

Pediatrics

Cerebral Palsy

Definition

- Abnormality of movement and posture
- Causing activity limitation
- Attributed to non-progressive pathology of developing brain
- Diagnosis is made clinically, attention to
 - Assessment of posture
 - Pattern of tone
 - Hand function
 - Gait

Terminologies

1. Spasticity
 - a. Velocity-dependent to stretch
 - b. Where a lack of inhibition results in excessive contraction of the muscles
 - c. Characterized by hyperreflexia and hypertonia
2. **Dyskinesia**
 - a. Movements which are
 - i. Involuntary
 - ii. Uncontrolled
 - iii. Occasionally stereotyped
 - iv. Aggravated by active movement or stress
 - b. Can be described as either
 - i. **Chorea**
 1. Movement that is
 - a. Irregular
 - b. Sudden
 - c. Brief non-repetitive
 - ii. **Athetosis**
 1. Slow
 2. Writhing movement
 3. Occur more distally such as fanning of fingers

iii. Dystonia

1. Simultaneous contraction of agonist and antagonist muscles
2. Of the trunk and proximal muscle
3. Giving the twisting appearance

3. Ataxia

- a. Lack of voluntary coordination of muscle movements

Types of Cerebral Palsy

1. Spastic Cerebral Palsy 90%

- a. Hemiplegia
- b. Quadriplegia
- c. Diplegia

2. Dyskinetic Cerebral Palsy

3. Ataxic Cerebral Palsy

4. Mixed Types

Etiology of Cerebral Palsy

1. Antenatal Causes 80%

- a. Vascular occlusion
- b. Cortical migration syndrome
- c. Structural maldevelopment of the brain
- d. Congenital infection
- e. Genetic syndromes

2. During Delivery 10%

- a. Hypoxic-Ischemic Injury
- b. Periventricular Leukomalacia

3. Postnatal 10%

- a. Meningitis
- b. Encephalitis
- c. Encephalopathy
- d. Head trauma
- e. Symptomatic hypoglycemia
- f. Hydrocephalus
- g. Hyperbilirubinemia (Kernicterus)

Rigidity

Characterized by an increase in muscle tone causing resistance to externally imposed joint movements

1. Lead pipe rigidity

- a. results when an increase in muscle tone causes a sustained resistance to passive movement throughout the whole range of motion, with no fluctuations

- i. Parkinson's disease

2. Cogwheel rigidity

- a. A combination of lead pipe rigidity and tremor which presents as a jerky resistance to passive movement as muscles tense and relax

- i. Parkinson's disease

3. Clasp knife rigidity

- a. The increased in limb tone may suddenly yield under pressure

- i. Spastic type Cerebral Palsy

Cerebral Palsy

Spastic Cerebral Palsy

Hemiplegia

Quadriplegia

Diplegia

Chorea

Dyskinetic Cerebral Palsy

Athetosis

Dystonia

Ataxic Cerebral Palsy

Mixed-type Cerebral Palsy

Gross Motor Function Classification System (GMFCS)

Level 1 – Walks without limitation

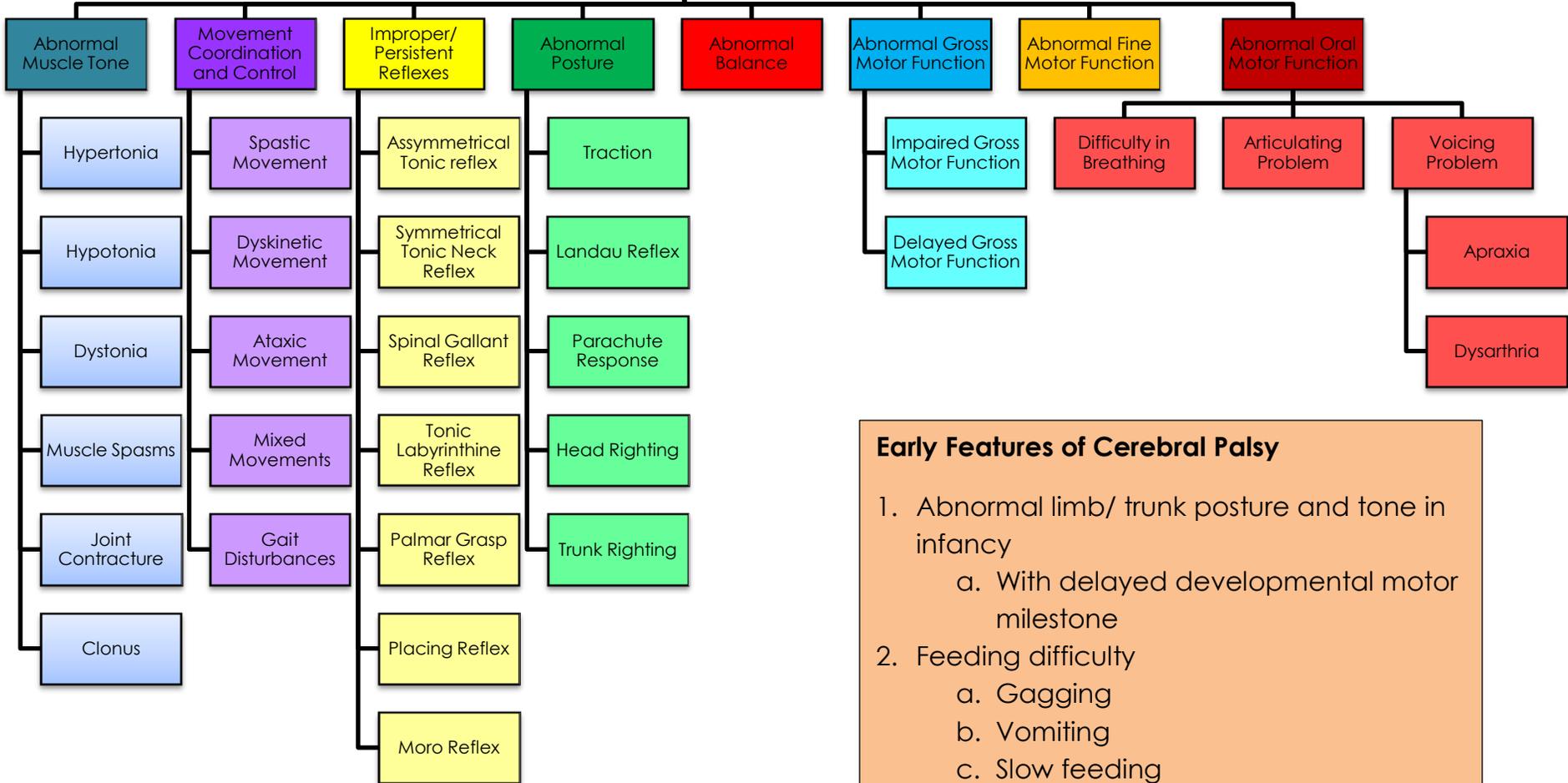
Level 2 – Walks with limitations

Level 3 – Walks using a handheld mobility device

Level 4 – Self mobility with limitations, may use powered mobility

Level 5 – Transported using a manual wheelchair

8 Clinical Signs of Cerebral Palsy



- Early Features of Cerebral Palsy**
1. Abnormal limb/ trunk posture and tone in infancy
 - a. With delayed developmental motor milestone
 2. Feeding difficulty
 - a. Gagging
 - b. Vomiting
 - c. Slow feeding
 3. Abnormal gait once able to walk
 4. Asymmetrical hand function before 12 months of age

8 Clinical Signs of Cerebral Palsy

Abnormal Muscle Tone	Movement Coordination and Control	Improper/ Persistent Primitive Reflexes
<p>The most noticeable sign of cerebral palsy is impairment of muscle tone – the ability of muscles to work together by maintaining proper resistance. Muscles coordinate with other muscles, oftentimes in pairs. As some muscles contract, others must relax.</p> <ul style="list-style-type: none"> • Hypertonia <ul style="list-style-type: none"> ○ Increased muscle tone or tension (stiff or rigid limbs) • Hypotonia <ul style="list-style-type: none"> ○ Decreased muscle tone or tension (flaccid, relaxed, or floppy limbs) • Dystonia <ul style="list-style-type: none"> ○ Fluctuating muscle tone or tension (too loose at times and too tight at others) • Mixed Type <ul style="list-style-type: none"> ○ The trunk of the body may be hypotonic while the arms and legs are hypertonic • Muscle Spasms <ul style="list-style-type: none"> ○ Sometimes painful, involuntary muscular contraction • Joint Contracture <ul style="list-style-type: none"> ○ Joints that are effectively fused together preventing proper motion • Clonus <ul style="list-style-type: none"> ○ Muscular spasms with regular contractions 	<p>The impairment of muscle tone affects a child's limbs and body in different ways, although all children with cerebral palsy will likely feel some effect on muscle control and coordination. Different muscle control impairments can combine to cause limbs to be perpetually extended, contracted, constantly moving in rhythmic patterns or jerking spastically.</p> <p>Some signs will be more apparent when the child is under stress. Some may be task related, such as reaching for an object. Sometimes signs will seem to disappear when the child is asleep and muscles are relaxed</p> <ul style="list-style-type: none"> • Spastic Movements <ul style="list-style-type: none"> ○ Hypertonic movements where the muscles are too tight resulting in muscle spasms, scissoring of the legs, clonus, contracture, fixed joints, and over-flexed limbs • Dyskinetic/ Athetoid Movements <ul style="list-style-type: none"> ○ Fluctuating muscle tone causing uncontrolled, sometimes slow, writhing movements which can worsen with stress • Ataxic Movements <ul style="list-style-type: none"> ○ Poor coordination and balance making tasks – such as writing, brushing teeth, buttoning shirts, tying shoes, and putting keys into slots – difficult • Mixed Movements <ul style="list-style-type: none"> ○ A mixture of movement impairments, most commonly a combination of spastic and athetoid types, affecting different limbs • Gait Disturbances*** 	<p>Reflexes are involuntary movements the body makes in response to a stimulus. Certain primitive reflexes are present at or shortly after birth, but disappear at predictable stages of development as the child grows. Specific reflexes that do not fade away – or those that don't develop as the child grows – can be a sign of cerebral palsy.</p> <p>Abnormal primitive reflexes may not function properly in children with cerebral palsy, or they may not disappear at specific points in development as they do with children with no impairment.</p> <ul style="list-style-type: none"> • Asymmetrical tonic reflex <ul style="list-style-type: none"> ○ When the head turns, the legs on the same side will extend, and the opposite limbs contract like in a fencing pose <ul style="list-style-type: none"> ○ Should disappear by 6 months • Symmetrical tonic neck reflex <ul style="list-style-type: none"> ○ The infant assumes a crawling position when the head is extended <ul style="list-style-type: none"> ○ Should disappear between 8-11 months • Spinal gallant reflex <ul style="list-style-type: none"> ○ When the infant lies on its stomach, the hips will turn towards the side of the body that is touched <ul style="list-style-type: none"> ○ Should disappear between 3-9 months • Tonic labyrinthine reflex <ul style="list-style-type: none"> ○ When the head is tilted back, the back arches, the legs straighten, and the arms bend <ul style="list-style-type: none"> ○ Should disappear 3 ½ years of age • Palmar grasp reflex <ul style="list-style-type: none"> ○ When stimulating the palm the hand flexes in a grasping motion <ul style="list-style-type: none"> ○ Should disappear between 4-6 months of age • Placing reflex <ul style="list-style-type: none"> ○ When an infant is held upright and the back of a foot touches the surface, the legs will flex <ul style="list-style-type: none"> ○ Should disappear by 5 months • Moro reflex <ul style="list-style-type: none"> ○ When the infant is tilted so his or her legs are above their head, the arms will extend <ul style="list-style-type: none"> ○ Should disappear by 6 months

*****Gait Disturbances in Cerebral Palsy**

In-Toeing	Out-Toeing	Limping	Toe Walking	Propulsive Gait	Scissor Gait	Spastic Gait	Steppage Gait	Waddling Gait
Toes angle or rotate inward	Toes angle or rotate outward	More weight is placed on one foot than the other, causing a dipping, or wavy stride ***shortens stance phase	The weight is unevenly placed on the toes	A child walks hunched over in a stiff posture with the head and shoulders bent forward	The hips flex slightly making it look like the child is crouching while knees and thighs slide past one another like scissors	One leg drags due to muscle spasticity	Toes drag because the foot drags	Duck-like walking pattern that can appear later in life

8 Clinical Signs of Cerebral Palsy

Abnormal Posture	Abnormal Balance
<p>Cerebral palsy affects posture and balance. Signs may appear as an infant begins to sit up and learn to move about. Typically, posture is expected to be symmetrical. For example, a baby in a sitting position would normally have both legs in front. When bent, they become mirror images of one another.</p> <p>Much like reflexes, postural responses are expected reactions when putting a baby in certain positions. They typically appear as the baby develops. Impairment may be a possibility if the responses do not develop, or if they are asymmetric</p> <ul style="list-style-type: none"> • Traction • Landau reflex <ul style="list-style-type: none"> ○ When the infant is supported in a lying position, pushing the head down will cause the legs to drop, and lifting the head will cause them to rise ○ should disappear between 4-5 months • Parachute response <ul style="list-style-type: none"> ○ When the infant is positioned with his or her head towards the ground, the infant should instinctively reach as if bracing for impact ○ Should disappear between 8-10 months • Head righting <ul style="list-style-type: none"> ○ When an infant is swayed back and forth, his or her head will remain straight ○ Should disappear by 4 months • Trunk righting <ul style="list-style-type: none"> ○ When a sitting infant is quickly pushed to the side, the infant will resist the force and use opposite hand and arm to brace against impact ○ Should disappear by 8 months 	<p>The impairment of gross motor function can affect a child's ability to balance. Signs become recognizable as a child learns to sit, rise from a sitting position, and begins crawling or walking. Infants need to use their hands often as they learn these skills. They develop the strength, coordination, and balance to accomplish the task when mastering it without the use of their hands.</p> <p>Signs to look for when a child sits include:</p> <ul style="list-style-type: none"> • Requiring both hands for support • Having difficulty balancing when not using hands for support • Unable to sit without using hands for support <p>Other signs to look for include, but are not limited to:</p> <ul style="list-style-type: none"> • Swaying when standing • Unsteady when walking • Difficulty making quick movements • Needing hands for activities that require balance • Walking with abnormal gait

8 Clinical Signs of Cerebral Palsy

Abnormal Gross Motor Function	Abnormal Fine Motor Function	Abnormal Oromotor Function
<p>As a child develops, signs of impaired or delayed gross motor function may be noticeable. The ability to make large, coordinating movements using multiple limbs and muscle groups is considered gross motor function.</p> <p>Gross motor function may be impaired by abnormal muscle tone, especially hypertonia or hypotonia.</p> <p>For example, hypertonic limbs can be too tight, or inflexible, to allow proper flexion and movement; whereas hypotonic limbs may be too loose to properly support a child's movements.</p> <ul style="list-style-type: none"> • Impaired gross motor functions <ul style="list-style-type: none"> ○ Limited capability of accomplishing common physical skills such as walking, running, jumping, and maintaining balance. • Delayed gross motor functions <ul style="list-style-type: none"> ○ Physical skills developed later than expected; often used in conjunction with developmental milestones for predictable stages of development <p>Significant milestones of gross motor function include:</p> <ul style="list-style-type: none"> • Rolling • Sitting up • Crawling • Standing • Walking • Balancing 	<p>Executing precise movements defines the category of fine motor function. Fine motor control encompasses many activities that are learned, and involve a combination of both mental (planning and reasoning) and physical (coordination and sensation) skills to master.</p> <p>Impaired or delayed fine motor skills are an indicator of possible cerebral palsy. An intention tremor, where a task becomes more difficult as it gets closer to completion, is one such sign. Examples of fine motor function development are:</p> <ul style="list-style-type: none"> • Grasping small objects • Holding objects between thumb and forefinger • Setting objects down gently • Using crayons • Turning pages in a book 	<p>Difficulty in using the lips, tongue, and jaw indicate impaired oral motor function; this is a sign that may be present in up to 90% of preschool-aged children diagnosed with cerebral palsy. Signs of oral motor function impairment include, but are not limited to difficulty with:</p> <ul style="list-style-type: none"> • Speaking • Swallowing • Feeding/chewing • Drooling <p>Speech requires proper intellectual and physical development. Cerebral palsy impairs the physical aspects of speaking by improperly controlling the muscles required to speak. Oral motor impairment can affect:</p> <ul style="list-style-type: none"> • Breathing – the lungs and specifically the muscles controlling inhalation and exhalation necessary for proper speech patterns. The diaphragm and abdominal muscles are important for proper air flow and posture. • Articulating – muscles controlling the face, throat, mouth, tongue, jaw, and palate all must work together to form the proper shape necessary for pronunciation of words and syllables. • Voicing – vocal cords are controlled by muscles that essentially stretch the vocal folds between two regions of cartilage. <p>Drooling is another sign of cerebral palsy that results from muscles in the face and mouth not being able to properly control coordination. Some specific factors which can contribute to drooling are impairments in:</p> <ul style="list-style-type: none"> • Swallowing • Closing the mouth • Positioning the teeth • Inability to move saliva to back of mouth • Tongue thrusting <p>Feeding difficulties can be present with cerebral palsy. They typically manifest as decreased ability to chew and swallow, and may also involve choking, coughing, gagging, and vomiting.</p>

Speaking Difficulties in Cerebral Palsy

Apraxia	Dysarthria
<p>An inability of the brain to effectively transmit proper signals to the muscles used in speaking, is one type of speech impairment common to cerebral palsy</p>	<p>Another speech impairment common to cerebral palsy. Like apraxia it is a neurological impairment, as opposed to a muscular condition. It is often found in cerebral palsy that result in hypertonia and hypotonia</p>
<ul style="list-style-type: none">• Verbal apraxia<ul style="list-style-type: none">○ Affects the articulation muscles, especially regarding the specific sequence of movements needed to carry out proper pronunciation. It is common in children with hypotonia.• Oral apraxia<ul style="list-style-type: none">○ Affects the ability to make nonspeaking movements of the mouth, but is not related solely to speaking. Example of oral apraxia would be the inability to lick the lips, or inflate the cheeks.	<ul style="list-style-type: none">• Ataxic dysarthria<ul style="list-style-type: none">○ Slow, erratic, inarticulate speech caused by poor breathing and muscular coordination• Flaccid dysarthria<ul style="list-style-type: none">○ Nasal, whiny, breathy speech caused by the inability of the vocal chords to open and close properly. There may be difficulty with consonants.• Spastic dysarthria<ul style="list-style-type: none">○ Slow, strenuous, monotone speech and difficulty with consonants• Mixed dysarthria<ul style="list-style-type: none">○ All three may be present

Complications of Cerebral Palsy

1. Contracture
 - a. Contracture is the shortening of muscle tissue due to severe tightening of the muscle (spasticity).
 - b. Contracture can inhibit bone growth, cause bones to bend, and result in joint deformities, dislocation or partial dislocation
2. Malnutrition
 - a. Swallowing or feeding problems can make it difficult for someone who has cerebral palsy, particularly an infant, to get enough nutrition.
 - b. This may cause impaired growth and weaker bones.
3. Breakthrough Seizures
4. Pressure sore due to prolonged immobility
5. Aspiration pneumonia
6. Depression
7. Bowel and urinary problem
 - a. Stools may become hard and difficult to pass and may cause pain
 - b. Bladder problems may lead to bed-wetting or daytime incontinence
8. GERD