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RESULTS OF REHABILITATION MEASURES IN CHILDREN WITH CEREBRAL PALSY

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ABSTRACT

Objective. To evaluate the results of the rehabilitation program based on the Bobath method, conducted in a hospital for cerebral palsy (CP). Materials and methods. The study included 28 children with CP who were undergoing inpatient treatment in a pediatric hospital. Inclusion criteria: inpatient treatment in our hospital from 2 to 12 years of age with a diagnosis of CP; the presence of one permanent primary caregiver; the absence of medical or psychotic problems in the caregiver. All patients underwent Bobath treatment for I hour per day, 5 days per week. Musculoskeletal, neurological and orthopedic examination, patients' Gross Motor Function Measure (GMFM) and long-term caregivers' Short Form-36 (SF-36) were assessed at hospital admission, hospital discharge and at 1 and 3 months post-discharge. Results. Post-hospital GMFM scores at discharge and at 1 and 3 months showed a significant increase. The SF-36 Social Function and Emotional Role subscales increased significantly at discharge. Conclusions. Bobath treatment is a promising direction in medical rehabilitation and further randomized controlled trials are needed to evaluate the effectiveness of rehabilitation techniques.

KEYWORDS: *Cerebral Palsy, Rehabilitation, Bobath*

INTRODUCTION

Cerebral palsy (CP) describes a group of permanent disorders affecting movement and posture, leading to activity limitations. These disorders are attributed to non-progressive disturbances that occur in the developing fetal or infant brain. Motor impairments in cerebral palsy are often accompanied by sensory, perceptual, cognitive, and communicative deficits, as well as behavioral disorders, epilepsy and secondary musculoskeletal complications [1].

CP is associated with a wide range of issues and presents with diverse symptoms, making it challenging to assess the patient's condition and set rehabilitation goals. When evaluating a child with CP, the type of impairment is identified, functional status and secondary deformities are assessed, patient needs are determined, and an individualized rehabilitation program is developed [2].

Rehabilitation programs for children with CP should be tailored to their age and functional status. The primary goal of rehabilitation in CP is to minimize disability while promoting independence and participation in social life [2].

Although the concept of CP rehabilitation has evolved in recent years to focus on patient participation in daily activities, the neurophysiological approach remains an integral part of combined therapy methods. The neurophysiological approach is based on the principle that sensory stimuli, delivered through various techniques, elicit reflex motor responses. The goal of this approach is to facilitate or inhibit specific muscle groups by stimulating exteroceptors and proprioceptors [3].

The Bobath method is the most widely used motor stimulation technique and is applied globally. In this method, the child is placed in reflex-inhibiting postures (RIP) to reduce spasticity. Specific reflexes and reactions are then stimulated to enhance normal movement perception. Therapists activate key control points on the body, triggering reflexes that promote head and trunk control [2]тя ко

The primary objective of this study was to evaluate the outcomes of inpatient rehabilitation based on the Bobath method for children with CP Additionally, this study assessed certain clinical characteristics of the patients.

MATERIALS AND METHODS

The study population consisted of 28 children with CP who were hospitalized in a pediatric rehabilitation inpatient clinic. Inclusion criteria were as follows: being an inpatient at our hospital aged 2 to 12 years with a confirmed diagnosis of CP: having at least one consistent primary caregiver: and the caregiver having no medical, chronic, or psychotic disorders.
The CP assessment form was completed during a comprehensive evaluation of the musculoskeletal, neurological, and orthopedic

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systems prior to the rehabilitation program. Gross Motor Function Measure (GMFM) scores were assessed and recorded for each patient. Patients were classified according to the Gross Motor Function Classification System (GMFCS), a standardized five-level system developed by Palisano et al. in 1997 for categorizing the gross motor function of children with CP [4]. The reliability of the Turkish version of this scale has been previously demonstrated [5].

GMFM is a standardized observational test used to measure temporal changes in gross motor function in children with CP..
The guidelines and CD containing assessment criteria were prepared with the approval of Russell et al. and were purchased for the study sessions. Patients were evaluated in accordance with these guidelines [6].

All patients underwent Bobath therapy under the supervision of a physical therapist for 1 hour per day, 5 days a week. Patients with restricted joint mobility also performed stretching exercises. Assistive devices and orthoses were provided based on clinical, neurological, and orthopedic assessments. Additionally, during hospitalization, primary caregivers were educated about CP and received instructions on a home exercise program.

The musculoskeletal, neurological, and orthopedic evaluations, along with GMFM and GMFCS assessments, were conducted at hospital admission, discharge, and at 1 and 3 months post-discharge. The length of hospitalization was determined by the lead physical therapist, who was blinded to the inclusion status of patients in the study. Patients also underwent ophthalmologic examinations during which engaging toys were used to maintain their attention. Anxiolytic syrup was administered to agitated patients when necessary The assessment included tests for visual acuity, eye movements, visual evoked potentials (VEP), and electroretinography (ERG). Children aged 4-12 years were evaluated by a psychologist specializing in standardized cognitive assessments using the SD Porteus and Kent EGY tests. The timing of patient discharge was determined by a clinical specialist who was unaware of which children were included in the study.Ethical approval for this study was obtained from the hospital's ethics committee. Since the participants were minors, written informed consent was obtained from their parents or legal guardians. For statistical analysis, the Wilcoxon signed-rank test and paired t-test were used following repeated measures ANOVA to compare patient data recorded at different time points. Spearman's correlation test was applied to assess the relationship between CP type and mental status.

RESULTS

Data from 43 patients with CP were analyzed. However, 15 patients were excluded from the study, and the final assessment included only the remaining 28 patients. The reasons for exclusion were as follows: two patients requested discharge before completing the rehabilitation program, while the remaining excluded patients had irregular attendance or missed follow-up visits..

The 28 evaluated children with CP were aged between 2 and 12 years (mean age: 6.96±2. 82 years). Of these, 12 (42.9%) were boys, and 16 (57.1 %) were girls. Clinically, 24 patients were classified as having spastic CP.

Family history analysis revealed that the parents of 10 (35.7%) participants were first- degree relatives. The mean age at diagnosis was 11.9 + 14.19 months, while the mean age at the start of rehabilitation was 35.6 ± 30.56 months. The average time interval between diagnosis and the initiation of rehabilitation was 23.7 ± 29.88 months. Although 71.4% of children exhibited noticeable issues within the first two years of life, only 9 (32.1%) began rehabilitation within this period. Of the 28 patients, 20 underwent ophthalmologic evaluation. Among them, only one had a normal eye examination. Hypermetropia, myopia, and astigmatism were not classified as refractive defects' these were the most commonly observed findings, followed by strabismus and optic disc pallor, which was identified during retinal examination.

Analysis of speech disorders revealed that 6 patients (21.43%) had normal speech, 7 (25%) had dysarthria, 9 (32.4%) were able to articulate only 1-2 words, and 6 (21.43%) were nonverbal.

Twenty patients underwent psychological testing to assess their mental status. Among them, 3 (15%) had a normal intelligence level, 7 (35%) had mild intellectual disability, 8 (40%) had moderate intellectual disability, and 2 (10%) had severe intellectual disability. No correlation was found between the degree of intellectual disability and the type of CP ($r = 0.11$, $p = 0.932$)..

The average duration of hospitalization for rehabilitation was 50.9 + 18.45 days. Patients were classified according to the GMFCS. At admission, 9 patients were categorized as level 5, which decreased to 6 patients at the 3-month follow-up. Similarly, the number of patients at level 4 decreased from 11 at admission to 9 at the 3-month follow-up. Conversely, the number of patients at level 3 increased from 2 to 7. There was no significant difference in overall GMFM scores between the 1-month and 3-month follow-ups. However, when comparing prehospitalization scores with post-discharge scores at the 1- and 3-month follow-ups, both post-discharge scores showed significant improvement compared to admission. Notably, there was a significant decline in GMFM scores between discharge and the 1-month follow-up (Table 5). Subgroup scores were analyzed separately. Comparisons across the four

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evaluation periods demonstrated significant improvements in sitting and standing parameters at both the 1- and 3- month follow-ups ($p<0.05$). The crawling and kneeling subgroups showed a significant decline between discharge and the 1-month follow-up. Similarly, walking-running-jumping scores significantly increased at discharge, decreased at the 1-month follow-up, and then improved again at the 3-month follow-up ($p<0.05$).

Among the primary caregivers, 24 cases (85.71%) were the patient's mother, while in 4 cases (14.29%), the caregivers were other relatives (aunt, grandmother).

DISCUSSION

The average incidence of cerebral palsy (CP) is approximately 2-3 per 1,000 live births, although it varies by country [7]. A multicenter cross-sectional study conducted in 27 cities in 1996, involving 146 physicians and 50,000 children aged 0 to 16 years, reported a CP prevalence of 0.2% in Turkey [8].

Given the wide variability in the presence and severity of comorbid conditions, cerebral palsy (CP) is considered a spectrum of symptoms rather than a distinct disease. Consequently, the rehabilitation of individuals with CP necessitates a multidisciplinary approach that prioritizes patient needs over the condition itself. Evaluating rehabilitation outcomes in CP is particularly challenging due to the diverse levels of motor and developmental abilities among patients. As a result, distinguishing whether observed improvements are attributable to rehabilitation interventions or the natural course of growth and development remains difficult.

This study evaluated the rehabilitation outcomes of 28 children with cerebral palsy (CP) who underwent inpatient treatment. According to the scientific literature, there is a limited number of such studies conducted in Uzbekistan. The use of 1 -month and 3-month follow-up assessments allowed for continuous monitoring of rehabilitation outcomes and home-based developmental progress after hospital discharge. Additionally, caregivers were provided with repeated information about their child's condition and were encouraged to perform specific exercises at home. However, a significant proportion of patients did not attend follow-up assessments and were lost to further observation. In the present study, 57.1% of patients were female, while 42.9% were male. This differs from a study conducted across 14 centers in Europe, which reported a higher proportion of male patients (M/F ratio = 1.33) [9].

The spastic type of cerebral palsy (CP) is the most common, accounting for approximately 75% of all cases [7]. Recent prevalence studies support this finding [9,10]. Similarly, in the present study, the spastic type had the highest prevalence.

Early diagnosis of cerebral palsy (CP) is crucial for initiating timely rehabilitation. Caregivers were asked to report the first detection of problems in their child. While 71.4% of patients exhibited signs of impairment within the first year of life, only 31.4% began rehabilitation during this period. In a CP population analyzed by Boyle et al., the diagnosis rate by the age of 2 was 35%, whereas 87% of patients were diagnosed by the age of 5 [11].

Among our patients, 14 had hyperopia, 12 had astigmatism, and 4 had myopia. Additionally, 7 patients had strabismus, and 6 exhibited optic disc pallor, a retinal examination finding. In a study by Yuksel et al., among 41 patients with CP, 24 (58.6%) had various visual impairments. They reported that 43.9% of patients had strabismus, while 24.3% had refractive errors [12]. Similarly, in a meta-analysis by Ashwal et al., 28% of patients with CP were found to have visual and ocular motor impairments [13]. A multicenter study conducted in Europe reported severe visual defects in 11.1% of CP patients [9]. The variability in the prevalence of visual impairments is associated with differences in the timing and severity of brain injury, the location of the lesion, and the resulting spectrum of visual disturbances depending on the type of CP.

The literature includes studies aimed at identifying visual markers in CP [14,15]. However, what is particularly important is that children with CP frequently experience visual impairments therefore, ophthalmologic evaluation should be conducted even in the absence of visible symptoms. This further underscores the necessity of a multidisciplinary approach. Intellectual disability is another concern among CP patients, with reported prevalence rates ranging from 30% to 50% [16,17]. In our study, 3 patients (15%) had normal intelligence, 7 (35 %) had mild intellectual disability, 8 (40%) had moderate intellectual disability, and 2 (10%) had severe intellectual disability. Approximately one-third of individuals with intellectual disabilities had a mild form. Patients with athetoid CP tend to have better cognitive outcomes compared to other types. On the other hand, severe intellectual disability is more commonly observed in spastic quadriplegia, particularly in cases involving rigidity, atonia, and severe motor impairment [16-19]. In this study, no correlation was found between the degree of intellectual disability and the type of cerebral palsy. Another significant consideration regarding cognitive function in children with CP is that life expectancy decreases as the severity of intellectual disability increases [18].

We utilized the Gross Motor Function Measure (GMFM) to assess rehabilitation outcomes. GMFM is a standardized motor function

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assessment tool developed by Russell et al. [20] to evaluate the effectiveness of physiotherapy in patients with cerebral palsy (CP). A study involving 111 children with cerebral palsy (CP) found a significant correlation between assessments conducted by physiotherapists, families, and blinded evaluators. This indicates that GMFM is sensitive to both positive and negative changes in patient condition [20]. Nordmark et al. reported that GMFM provides reliable inter-rater and intra-rater assessments over time [21]. GMFM is a valid and reliable tool that has been widely used in recent years to evaluate the effects of physiotherapy, pharmacological treatments, and orthopedic interventions on motor function in children with CP. Numerous studies have investigated the impact of botulinum toxin, pallidal stimulation, therapeutic electrical stimulation, tendon release surgery, assistive walking devices and orthoses, hippotherapy, and strengthening exercises on gait function [6].

In this study, the mean GMFM score at admission was 34.02 ± 28.95, which significantly increased to 41.08 ± 28.55 at discharge. This result indicates that inpatient rehabilitation was effective in improving motor function. Additionally, a statistically significant difference was observed between the 1-month and 3-month follow-ups compared to the total GMFM score at admission. A significant difference was also found between the GMFM score at discharge and the scores at the 1-month and 3- month follow-ups. This suggests that the information and home-based training provided to caregivers to enhance daily activities may have contributed Io maintaining significant improvement in the GMFM score compared to admission. The decline in GMFM scores at the 1-month follow-up compared to discharge may be attributed to the process of readjusting to home life. However, the increase in scores between the 1-month and 3- month follow-ups was not statistically significant. This finding suggests that mothers were highly motivated and enthusiastic about rehabilitation during the first month after hospital discharge, but their motivation decreased over time. In a previous Turkish study, Dogan et al. analyzed GMFM scores at admission and discharge among children hospitalized with CP. Their study reported similar mean age, male-to-female ratio, and average hospitalization duration as the present study [22]. Similarly, they observed a significant increase in GMFM scores at discharge, including improvements in subgroup scores. These findings suggest that rehabilitation programs positively impact overall motor function in children with CP.There is a substantial body of research investigating the effects of various treatment methods for CP, many of which focus on reducing spasticity. Knox et al. (2001) analyzed the impact of therapy methods using GMFM and reported significant improvements in total GMFM scores among children who underwent a 6-week Bobath therapy program [23]. In another study utilizing GMFM, patients receiving a combination of physiotherapy, hippotherapy, hydrotherapy, and occupational therapy were followed for 18 months after therapy [24]. A comparative analysis of two groups—one undergoing intensive therapy and the other receiving conventional physiotherapy—found no long-term differences in GMFM scores. Although the objective of that study differed from the present one, it shares similarities in terms of assessing rehabilitation outcomes using GMFM. The patients in that study received outpatient physiotherapy, and the extended 18-month follow-up allowed researchers to observe long-term rehabilitation effects. Dogan et al. further evaluated the rehabilitation nnlcnmes nt children with C.P

Patients were categorized into subgroups based on chronological age and developmental age according to the Denver Developmental Screening Test. They were also assessed using the GMFCS relative to the type of CP [22]. Due to the small sample size in this study and the fact that GMFCS provides a more comprehensive representation of motor development, we opted not to conduct comparisons based on CP type. Instead, our patients were grouped into monitoring subgroups according to their GMFCS classification. The aim of this study was to analyze group distribution rather than measure changes in motor function.

CONCLUSION

1. The children in this study had different types of CP and varying GMFCS levels, making it a comparison of rehabilitation outcomes in a heterogeneous group. However, all participants were children diagnosed with CP who underwent inpatient physiotherapy. Additionally, 289 literature sources contain other studies that included participants with different GMFCS levels and CP types [24].
2. The length of hospital stay varied. However, the upper limit was established based on the Bobath concept, and the duration of hospitalization was determined by the lead physiotherapist, who was blinded to the patients included in the study.
3. The study did not include a control group: however, potential delays associated with such a methodology make it ethically inappropriate to exclude a child with CP from a rehabilitation program for more than three months.

In light of the study results and considering the limitations of similar studies, further randomized controlled trials are needed with a greater number of activity and participation parameters, as well as a larger sample size of patients with CP.

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