CURRENT TRENDS IN CEREBRAL PALSY REHABILITATION

Sarah Anjum[1], Dr. Huma[2], Ruchi Basista[3], Madhusmita Jena[1], Huma Parveen[1].

1. BPT student, Department of Physiotherapy, Jamia Hamdard University, New Delhi

2. Assistant Professor, Department of Physiotherapy, Jamia Hamdard University, New Delhi.

3. PHD scholar, Department of Physiotherapy, Jamia Hamdard University, New Delhi

1. ABSTRACT

Cerebral Paralysis(CP) is one of the most frequent causes of motor disability in children. 3 In every 1000 babies suffer from CP. The frequency is advanced in premature birth. CP is a collection of interminable disorders that affect the growth of movement and posture and result in activity limitations. These disorders are thought to be the result of non-progressive disturbances that occurred in the developing fetal or infant brain. The threat factors for CP can be divided into pre-conception, antenatal, perinatal, and postnatal bones. The bracket of CP can be grounded on
The type of movement complaint, level of damage, and Area of involvement. There
are other medical conditions that are generally associated with CP, like epilepsy, internal deceleration, malnutrition, speech problems, osteoporosis, dysphagia, respiratory problems, vision problems, and sleep diseases. There's no cure for the complaint yet, but the symptoms
can be managed through colorful approaches. Physiotherapy plays a veritably big part in treating the musculoskeletal symptoms of CP. Muscle training, flexibility, balance, mobility, and gait training are the core aspects of the physiotherapeutic approach. Recent advancements in the recuperation of CP help to avoid expensive hospitalization, reduce sanitarium length of stay, and allow patients to remain independent at home, it minimizes the need for fiscal or
caregiver support. Other ways of managing CP include medications, surgeries, and other forms of curative therapy. There are also certain challenges that patients and their caretakers might come across during the battle to fight the complaint, which should be taken into consideration while designing the protocol for recuperation. Thorough assessment, personalized treatment plans, and regular evaluation are required to address the specific requirements and challenges faced by these cases.

2. INTRODUCTION

The CP description has evolved over time; the problem is aetiologically and clinically verifiably miscellaneous. CP generally coexists with other medical conditions like epilepsy, in particular medicine-resistant epilepsy, but also with internal deceleration, visual and hearing impairment, as well as feeding and behavioral diseases. The degree of motor problems varies from mild to verifiably severe, making the child completely dependent on caregivers. CP is divided into forms depending on the type of motor diseases that dominate the clinical donation; the traditional groups by Ingram and Hagberg have now been replaced by the Surveillance of Cerebral Palsy in Europe bracket, which divides CP into three orders: namely, spastic, dyskinetic, and ataxic forms. Although cerebral paralysis is a clinical opinion, ultramodern individual imaging provides information that allows the division of the results of magnetic resonance imaging in children with cerebral paralysis into five groups according to the magnetic resonance imaging classification system. The clinical features and the factors predisposing to CP are veritably different, so treatment is also a veritably complex problem. (1) .

2.1. RISK FACTORS

A number of factors may cause damage to the central nervous system(CNS) at an early stage of its development. The threat factors fall into the following categories: preconception, concerning the astronomically defined health and living conditions of the mother before she conceived the child; antenatal, which are related to the course of gestation; perinatal; as well as threat factors in the neonatal and infant period.(1) One of the major CP threat factors is prematurity. The frequency and severity of neurodevelopmental diseases are associated with gestational duration, which means the shorter the gestation, the more severe the diseases. Low birth weight in premature babies is another threat factor. (1) .

2.2. CLASSIFICATION

As injury to the developing brain occurs due to multitudinous causes and manifests in different clinical presentations and severity, it has been described under colorful headlines grounded on

1. The type of movement complaint
   According to the type of movement complaint, CP is classified as spastic, dyskinetic, or ataxic.
2. Level of damage, and
3. Area of involvement, Based on the area of donation, it can be classified into involvement in one side or both sides of the body, i.e., quadriplegic, hemiplegic, diplegic, and monoplegic, with diplegic being the most common, followed by hemiplegic (20–30) and quadriplegic (10–15). In quadriplegic CP, all four branches are affected. In quadriplegia, the hands are more affected than the legs, and this occurs due to acute hypoxic asphyxia during the perinatal period, inordinate cystic degeneration of the brain, and experimental abnormalities similar to polymicrogyria and schizencephaly. The condition presents with limited voluntary movements of all the extremities,

pseudobulbar signs, accidental food entry in the airways, difficulty swallowing, optical atrophy, seizures, and severe intellectual abnormalities. In hemiplegia, hand functions are substantially affected. Dorsiflexion and eversion of the bottom are severely impaired in the lower branch. Increased spasticity in flexor muscles, sensory abnormalities, seizures, and visual problems are common findings; only one side of the body is affected with a high tone in flexor muscles and sensory loss. Apart from this, hand function is severely impaired as compared to leg function. In the bottom, dorsiflexion and eversion are affected. Both mature and pre-mature-born children are at threat of hemiplegic CP. In diplegic, CP cystic periventricular leukomalacia is the most common neurological point seen in pre-mature babies (5).

2.3. OTHER MEDICAL CONDITIONS ASSOCIATED WITH CP

2.3.1. Epilepsy in Children with Cerebral Palsy

Epilepsy is a separate, verifiably important clinical problem in children with CP. Its prevalence ranges from 15 to 55–60%, and according to some authors, indeed, up to 90–94% of children and grown-ups with CP (1) Epilepsy in children with CP is substantially revealed in the first 4–5 years of life, generally in the first year of life. (1) The prevalence of epilepsy varies depending on the type of cerebral palsy. Epilepsy is generally observed in tetraplegia (50–94%); it constantly accompanies hemiplegia (33–50%), but it infrequently affects children suffering from diplegia and the ataxic type of CP (16–27%). (1) .

2.3.2. Mental Retardation

Intellectual disability is an important and fairly common accompanying impairment in CP that has the potential to further affect diurnal conditioning, burden of care, quality of life, effectiveness of interventions, and life. Intellectual developmental disability or mental retardation is defined by significant detention in two or more developmental disciplines at less than 5 years old and an intelligence quotient of 70 or below at an older age (1, 2).

2.3.3. Malnutrition and Gastrointestinal Complications

The majority of children with cerebral paralysis have feeding difficulties and gastrointestinal problems similar to oropharyngeal dysfunction, gastroesophageal complaints, and constipation. 10) Oral feeding is a complex process that requires a mature stinking capability and an especially mature collaboration of stinking with breathing and swallowing. (14) Children with cerebral paralysis frequently have difficulty stinking. Nutritional sucking is a largely systematized process that's essential for a child’s feeding during the first 6 months of their lives. An infant’s inability to perform a safe and successful sucking action for oral feeding can be an early sign of an underdeveloped central nervous system. (5) A pilot study shows, using diffusion imaging, the relationship between nutritional sucking patterns and the microstructural integrity of sensory-motor tracts in babies with brain injury. (1) (16)

2.3.4. Speech Problems

Over 50% of children with CP exhibit some sort of speech impairment. [2] [17]
Speech production involves respiration together with laryngeal, velopharyngeal, and articulatory movements, and any of these functions may be disturbed in CP. [2] Motor disorders affecting speech include dysarthria or anarthria and dyspraxia or apraxia of speech. Dysarthria is characterized by slow, weak, imprecise, and/or uncoordinated movements of the speech musculature. [3] Apraxia, or dyspraxia, is characterized by a disturbance in the motor planning and programming of speech movements. [3] Speech ability is related to the type of CP, gross motor function, the presence of mental retardation, and the localization of brain maldevelopment and lesions.

An association between the type of CP and speech capability was reported by Andersen et al. in the Norwegian study. Ninety percent of the children with unilateral discontinuous CP had normal or accessible speech, while 97 percent of the children with dyskinetic CP had oppressively impaired or no speech. (1) .

2.3.5. Osteoporosis

Osteoporosis causes weak bones. It causes the bone to break fluently with veritably little stress or a light impact fall. It's present in CP cases due to lack of nutrition, dropped weight bearing, and the use of certain drugs that cause decay of the bones. (10) Aged cases are advised to screen bone mass before treatment using the fracture threat assessment tool or the Q fracture tool and dual-energy X-ray absorptiometry. Calcium, vitamin D supplements, and bisphosphonates are some supplements that are useful in managing osteoporosis(10). Weight-bearing exercises are set up to ameliorate bone mineral viscosity in cerebral palsy children and hence need to be enforced to ameliorate bone conditions (6, 7).

2.3.6. Dysphasia

Swallowing diseases are common in CP children due to neurological involvement. Its treatment consists of oral care, careful feeding methods, food variations, and stimulation of the oral musculature. (1) Drooling is also seen in CP children due to weakness of the facial and neck muscles. It can be managed with neck posture control, mouth closing, tongue control, behavioral therapies, intraoral appliances, and certain specifics like anticholinergic medicines beneficial for this condition. (10) Surgical removal of the salivary glands and duct ligation can help with this problem(5).

2.3.7. Respiratory Problems

Respiratory problems are frequently seen in CP children and are the main cause of death in adults floundering with this complaint. Due to factors such as weakness of the muscles, bad posture, and bad postural control, there's the accidental entry of food patches into the respiratory system, which occasionally leads to bacterial growth causing respiratory failures. (10) The operation of similar conditions includes life variations such as postural variations, food variations, and weight loss. Enhancement of motor functions and respiratory hygiene includes perfecting lung functions, perfecting

lung expansion, and aerobic fitness, along with airway concurrence and producing an effective cough (1). Oromotor strategies such sensitive awareness training, neck control exercises, general postural operations, certain medicines, and surgical interventions similar to duct transposition and duct ligation are important strategies for managing feeding and swallowing problems (4) .

2.3.8. Vision Problems

Abnormal brain development or damage to the brain results in cerebral visual impairment (CVI), preliminarily known as cortical blindness, which presents with visual deficits and perceptual imperfections. The CVI force and assessment are used to diagnose the functional limitations that are due to cerebral visual impairment(9). Treatment of hypoxic-ischemic encephalopathy can reduce the frequency of CVI, and other treatment approaches like visual stimulation and stem cell remedies need to be assessed further(6). Vision impairment may be an important aftereffect of brain damage, especially in those born preterm. Some probable aspects that can help these children are family comforting and involving the family in the recuperation process, and colorful welfare services from the government like education allowances, special books, education, scholarships, authorization to use assistive bias, large print question paper, a scribe for writing the examination, redundant time in the examination, and substituting visual questions(1).

2.3.9. Sleep disorders

Sleep disorders are veritably common in CP children, which produces a huge psychological burden on their families. Sleep diseases also lead to decreased function. Piecemeal from this, sleep diseases lead to behavioral changes, which beget functional problems in the body structure and affect the quality of life of the patient and family. A methodical review was conducted in 2021 to gather information on sleep diseases in CP children under 2 years, which established polysomnography as a good assessment tool for CP children. (1) Treatment includes cannabis, surgical interventions, and stimulation of the sensory system. (1)

3. PHYSIOTHERAPEUTIC MANAGEMENT OF CEREBRAL PALSY

Muscle training and exercises can help the child's strength, flexibility, balance, motor development, and mobility. Parents should learn how to safely watch for the child's everyday requirements at home, such as bathing and feeding the child. A therapist can give guidance on how to continue muscle training and exercise at home between therapy visits. For the first 1 to 2 years after birth, both physical and occupational therapists work on issues such as head and neck control, rolling, and grasping. Later, both types of therapists are involved in wheelchair assessments.

Physiotherapy has made great achievements in the field of cerebral paralysis. It helps
in perfecting the muscle structure and function and common range of motion and reduces contractures; some ways used to achieve this
are muscle stretching, common range of motion exercises, low-resistance repetitive exercises, progressive

resistance training, functional strength training, balance training, plyometrics, and selective muscle activation in ways similar to constraint-induced movement remedies.

An emergent remedy called hippotherapy has improved neck control and posture control in sitting, along with the upper extremities and trunk. There's an overall posture enhancement due to the stimulation of balance responses, which has a positive effect on balance and spasticity. 30–45-minute sessions, twice daily for 8–12 weeks, produce a positive effect on gross motor function in children with CP(8).

Deep brain stimulation in the case of dyskinetic CP and electrical stimulation via TENS and NMES in discontinuous CP are two ways to ameliorate the strength and function of muscles(8).

Braces, slivers, or other probative bias might be recommended for the child to help with function, such as better walking and stretching stiff muscles. Periodical casting is a technique used to stretch tight muscles to ameliorate the range of motion by applying a cast to the affected part(10).

3.1. GAIT TRAINING

The robot-assisted gait training authority is effective in perfecting gross motor function in children whose both sides are affected. After this intervention, all of the measures of gross motor function showed improvement. It also improved the locomotor capability of ambulatory children(9). Functional gait training, or practicing walking on a routine with limited body weight support, helps with standing erect with a dropped load on the lower extremity joint. This helps with gait training and is most useful in GMFCS grades IV and V. It also helps with good posture and control. You can do it on or off a treadmill.

Virtual reality and biofeedback can be incorporated; they produce a positive effect (2, 3). Biofeedback is a common strategy used in recuperation that can be used to represent any natural parameters and their changes. There are many different ways to notice the changes, including visual, aural, and haptic responses.

It's effective in perfecting motor function by relating effective motor performance to motor learning (7).
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3.2. NEURODEVELOPMENTAL THERAPY

A study was done on the effects of neurodevelopmental therapy in CP children, which revealed better function in various conditionings of children after the application of the intervention technique. NDT also reduced spasticity and improved overall function in CP children; still, there wasn't an important enhancement in walking, running, or jumping(7).

Neurodevelopmental therapy(NDT; Brunnstrom and Bobath system) and proprioceptive neuromuscular facilitation approaches have been shown to enhance the functional situations of individuals with CP. (8) The results show that the Neurodevelopmental Bobath Treatment system was applied in the

two cases' rehabilitation regimes in order to reduce motor-sensory impairments and enhance the experience of regular movement and functional independence.

The crucial element of the remedy program was trunk control exercises, since they were pivotal for establishing dynamic stabilization in several body regions and reducing irregularities in other body parts. (10)
Joint mobilization, pelvic mobilization, and deep friction massage were used to reduce the intensity of sensory input. The recuperation curriculum included exercises for weight transfer and functional reaching in both sitting and standing positions. (10)

4. RECENT ADVANCES IN CP REHABILITATION

4.1. Robot- assisted Devices

Robotics is a new technique that works on a computerized control system and helps in motor learning and cortical reorganization to ameliorate function in the upper and lower extremities.
As functional movements are more fruitful than normal movement patterns, it's been found that gait rehabilitation has a more positive impact on lower limb function. With advanced technology, robot-supported gait training has taken over traditional gait rehabilitation.

RAGT is salutary as it works with increased duration, repetition, constant speed, and pattern. Lower-limb robotic exoskeletons are set up to be apparent in perfecting the quality of life in CP children.

The most apparent robotic systems in the literature are Lokomat, Innowalk, Robogait, and Waltbox-K, but due to a lack of literature, their efficacy is still a question.

It's been found that an ankle foot orthosis is most beneficial for lower extremities in CP children, and an electronic varience device of similar design is scarce. There are numerous clinical trials, but review studies are lacking in the literature. Expansive studies are needed for upper-extremity robotic backing.

Piecemeal from these, social robots are also another corner of artificial intelligence that has to ameliorate communication and participation among CP children, along with provocation in rehabilitation (6, 7).

4.2. Virtual Reality

Virtual reality is a recent development in the field of neurorehabilitation that induces imaginations as real as reality, and patients are allowed to perform functional activities in similar surroundings. It was created in the 1960s and is employed as a diagnostic aid in some psychiatric situations. Numerous clinical trials on VR

Numerous clinical trials on VR are currently being done with stroke patients, COPD patients, and most recently, obstetric and gynecological patients. As a pain management strategy in CP cases, functional outgrowth studies are scarce in this population (6).

4.3. Augmentative and Indispensable Communication devices

The communication problem is found to be present in 25 percent of cases of CP children, and most of this population has some or other oromotor problems. Augmentative and indispensable communication devices are used to ameliorate the communication capacities of speech-impaired children. (6)

It helps develop a communication pattern among the CP child and other different members of the community. There are certain manual boards used in this strategy that can be used in the form of numbers, number symbols, etc. Other AAC devices used with speech and language problems are some form of technological device that helps expose the child's thinking. All studies with AAC show a good result, but verifiably lower studies are done on CP children. (9)

4.4. Mobile Applications for Cerebral Palsy Children

The use of mobile operations has drastically changed the script of the health care delivery system. These apps are dependable and valid, have become veritably common and handy, and are salutary in transferring information, forming analyses, monitoring, and treating. 23 mobile operations are specifically used for CP children, and there are numerous others that can be of significance. Some services of these apps include correcting the foot deformities of CP children by producing an auditory signal during altered biomechanics in foot placement and risk evaluation of hip dysplasia in CP children by health care specialists. (5)

4.5. Metaverse

The metaverse is a new emerging technology that gives a deeper, more persistent, and immersive 3D experience by combining multiple different virtual approaches in a full continuum of physical and digital interaction spaces. Despite numerous of the characteristics being analogous to virtual reality(VR) and augmented reality (AR), the metaverse has a service-oriented, solid model with an emphasis on social and content dimensions. Metaverse can provide multidimensional recuperation for CP thanks to a well-tested and customized rehabilitation protocol. (15)

5. OTHER WAYS OF MANAGING OF CP

Modern treatment of spasticity includes both botulinum toxin therapy and surgical methods, e.g., rhizotomy. (1)

5.1. MEDICATIONS

Medicines that
can lessen muscle stiffness might be used to improve functional capacities, treat pain, and manage compli cations related to spasticity or other CP symptoms.

5.1.1. Muscle or nerve injections

To treat tightening of a specific muscle, doctors might recommend injections of botulinum toxin A(Botox) or another agent. Approximately every three months, the injections must be repeated.
Side effects can include pain at the injection point and mild flu-like symptoms. Other more serious side effects include difficulty breathing and swallowing. (7)

5.1.2. Oral muscle relaxants

Drugs analogous to baclofen, tizanidine(Zanaflex), diazepam (Valium), or dantrolene(Dantrium) are constantly used to relax muscles.
In some cases, baclofen is pumped into the spinal cord with a tube(intrathecal baclofen). The pump is surgically inserted beneath the abdominal skin.

5.1.3. Specifics to reduce drooling

Botox injections into the salivary glands are applied.

5.2. OCCUPATIONAL THERAPY

Occupational therapists work to help the child gain independence in daily
activities and routines at home, at school, and in the community. Adaptive equipment recommended for the child can include walkers, wide-based canes, standing and seating systems, or electric wheelchairs.

5.3. SPEECH AND LANGUAGE THERAPY

Speech-language pathologists can help improve a child's capability to speak fluently or
to communicate using sign language. They can also educate themselves on the use of communication devices analogous to a computer and voice synthesizer if communication is difficult. Speech therapists can help people who have trouble swallowing and eating.

5.4. RECREATIONAL THERAPY

Some children profit from regular or adaptive recreational or competitive sports, such as therapeutic horseback riding or skiing. This type of remedy can help improve the child's motor skills, speech, and emotional well-being. Both adults and children benefit from regular physical activities and exercise for general health and fitness.

5.5. SURGICAL PROCEDURES

Surgery may be required to lessen muscle tightness or correct bone abnormalities caused by spasticity. These treatments include:

5.5.1. Orthopedic surgery

Children with severe contractures or scars might need surgery on bones or joints to place their arms, spine, hips, or legs in their correct positions. Surgical procedures can also lengthen muscles and stretch or reposition tendons that are shortened by contractures.
These corrections can lessen pain and improve mobility. Additionally, the procedures may ease the use of crutches, braces, or a walker.

5.5.2. Cutting nerve fibers (selective dorsal rhizotomy)

In some severe cases, when other treatments have not helped, surgeons might cut the nerves serving specific spastic muscles in a procedure called selective dorsal rhizotomy. This relaxes the muscles in the legs and reduces pain, but it can also cause numbness.

6. BARRIERS TO TREATMENT

People with CP face various walls and obstacles that have little to do with their physical or cognitive capacities. These barriers are caused by external forces such as inaccessible buildings and transportation, societal attitudes, and rejection from education and employment openings.

6.1. Incapacity of patients to recognize their needs

Until the first couple months and sometimes even years of life, the symptoms can go undiagnosed, which can lead to delays in the treatment process. The prognosis is improved with early treatment initiation.

6.2. Cost of Rehabilitation

Indeed, while this may feel daunting(especially if you have health problems), it's cheering to know that you have a plan in place to control healthcare charges. (9)

6.3. Poor understanding of the benefits and significance of physical activity

Some individuals reported that they associate physical exertion with pain, discomfort, and monotony(13, 14). Other individuals reported that they suspect the significance of PA and are uncertain about its benefits (13).

6.4. Negative self-conscious studies

Individuals may feel A comprehensive assessment of CP cases is vital for understanding their medical history, past and present treatments, and implicit complications. This information helps in developing personalized treatment plans and setting realistic expectations.
At appearing physically unfit in front of other people (14), and uncomfortable if the physical exertion highlights their body as dysfunctional (13), individuals also reported feeling shamed towards their caregivers when asking for help during a physical activity. (12)

7. CONCLUSION

Cerebral Paralysis is a complex problem in terms of description, classification as well as treatment. Children at risk of CP due to common threat factors, such as prematurity, should be under special care to start watching for experimental support beforehand. CP comorbidities, especially epilepsy and malnutrition, should be diagnosed and supervised; proper control of CP comorbidities may pave the way to ameliorating the development of children with CP. The main focus of recuperation for CP is known to be activity, although other medical, surgical, and remedial approaches have also been shown to relieve symptoms. Recent advancements in the recuperation of CP can yield brisk, cheaper, and easier results. Further study is needed to comprehend the function of recuperation for those with CP.

In addition to perfecting functional capacities during the complaint, recuperation interventions should also be concentrated on enhancing the patient's quality of life, symptom relief, avoiding complications, mobility, and daily conditioning.

8. SUMMARY

This paper discusses current trends in the recovery of cerebral paralysis, threat factors, classification, and other medical conditions associated with it. It

emphasizes on the physiotherapeutic operation, recent advancements in the field, and further discusses other operation approaches. Incipiently, barriers to treatment and recuperation are discussed. CP is a group of endless diseases that affect the development of movement and posture, causing activity limitations that are attributed to non-progressive disturbances that pass through the developing fetal or infant brain. The comprehensive assessment of CP cases is pivotal for understanding their medical history, past and present treatments, and implicit complications. This information helps in developing individualized treatment plans and setting realistic expectations. The threat factors for CP can be divided into pre-conception, antenatal, perinatal, and postnatal. The shorter the gestation, the more severe the diseases. The classification of CP can be grounded on The type of movement complaint (spastic, dyskinetic, and ataxic), Level of damage, and Area of involvement. There are other medical conditions that are generally associated with CP, like epilepsy, internal deceleration, malnutrition, speech problems, osteoporosis, dysphagia, respiratory problems, vision problems, and sleep diseases. In order to manage the symptoms of CP, these comorbidities also need to be assessed and addressed accordingly. There's no cure for the complaint yet, but the symptoms can be managed through colorful approaches. Physiotherapy plays a veritably big part in treating the musculoskeletal symptoms of CP. Muscle training, flexibility, balance, mobility, and gait training are the core aspects of the physiotherapeutic approach. Breathing exercises and pulmonary training are also needed to deal with and help with respiratory problems. Evidence-based activity interventions for managing symptoms and perfecting the quality of life of CP cases highlight the role of exercise programs in maintaining gait pattern, muscular strength, and function. Physical exertion has been shown to effectively address spasticity in CP cases. Neurodevelopmental remedy is an area of activity that reveals better function and conditioning of diurnal living, reduces spasticity, and enhances locomotor conditioning.

Recent advancements in the recuperation of CP help to avoid expensive hospitalization, reduce length of stay, and allow patients to remain independent at home, minimizing the need for fiscal or caregiver support. The ways may include Robot-assisted devices, virtual reality, augmentative and alternative communication devices, the metaverse, and mobile operations for cerebral paralysis. Other ways of managing CP include medicines(like botulinum toxin or muscle relaxants), surgeries like rhizotomy and muscle stretching, and other forms of curatives like occupational therapy, speech therapy, and recreational therapy. There are also certain walls, like the cost of Rehabilitation, poor patient education, and negative self-conscious thoughts that patients and their caretakers might come across during the battle of fighting the complaint, that should be taken into consideration while designing the protocol for recuperation. Thorough assessment, personalized treatment plans, and regular evaluation are required to address the specific requirements and challenges faced by these cases.

Overall, the significance of a multidisciplinary approach and evidence-based activity interventions in the recuperation of cases with cerebral paralysis is bandied about. It emphasizes the need for comprehensive assessment, personalized treatment plans, and regular evaluation to address the specific requirements and challenges faced by these cases.

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17. Cerebral Palsy: Current Opinions on Definition, Epidemiology, Risk Factors, Classification and Treatment Options
Małgorzata Sadowska,1 Beata Sarecka-Hujar,2 and Ilona Kopyta3