CEREBRAL PULSY (CP)

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Definition

- is an **umbrella term** encompassing a group of **non-progressive** non-contagious motor conditions that cause **physical disability in human development**, chiefly in the various areas of body movement.

- Cerebral refers to the **cerebrum**, which is the affected area of the brain (although the disorder most likely involves connections between the **cortex** and other parts of the brain such as the **cerebellum**), and **palsy** refers to disorder of movement. Furthermore, "**paralytic disorders**" are not cerebral palsy
Cerebral palsy is caused by damage to the motor control centers of the developing brain and can occur during pregnancy, during childbirth or after birth up to about age three. Resulting limits in movement and posture cause activity limitation and are often accompanied by disturbances of sensation, depth perception and other sight-based perceptual problems, communication ability; impairments can also be found in cognition, and epilepsy is found in about one-third of cases. CP, no matter what the type, is often accompanied by secondary musculoskeletal problems that arise as a result of the underlying etiology.
Epidemiology

Prevalence of cerebral palsy is best calculated around the school entry age of about six years, the prevalence in the U.S. is estimated to be 2.4 out of 1000 children.

The SCPE reported the following incidence of comorbidities in children with CP (over 4,500 children over age 4 whose CP was acquired during the prenatal or neonatal period were included):

- Mental disadvantage (IQ < 50): 31%
- Active seizures: 21%
- Mental disadvantage (IQ < 50) and not walking: 20%
- Blindness: 11%
Classification

Cerebral palsy (CP) is divided into four major classifications to describe different movement impairments. These classifications also reflect the areas of the brain that are damaged. The four major classifications are:

1. spastic
2. ataxic
3. athetoid/dyskinetic
4. mixed
Spastic cerebral palsy is by far the most common type. 80% of all cases of CP. People with this type of CP are hypotonic and have what is essentially a neuromuscular mobility impairment (rather than hypotonia or paralysis) stemming from an upper motor neuron lesion in the brain as well as the corticospinal tract or the motor cortex. This damage impairs the ability of some nerve receptors in the spine to properly receive gamma amino butyric acid, leading to hypertonria in the muscles signaled by those damaged nerves.

Spastic CP is typically more easily manageable by the person affected, and medical treatment can be pursued on a multitude of orthopedic and neurological fronts throughout life.
Spastic CP is classified by topography dependent on the region of the body affected; these include: Spastic hemiplegia is one side being affected. Generally, injury to muscle-nerves controlled by the brain's left side will cause a right body deficit, and vice versa. Typically, people that have spastic hemiplegia are the most ambulatory of all the forms, although they generally have dynamic equinus (a limping instability) on the affected side and are primarily prescribed ankle-foot orthoses to prevent said equines.
• Spastic diplegia is the lower extremities affected, with little to no upper-body spasticity. The most common form of the spastic forms (70-80% of known cases), most people with spastic diplegia are fully ambulatory, but are "tight" and have a scissors gait. Flexed knees and hips to varying degrees, and moderate to severe adduction (stemming from tight adductor muscles and comparatively weak abductor muscles), are present. The intelligence of a person with spastic diplegia is unaffected by the condition. Over time, the effects of the spasticity sometimes produce hip problems and dislocations.
- **Spastic monoplegia** is one single limb being affected.
- **Spastic triplegia** is three limbs being affected. **Spastic quadriplegia** is all four limbs more or less equally affected. People with spastic quadriplegia are the least likely to be able to walk, or if they can, to desire to walk, because their muscles are too tight and it is too much of an effort to do so. Some children with spastic quadriplegia also have hemiparetic tremors, an uncontrollable shaking that affects the limbs on one side of the body and impairs normal movement.
Ataxic

Ataxia type symptoms can be caused by damage to the cerebellum. The forms of ataxia are less common types of cerebral palsy, occurring in at most 10% of all cases. Some of these individuals have hypotonia and tremors. Motor skills such as writing, typing, or using scissors might be affected, as well as balance, especially while walking. It is common for individuals to have difficulty with visual and/or auditory processing.
Achetoid cerebral palsy or dyskinetic cerebral palsy is mixed muscle tone – both hypertonia and hypotonia mixed with involuntary motions. People with Dyskinetic CP have trouble holding themselves in an upright, steady position for sitting or walking, and often show involuntary motions. For some people with dyskinetic CP, it takes a lot of work and concentration to get their hand to a certain spot (like scratching their nose or reaching for a cup). Because of their mixed tone and trouble keeping a position, they may not be able to hold onto objects, especially small ones requiring fine motor control (such as a toothbrush or pencil).
About 10% of individuals with CP are classified as dyskinetic CP but some have mixed forms with spasticity and dyskinesia. The damage occurs to the extrapyramidal motor system and/or pyramidal tract and to the basal ganglia. In newborn infants, high bilirubin levels in the blood, if left untreated, can lead to brain damage in the basal ganglia (kernicterus), which can lead to dyskinetic cerebral palsy.
Signs and symptoms

All types of cerebral palsy are characterized by abnormal muscle tone (i.e., slouching over while sitting), reflexes, or motor development and coordination. There can be joint and bone deformities and **contractures** (permanently fixed, tight muscles and joints). The classical symptoms are spasticities, spasms, other involuntary movements (e.g. facial gestures), unsteady gait, problems with balance, and/or soft tissue findings consisting largely of decreased muscle mass.
Scissor walking (where the knees come in and cross) and toe walking (which can contribute to a gait reminiscent of a marionette) are common among people with CP who are able to walk, but taken on the whole, CP symptomatology is very diverse. The effects of cerebral palsy fall on a continuum of motor dysfunction which may range from slight clumsiness at the mild end of the spectrum to impairments so severe that they render coordinated movement virtually impossible at the other end the spectrum. Babies born with severe CP often have an irregular posture; their bodies may be either very floppy or very stiff. Birth defects, such as spinal curvature, a small jawbone, or a small head sometimes occur along with CP.
Symptoms may appear or change as a child gets older. Some babies born with CP do not show obvious signs right away. Classically, CP becomes evident when the baby reaches the developmental stage at six and a half to 9 months and is starting to mobilise, where preferential use of limbs, asymmetry or gross motor developmental delay is seen. Secondary conditions can include seizures, epilepsy, apraxia, dysarthria or other communication disorders, eating problems, sensory impairments, mental retardation, learning disabilities, urinary incontinence, fecal incontinence and/or behavioral disorders.
Speech and language disorders are common in people with cerebral palsy. The incidence of dysarthria is estimated to range from 31% to 88%. Speech problems are associated with poor respiratory control, laryngeal and velopharyngeal dysfunction as well as oral articulation disorders that are due to restricted movement in the oral-facial muscles. There are three major types of dysarthria in cerebral palsy: spastic, dyskinetic (athetosis) and ataxic.
Skeleton

The shafts of the bones are often thin (gracile) and become thinner during growth. When compared to these thin shafts (diaphyses), the centers (metaphyses) often appear quite enlarged (ballooning). With lack of use, articular cartilage may atrophy, leading to narrowed joint spaces. Depending on the degree of spasticity, a person with CP may exhibit a variety of angular joint deformities. Because vertebral bodies need vertical gravitational loading forces to develop properly, spasticity and an abnormal gait can hinder proper and/or full bone and skeletal development. People with CP tend to be shorter in height than the average person because their bones are not allowed to grow to their full potential. Sometimes bones grow to different lengths, so the person may have one leg longer than the other.
Pain and sleep disorders

Pain is common, and may result from the inherent deficits associated with the condition, along with the numerous procedures children typically face. There is also a high likelihood of suffering from chronic sleep disorders associated with both physical and environmental factors. Pain is also associated with tight and/or shortened muscle, abnormal posture, stiff joints, unsuitable orthosis etc.
1- Lack of muscle coordination when performing voluntary movements (ataxia);
2- Stiff or tight muscles and exaggerated reflexes (spasticity);
3- Walking with one foot or leg dragging;
4- Walking on the toes, a crouched gait, or a “scissored” gait;
5- Variations in muscle tone, either too stiff or too floppy;
6- Excessive drooling or difficulties swallowing or speaking;
7- Shaking (tremor) or random involuntary movements; and
8- Difficulty with precise motions, such as writing or buttoning a shirt.
Causes
In certain cases there is no identifiable causetypical causes include problems in intrauterine development (e.g. exposure to radiation, infection), asphyxia before birth, hypoxia of the brain, and birth trauma during labor and delivery, and complications in the perinatal period or during childhood. CP is also more common in multiple births. Prematurity, intrapartum asphyxia, low birth weight, mother’s infection increase risk to develope CP. After birth, other causes include toxins, severe jaundice, lead poisoning, physical brain injury, shaken baby syndrome, incidents involving hypoxia to the brain (such as near drowning), and encephalitis or meningitis. The three most common causes of asphyxia in the young child are: choking on foreign objects such as toys and pieces of food, poisoning, and near drowning.
Risk Factors

1. Low birth weight.
2. Multiple birth.
3. Infections during pregnancy.
5. Exposure to toxic substances.
6. Thyroid abnormalities, Mental retardation or seizure.
8. Complicated labor and delivery.
10. Low apgar score.
11. Jaundice.
12. Seizure.
Diagnosis
The diagnosis of cerebral palsy has historically rested on the patient's history and physical examination further diagnostic tests are CT and MRI imaging. The neuroimaging study with CT or MRI is warranted when the etiology of a patient's cerebral palsy has not been established. MRI is preferred over CT due to diagnostic yield and safety.
Treatment

Treatment for cerebral palsy is a lifelong multi-dimensional process focused on the maintenance of associated conditions. Various forms of therapy are available to people living with cerebral palsy as well as caregivers and arentscaring for someone with this disability. The earliest proven intervention occurs during the infant's recovery in the neonatal intensive care unit (NICU). Treatment may include one or more of the following: physical therapy; occupational therapy; speech therapy; drugs to control seizures, alleviate pain, or relax muscle spasms (e.g. benzodiazepines, baclofen and intrathecal phenol/baclofen); hyperbaric oxygen; the use of Botox to relax contracting muscles; surgery to correct anatomical abnormalities or release tight muscles; braces and other orthotic devices; rolling walkers; and communication
aids such as computers with attached voice synthesizers. For instance, the use of a standing frame can help reduce spasticity and improve range of motion for people with CP who use wheelchairs. Treatment is usually symptomatic and focuses on helping the person to develop as many motor skills as possible or to learn how to compensate for the lack of them.

Interpersonal therapy
Physiotherapy
Occupational therapy
Speech therapy
Conductive education
Biofeedback
Massage therapy
Occupational therapy
Occupational Therapy (OT) enables individuals with CP to participate in activities of daily living that are meaningful to them. A family-centred philosophy is used with children who have CP. Occupational therapists work closely with families in order to address their concerns and priorities for their child.

Medication

Botulinum toxin A injections are given into muscles that are spastic or sometimes dystonic, the aim being to reduce the muscle hypertonus that can be painful. A reduction in muscle tone can also facilitate bracing and the use of orthotics. Most often lower extremity muscles are injected. Botulinum toxin is focal treatment meaning that a limited number of muscles can be injected at the same time. The effect of the toxin is reversible and a reinjection is needed every 4–6 months.
Surgery and orthoses
Surgery usually involves one or a combination of:
• Loosening tight muscles and releasing fixed joints, most often performed on the hips, knees, hamstrings, and ankles. In rare cases, this surgery may be used for people with stiffness of their elbows, wrists, hands, and fingers.
• The insertion of a baclofen pump usually during the stages while a patient is a young adult. This is usually placed in the left abdomen. It is a pump that is connected to the spinal cord, whereby it sends bits of Baclofen alleviating the continuous muscle flexion. Baclofen is a muscle relaxant and is often given by mouth to patients to help counter the effects of spasticity.
Straightening abnormal twists of the leg bones, i.e. femur (termed femoral anteversion or antetorsion) and tibia (tibial torsion) The surgery is called derotation osteotomy, in which the bone is broken (cut) and then set in the correct alignment.

- Cutting nerves on the limbs most affected by movements and spasms. This procedure, called a rhizotomy

**Prognosis**

CP is not a progressive disorder (meaning the brain damage does not worsen), but the symptoms can become more severe over time due to subdural damage. A person with the disorder may improve somewhat during childhood if he or she receives extensive care from specialists, but once bones and musculature become more established, orthopedic surgery may be required. The full intellectual potential of a child born with CP will often not be known until the child starts school. People with CP are more likely to have learning disabilities, although these may be unrelated to IQ, and are more likely to show varying degrees of intellectual disability.
Complications

1. Mental retardation (2/3 of cases with CP).
2. Seizure (50%).
3. Delayed growth and development (common in CP).
5. Impaired vision, hearing and speech.
6. Drooling.
7. Incontinence (common).
8. Abnormal sensation: decrease in touch and perception - Stereognosia.
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