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Review of Neurological Diagnosis
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Cerebral Palsy & Hemiplegia

Introduction

Pediatric physical therapists are likely to treat children and adolescents with cerebral palsy. An evidence-based understanding of the condition and its related sequelae is essential for meaningful and effective intervention. A review of cerebral palsy and its characteristics, the impact it has on those who live with it, and an evidence-review of one possible intervention are all included below. Rosenbaum, et al[4] intended to clarify the concept of CP and promote cohesive use of the term across professional healthcare fields by offering this standard definition:

> *Cerebral palsy (CP) describes a group of permanent disorders of the development of movement and posture, causing activity limitation, 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.*

Epidemiology

Cerebral palsy (CP) is the most common motor disability in childhood, with a prevalence ranging from 1.5 to more than 4 per 1,000 live births. The Autism and Developmental Disabilities Monitoring Network (ADDM) estimates that 1 in 323 children are diagnosed with CP. Research suggests that CP is more common in boys than girls, and Black children are affected more than Hispanic or White children. More than three quarters of children diagnosed with cerebral palsy have spastic CP. Co-occurring conditions are common in children with CP; for example, 41% have epilepsy. The Metropolitan Atlanta Developmental

Disabilities Surveillance Program (MADDSP) reports that of 8-year-old children with CP, 60% have another developmental disability, 40% have an intellectual disability, and nearly a quarter have both an intellectual disability and epilepsy.[1]

Risk factors include low birthweight and premature birth. The MADDSP reports that babies born weighing 2,500 grams or more have a prevalence of 1.1 per 1,000 births. This number increases to 6.2 per 1,000 in babies born weight 1,500 – 2,499 grams. For babies born weighing less than 1,500 grams, the prevalence increases to 59.5 per 1,000 live births. Other risk factors include ischemic stroke to the developing fetal brain, infection in a pregnant mother, birth defects of the central nervous system, and brain injuries and/or infections in infants (i.e. motor vehicle crash, fall, meningitis).[1]

Pathology & Pathophysiology

Cerebral palsy is a collective term for brain damage or abnormal brain development that results in neurological disorders that affect movement, coordination, and balance.[2,5] Traditional research suggests that cerebral palsy is caused by brain asphyxia en utero, or a lack of adequate oxygen to the brain of the fetus.[3] Essentially, this equates to the fetus having a stroke, and the resultant brain damage manifests later in development (i.e. hemiplegia). Recent research indicates there may be more to it, though.[3,4] For example, new evidence suggests CP is the result of a combination of predisposing factors (i.e. congenital abnormalities, genetic factors, etc.), acute perinatal events (i.e. birth asphyxia, inflammation, etc.), and additional postnatal factors (i.e. stress, nutrition, etc.).[3]

Congenital cerebral palsy is damage to the brain that occurs before or during birth. This is the case for 85-90% of children with CP, and often the cause is unknown. Risk factors for congenital CP include low birthweight, premature birth, multiple births, assisted reproductive technology, infections during pregnancy, jaundice and kernicterus, medical conditions of the mother, and birth complications. Acquired CP represents a much smaller portion of children with CP and is the result of brain damage that occurs more than 28 days after birth. Acquired CP is associated with head injury (i.e. motor vehicle crash, fall), infection (i.e. meningitis), and problems with blood flow to the brain (i.e. stroke).[5]

Cerebral palsy is not hereditary. Risk factors associated with CP do not cause the disorder, but rather indicate that a child is at an increased risk of being born with it.[2]

Disease Progression & Impairments

Cerebral palsy is not a progressive disorder, meaning the symptoms do not get worse over time. Delayed motor or movement milestones are the primary sign that a child might have CP.[7] Signs associated with CP are usually observed before the age of three years and include ataxia, spasticity, and gait abnormalities.[2] While earlier signs are possible, such as feeling stiff or floppy in a baby younger than 6 months or delayed/altered movement milestones up to 10 months of age, it's important to know that children without CP may also display these signs.[7] Other commonly associated neurological symptoms include seizures, hearing loss, impaired vision, bladder and/or bowel control issues, and pain or abnormal sensations.[2]

Impairments are dependent upon which part of the brain is affected by injury, which means symptoms vary widely. Motor disorders observed in individuals with cerebral palsy may include tonal abnormalities (i.e. hypertonia, hypotonia), movement disorders (i.e. spasticity, ataxia, dystonia, athetosis), dysfunctional ambulation, and oromotor and speech function deficits.[4] Other impairments may include general or specific muscle weakness, decreased bone mineral density, range of motion, and aerobic fitness, seizures, hearing or vision problems, attentional/behavioral/emotional issues, cognitive deficits, etc.[4,6] Research indicates that as many as 30% of children with CP demonstrate limited or no walking ability, 11% use a mobility device, and up to 58% walk independently.[1] Another study suggests that 41% are limited in their ability to crawl, walk, run, or play, while 31% require adaptive equipment such as walkers or wheelchairs.[1]

There are four types of cerebral palsy. The most common type is spastic CP, representing about 80% of individuals with CP. This type is characterized by increased muscle tone and can further be classified as spastic diplegia (legs), hemiplegia (one side of the body), or quadriplegia (all four limbs, trunk, and face). The second type is dyskinetic CP, characterized by dyskinesia, or dysfunctional movement of the hands, arms, feet, and/or legs. Movements can be slow and writhing or rapid and jerky. The third type is ataxic CP, characterized by ataxia, or difficulty with balance and coordination. Individuals with this type of cerebral palsy may have difficulty with walking, quick movements, or movements that require skilled control (i.e. writing). Finally, an individual may also demonstrate a combination of these different types, called mixed CP. The most common type of mixed CP is spastic-dyskinetic CP.[7]

Activity, Participation, & Quality of Life

The range of impairments observed in individuals with cerebral palsy contributes to an equal variety and range of activity and participation limitations. An individual's limitation is dependent upon his/her specific impairments, but common challenges include areas such as general tasks and demands (i.e. activities of daily living), self care and domestic life (i.e. cooking, brushing teeth, showering), communication (i.e. speech, writing, comprehension), mobility (i.e. ambulation, driving), interpersonal interactions and relationships, learning (i.e. accessible environment, adaptive equipment), and community, social, and civic life.[8]

Research indicates that children with CP who have moderate or severe motor deficits are significantly more likely to experience activity and participation challenges.[11,13] Furthermore, research shows that the Gross Motor Function Measure (GMFM) score and the International Classification of Functioning, Disability, and Health – Child and Youth Checklist (ICF-CY) function domain have negative correlations to ICF-CY activity and participation.[12] Adolescents with CP spend less time with friends, participate much less in sports, and have less autonomy in their daily lives than peers without CP.[13]

Children and adolescents with cerebral palsy report generally similar quality-of-life to that of their peers without CP; however, there is a correlation between increased pain and/or motor involvement and decreased quality of life reports.[9,10]

Intervention

There is no cure for cerebral palsy, but early treatment can improve a child's capabilities, help him/her to overcome developmental disabilities, and learn new ways to accomplish tasks.[2] Early intervention and school-aged services are available through the Individuals with Disabilities Education Act (IDEA).[7] Other interventions include medication, surgery, therapy services (i.e. physical therapy, occupational therapy, speech therapy), orthotic devices, assistive devices (i.e. walkers, wheelchairs), and communication aids.[2]

Baclofen is a common medication used to treat spasticity in individuals with cerebral palsy. It is administered either orally or intrathecally (i.e. via catheter inserted into the spinal column), with different levels of effectiveness. Literature reviews often cite the limited evidence necessary to make meaningful conclusions. For example, a 2000 systematic review reported limited evidence for intrathecal baclofen reducing spasticity in the lower extremities and upper extremity effects that were unclear. Reported complications included somnolence, hypotonia, headache, nausea, vomiting, infections, cerebrospinal fluid leaks, and seizure activity.[14] Other studies report improved pain and spasm relief, improved sleep, independence, and ease of care.[14,15]

A 2015 Cochrane review evaluated the efficacy of intrathecal baclofen for spasticity in children with cerebral palsy and found limited evidence for effective short-term use, and less certain support for long-term use. In addition to treating spasticity, intrathecal baclofen may also improve gross motor function, improve ease of care, comfort, and quality of life, but more quality evidence is needed to confirm this.[15] A 2011 systematic review[16]

studied the effect of intrathecal baclofen (ITB) on ambulation in children and adolescents with spasticity and dystonia. Again, the authors caution interpretation of the results due to the reduced quality of evidence, but interesting results were produced nonetheless. ITB was shown to improve the quality of gait in those participants who were already ambulatory before receiving ITB; however, the ambulatory status did not change for those who were non-ambulatory prior to treatment, including no change in the level of assistance needed for ambulation.[16] As in the study mentioned above, frequent adverse events were reported in this study.

The effectiveness of oral baclofen in treating spasticity in children and adolescents with cerebral palsy was examined in a 2015 systematic review[17]. The review failed to find clear evidence that oral baclofen is effective in treating spasticity and improving function or activity in this demographic.[17] However, low-quality evidence was again listed as a concern.

As the physical therapy profession moves more towards autonomous practice, it's important that clinicians maintain a relevant understanding of the medications that their patients may be taking, or may inquire about. When considering pediatric patients with cerebral palsy, baclofen may have short-term benefits for spasticity, comfort, ease of care, gross motor function, and quality of life, but significant and frequent adverse effects are common. Additionally, most of the literature reviews on this intervention are based on low-quality evidence.

Resources

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