

Original Article

Role of intensive rehabilitation in spastic cerebral palsy

Amin MR¹, Moniruzzaman M², Hossain MS³, Islam MJ⁴, Asaduzzaman SM⁵, Rahman S⁶**Abstract**

Cerebral palsy is the most common childhood disability with a prevalence of 1.5 to 3 per 1000 live births. Spasticity is one of the common features of cerebral palsy as it contributes to limitations in body structure and function, leading to deformity. The treatment of cerebral palsy is multifactorial. In this study we find out the efficacy of intensive rehabilitation in the treatment of spastic cerebral palsy. This observational study was conducted over 30 patients in Dhaka Medical College Hospital from January 2011 to December 2011. The patient satisfying the inclusion and exclusion criteria was randomly enrolled in this study. They received intensive rehabilitation 1 hour daily five times a week for 24 weeks. All patients were followed up at 4 weeks interval and were evaluated for a total of 24 weeks. Intensive rehabilitation is effective in reducing tone in spastic cerebral palsy by using Modified ashworth scale ($p < 0.05$). Intensive rehabilitation is also effective in joint angle improvement in spastic cerebral palsy measured by physician rating scale crouch ($p < 0.05$) and foot contact, ($p < 0.05$) and also improvement in gross motor function ($p < 0.05$). For reduction of generalized spasticity regarding muscle tone, range of motion of the joint and improvement of gait in cerebral palsy patients, intensive rehabilitation may be used.

Keywords: Cerebral Palsy, intensive rehabilitation, therapeutic exercises

1. *Dr Md. Ruhul Amin, Assistant Professor, Department of Physical Medicine & Rehabilitation, Dhaka Medical College, Dhaka. E-mail: Drruhulamin73@yahoo.com
2. Dr Mohammad Moniruzzaman, Assistant Professor, Department of Physical Medicine & Rehabilitation, Dhaka Medical College, Dhaka
3. Dr Md Shahadat Hossain, Associate Professor, Department of Physical Medicine & Rehabilitation, Dhaka Medical College, Dhaka
4. Dr Md Jahidul Islam, Assistant Professor, Department of Physical Medicine & Rehabilitation, National Institute of Neuroscience, Dhaka
5. Dr S M Asaduzzaman, Department of Neurosurgery, BSMMU, Dhaka
6. Professor Dr Sohely Rahman, Professor & Head, Department of Physical Medicine & Rehabilitation, Dhaka Medical College, Dhaka.

*For correspondence

Introduction

Cerebral Palsy (CP) describes a group of permanent disorders of the development of movement and posture, causing activity limitations that are attributed to non-progressive disturbances that occurred in the developing fetal or infant brain. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, perception, cognition, communication, and behavior; by epilepsy, and by secondary musculoskeletal problems.¹ In a majority of cases, the predominant motor abnormality is spasticity². Cerebral palsy is the most common childhood disability with a prevalence of 1.5 to 3 per 1000 live births.^{3,4} There is no epidemiological data from developing countries. However, in a study at Physical Medicine & Rehabilitation Department of BSMMU 1.72% patients were diagnosed as CP.⁵ Spastic cerebral palsy is the most common type, accounting for 75% of cases which affects a large proportion of this population⁶. Spasticity is one of the common features of cerebral palsy as it contributes to limitations in body structure and function, leading to deformity.⁷ Children diagnosed with cerebral palsy have great difficulty in performing daily activities because of their inability to adequately control movement and posture or prevent involuntary movement. Treating the spasticity component of the movement disorder might enable improvement in the performance, participation, and satisfaction in everyday activities of these children.⁶ Treatment of spastic cerebral palsy includes physiotherapy along with antispastic medication. Available drugs that are used to treat spasticity includes benzodiazepines, baclofen, alpha-adrenergic agonists (tizanidine, clonidine), dantrolene sodium, and gabapentine.⁸ Baclofen is a GABA agonist that is used to reduce muscle tone. Intensive rehabilitation is supervised and individualized multidisciplinary program involving many health workers including the family to make the child to his/her optimum development of functions that make him or her independent to provide quality of life. Intensive rehabilitation may be defined as 1 hourly intervention, 5 days a week, as opposed to a therapy sessions once a week or once every second week.⁹ It consists of neurodevelopmental treatment (NDT), therapeutic exercises (TEs) and activities of daily living (ADL) training.¹⁰ The aim of this study was to find out the role of

oral baclofen in combination with intensive rehabilitation in reducing spasticity in cerebral palsy.

Methods

An observational study was done in the Department of Physical Medicine & Rehabilitation, Dhaka Medical College Hospital and Department of Pediatrics, Dhaka Medical College Hospital. The total duration of study was from January 2011 to December 2011. All the spastic cerebral palsy patients seeking treatment in outpatient department of Physical Medicine & Rehabilitation and Pediatrics, Dhaka medical college hospital were the reference population. From reference population, patients enrolled in the study who met the inclusion and exclusion criteria.

In Inclusion criteria, Patients aged between 12 months to 12 years of both sexes, with disorder in the development of movement and posture presumably of cerebral origin started before 2 years of age, presence of spasticity associated with or characterized by increased tone reflexes, clonus or extensor plantar response, and delayed milestones of development which is improving over time. In Exclusion criteria, those with mixed type of cerebral palsy receiving systemic anti-spasticity medications or had received phenol and/or botulinum toxin type A injections; past surgical intervention that might interfere with ankle joint movement; neurodegenerative disorders, chromosomal abnormality such as Down syndrome, inborn errors of metabolism such as galactosemia and presence of comorbidity such as epilepsy were excluded from the study.

A total number of 30 patients were primarily selected. Complete history and clinical examination were done for all enrolled patients. After taking written informed consent they were finally selected for the study. Intensive rehabilitation (1 hour daily for 5 days a week) was given for 24 weeks. Patients were first assessed with Modified Ashworth Scale (MAS) based on muscle tone to determine the extent of spasticity. Then Physician Rating Scale to measure joint angle (crouch) specially by standard goniometer, knee recurvatum, foot contact and overall functional status by Gross Motor Functional Classification System¹¹. Then intervention was done by giving intensive rehabilitation to reduce spasticity. Uniform intensive rehabilitation protocol was applied which includes prone lying position, sitting balance in specialized sitting chair, range of motion exercise, stretching exercise, activities of daily living (ADL) training. After 4 weeks (1st follow up) patients were again assessed by principal investigator using

before mentioned 3 scales. After 8 weeks (2nd follow up) patients were again assessed by principal investigator using before mentioned 3 scales. Then follow up assessment was done every 4 weekly at 12th week, 16th week, 20th week and lastly 24th week using same scales by principal investigator. Intensive rehabilitation was given by an experienced physiotherapist at the department of Physical Medicine & Rehabilitation, Dhaka Medical College Hospital, Dhaka.

One hour intensive physiotherapy was done daily for 5 days a week. Activities included in each session were body alignment weight transfer in various positions, bimanual activities and facilitation sequences of movements. The treatment highlighted functional, meaningful task, in contexts appropriate for each child. Parents were shown how to handle their children when dressing and undressing, and how to facilitate variation of movement pattern during play. Moreover, sitting modified chairs were used for proper positioning of the child. Also the mother or attendant was advised to make such wooden chair at home by the carpenter or readymade chair from CRP, Savar.

Ethical clearance has been obtained from the concerned authority to conduct the research work of study subjects.

Data were collected through a pretested structured questionnaire. Data were processed and analyzed using SPSS (statistical package for social science) version 17. Test statistics used to analysis the data were paired T test. The level of significance was set 0.05 and p-value of less than 0.05 was considered significant.

Results

A total of 30 patients were recruited to yield 17 male and 13 female, 56.7% male and 43.3% female. Mean age (months) was 25.3 ± 2.8. Mean weight was 9.3 ± 2.7. (Table-I)

Table – I: Demographic characteristics

Age	Sex		Weight
	Male	Female	
25.3 ± 2.8	17(56.7%)	13(43.3%)	9.3 ± 2.7

Baseline characteristics shows that Modified Ashworth Scale (MAS) grade was 5 (16.7%) at level 3, 22(73.3%) at level 4 and 3(10.0%) at level 5. After 3 months was 1 (3.3%) at level 3, 25 (83.3%) at level 4 and 4 (13.3%) at level 5. After 6 months was 1 (3.3%) at level 3, 28 (93.3%) at level 4 and 1 (3.3%) at level 5. P value was 0.133 which was not significant ($P < 0.05$). (Table-II)

Table –II: Modified Asworth scale measurement in spasticity

Level	Pretreatment score	Level	Score after three month of starting treatment	Score after six month of starting treatment	Chi Square test P value
3	5 (16.7%)	0-1	1 (3.3%)	1 (3.3%)	$\chi^2 = 7.04$
4	22 (73.3%)	2-3	25 (83.3%)	28 (93.3)	$P = 0.133$ NS
5	3 (10%)	4-5	4 (13.3%)	1 (3.3%)	$P < 0.05$

Baseline characteristics shows the physician rating scale in terms of knee recurvatum >5 was 2 (6.7%), Recurvatum <0-5 was 2 (6.7%), No recurvatum was 26 (86.7%). After 3 months was 00 (00%), 3 (10.00%), 27 (90%) and after 6 months was 00 (00%), 4 (13.3%), 26 (86.7%) respectively. Angle for crouch gait in pretreatment was in severe 10 (37.0%), moderate 16 (59.3%), mild 00 (00%) and none 1 (3.7%). After 3 months, in severe was 24 (88.9%), in moderate was 3 (11.1%), mild was 00 (00%) and after 6

months severe was 00 (00%), moderate was 20 (74.1%), mild was 7 (25.9%). P value was <0.00001 which was highly significant ($P < 0.05$). In foot contact preterm treatment was in toe 25 (83.3%), in toe-heel was 5 (16.7%) and flat was 00 (00%). After 3 months it was 3 (10.0%), 26 (86.7%), 1 (3.3%) and after 6 months was 00 (00%), 19 (63.3%), 11 (36.7) in toe, toe-heel and flat respectively. P value was <0.00001 which was highly significant ($P < 0.05$). (Table-III).

Table – III: Assessment of physician rating scale

Physical rating scale	Pre treatment	At 3 rd Month after treatment	At 6 th Month after treatment	Chi Square test P value
Knee*				
Recurvatum >5	2(6.7%)	00	00	$\chi^2 = 12.35$
Recurvatum <0-5	2(6.7%)	3(10.0%)	4(13.3%)	$P = 0.014$ S
No Recurvatum	26(86.7%)	27(90.0%)	26 (86.7%)	$P < 0.05$
Angle for crouch gait*				
Severe	10 (37.0%)	24(88.9%)	00	$\chi^2 = 53.80$ $P < 0.00001$ S $P < 0.05$
Moderate	16 (59.3%)	3(11.1%)	20 (74.1%)	
Mild	00	00	7 (25.9%)	
None	1 (3.7%)	00	00	
Foot contact*				
Toe	25 (83.3%)	3(10.0%)	00	$\chi^2 = 72.14$ $P < 0.00001$ S $P < 0.05$
Toe-heel	5 (16.7%)	26(86.7%)	19 (63.3%)	
Flat	00	1(3.3%)	11(36.7%)	
Occasional heel-toe	00	00	00	

Baseline characteristics show in the gross motor function in level 1, level 2, level 3, level 4 and level 5 was 00, 00, 00, 11(36.7%) and 19(63.3%). , after three months, it was 00, 00, 1(3.3%), 18(60.0%), 11(36.7%) and after six months, it was 00, 00, 4(13.3%), 22(73.3%), 4(13.3%) in respectively. P value was <0.000 which was significant ($p < 0.05$). (Table-IV)

Table – IV: Assessment of gross motor function

Gross Motor Function	Pre treatment	At 3 rd Month after treatment	At 6 th Month after treatment	Chi Square test P value
Level-1	00	00	00	$\chi^2 = 18.78$
Level-2	00	00	00	$P < 0.0001$ S
Level-3	00	1(3.3%)	4(13.3%)	$P < 0.05$
Level-4	11(36.7%)	18 (60.0%)	22 (73.3%)	
Level-5	19(63.3%)	11 (36.7%)	4 (13.3%)	

Discussion

In this study, 30 children with cerebral palsy were enrolled. At the baseline evaluation; in Modified Ashworth Scale, 5(16.7%) were grade 3, 22(73.3%) grade 4, 3(10.0%) grade 5. After 6 months, spasticity also significantly reduced; 1(3.3%) children showed Modified Ashworth Scale grade 0-1, 28(93.3%) were grade 2-3 and 1(3.3%) grade 4-5. In this study we found that intensive rehabilitation is effective in reducing spasticity ($p < 0.001$). Regarding Physician ratings scale, most of the severe and moderate angle for crouch gait at baseline changed to moderate and mild angle respectively ($p = 0.00001$). Changes in knee recurvatum were not significant as very few children had knee recurvatum > 5 or $< 0-5$ ($p = 0.014$). During measuring crouch, the patient had at baseline 37% severe and 59% moderate angle at baseline and at 1st month scores were found no change. But after 6 months shows improvement in angle for crouch ($p = 0.00001$). In this study most of the children having foot contact with their toes at baseline changed to toe-heel contact (63.3%) or flat foot (36.7%) ($p = 0.029$). In gross motor function level, most of the children with level 5 and 4 gross motor function at baseline changed to level 4 and 3 respectively ($p = 0.0001$), which indicate better improvement in activities in daily life. In a study Intermittent versus continuous physiotherapy in children with cerebral palsy-Christiansen et al.¹² reported that GMFM-66 score increased significantly in both intermittent and continuous group. In a study of infants receiving physical therapy, Scherzer et al noted improvement in broadly defined motor and social skills and in the patient's ability to address the children's daily needs, but could not separate the influences of age, therapy and cognitive level.¹³ A single-subject design was used. Intervention consisted of two sessions of 4-week periods of daily physiotherapy, interrupted by 8 weeks of physiotherapy as usual. The children were assessed every 4th week using the Gross Motor Function Measure. Results were visually analyzed, and statistical significance of Gross

Motor Function Measure-66 scores was established with the 2 SD band method. Compliance was high. All infants showed gross motor progress compared with baseline, but separating effect of daily physiotherapy from physiotherapy as usual was inconclusive. Parents preferred the intensive treatment alternative. Blocks of intensive therapy can be an alternative to regular dosage of physiotherapy, but until further studies are conducted, the physiotherapy intervention, intensity, and frequency should be tailored to meet the needs of each individual infant and family.¹⁴

Analytical findings of this study showed that intensive rehabilitation is beneficial to decrease stiffness and spasm and thereby improving movement in a young child with cerebral palsy.

Analytical results of this study shows that basic motor abilities and self-care improved after intensive physiotherapy is effective for reducing generalized spasticity regarding muscle tone and joint angle stiffness and gait improvement in cerebral palsy patients.

References

1. Rosenbaum P, Paneth N, Leviton A, Goldstein M, Bax M, Damiano D et al. A report: the definition and classification of cerebral palsy April 2006. Dev Med Child Neurol. 2007;109:8-14.
2. Thomas MO Diagnosis Treatment and prevention of cerebral palsy. Clinical Obstetrics and Gynaecology. 2008; 514, 816–828.
3. Surveillance of Cerebral Palsy in Europe (SCPE). Surveillance of cerebral palsy in Europe: a collaboration of cerebral palsy surveys and registers. Dev Med Child Neurol. 2000;42(12): 816-824.
4. Reddighough DS, Collins KJ. The epidemiology and causes of cerebral palsy. Aust J Physiother. 2003; 49(1):456-462.

5. Khan MSZ. A study on patients with cerebral palsy attending Physical Medicine Department of BSMMU. *Bangladesh Med Res Counc Bull.* 1998; 50-52.
6. Tal KC, Tal J, Aviva FV. Upper Extremity Function and Occupational Performance in Children with Spastic Cerebral Palsy Following Lower Extremity Botulinum Toxin Injections. *Journal of Child Neurology.* 2010; 25(6): 694-700.
7. Yam WK, Leung MS. Interrater Reliability of Modified Ashworth Scale and Modified Tardieu Scale in Children With Spastic Cerebral Palsy. *J Child Neurol.* 2006 ; 21: 1031-1035.
8. Katz RT: Management of spastic hypertonia after stroke. *J Neurol Rehabil.* 1991;5:S5-S12.
9. Tordis U, Anne BS, Anne EL. Effects of intensive physiotherapy in infants newly diagnosed with cerebral palsy. *Pediatr Phys Ther.* 2009; 21:140-149.
10. Rosenbaum P, Dan B, Leviton A, Paneth N, Jacobsson B, Goldstein M. Proposed definition and classification of cerebral palsy. *Dev Med Child Neurol.* 2005;47:471-576.
11. Milla PJ, Jackson AD, Acontrolled trial of baclofen in children with cerebral palsy. *J Int Med Res.* 1977; 5:398-440.
12. Christiansen AS, Lange C. Intermittent versus continuous physiotherapy in children with cerebral palsy. *Dev Med child Neurol.* 2008; 50:290-293.
13. Scherzer AL, Mike V, Lpon J. Physical therapy as a determinant of change in the cerebral palsied infant. *Pediatrics.* 1976;58: 47-52.
14. Pellegrino L. Cerebral palsy. In ML Batshow; ed., *children with disabilities*, Baltimore; Paul H. Brookes publishing. 4th ed. Pp. 499-528.