplarına ayrıldı. Hastalar fizyoterapi programına başlamadan önce ve taburculuktan hemen önce: İnme Rehabilitasyonunda Hareket Değerlendirme Ölçeği (STREAM), Gövde Bozukluk Ölçeği (GBÖ), Berg Denge Ölçeği (BDÖ) ve Barthel İndeksi (Bİ) ile değerlendirildi. NGT-B grubundaki hastalara rehabilitasyon programı Bobath yöntemine uygun başlatıldı ve her seans 60 dakika olmak üzere; haftada beş gün uygulandı. SR grubuna hastanede uygulanan rutin programındaki egzersizler (pasif eklem hareketi ve yatak içi egzersizler) uygulandı.
BULGULAR: NGT-B'ın, hastanede geçirilen süreyi azalttığı, akut iskemik inme olan bireylerde mobilite ve dengeyi iyileştirmede SR'dan daha etkili olduğu görüldü (ortanca 8 güne karşı 11,5 gün, p = 0.02). İki tedavi yöntemi karşılaştırıldığında, NGT-B grubunda özellikle temel mobilite ve alt ekstremite becerilerinin daha fazla geliştiği görüldü. BDÖ'de yalnızca NGT-B grubunda önemli gelişmeler sağlandı. Her iki grupta da GBÖ ve Bİ ile tedaviler sonrası gelişme gözlendi (p <0.05). Çalışma sırasında herhangi bir komplikasyona rastlanmadı.
TARTIŞMA ve SONUÇ: Bobath rehabilitasyonu klasik egzersizlerden farklı olarak görev odaklı, çok tekrarlı ve 24 saati içeren bir rehabilitasyon yaklaşımı olmasından dolayı özürlülük düzeyi üzerine direkt etkisi vardır. Yapılacak olan rehabilitasyon programlarına erken dönemde başlanması ve Bobath yaklaşımıyla desteklenmesi daha iyi sonuçlar elde edilmesini sağlayabilir.

Anahtar Sözcükler: Akut, inme, rehabilitasyon.

INTRODUCTION

Neurodevelopmental-Bobath (NDT-B) approach is a problem-solving method used in the assessment and treatment of individuals with neurological conditions. According to this approach, lesions in the central nervous system cause impairments in the coordination of movement and posture combined with problems in muscle tone which lead directly to functional limitations. Due to the fact that more practice leads to better motor learning and increases neural plasticity, practice has a great role in treatment in this approach. Moreover, factors such as the type and duration of rehabilitation, the compatibility of the patient and the amount of daily activity affect motor learning and plasticity. It is also advocated that early, intensive and repetitive training may contribute to motor learning. Therefore, it is important to manage the rehabilitation process after stroke precisely (1).

According to NDT-B, the duration of treatment should not be limited to rehabilitation sessions, but should be designed to be applied throughout the day and should be adapted to the daily life of patients. In order to apply to the newly learned movements in daily life, the caregivers should be assistive in treatment and the environment should be suitable. As gains integrated into activities in daily life are used over and over in various forms, it will be easier and quicker to increase motor learning and the quality of movement (2).

Early rehabilitation programs are developed according to the patients' general clinic condition. Even though it is important to initiate rehabilitation programs early and intensely, when put into practice, the duration of rehabilitation sessions is limited. For this reason, it is not known whether the duration of the applied physiotherapy programs is sufficient. When the principles of motor learning are taken into consideration, increasing the duration and quality of the treatment in stroke patients will be beneficial (3).

In literature, it is seen that early term physiotherapy programs focus more on approaches to prevent complications that may arise and exercise-based approaches are used in this period. Among these approaches NDT-B which is based on motor learning, neural plasticity, the systems theory of motor control and primary features of functional movement, is constantly

developing and widespread in rehabilitation practices. However, the number of studies investigating the effects of NDT-B in early term phase of stroke are inadequate (1, 4-6). Therefore, the aim of this study was to investigate the effects of the NDT-B approach applied in the early term of stroke on functional recovery as assessed by postural control, functional movement, balance and activities of daily living.

METHODS

Patients: Participants who were admitted to the Emergency Service of Gazi University Hospital and were diagnosed with acute ischemic stroke by a neurologist were included in the study. Neurologic assessment was performed with National Institutes of Health Stroke Scale (NIHSS) by a neurologist blind to the study (7). The Turkish version of NIHSS was used in this study (8). The inclusion criteria were set as: being older than 18 years of age, having a disability level of ≤4 according to modified Rankin Scale (9) and being able to respond to verbal commands. Participants with a history of previous stroke, accompanying progressive neurological disturbances, acute coronary disease, severe heart failure, rheumatologic diseases, a fracture or an acute orthopedic disorder that would prevent mobilization were excluded from the study. The ethical approval was obtained from Gazi University Ethics Committee (Date: 07.01.2020, Number: 01) and the authors conformed to the ethical guidelines of the 1975 Declaration of Helsinki. Written consents were obtained from participants or their caregivers prior to the study. The study was registered on clinicaltrials.gov with an ID 196 of NCT 03602326.

Study Design: The study was planned as a randomized controlled design and the randomization was performed by using an internet-based method (randomizer.org) by a physiotherapist blind to the study groups. The therapists performing the exercises, the therapists assessing the outcomes and the participants were also blind to the study. Eighty-four ischemic stroke survivors were assessed for the eligibility. Forty-two participants were randomized into two groups: NDT-B Group and the standard rehabilitation (SR) group. The study was completed with 39 acute ischemic persons with stroke.

The flow chart of the study is given in Figure 1.

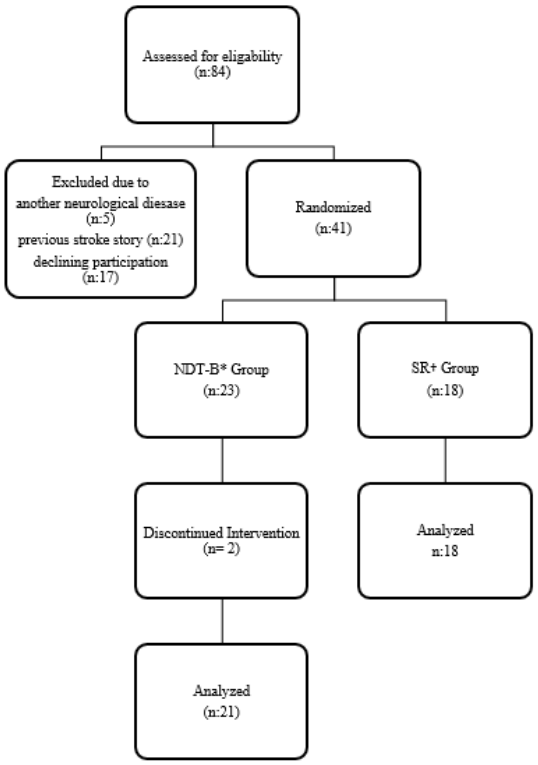

Figure 1. Flowchart of the study.

Outcome Measures: All participants who agreed to participate in the study were evaluated before initiating the rehabilitation program. The demographic data as age, gender, side of stroke, time to reach the hospital after the stroke, the initiation time of the physiotherapy after the stroke and total length of stay in hospital were recorded.

The Stroke Rehabilitation Assessment of Movement Scale (STREAM) was used to assess functional movements and mobility. The scale consists of two subsections and a total of 30 tests evaluating the performance and the quality of the individual's voluntary limb movements (20 tests) and basic mobility activities (10 tests). The total score is 70. A higher score indicates less motor impairment, while a lower score indicates increased motor impairment (10).

The Trunk Impairment scale (TIS) was used to assess sitting balance and postural control. TIS consists of 3 sections and 17 tests evaluating static-dynamic sitting balance and coordination. The total score is 23. A higher score indicates

better control of the trunk while a lower score indicates poor postural trunk control (11). The Turkish reliability and validity of the scale was performed in stroke patients previously by Sag et al was used in this study (12).

The Berg Balance Scale (BBS) was used to assess functional balance. BBS consists of 14 tests evaluating balance during postural changes, at different positions and during movement. Each test is rated from 0 to 4 and the total score ranges from 0 to 56. A higher score indicates better balance (13). The Turkish form of the BBS which was translated into Turkish by Sahin et. al, was used in this study (14).

The Barthel Index (BI) was used to assess independence in activities of daily living. In this scale consisting of 10 items the total score ranges from 0 to 100. According to the total score obtained, the individuals' level of dependence in activities of daily living is categorized. Scores of: 0-20 indicate total dependency, 21-60 indicate severe dependency, 61-90 indicate moderate dependency, 91-99 indicates slight dependency and 100 points indicates the patient is fully independent (15). The Turkish version of BI which was translated by Kucukdeveci et al. was used in this study (16). Permission to use the index was obtained from the authors.

Evaluation and Medical treatment: In order to determine the etiology of stroke routine blood tests, electrocardiography (ECG), cranial computerized tomography (CT) and diffusion weighted imaging (DWI), CTA (CT Angiography) and/or MR angiography, and/or carotid and or vertebral artery doppler ultrasonography(USG), echocardiography(ECHO) heart rhythm [based on 24-hour rhythm Holter monitoring) were conducted for each patient at admission. In eligible participants, specific treatments for acute ischemic stroke (Intravenous thrombolytic therapy and/or mechanical thrombectomy) were given/performed. All participants received antithrombotic therapy for secondary prevention from stroke.

Interventions: The criteria for the application of physiotherapy was: having a systolic blood pressure between 120 and 220 mmHg, having an oxygen saturation >92% (with or without O2 support), having a heart rate of 40 to 100 beats/min, having a body temperature of <38.5°C (17).

Neuro - Developmental Treatment - Bobath Group (NDT-B group): NDT-B principles and exercises were performed daily for five days a week, 60 minutes per session. The participants were included in the rehabilitation program as early as possible and the program continued until the participants were discharged. The program was initiated according to the principles of the Bobath method by an experienced NDT-B physiotherapist. NDT-B exercises were implemented according to the status of the participants and were used to maintain and improve muscle strength and endurance. Both the unaffected and affected side were included in rehabilitation. The exercises given were designed to be simple, understandable, task-oriented and repetitive in accordance to the Bobath approach and were performed in supine, sitting and standing positions. Mobilization was initiated in the first session and in accordance to their conditions, the participants were mobilized in sitting or standing. Mobilization level was gradually increased by changing the participants' position (sitting on the edge of the bed, sitting in a chair, walking) and increasing duration and walking distance. Alongside basic extremity exercises, weight transfer exercises and balance training were applied. During the exercises the importance of the quality of the movement was emphasized and external support was provided if necessary. The patient was asked to actively participate in the exercises. In order to prevent motor amnesia and neglect of the affected side correct positioning and sensory input were provided. Additionally, the patient and their caregivers were trained about resting positions, transfers and walking. Participants and their caregivers were asked to repeat the given exercises at least twice during the day and whether the exercises were performed or not was checked the next session (2).

Standard Rehabilitation Group: The standard rehabilitation sessions were performed by clinical physiotherapists according to the hospital routine, five days a week. The standard rehabilitation consisted of joint range of motion exercises in-bed and bedside sitting and walking according to the participants' functional capacity.

Statistical Analysis: Statistical analyses of the study were carried out with "statistical package for social sciences" (SPSS) version 21.0 (SPSS INC.,

Chicago, IL, USA) software. Categorical variables were noted in frequency and percentage. The normal distribution of the data was analyzed with visual (histogram and probability graphs) and analytical (Shapiro-Wilk test) methods. Mann-Whitney U test was used since the data was non-normally distributed. The level of significance was set at $p< 0.05$. According to post-hoc analysis which was based on BBS, our sample size achieved 90% power (18). This indicates an adequate sample size for interpreting our results.

RESULTS

A total of 39 participants were randomly allocated to the NDT-B or SR groups. The groups were not significantly different in age, gender, side of stroke, NIHSS or modified Rankin score. Information on the participants' demographics and characteristics is provided in Table 1.

Table 1. Characteristics of subjects.

	Experimental Group N=21 Median (IQR 25/75)	Control Group N=18 Median (IQR 25/75)	p
Age (year)	66 (59.5-78.5)	65.5 (58.5-79.25)	0.917
Weight (kg)	79 (71-87.5)	80 (71.5-90)	0.811
Height (cm)	165 (158.5-175)	164 (158.75-172)	0.956
BMI (kg/m^2)	28.02 (25.2-32.26)	28.53 (26.72-31.27)	0.890
MRS^	4 (4-4)	4 (2.75-4)	0.383
FAS^	0 (0-1)	1.5 (0-3)	0.032*
NIHSS^	6 (4.5-7)	4.5 (3-6)	0.125

BMI: Body Mass Index, MRS: Modified Rankin Scale, FAS: Functional Ambulation Scale, NIHSS: National Institutes of Health Stroke Scale ^: 'at baseline', $p<0.05$.

When the hospitalization period of the two groups was compared, participants treated according to NDT-B stayed less days in hospital than those treated according to SR (median 8 days versus 11.5 days, $p= 0.02$).

All of the subscales and the total STREAM score, TIS, BBS and BI scores were improved at the discharge in NDT-B group ($p<0.05$, Table 2).

The upper extremity subscale and total STREAM score, TIS and BI were improved in SR group ($p<0.05$, Table 2). Lower extremity and basic mobility subscales of STREAM and BBS score were not changed in the SR group ($p>0.05$, Table 2). When the improvements between the groups were analyzed, it was found that the STREAM, TIS and BI scores improved more in the NDT-B group ($p<0.05$, Table 3). The participants were able to tolerate both of the treatment programs and no complications were encountered in any of the participants.

DISCUSSION

In the present study, which was planned to investigate the effects of NDT-B applied in the early term of ischemic stroke, it was seen that persons with stroke who received NDT-B achieved more gains in balance, basic mobility skills and better functional recovery at discharge when compared to the participants who received SR.

Many advantages can be obtained with early discharge such as, reducing risks associated with prolonged inpatient care, allowing the patient to adapt to daily life and saving in costs. For example, early discharge frees up hospital beds for other patients on waiting lists. Thus, any savings obtained from an early discharge may be used by other patients that can therefore receive care (19). According to our results, it can be seen that applying NDT-B leads to an earlier discharge with better functional outcome. Since the stay in hospital is less in the NDT-B group the cost of hospitalization is lower than the SR group.

Many methods are used to recover lost function in stroke patients. The timing of these rehabilitation methods is just as significant as their content. Rehabilitation approaches administered in the chronic period may not fully show their effects due to the decrease in healing and plasticity processes. Additionally, patients can benefit from the effects of brain plasticity more in the early period. Patients develop compensation against paresis after stroke and this is inevitable. The development of compensation leads to disorders in gait, a decrease in quality of movement and accordingly, dependence on others in daily life increases. In order to prevent these negative results, the main objective should be to achieve correct and high quality movement via early intervention before these compensations are developed. In literature, it can be seen that studies including the NDT-B approach in the early term of stroke are inadequate.

Balcı et al. (4) examined the effects of NDT-B on motor functions, balance and independence in the early phase of acute ischemic stroke. All participants received a rehabilitation program consisting of NDT-B for five days a week, twice a day during the hospitalization period. The researchers reported that NDT-B implemented in the early period improved motor and functional capacity and increased independence in activities of daily living. Even though the findings of our

Table 2. Comparison of assessments results in stroke patients at onset and discharge.

			NDT-B Group N=21 IQR (25/75)		Standard Rehabilitation Group N=18 (IQR 25/75)		
	Baseline Median (IQR 25/75)		Discharge Median (IQR 25/75)	p	Baseline Median (IQR 25/75)	Discharge Median (IQR 25/75)	p
TIS	8 (3-12)		16 (14-18.5)	<0.001*	13.5 (5.5-17.25)	17 (11-19.75)	0.004*
BI	45 (27.5-57.5)		75 (65-85)	<0.001*	67.5 (55-80)	75 (58.75-95)	0.001*
BBS	6 (3-7)		31 (20.5-41)	0.001*	22 (6-39.5)	22 (16.75-41.75)	0.112
STREAM	Upper Extremity	10 (8-16)	16 (12-19)	<0.001*	12.5 (9-16.75)	15 (11-19.25)	0.004*
	Lower Extremity	13 (9.5-16.5)	18 (14.5-19.5)	<0.001*	14.5 (9.5-18.25)	16 (12.5-18.25)	0.236
	Trunk	12 (6.5-16)	20 (19-25.5)	<0.001*	18.5 (10-24)	18 (16-26)	0.112
	Total	36 (28-47.5)	54 (47-62.5)	<0.001*	46.5 (30-56.75)	48 (38-63)	0.045*

TIS: 'Trunk Impairment Scale', BI: 'Barthel Activities of Daily Living Index', BBS: 'Berg Balance Scale', STREAM: 'The Stroke Rehabilitation Assessment of Movement', p<0.05

Table 3. Comparison of improvements in results between groups.

		NDT-B N=21 IQR (25/75)	Standard Rehabilitation Group n:18 IQR (25/75)	p
ΔTIS		9 (5.5/10.5)	2 (0/7)	0.001*
ΔBI		30 (25/40)	5 (0/10)	<0.001*
ΔBBS		25 (13/31.5)	4 (-3.25/14.25)	<0.001*
ΔSTREAM	Upper Extremity	3 (1/7)	3.5 (0.75/5.25)	0.506
	Lower Extremity	5 (1.5/7)	3 (-2.75/8)	0.462
	Trunk	9 (5.5/12.5)	2.5 (-2/6.5)	<0.001*
	Total	17 (9.5/22.5)	9.5 (-5.25/17.5)	0.024*

TIS: 'Trunk Impairment Scale', BI: 'Barthel Activities of Daily Living Index', BBS: 'Berg Balance Scale', STREAM: 'The Stroke Rehabilitation Assessment of Movement', p<0.05

studies are similar, the study conducted by Balci et. al had no control group making it difficult to distinguish whether the positive effects were solely due to the Bobath approach.

According to the pilot trial conducted by Poletto et al., (6) early mobilization after acute ischemic stroke was safe and feasible. The researchers investigated the results of rehabilitation applications of NDT-B and SR initiated within 48 hours. As a result, the researchers concluded that mobilization which consisted of NDT-B exercises and was initiated in the early phase was reliable and feasible, however no statistically significant difference was found in terms of outcome measures at discharge between NDT-B and SR groups. Compared to their findings, we have found that statistically NDT-B was superior to SP. The family was educated regarding the exercises and they repeated the given exercise program. Actually, we believe that we applied the NDT-B exactly as it should be, repetitive and intensive. Thus the difference between the studies may have occurred due to the increased number of NDT-B sessions in our study.

Brock et al. (5) investigated how NDT-B approach in conjunction with task-oriented gait training compared to only task-oriented gait training influenced gait characteristics in persons with stroke. As a result, in both groups, the walking performance and balance of the individuals had improved whilst gait velocity increased further in the group which NDT-B was implemented. Our results are similar to this study. The NDT-B approach focuses on functional rehabilitation with multiple repetitions, therefore it has more effect on motor learning. In our study, our NDT-B program was also applied with multiple repetitions and throughout the day to increase motor learning and we believe that our positive results are due to these factors.

We also observed improvements in the SR group. However, our results showed us that with SR, we can only provide limited benefits and can only prevent complications. These developments were not as much as in the NDT-B group. In our opinion, the greater improvements obtained in the NDT-B group could be associated with rehabilitation being applied throughout the day.

The NDT-B approach has a direct effect on the results of rehabilitation because unlike classical exercises, it is a task-oriented, 24-hour rehabilitation approach with multiple-repetitions. Our findings imply that initiating rehabilitation programs in the early phase and supporting the

programs with the NDT-B approach could lead to better results.

In addition, our study provides detailed information on the content and intensity of the NDT-B approach applied in the early phase of stroke. The results and information obtained from our study are thought to guide physiotherapists working in this field.

The limitations of this study are that this study only provides the short term effects of NDT-B in persons with acute stroke and long-term effects in larger groups should be investigated to draw definite conclusions.

As conclusion, the use of the NDT-B approach in the early term of stroke rehabilitation was found to be more effective compared to SR. It should be advocated that applying rehabilitation methods throughout the day and using methods which emphasize the functionality of the patient will help to obtain better results.

REFERENCES

1. Vaughan-Graham J, Cott C, Wright FV. The Bobath (NDT) concept in adult neurological rehabilitation: what is the state of the knowledge? A scoping review. Part II: intervention studies perspectives. Disabil Rehabil 2015; 37(21): 1909-1928.
2. Gjelsvik BEB, Syre L. The Bobath concept in adult neurology. 2nd ed. Stuttgart: Thieme; 2016.
3. Langhorne P, Wu O, Rodgers H, et al. Very Early Rehabilitation Trial after stroke (AVERT): a Phase III, multicentre, randomised controlled trial. Health Technol Assess 2017; 21(54): 1-120.
4. Balcı B, Ertekin E, Kara B, et al. The Effects of Inpatient Rehabilitation Program in Acute Stroke Patients. J Neurol Sci Turk. 2011;28(2):142-154.
5. Brock K, Haase G, Rothacher G, et al. Does physiotherapy based on the Bobath concept, in conjunction with a task practice, achieve greater improvement in walking ability in people with stroke compared to physiotherapy focused on structured task practice alone? A pilot randomized controlled trial. Clin Rehabil 2011; 25(10): 903-912.
6. Poletto SR, Rebello LC, Valença MJM, et al. Early mobilization in ischemic stroke: a pilot randomized trial of safety and feasibility in a public hospital in Brazil. Cerebrovasc Dis Extra 2015; 5(1): 31-40.
7. Goldstein LB, Samsa GP. Reliability of the National Institutes of Health Stroke Scale: extension to non-neurologists in the context of a clinical trial. Stroke 1997; 28(2): 307-310.
8. Turkish Neurological Society. Akut iskemik inmede intravenöz doku plazminojen aktivatörü (tpa) kullanım cep kitabı. 1st ed. İstanbul: Galenos Press; 2017.
9. Sulter G, Steen C, De Keyser J. Use of the Barthel index and modified Rankin scale in acute stroke trials. Stroke. 1999; 30(8): 1538-1541.
10. Ahmed S, Mayo N, Higgins J, et al. The Stroke Rehabilitation Assessment of Movement (STREAM): A Comparison With Other Measures Used to Evaluate Effects of Stroke and Rehabilitation. Phys Ther 2003; 83(7): 617-630.
11. Verheyden G, Nieuwboer A, Mertin J, et al. The Trunk Impairment Scale: a new tool to measure motor impairment of the trunk after stroke. Clin Rehabilitation 2004; 18(3): 326-334.
12. Sağ S, Buyukavci R, Sahin F, et al. Assessing the validity and reliability of the Turkish version of the Trunk Impairment Scale in stroke patients. North Clin Istanb 2019; 6(2): 156-165.
13. Berg K, Wood-Dauphinee S, Williams JI. The Balance Scale: reliability assessment with elderly residents and patients with an acute stroke. Scand J Rehabil Med 1995; 27(1): 27-36.
14. Sahin F, Yilmaz F, Ozmaden A, et al. Reliability and validity of the Turkish version of the Berg Balance Scale. J Geriatr Phys Ther 2008; 31(1): 32-37.
15. Collin C, Wade DT, Davies S, et al. The Barthel ADL Index: a reliability study. Int Disabil Stud 1988; 10(2): 61-63.
16. Kucukdeveci A, Yavuzer G, Tennant A, et al. Adaptation of the modified Barthel Index for use in physical medicine and rehabilitation in Turkey Scand J Rehabil Med 2000; 32(2): 87-92.
17. Bernhardt J, Dewey H, Thrift A, et al. A very early rehabilitation trial for stroke (AVERT) phase II safety and feasibility. Stroke 2008; 39(2): 390-396.
18. Hayran M. Sağlık araştırmaları için temel istatistik. 1st ed. Ankara: Omega Araştırma; 2011.
19. Gonçalves-Bradley DC, Iliffe S, Doll HA, et al. Early discharge hospital at home. Cochrane Database Syst Rev 2017; 26(6): 1-109.

Ethics

Ethics Committee Approval: The study was approved by Gazi University Ethics Committee (Date: 07.01.2020, Number: 01).

Informed Consent: The authors declared that informed consent was signed by the patients or their caregivers.

Authorship Contributions: Surgical and Medical Practices: GY, AGG, HZBÇ, ÇÖ, MVY, BN. Concept: GY, AGG, HZBÇ, ÇÖ, MVY, BN. Design: GY, AGG, HZBÇ, ÇÖ, MVY, BN. Data Collection or Processing: GY, AGG, HZBÇ, ÇÖ, MVY, BN. Analysis or Interpretation: GY, AGG, HZBÇ, ÇÖ, MVY, BN. Literature Search: GY, AGG, HZBÇ, ÇÖ, MVY, BN. Writing: GY, AGG, HZBÇ, ÇÖ, MVY, BN.

Copyright Transfer Form: Copyright Transfer Form was signed by all authors.

Peer-review: Internally peer-reviewed.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.