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Neuro-Physiotherapy for Enhancing Gross Motor Function in a male patient With Spastic Diplegic Cerebral Palsy: Case study

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Introduction

Cerebral palsy (CP) is a neurological disorder resulting from a non-progressive lesion in the developing brain, which affects movement, muscle tone, and motor skills. CP has a wide range of prevalence, ranging from 1.5 to three cases per 1000 persons [1]. Neonates with low birth weight are increasingly common among children diagnosed with cerebral palsy (CP). Newborns weighing less than 2,500 grams now account for half of all incidences of cerebral palsy (CP). The incidence of CP follows a distinct social class gradient [2]. While hypoxia of prematurity has long been thought to be a primary etiologic component, current research suggests that there may be other causes, such as circulating toxins from maternal illness, primarily in the urinary tract but perhaps from other sources [3]. Periventricular leukomalacia (PVL), which is characterized by bilateral necrosis of the frontal and parietal periventricular white matter, is the most common brain lesion associated with spastic diplegia [4]. Even though the underlying brain injury is stable, individuals with spastic diplegia frequently develop issues with muscle tone, posture, and gait. Due to calf muscle spasticity, standing and walking are delayed, often with the ankles in an equino-varus position. As a kid grows older, the crouch gait can be caused by gradual stiffness of the hip flexors and hamstrings, making prolonged walking difficult and giving the appearance of neurological degeneration [4].

There are several causes of the condition, including cerebral anoxia, bleeding, infection, and hereditary disorders. Children with cerebral palsy (CP) benefit from a range of treatment approaches designed to enhance their physical function and overall quality of life. Traditional physical therapy exercises play a crucial role in these treatment plans.

The therapist should additionally promote greater trunk and pelvic mobility as well as active trunk extension which may result in better balance and posture [5].Aqua- therapy, which involves alternating movements of the lower extremities, and therapeutic riding on horses are additional beneficial treatments [6].

Clinical management in physical therapy plays a pivotal role in enhancing organizational capacity, integrating evidence-based practices, and improving patient outcomes. This approach involves a systematic and structured process to ensure high-quality care delivery, efficient resource utilization, and continuous improvement in therapy practices. Cerebral palsy (CP) is a group of disorders affecting movement and posture, often caused by damage to the developing brain. Several risk factors can increase the likelihood of a child developing CP. Among the most

common are low birth weight, intrauterine diseases, and multiple pregnancies. Cerebral palsy (CP) is indeed more prevalent among children with low birth weight, particularly those whose birth weight falls below the 10th percentile for their gestational age. . Intrauterine infections raise the chance of CP by five times in full-term newborns and by two times in preterm infants [2]. For children with cerebral palsy (CP), a multidisciplinary approach to therapy is often most effective. This approach combines various therapies to address the complex and multifaceted needs of these patients. There is no "magic bullet" for treating children with spastic diplegia; rather, a combination of modalities must be used to achieve the best possible outcome [3].

Case Presentation

Patient information

The clinical presentation of the 20-month-old male child suggests an acute neurological event, likely a seizure, accompanied by other significant symptoms. The history provided indicates that the child had a sudden onset of seizure four months ago, along with fever, drowsiness, frothing from the mouth, and up-rolling of eyes. 20-month-old male child with a history of global developmental delay, breakthrough seizures, fever, drowsiness, frothing from the mouth, up-rolling of eyes, and anemia under evaluation suggests a complex clinical scenario.

Child was a full-term baby without any post-natal complications. The patient being admitted on the 12th day of life with fever and difficulty feeding but no detected abnormalities, allowing the discharge with regular follow-up. Immunization history: the child was immunized till 1.5 years of age, and last received pulse polio.

Narrative from the mother about the child's first convulsion episode at 8AM, further devloping weakness in the left hand,up rolling of eyes,frothing at the mouth,urinary incontinence during the episode. The seizure episode lasted for one hour and was followed by postictal drowsiness and unconsciousness. The child gives a history of falls from the height of approximately four feet two days ago. There was no associated loss of consciousness or abnormal behavior. With the absence of discharge/bleeds through the ear/nose and the absence of symptoms like fever, cough/cold, vomiting, or loose stools. After one and a half months, the child was again admitted to a nearby hospital given the recurrence of fever and drowsiness. He was managed with medications, i.e., ibuprofen (5mL/6hrly), cephalosporin and phenytoin. Child was left the hospital before the medical team recommended, which is referred to as being discharged against medical advice (AMA), However, leaving against medical advice can pose risks, as it may mean they're not fully recovered or may require further monitoring or treatment. The child was experiencing developmental delays in motor skills, such as sitting independently, transitioning between movements, and standing. These concerns prompted the mother to seek medical evaluation. Seeking further evaluation and management at the hospital is a positive step to address these developmental challenges and provide appropriate support and interventions for the child's development.

Clinical findings

The baby was described as ectomorphic, indicating a lean and slender body type. The baby was also conscious, cooperative, and well-oriented to time, place, and person.

On observation notes indicate that the child has a plantarflexion posture of the right ankle, meaning the foot points downward more than usual. A child was unable to get a word out(tongue tied). The child has mild torticollis to the right, which is a condition where the neck muscles cause the head to tilt to one side. These physical findings suggest

specific musculoskeletal abnormalities that could contribute to the child's difficulties with movement and motor skills.

On examination, there was increased tone in hamstrings, Modified Ashworth scale- Grade 1+. Muscle power in the upper limbs was high (grade 4) as compared to lower limbs (grade 3) as graded as pediatric muscle testing [7].

The presence of exaggerated deep tendon reflexes in the lower limbs and a plantar extensor response (Babinski sign) suggests an upper motor neuron lesion. The tightness in the hamstrings, tendo-Achilles (Achilles tendon), and adductors on both lower limbs indicates spasticity, which is a condition characterized by increased muscle tone and stiffness.

The child can crawl and can sit up from lying down with good balance when still. However, the child has trouble keeping balance when moving while sitting, and finds it hard to stand and walk on their own.

Clinical diagnosis

The MRI findings reveal extensive brain injury due to hypoxia-ischemia, with gliotic changes in several critical areas associated with motor function. These findings, combined with clinical symptoms of spasticity, particularly in the legs, suggest a diagnosis of spastic diplegic cerebral palsy. This condition results from brain damage around the time of birth, leading to motor impairments primarily in the lower limbs.

Physiotherapy functional assessment

The report on the range of motion (ROM) and strength assessments, ROM tests for both upper and lower limbs were normal indicates that there is no significant joint contracture or limitation in the passive movement of the limbs.

The strength assessment showing "good" strength in the upper extremities suggests that the muscles in the arms and hands are relatively unaffected.

The strength in the lower extremities being "poor to fair" indicates significant weakness and reduced muscle strength in the legs. This weakness can contribute to difficulties with standing, walking, and overall mobility, which is characteristic of spastic diplegia.

The development of tightness in the bilateral tendo-Achilles, hamstrings, and short adductors is a significant finding and is common in patients with spastic diplegic cerebral palsy (CP). This tightness, or spasticity, can lead to functional limitations and affect the patient's mobility and posture.

Difficulty in independent standing and walking, the patient’s challenges are significant and likely impacting their daily life considerably. These issues are commonly associated with spastic diplegic cerebral palsy (CP) due to muscle tightness and weakness, particularly in the lower extremities.

The patient walking on toes and with a scissoring gait when provided with maximum support highlights the severity of the spasticity and motor control issues associated with spastic diplegic cerebral palsy (CP). This pattern is typically caused by muscle tightness and spasticity in the lower extremities, affecting the patient's ability to walk normally.

On the first day of testing, the MAS grading for hamstrings was 2 and the Gross Motor Function Measurement (GMFM-88) was 22%.

Physiotherapeutic treatment (intervention)

The physiotherapeutic treatment(intervention) is provided in Table 1. Tongue tie was present initially but was managed non-surgically. Tongue movements were taught to the child and the caregiver, who performed these exercises regularly. The child, now 2.5 years old, no longer has a tongue tie.

For torticolis, Manual stretching exercises were performed, holding each stretch for 10 seconds with three repetitions, three times a day.

Problem detected	**cause**	**Physiotherapy Intervention(treatment)**
tightness of hamstring, adductors, and tendo-achiles.	Hypertonia	Sustained passive stretching of hamstring, tendo-achiles, and adductors (30 secs hold * 3 rep) to alleviate muscle tightness and spasticity.
Trouble in standing independently from sitting.	Tight muscles of the lower limb and reduced trunk control	Sit to stand facilitation on bolster, single leg sit to stand, and multidirectional reach-outs in sitting to strengthen trunk muscles and improve stability during transitions.
Standing and walking transitions	The inactive base of support	Standing training initially with maximum support at pelvis and knees, gradually transitioning to assisting the child in taking steps with minimal pelvic support. Task-oriented approaches to facilitate weight shifting and improve motor control during transitions.
Trouble in walking independently	Deficient trunk control and reduce motor control	Gait training with minimal pelvic support assistance, focusing on stepping forward and incorporating reach-outs to improve balance and coordination during walking.
Trouble in stair climbing	Deficient trunk control	Step up and step-down facilitation using a stepper and bolster, along with half-kneeling exercises to strengthen trunk muscles and improve control during stair negotiation.

TABLE 1: The physiotherapeutic intervention in detail

Follow-up and outcomes

After six weeks of special therapy that combines different methods like stretching, exercises to bear weight, and doing tasks, the child got much better at controlling their body near the center. By the end of four weeks, the tightness and stiffness in the muscles decreased, and the muscles returned to a normal level of tension.The child started moving between positions on their own, but sometimes they experienced sudden uncontrolled movements, like going into a backward arching posture called opisthotonos(back arching).
To address these issues, incorporated transitions from kneeling to quadruped and kneeling to half-kneeling to engage the baby's support base, following Neurodevelopmental Treatment (NDT) principles. During kneeling, emphasized oblique activities to strengthen the oblique muscles, as maintaining stable eye focus during activities helps with overall posture stability.

The child demonstrated improvement by taking confident initial steps and requiring minimal assistance from the caregiver while walking.
The prognostic plan for the baby over the next six weeks is to decrease involuntary movements and enhance intentional movements, particularly during transitions.

Discussion

The child responded well to the treatment. His compliance during the sessions was excellent, which we attribute to the treatment strategy and techniques employed, incorporating playful activities throughout the sessions. Functional goal-oriented approaches were found to be effective in a study by Das and Ganesh [8], our treatment approach is in line with that study. The success of the treatment regimen also goes to the constancy with which the caregiver delivered home exercise programs and hold numerous meetings to address the mother's concerns [9,10]. After one month of rehabilitation, the child was able to maintain sitting balance, reach out while sitting, and stand up with support from a sitting position. After six weeks, the caregivers were overjoyed to see the child walking with strong trunk and pelvic control and with minimal assistance.

This significant improvement shows the positive effects of play therapy along with neurodevelopmental treatment [2]. Similar significant results were obtained in a study based on task-oriented neurodevelopmental therapy [11].
Physiotherapy management was developed using neurodevelopmental treatment principles.The findings of a study suggest that an eight-week neurodevelopmental treatment based on posture and balance training is an efficient method for increasing functional motor level and functional independency in diparetic and hemiparetic CPC by enhancing postural control and balance [12]. In the past 10 years, there has been a noticeable rise in the use of exercise-based therapies to enhance postural control in children with CP [13]. Using neurodevelopmental therapy, we gained commendable results in the child. A previous investigation exploring the use of GMFM 88 in conditions other than CP yielded similar results [3,14].

Conclusions

This case report concludes that early integrative neuro-physiotherapy, using a goal-oriented therapeutic regimen that includes neurodevelopmental treatment principles, passive stretching, static weight-bearing exercises, and task-oriented approaches, helps improve gross motor developmental milestones in children with spastic diplegia. The child showed improvement both clinically and in the outcome measures. The child was able to walk with minimal

assistance after one month and gained independent walking within two months. He gained good trunk and pelvic control after rehabilitation.

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References

1. Dabney KW, Lipton GE, Miller F: Cerebral palsy. Curr Opin Pediatr. 1997, 9:81-8. 10.1097/00008480-199702000-00017
2. Odding E, Roebroeck ME, Stam HJ: The epidemiology of cerebral palsy: incidence, impairments and risk factors. Disabil Rehabil. 2006, 28:183-91. 10.1080/09638280500158422
3. Sussman MD, Aiona MD: Treatment of spastic diplegia in patients with cerebral palsy . J Pediatr Orthop B. 2004, 13:S1-12. 10.1097/00009957-200403000-00016
4. Huntsman R, Lemire E, Norton J, Dzus A, Blakley P, Hasal S: The differential diagnosis of spastic diplegia . Arch Dis Child. 2015, 100:500-4. 10.1136/archdischild-2014-307443
5. Binder H, Eng GD: Rehabilitation management of children with spastic diplegic cerebral palsy . Archives Phys Med Rehab. 1989, 70:482-9. 10.1016/0003-9993(89)90012-9
6. Elnaggar RK, Alghadier M, Abdrabo MS, Abonour AA: Effect of a structured aqua-plyometric exercise program on postural control and functional ability in children with hemiparetic cerebral palsy: a two-arm randomized controlled trial. NeuroRehabilitation. 2022, 1:12. 10.3233/NRE-220020
7. Muscle and Sensory Testing . (2022). Accessed: September 11, 2022: https://books.google.co.in/books?hl=en&lr=&id=nOneDwAAQBAJ&oi=fnd&pg=PP1&dq=muscle%2Band%2Bsensory%2Btesting%2Bnancy%...
8. Das SP, Ganesh GS: Evidence-based approach to physical therapy in cerebral palsy . Indian J Orthop. 2019, 53:20-34. 10.4103/ortho.IJOrtho_241_17
9. Kovela R, KR J, Thakur A, Priya P: Effectiveness of mother as a rehabilitative aid (Mara) program in the recovery of children with cerebral palsy an assessor blinded randomized controlled trial. Indian J Public Health Res Dev. 2020, 11:419-24.
10. Patel DR, Neelakantan M, Pandher K, Merrick J: Cerebral palsy in children: a clinical overview . Transl Pediatr. 2020, 9:S125-35. 10.21037/tp.2020.01.01
11. Sah AK, Balaji GK, Agrahara S: Effects of task-oriented activities based on neurodevelopmental therapy principles on trunk control, balance, and gross motor function in children with spastic diplegic cerebral palsy: a single-blinded randomized clinical trial. J Pediatr Neurosci. 2019, 14:120-6. 10.4103/jpn.JPN_35_19
12. Tekin F, Kavlak E, Cavlak U, Altug F: Effectiveness of neuro-developmental treatment (Bobath Concept) on postural control and balance in cerebral palsied children. J Back Musculoskelet Rehabil. 2018, 31:397-403. 10.3233/BMR-170813

13. Dewar R, Love S, Johnston LM: Exercise interventions improve postural control in children with cerebral palsy: a systematic review. Dev Med Child Neurol. 2015, 57:504-20. 10.1111/dmcn.12660

14. Harvey AR: The gross motor function measure (GMFM) . J Physiother. 2017, 63:187. 10.1016/j.jphys.2017.05.007