
being
The Parent
.com


6
months


Spoon

Children Neurorehabilitation

How is it different from rehabilitation for adults?

Children Neurorehabilitation

Children Neurorehabilitation

According to the World Health Organization (WHO), more than 650 millions of individuals live with disabling conditions worldwide (Organisation mondiale de la santé, 2010), out of which 200 million are children.

Children Neurorehabilitation

What is Rehabilitation ?

Rehabilitation is combined and coordinated use of medical , therapeutic , social , educational and vocational measures for training or retraining the individual to highest possible level of function

- Holistic Approach
- QOL

Children Neurorehabilitation

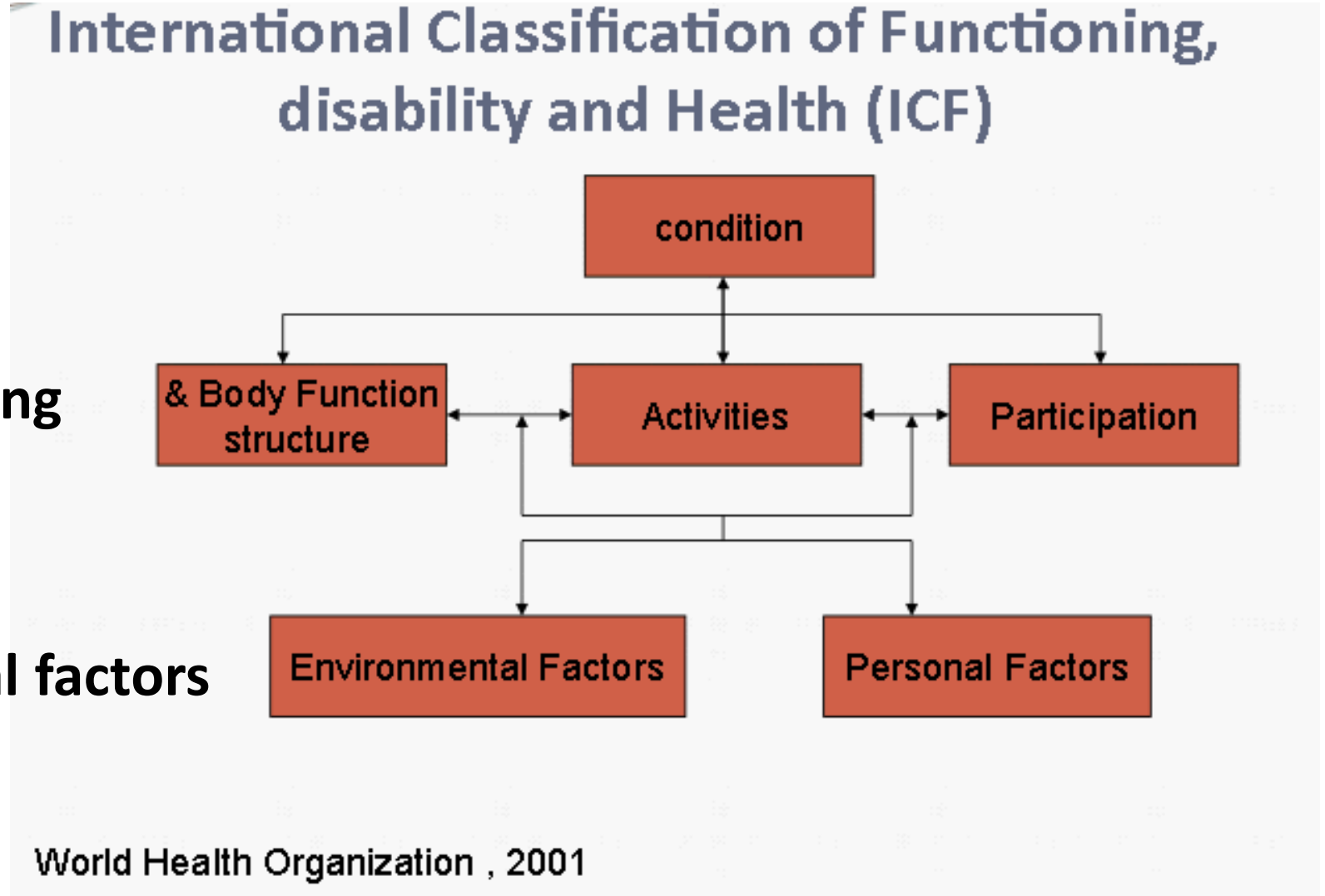
Aims

- Improve functional status
- Prevent secondary impairments & functional limitations
- Efficiently use resources when there is reasonable prognosis for improvement
- Facilitate integration into the community

Children Neurorehabilitation

Functioning

Contextual factors



Children Neurorehabilitation

Children with disabilities can develop and achieve their full potential with assistance from the rehabilitation services.

Normal development

Childhood is a time of tremendous growth and learning. Growth tends to follow a certain sequence.

Is your baby on track?- childhood milestones

Smiles 2 mo

After two months of sleepless nights and round-the-clock soothing, you've seen plenty of your baby's tears. Maybe you've spotted a fleeting smile, but then again, it could have been gas. Now it's time for the real reward. By around 2 months of age, your baby will smile *in response to you!* The sound of your voice or the sight of your face is often all it takes to trigger your baby's irresistible grin.

Is your baby on track?- childhood milestones

Laughs 4 mo

If the frequent sound of your baby's crying has you on edge, take heart. By 4 months, you can look forward to another sound, possibly the sweetest you'll ever hear -- your baby's laughter. The best part is how easily a baby laughs. Silly faces, tickling, and peek-a-boo are usually more than enough to set off lots of squeals and giggles.

Is your baby on track?- childhood milestones

Crawls 8 mo

If you have an 8-month-old, you may want to put your gym membership on hold. You're about to get plenty of exercise chasing your suddenly mobile baby around the house. By 9 months, most babies crawl using both hands and feet, though some babies never crawl, preferring to creep or wriggle instead. Crawling is not an essential baby milestone, and infants who choose to scoot or creep still tend to reach other milestones on schedule.

Is your baby on track?- childhood milestones

Eats Finger Food 9-12 mo

Just when spoon-feeding begins to lose its luster, babies are ready to feed themselves. Between 9-12 months, babies develop better control over their hands and fingers, making it easier to grab small objects -- like finger foods! Unfortunately, babies this age love to explore taste and texture, so food is not the only thing they'll try to pop into their mouths. Environmental safety should, therefore, become a big parental concern at this age.

Is your baby on track?- childhood milestones

Stands 12 mo

By 12 months, most babies begin to stand briefly without support. They also take small steps while holding onto furniture or other objects, an activity called "cruising." In the weeks or months before they walk independently, babies may spend hours cruising to practice for the real thing.

Is your baby on track?- childhood milestones

Takes a Step 9-17 mo

You might call it the crown jewel of baby milestones. Perhaps no other moment is met with more anticipation (or camera clicks) than a baby's first step on his or her own. But not all babies walk by their first birthday. The normal range is anywhere from 9 to 17 months, with most babies taking at least a few steps by about 13 months.

Is your baby on track?- childhood milestones

Says a Word

"Mama! Dada!" There's nothing like hearing your baby call your name, and it usually happens right around the one-year mark. By this time, most babies can say at least one real word and actively try to imitate others. It won't be long before you finally get to hear what's on your little one's mind.

How Parents Can Help ?

Gross Motor Skills

- Place infants on their tummies while awake to develop neck and back muscles
- Create a safe home environment and put babies on the floor to explore
- Give older children time outside where they can run and jump

How Parents Can Help ?

Fine Motor Skills

- Provide toys with different textures that encourage babies to explore with their fingers
- Provide age-appropriate puzzles, blocks, paper, and crayons
- Encourage older babies to feed themselves

How Parents Can Help ?

Language Skills

- Play music for newborns to stimulate hearing
- Talk to your child
- Read to your child
- Name objects as you point to pictures in a book

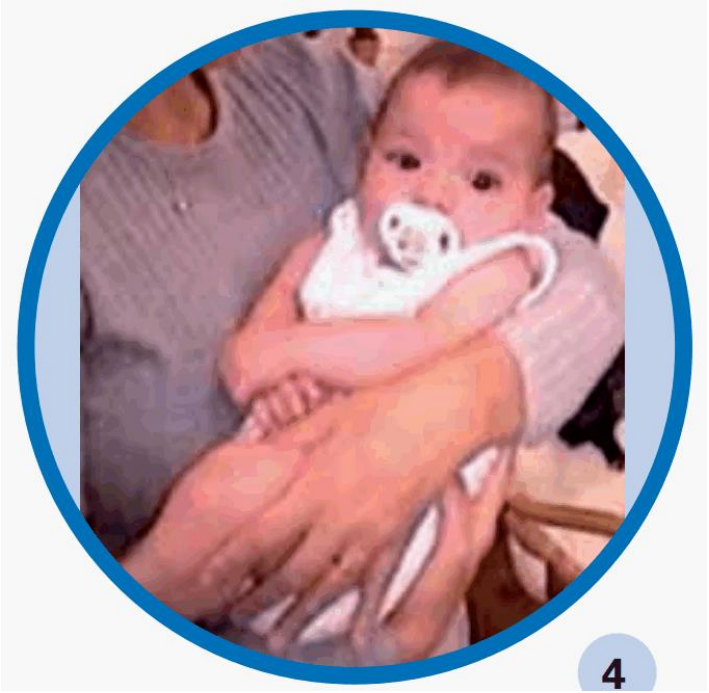
How Parents Can Help ?

Social Interaction

- Laugh and smile with your baby
- Limit television and play with your child

How Parents Can Help ?

Proper Baby Handling



The child unconsciously exercise every day, during: changing dipers feeding, carrying, holding, changing clothes, lifting and lowering, burping.

Spotting Developmental Delays

Six main categories:

1. Gross motor skills, such as crawling and walking
2. Fine motor skills, such as stacking blocks or coloring
3. Language skills, including speech and comprehension
5. Thinking skills
6. Social interaction

Primitive Reflex Patterns

1.

TABLE 56.4 Normal Acquisition and Regression of Primitive Reflex Behaviors

Reflex	Age of Onset	Age Reflex Disappears
Moro	Birth	6 mo
Palmar grasp	Birth	6 mo
Plantar grasp	Birth	9–10 mo
Adductor spread of patellar reflex	Birth	7 mo
Tonic neck	2 mo	5 mo
Landau	3 mo	24 mo
Parachute response	8–9 mo	Persists

Reprinted with permission from Swaiman KF, Jacobson RI. Developmental abnormalities of the central nervous system. In: Baker AB, Joynl RJ, eds. Clinical Neurology. Philadelphia, PA: Harper & Row; 1984.

Primitive Reflex Patterns

Gross Motor Milestones

2.

TABLE 56.3 Examples of Gross Motor Milestones

Age	Activity
2 mo	Head in midline
3 mo	Prone prop on extended elbows
4 mo	Rolls prone to supine
5 mo	Rolls supine to prone
	Infantile "swimming"
	Pivot circles in prone
6 mo	Sits with straight back
9 mo	Crawls on hands and knees ("creeps")
	Transitions into sit from four point
10 mo	Pulls to stand through half-kneel cruises
12 mo	Independent ambulation
15 mo	Comes to stand independently
18–19 mo	Climbs into adult size chair
21–24 mo	Up and down stairs with hands on rail
30 mo	Jumps clearing ground and lands on feet together
3 y	Pedals tricycle
	Upstairs alternating feet
	True run
4 y	Hops, gallops (not true skipping)
	Down stairs alternating feet
5 y	True skipping

An understanding of all areas of normal development is essential if an abnormality is to be recognized.

What are the warning signs of a developmental delay?

- **Gross Motor Warning Signs** Has stiff arms and/or legs
- Has a floppy or limp body posture compared to other children of the same age
- Uses one side of body more than the other
- Has a very clumsy manner compared with other children of the same age

What are the warning signs of a developmental delay?

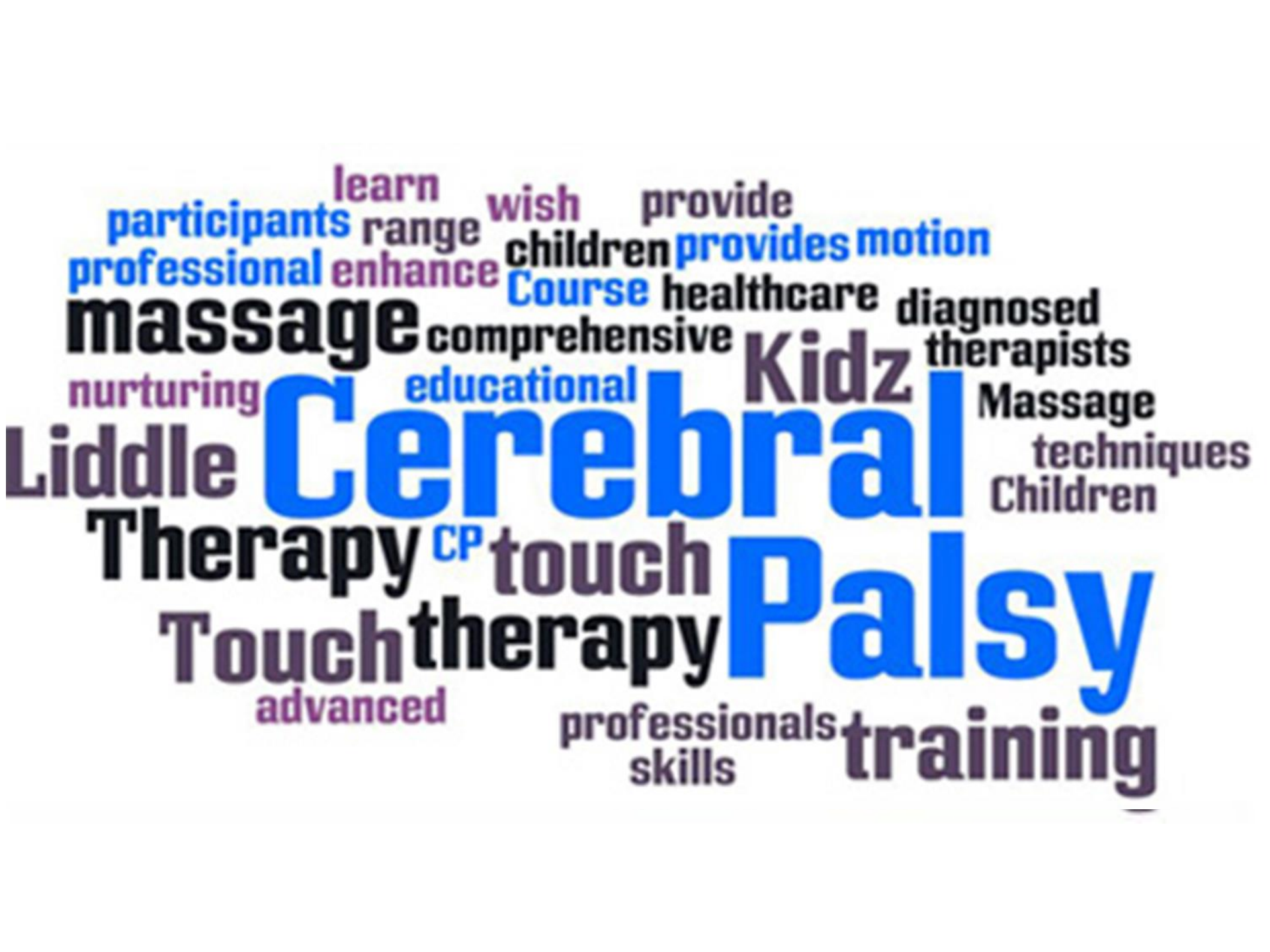
- **Behavioral Warning Signs** Does not pay attention or stay focused on an activity for as long a time as other children of the same age
- Focuses on unusual objects for long periods of time; enjoys this more than interacting with others
- Avoids or rarely makes eye contact with others
- Gets unusually frustrated when trying to do simple tasks that most children of the same age can do
- Shows aggressive behaviors and acting out and appears to be very stubborn compared with other children
- Displays violent behaviors on a daily basis
- Stares into space, rocks body, or talks to self more often than other children of the same age
- Does not seek love and approval from a caregiver or parent

What are the warning signs of a developmental delay?

- **Vision Warning Signs** Seems to have difficulty following objects or people with her eyes
- Rubs eyes frequently
- Turns, tilts or holds head in a strained or unusual position when trying to look at an object
- Seems to have difficulty finding or picking up small objects dropped on the floor (after the age of 12 months)
- Has difficulty focusing or making eye contact
- Closes one eye when trying to look at distant objects
- Eyes appear to be crossed or turned
- Brings objects too close to eyes to see
- One or both eyes appear abnormal in size or coloring

What are the warning signs of a developmental delay?

- **Hearing Warning Signs** Talks in a very loud or very soft voice
- Seems to have difficulty responding when called from across the room, even when it is for something interesting
- Turns body so that the same ear is always turned toward sound
- Has difficulty understanding what has been said or following directions after once she has turned 3 years of age
- Doesn't startle to loud noises
- Ears appear small or deformed
- Fails to develop sounds or words that would be appropriate at her age


learn
participants
range
wish
provide
professional
enhance
children
provides
motion
Course
healthcare
massage
comprehensive
diagnosed
Kidz
therapists
nurturing
educational
Cerebral
Massage
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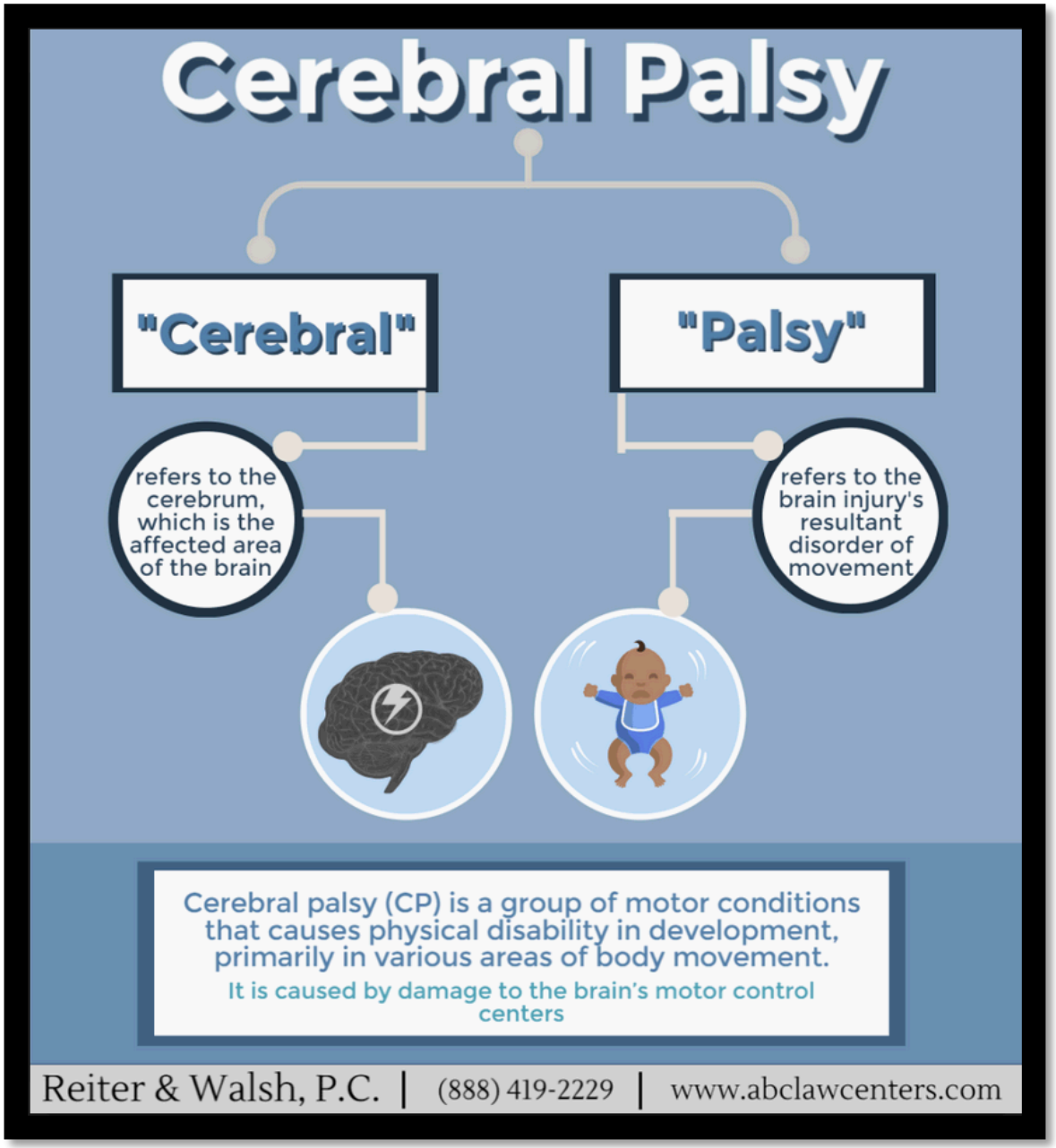
techniques
Children
Therapy
CP
touch
Palsy
Touch
therapy
advanced
professionals
training
skills

Cerebral Palsy- Definition

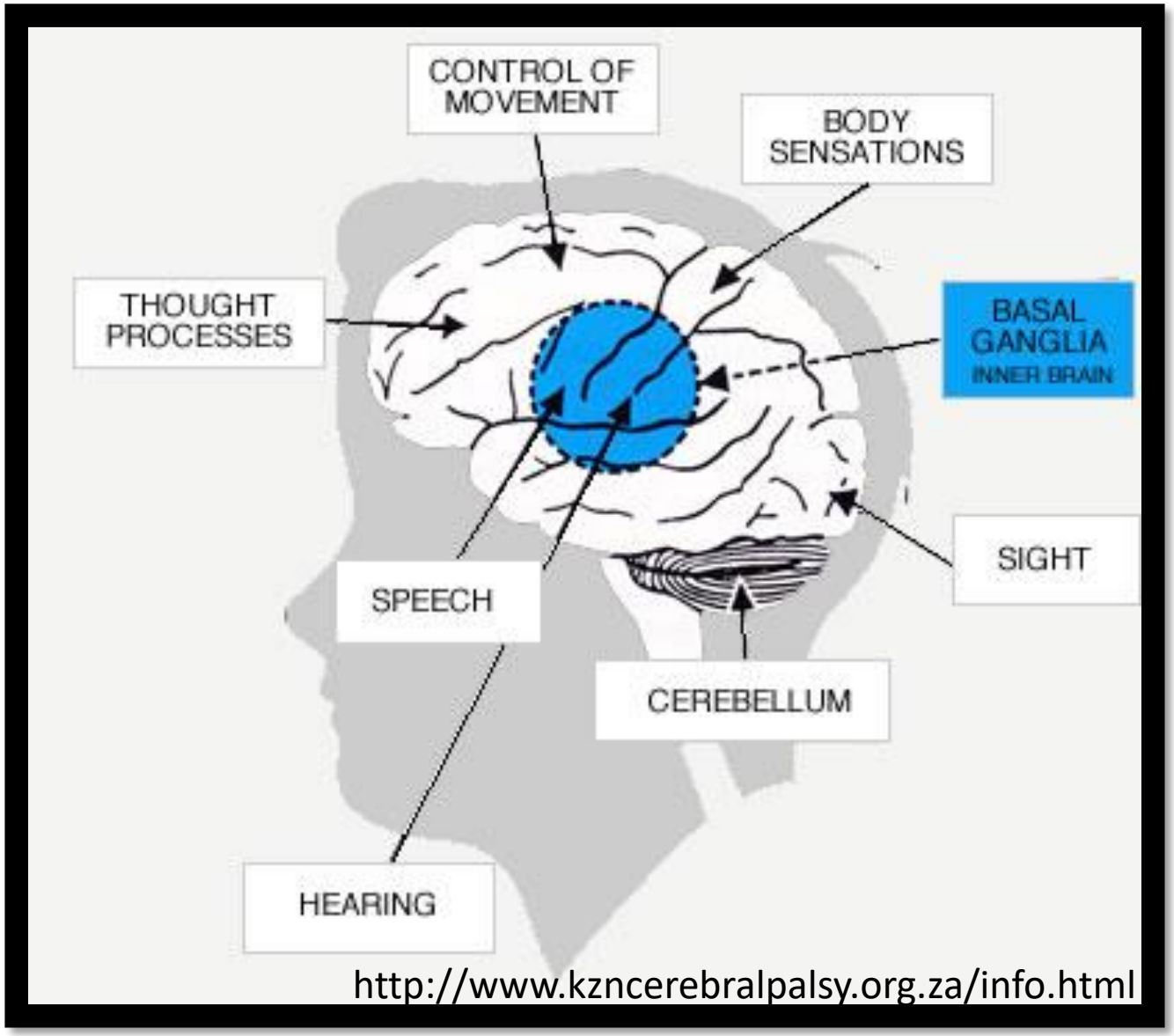


Cerebral Palsy- Definition

- Cerebral palsy (CP) is a **heterogeneous group of movement disorders with various etiologies**.
- The primary functional difficulty is in **movement and posture**, i.e. the movement disorder is not secondary to another neurofunctional disability.
- CP is associated with a **permanent, non-progressive pathology that formed *in utero* or early infancy** (before 2-3 years of age).
- CP excludes transient disease processes.
- CP is often accompanied by disturbances of sensation, perception, cognition, communication, behaviour, epilepsy, and secondary musculoskeletal problems.

Dev Med Child Neurol Suppl. 2007 Feb;109:8-14.

Cerebral Palsy- Definition



http://www.kzncerebralpalsy.org.za/info.html

No Two Children with Cerebral Palsy are Exactly Alike!

MANUAL ABILITY

At least two thirds of children with cerebral palsy will have movement difficulties affecting one or both arms. Almost every daily activity can be impacted.

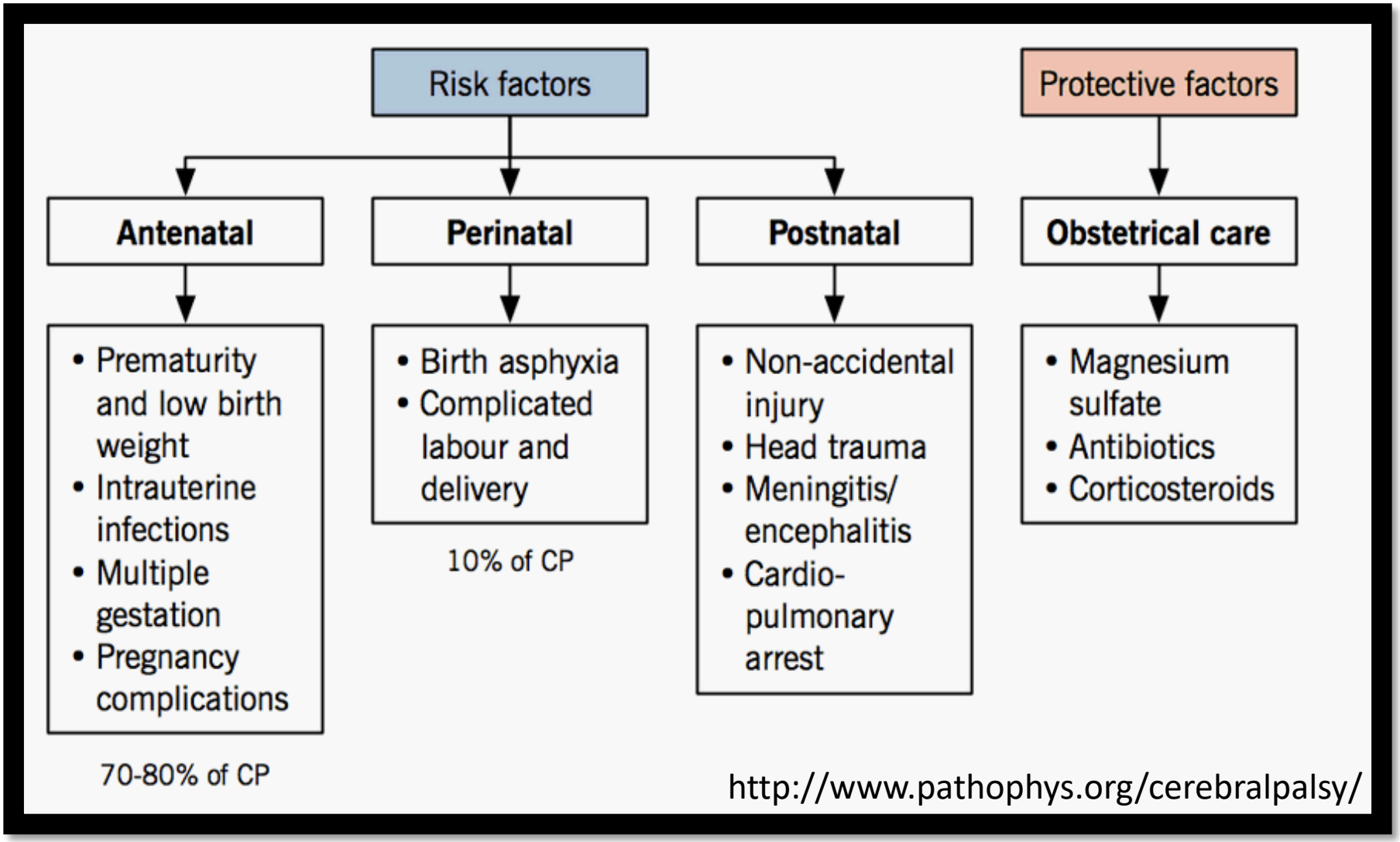
Eating

Dressing

Writing

Catching a ball

Cerebral Palsy- Risk Factors



It is now thought that most cases of CP stem from injury incurred in the antenatal period.

Cerebral Palsy and Brain Damage

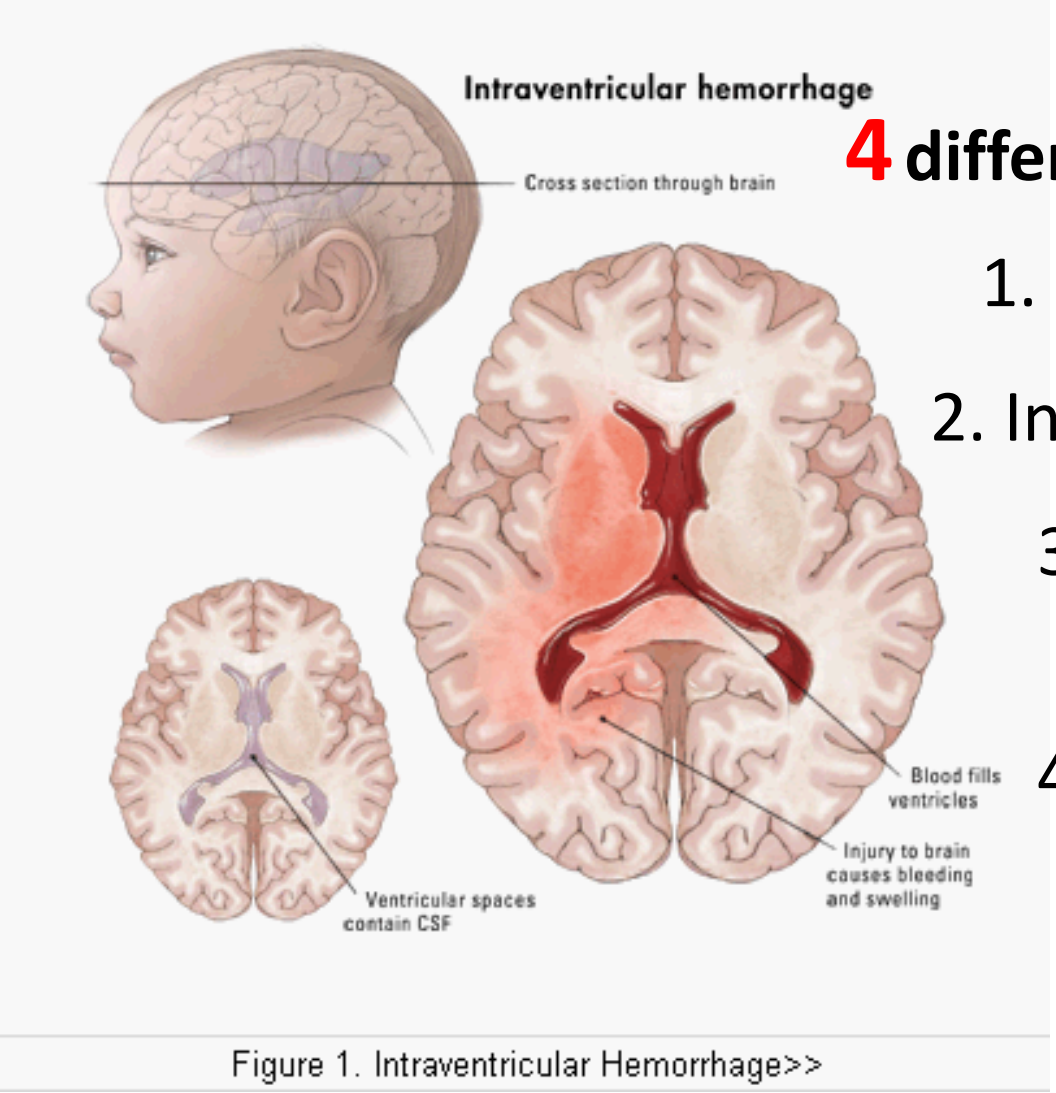


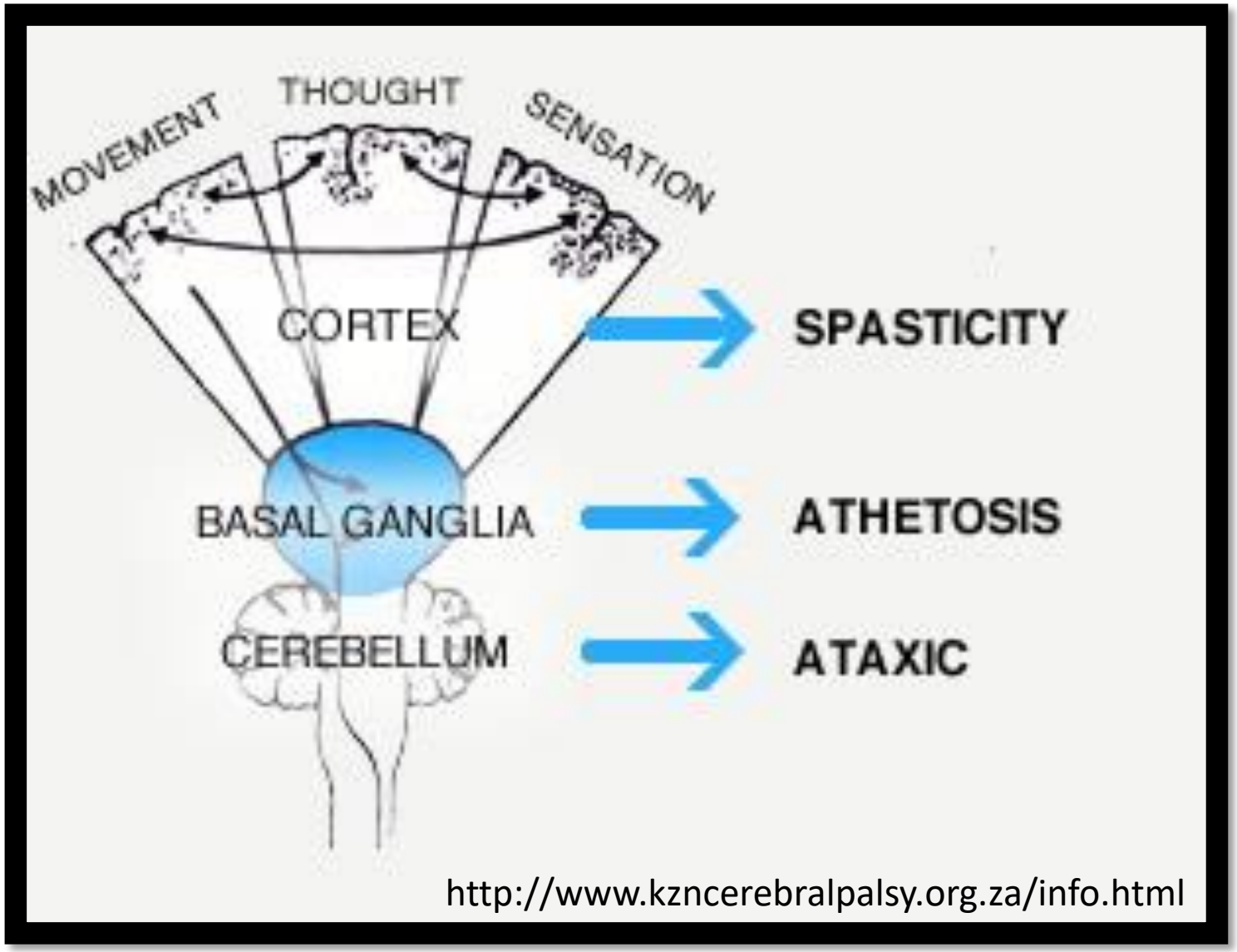
Figure 1. Intraventricular Hemorrhage>>

4 different kinds of brain damage:

1. Cerebral Dysgenesis
2. Intraventricular Hemorrhage
3. **Periventricular Leukomalacia (PVL)**
4. Hypoxic-Ischemic Encephalopathy (HIE)

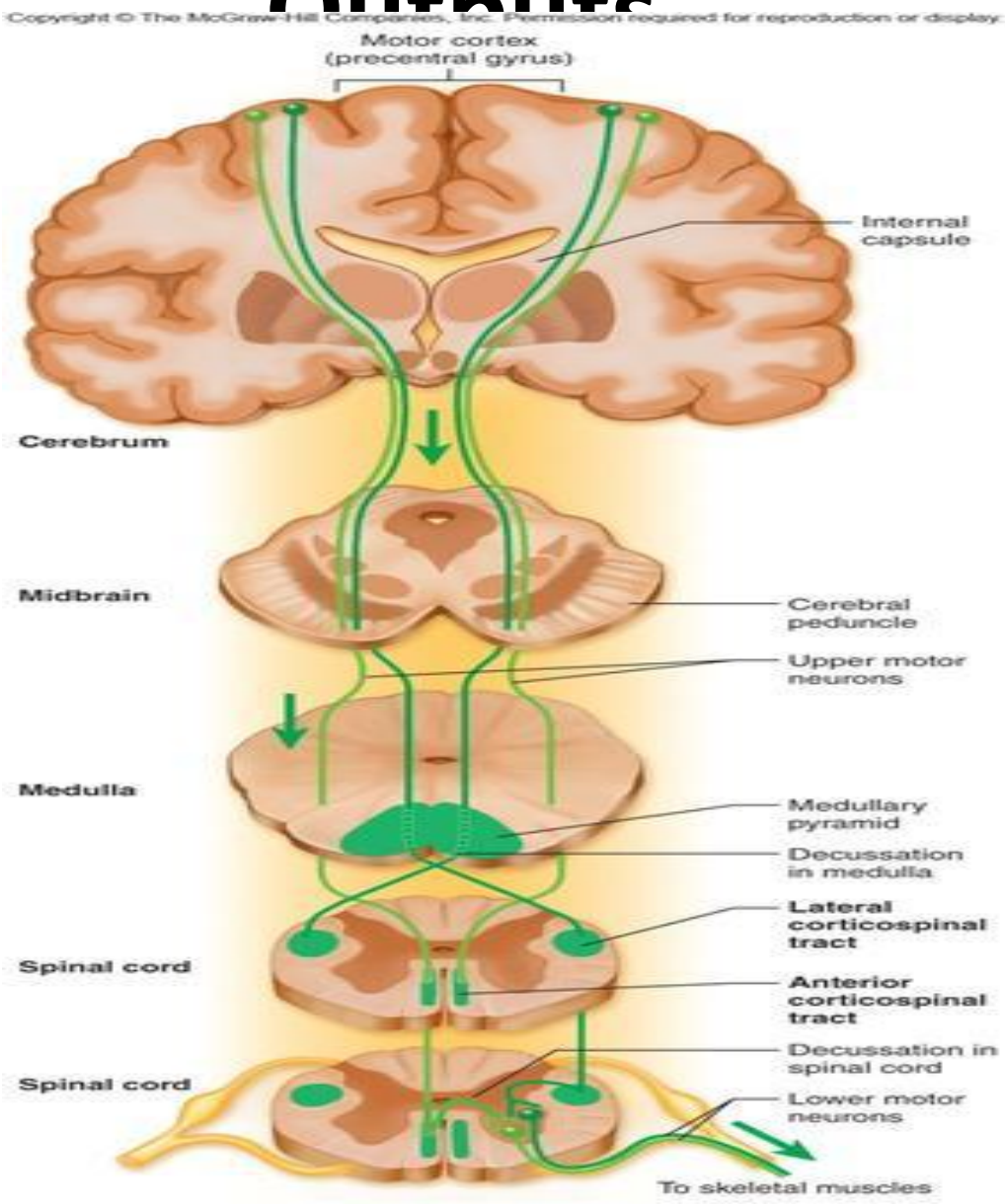
https://kin450-neurophysiology.wikispaces.com/Cerebral+Palsy+III

Cerebral Palsy and Brain Damage



The etiology or pathophysiology of the brain lesion differs with gestational age and determines the resultant CP subtype and associated movement disorder.

Cerebral Palsy – Inputs and Outputs



Cerebral Palsy is usually seen as more of a problem with outputs than inputs.

Cerebral Palsy and Brain Damage

The pathology in CP is in the upper motor neurons.

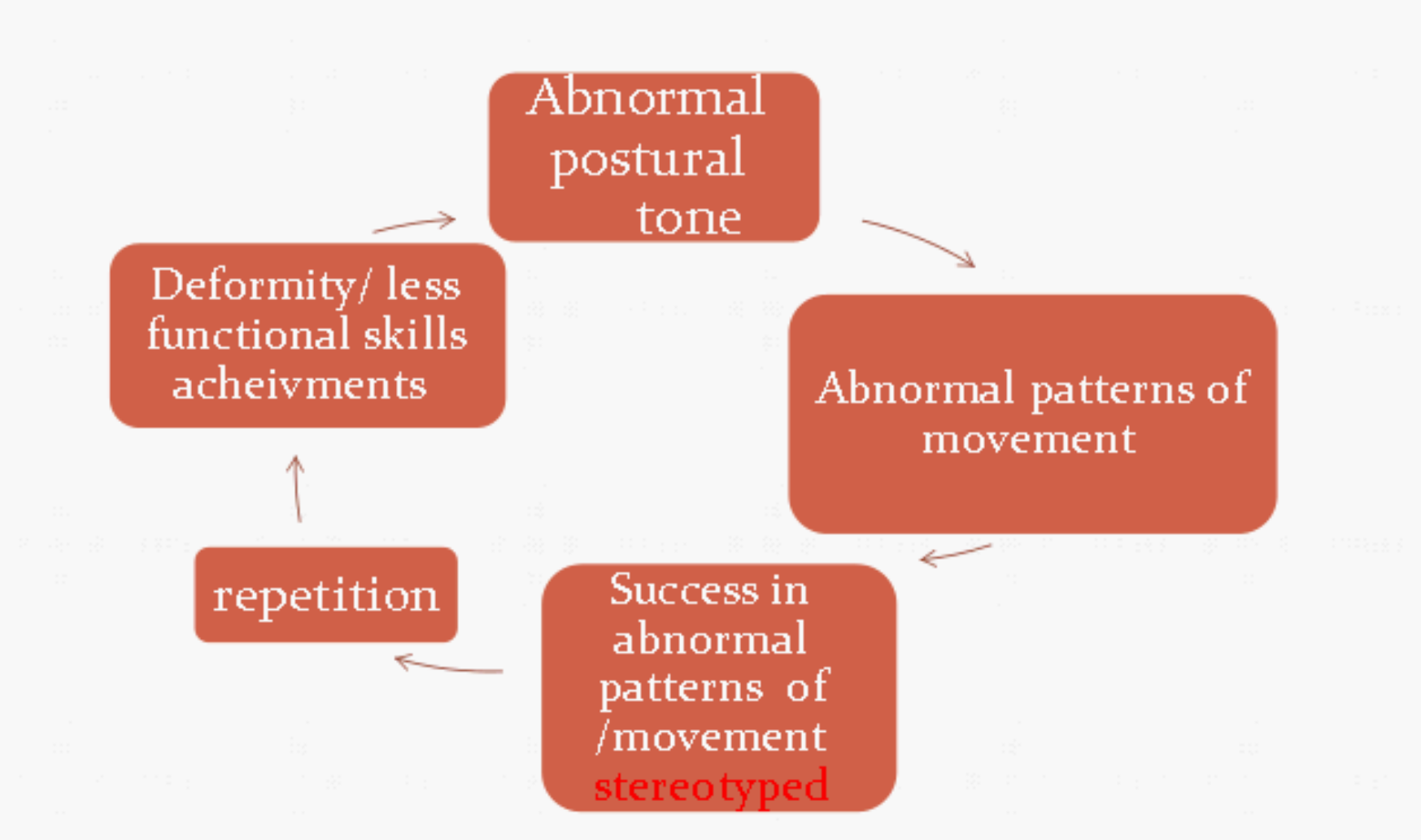
Comparison of UMN and LMN lesion clinical presentations

Upper motor neuron lesion	Lower motor neuron lesion
Spasticity	Flaccid paralysis
Increased tone	Decreased or absent deep tendon reflexes
Hyperactive deep reflexes	Fasciculations and fibrillations
Clonus	Severe muscle atrophy (from disuse)
Babinski sign	
Little to no muscle atrophy	

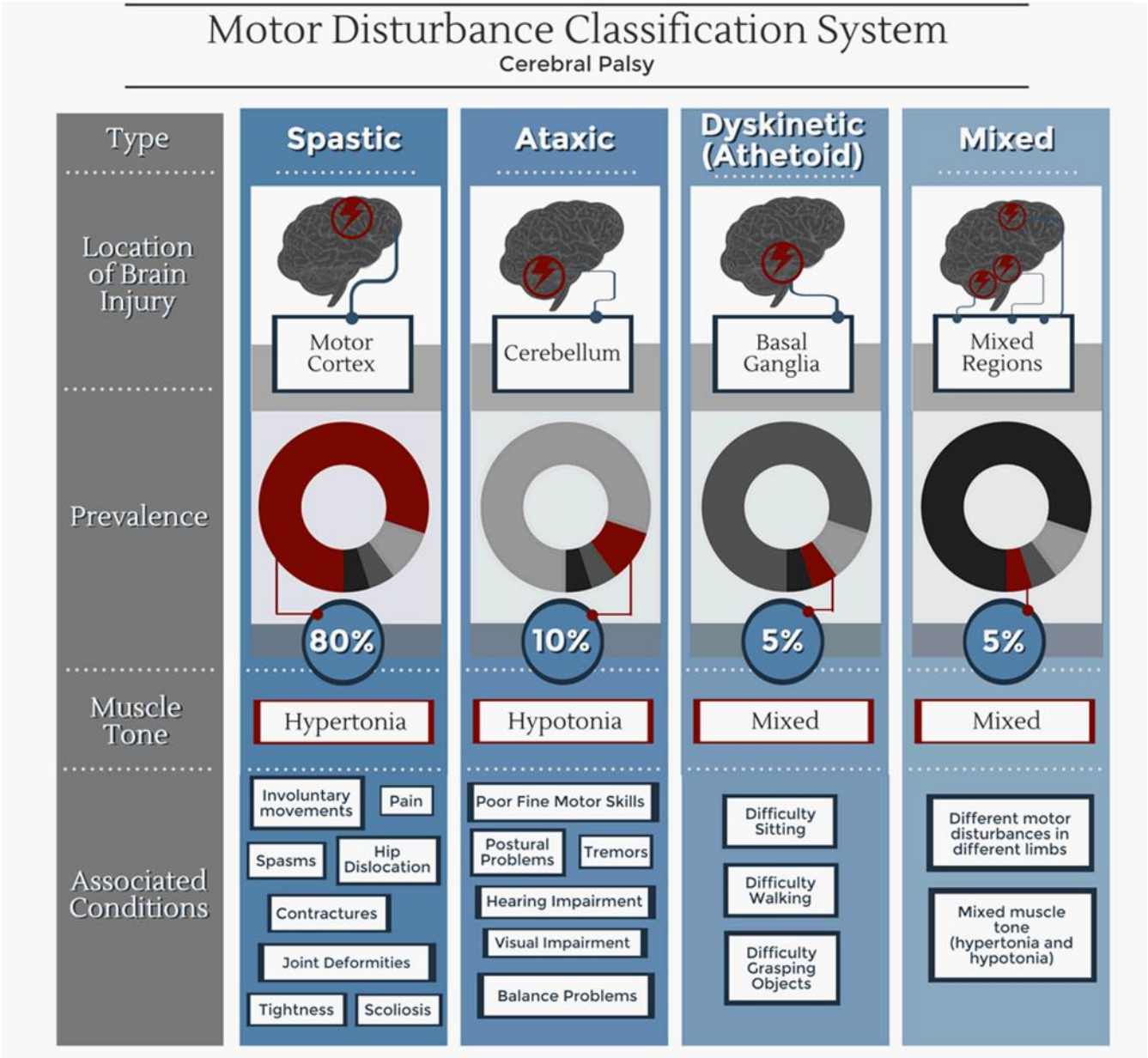
http://www.pathophys.org/cerebralpalsy/

Note that lesions in the **extrapyramidal tracts** do ***not*** cause these UMN signs.

Cerebral Palsy and Brain Damage



Cerebral Palsy –Classification by Tone

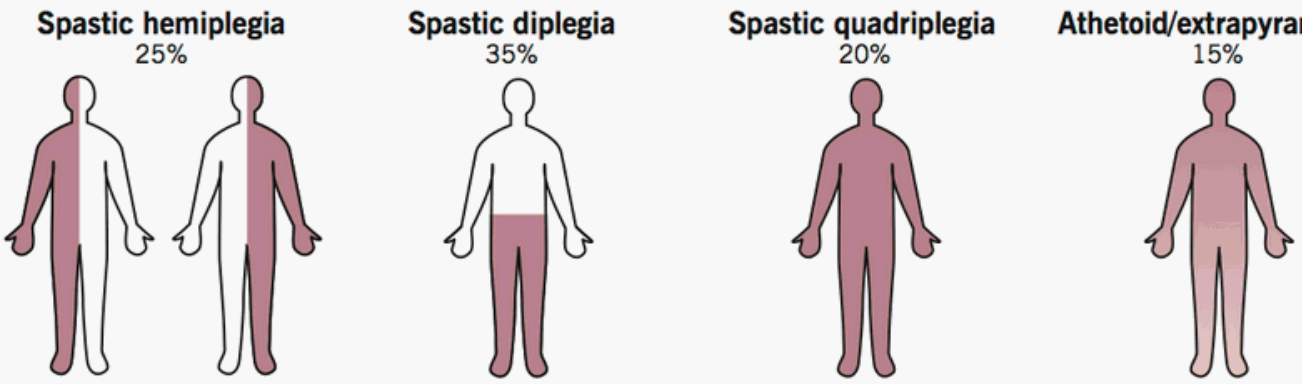


Cerebral Palsy – Classification by Distribution of Limb Involment

Motor syndromes of cerebral palsy

Eric Wong

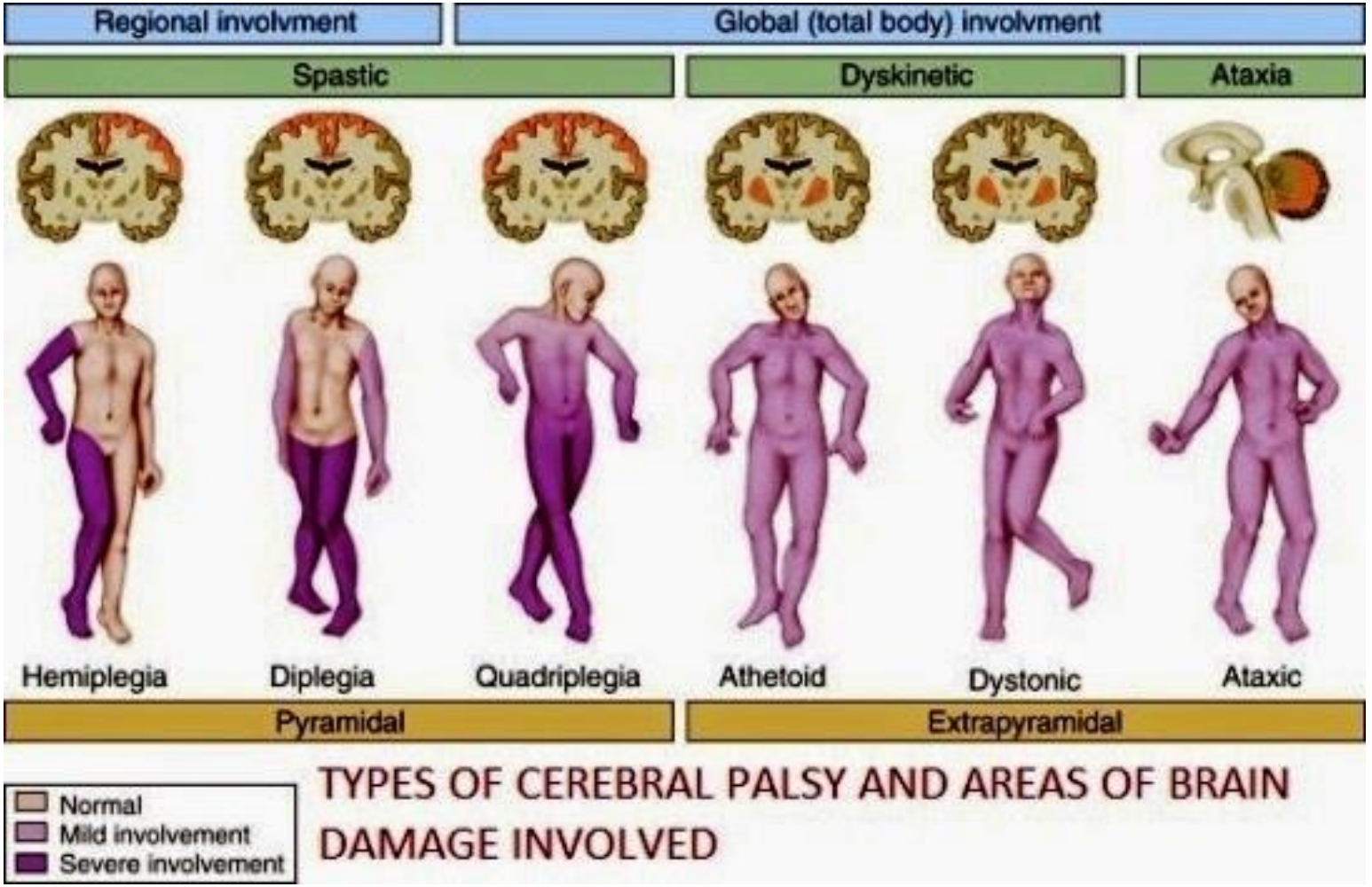
Source: Nelson Textbook of Pediatrics, 19E



Upper motor neuron signs: spasticity, hyperreflexia, clonus, Babinski sign			**No UMN signs:** hypotonia with increasing tone in later life.
Location of lesion	**Corticospinal tracts** (pyramidal tracts)		**Extrapyramidal tracts**
Etiology Stroke, IVH	PVL		Birth asphyxia
• **Circumductive gait**: reduced flexion on affected side requires swinging the leg outward to clear the ground. • **Early handedness**: decreased use of affected side; early preference for unaffected hand.	• **Scissor gait**: increased tone in the hip adductor muscles causes legs to adduct past midline (like a pair of scissors) when the child is lift by the upper body. • **Commando crawl**: normal alternating movement of hands while crawling but drags legs behind due to lower limb weakness.	• **Most severe form of CP.** Affects all limbs and often affects swallowing. • High likelihood of seizures and cognitive impairment.	• Involuntary contraction of all muscle groups. Difficulty with speech and swallowing. • Normal intelligence and low risk of seizures. • Upper body is slightly more affected than lower body.

http://www.pathophys.org/cerebralpalsy/

Cerebral Palsy – Classification by Distribution of Limb Involment



http://www.viviennebalonwu.com/2015/03/cerebal-palsy.html

Cerebral Palsy – Classification

Figure 8.2 A child with dystonic cerebral palsy.

Figure 8.3 A child with hemiparetic cerebral palsy.

Braddom's, Physical medicine and rehabilitation 5th Ed

Cerebral Palsy – Classification

Figure 8.4 A child with diparetic cerebral palsy.

Figure 8.5 A child with quadriparetic cerebral palsy.

Braddom's, Physical medicine and rehabilitation 5th Ed

Cerebral Palsy -Diagnosis

Characteristic features of CP based on age*

Age	Characteristics that may indicate CP
< 6 months	• Head lags when infant is picked up from supine position • Feels stiff or floppy in your arms • Scissoring of legs when picked up
> 6 months	• **Asymmetric tonic neck reflex**: reaches with one hand while the other is in a fist
> 10 months	• Mobilizes/crawls not using all limbs (e.g., *commando crawl* of spastic diplegia)

http://www.pathophys.org/cerebralpalsy

Cerebral Palsy -Diagnosis

TABLE 56.4 Normal Acquisition and Regression of Primitive Reflex Behaviors

Reflex	Age of Onset	Age Reflex Disappears
Moro	Birth	6 mo
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Plantar grasp	Birth	9–10 mo
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Landau	3 mo	24 mo
Parachute response	8–9 mo	Persists

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Cerebral Palsy -Diagnosis

FIGURE 53-5 Child with asymmetric tonic neck reflex.

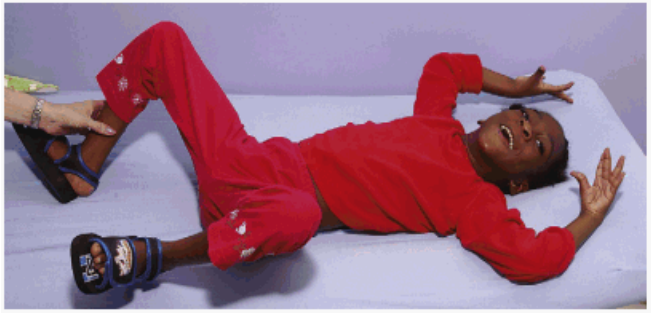


FIGURE 53-6 Child with persistent Moro, or startle, reflex.

Cerebral Palsy -Diagnosis

FIGURE 53-7 Child with flexor posturing.

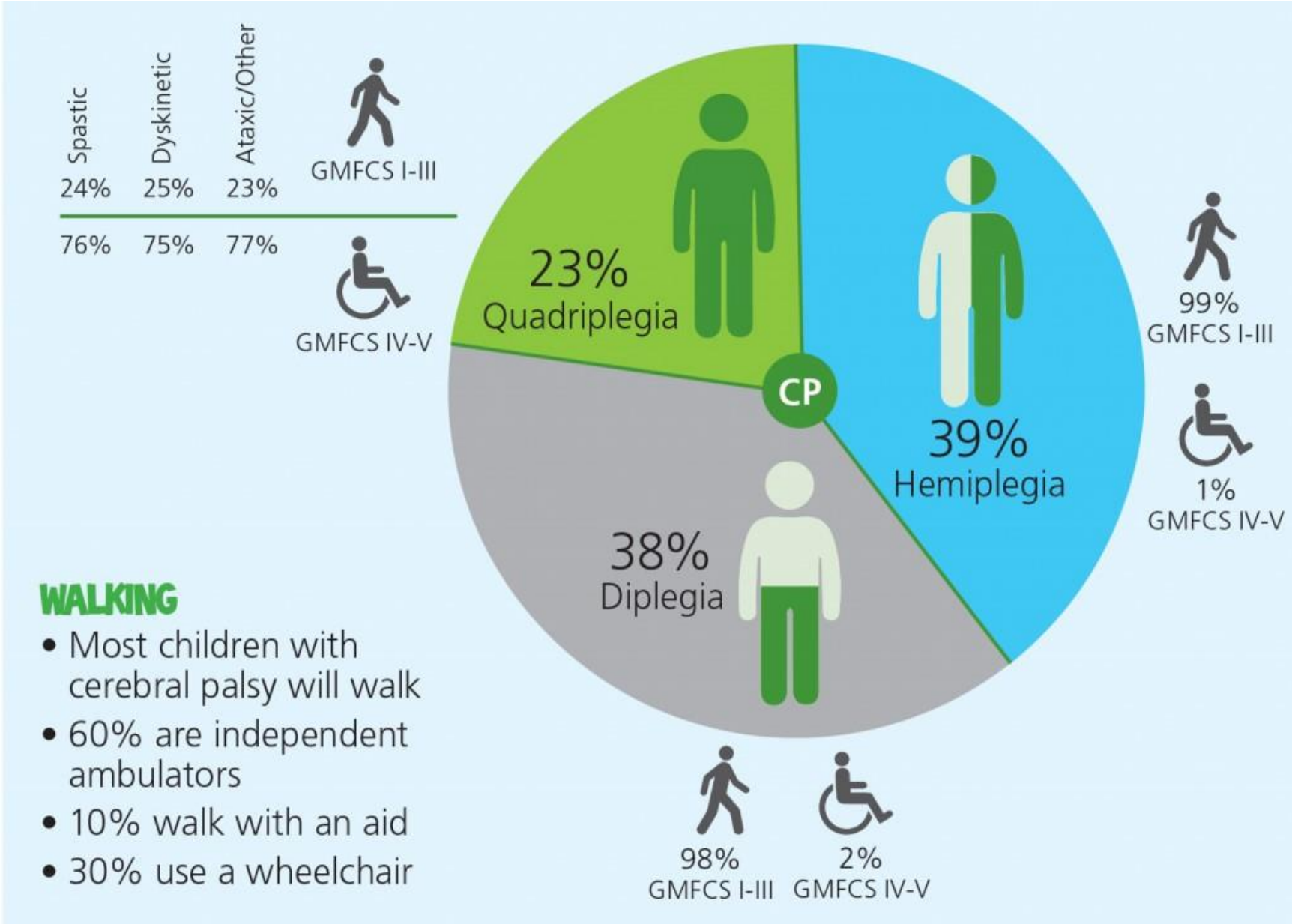
FIGURE 53-8 Child with opisthotonic posturing.

Cerebral Palsy -Diagnosis

FIGURE 53-9 Child with extensor posturing and scissoring. Note the athetoid posturing of the hands.

Will My Child with Cerebral Palsy Walk?

Whill my Child Walk?



GMFCS

Gross Motor Function Classification System

Level	Mobility	Equipment Needs	Physical Ability*
I	Walks without limitations	None Can walk, run, jump and move without limitations	
II	Walks with limitations	Minimal May require equipment when: •Learning to walk •Traveling long distances	
III	Walks with handheld equipment	Handheld •Canes, crutches and walkers •Wheeled devices for long distance	
IV	Self-mobile with limitations	Total •Self mobility with power chairs •Assisted transportation •Sitting supports	
V	Dependent on humans and equipment	Extreme •Adaptive equipment •Assistive technology •Communication device	

*The GMFCS does not take cognitive ability and IQ into consideration when determining ability. Cognitive function is a critical aspect of one's overall functional ability.

Sources: http://www.uptodate.com/contents/management-and-prognosis-of-cerebral-palsy?source=machineLearning&search=gross+motor+function+classification+system&selectedTitle=1~4&sectionRank=1&anchc H107637599#H107637599

Whill my Child Walk?

Good prognosis for ambulation:

- **Independent sitting by 2yr: 100% without assistive devices**
- **Sitting by 3yr: 50% commuity ambulator**

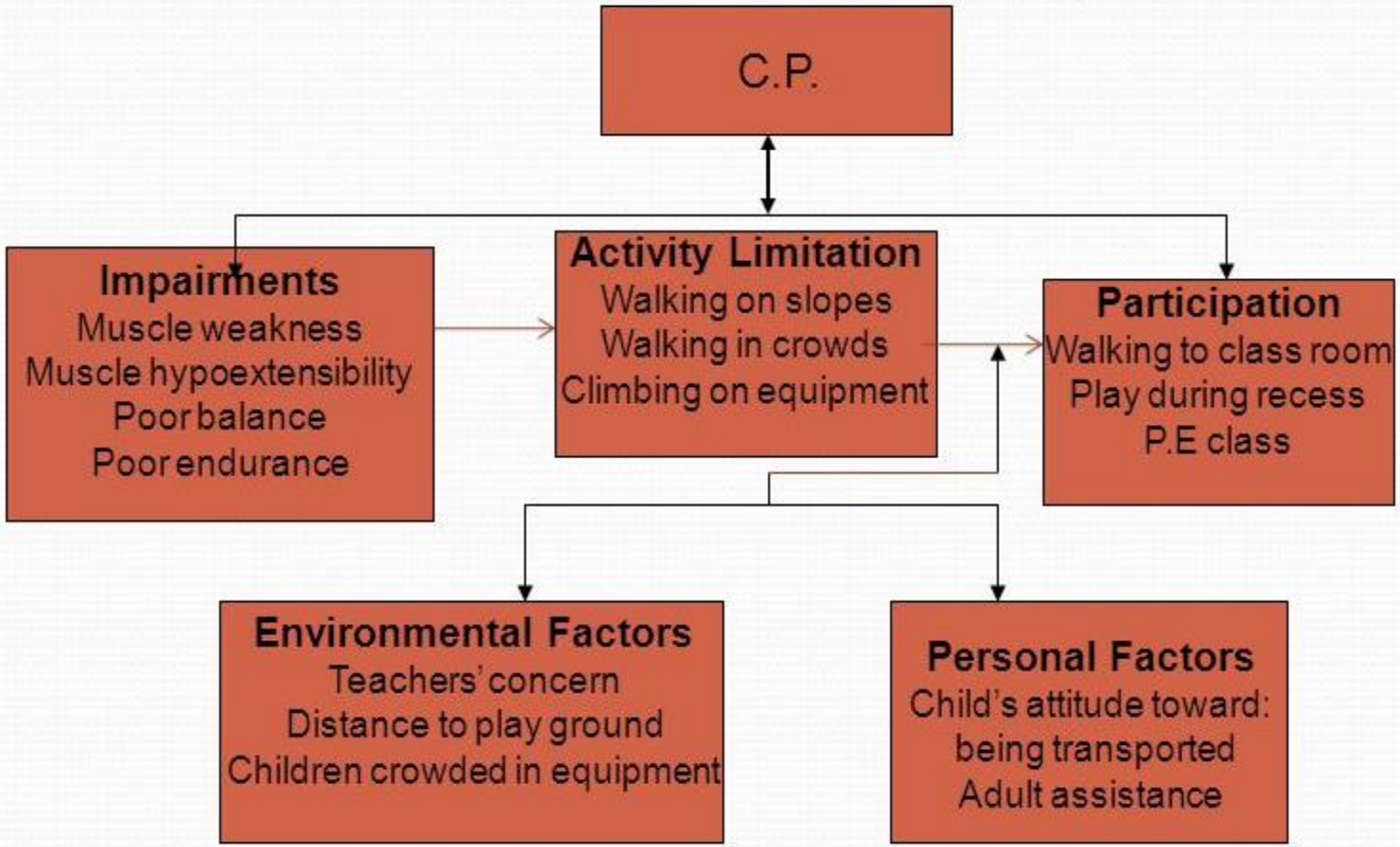
Bad prognosis for ambulation:

- **> 3 primitive reflexes at 18-24 mo**
- **Lack of sitting by 4yr: no potential for ambulation**

Cerebral Palsy-Rehabilitation Team

http://www.pathophys.org/cerebralpalsy

Children Neurorehabilitation- Setting Goals



Children Neurorehabilitation- Setting Goals

1. Alleviate the effects of impaired body structures and systems
2. Foster the development of children's capacities
3. Foster development of children participation to various activities
4. Reinforce environmental facilitators

Early Intervention Is Key

The brain is without doubt our most fascinating organ. Parents, educators, and society as a whole have a tremendous power to shape the wrinkly universe inside each child's head, and, with it, the kind of person he or she will turn out to be. We owe it to our children to help them grow the best brains possible.
—Lise Eliot, *What is Going in There?*

Neurorehabilitation- Outcome Measures

Table 53-2 Outcome Measures for Cerebral Palsy Rehabilitation

Outcome	Measure
Spasticity	Ashworth score Tardieu angles
Range of motion	Goniometer
Dystonia	Barry Albright Dystonia Scale
Strength	Medical Research Council muscle grade (0-5) Modified sphygmomanometer Hydraulic strength or torque Maximum 10 repetitions weight lift
Cognition	IQ
Speech	Intelligibility
Health	Short Form 12 or 36
Social and self-care skills	WeeFIM Pediatric Outcomes Data Collection Instrument Canadian Occupational Performance Measure
Pain	Faces Pain Scale Nonverbal Pain Scale
Community integration	Child Health Questionnaire Demographics Craig Handicap Assessment and Reporting Technique
Hand and arm function	Melbourne Assessment of Unilateral Upper Limb Function Quality of Upper Extremity Skills Test
Gross motor function	Gross Motor Function Measure Peabody Scales of Infant Development
Gait	Velocity, stride length, balance Oxygen cost Kinetics or kinematics on gait analysis

Choosing the right tool is the key to comparing outcomes in rehabilitation!

Cerebral Palsy- Neuromotor Therapy Approaches

Table 53-3 Similarities and Differences Between Neuromotor Therapy Approaches to Cerebral Palsy

	Neurodevelopmental Treatment (Bobaths)	Sensorimotor Approach to Treatment (Rood)	Sensory Integration Approach (Ayres)	Vojta Approach	Patterning Therapy (Doman-Delacato)
Central nervous system model Goals of treatment	Hierarchic • To normalize tone • To inhibit primitive reflexes • To facilitate automatic reactions and normal movement patterns	Hierarchic • To activate postural responses (stability) • To activate movement (mobility) once stability is achieved	Hierarchic • To improve efficiency of neural processing • To better organize adaptive responses	Hierarchic • To prevent cerebral palsy in infants at risk • To improve motoric behavior in infants with fixed cerebral palsy	Hierarchic • To achieve independent mobility • To improve motor coordination • To prevent or improve communication disorders • To enhance intelligence
Primary sensory systems utilized to effect a motor response	• Kinesthetic • Proprioceptive • Tactile	• Tactile • Proprioceptive • Kinesthetic	• Vestibular • Tactile • Kinesthetic	• Proprioceptive • Kinesthetic • Tactile	All sensory systems are utilized
Emphasis of treatment activities	• Positioning and handling to normalize sensory input • Facilitation of active movement	Sensory stimulation to activate motor response (tapping, brushing, icing)	Therapist guides but child controls sensory input to get adaptive purposeful response	Trigger reflex locomotive zones to encourage movement patterns (e.g., reflex crawl)	Sensory and reflex stimulation, passive movement patterns, encouragement of independent movements
Intended clinical population	Children with cerebral palsy Adults post–cerebrovascular accident (CVA)	Children with neuromotor disorders such as cerebral palsy Adults post-CVA	Children with learning disabilities Children with autism	Young infants at risk for cerebral palsy Young infants with fixed cerebral palsy	Children with neonatal or acquired brain damage
Emphasis on treating infants	Yes	No	No	Yes	No
Emphasis on family involvement during treatment	Yes Handling and positioning for activities of daily living	No	No Supportive role encouraged	Yes Family administers treatment at home daily	Yes Family and friends administer treatment several times daily
Empiric support	Few studies Conflicting results	Very few studies Conflicting results	Many studies Conflicting results with school-age children Positive results for tactile and vestibular input with infants	Few studies Conflicting results	Few studies Conflicting results

From Harris SR, Atwater SW, Crowe TK: Accepted and controversial neuromotor therapies for infants at high risk for cerebral palsy. *J Perinatol* 8:3-13, 1988, with permission.

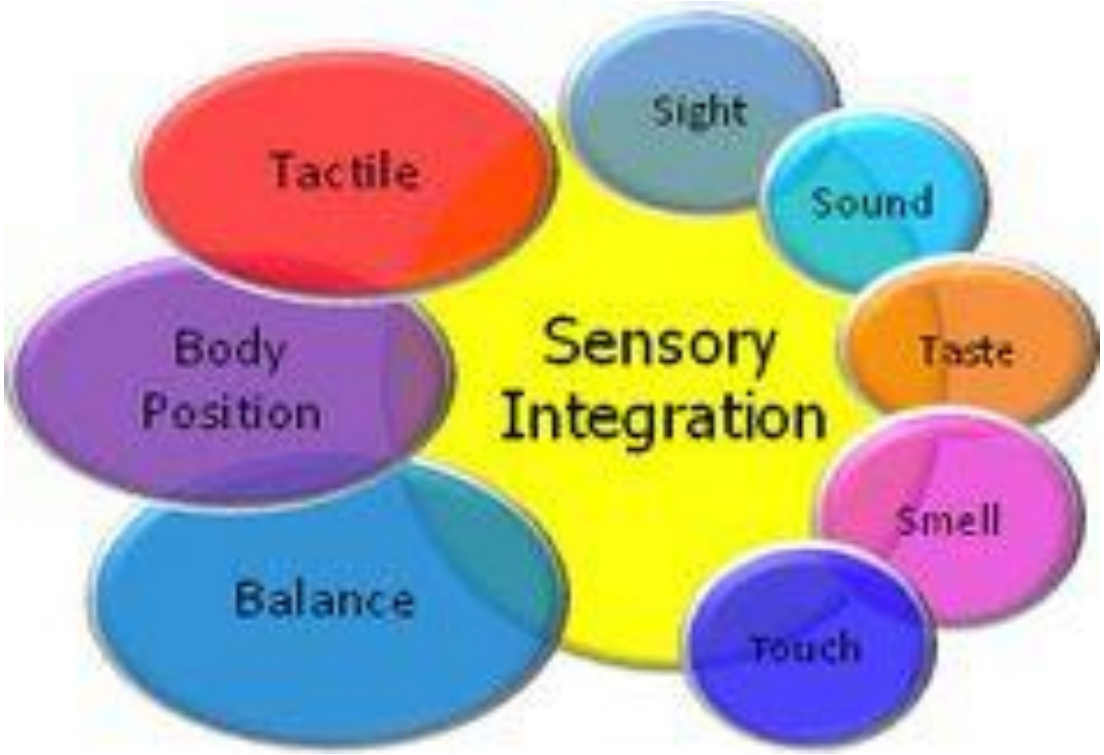
Neurodevelopmental Therapy (NDT)

- Moving through normal movement patterns to experience normal movement
- **Major components:**
  - reflex-inhibiting posture
  - inhibition of abnormal reflexes
  - normalization of muscle tone
  - adherence to normal developmental sequence of motor progression

Sensory Integration Therapy

Emphasis on importance of three body centered sensory systems : tactile, proprioceptive & vestibular

Sensory Integration Therapy



Principle: a neurobiological process organizes sensation from one's own body and from environment and makes it possible to use the body effectively within environment

Constraint - Induced Movement Therapy

Systematic review has found the effectiveness of CIMT for children with hemiplegic CP.

Serial casting

- Reduces spasticity
- Reduces pain
- Improves ROM
- Provides stability

Strengthening Progressive Resisted Exercise

Assistive Technology & Adaptive Equipment

- Optimizes alignment, posture & function.
- Inhibits spasticity patterns.
- Facilitates more normal movement.

Cerebral Palsy- Orthotic Devices

Give a girl the right pair of shoes,

and she can conquer the

World !

Cerebral Palsy- Orthotic Devices

Can develop higher levels of functioning, including:

- **Increased range of motion**
- **Strengthened muscles**
- **Improved endurance**
- **Increased coordination, cadence**
- **Increased step length**
- **Improved control over spastic movements**

Cerebral Palsy- Orthotic Devices

- Some ways orthotics can help enhance quality of life:
- Improve independence by enhancing mobility
- Reduce stress and fatigue
- Reduce the likelihood of a fall, or an injury
- Take the focus off of required mobilzation and onto family time, play time, building relationships and pursuing interests

Cerebral Palsy- Orthotic Devices

Cerebral Palsy- Orthotic Devices

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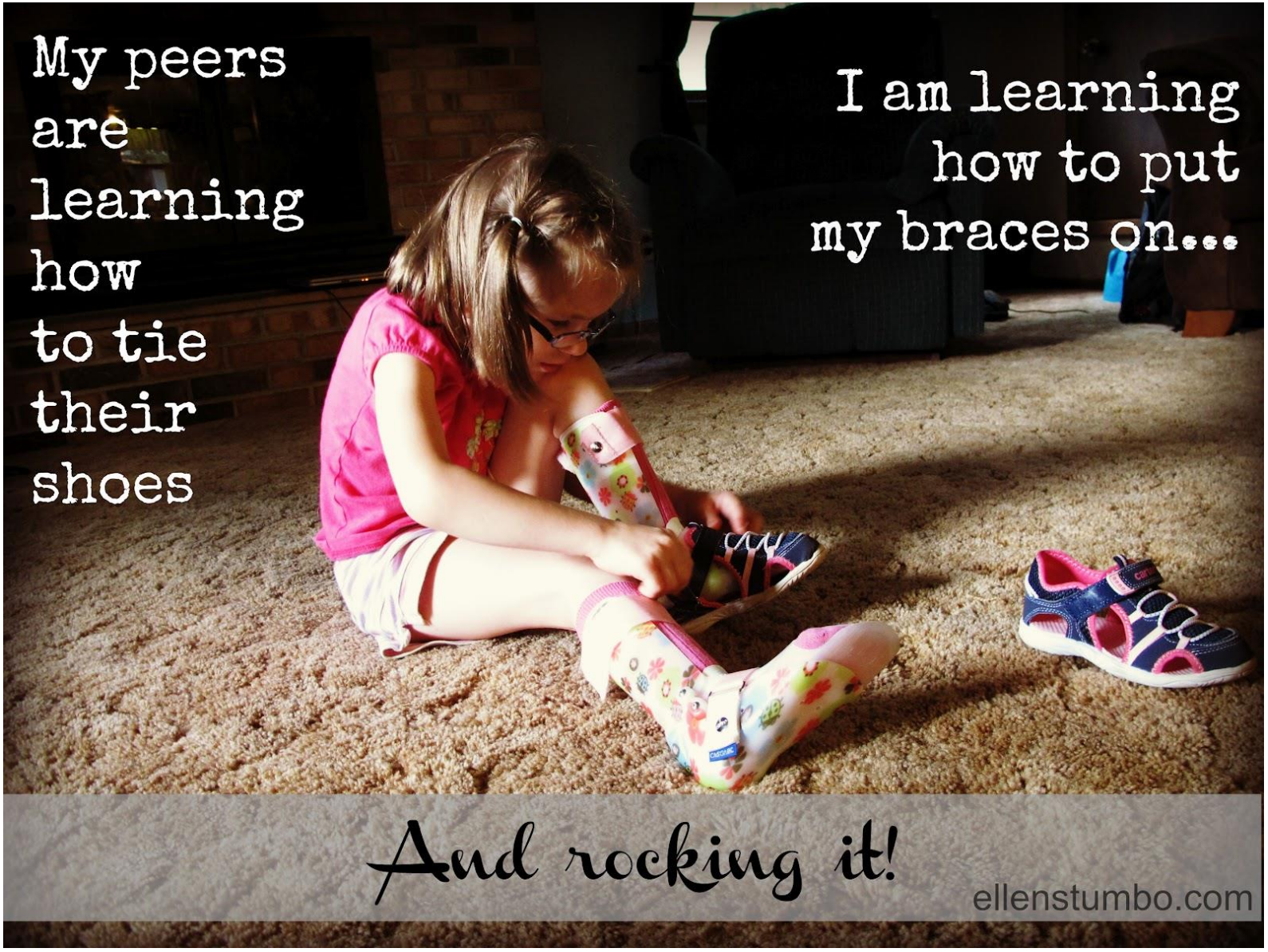


Cerebral Palsy-Aquatic Therapy

Cerebral Palsy -Hippotherapy

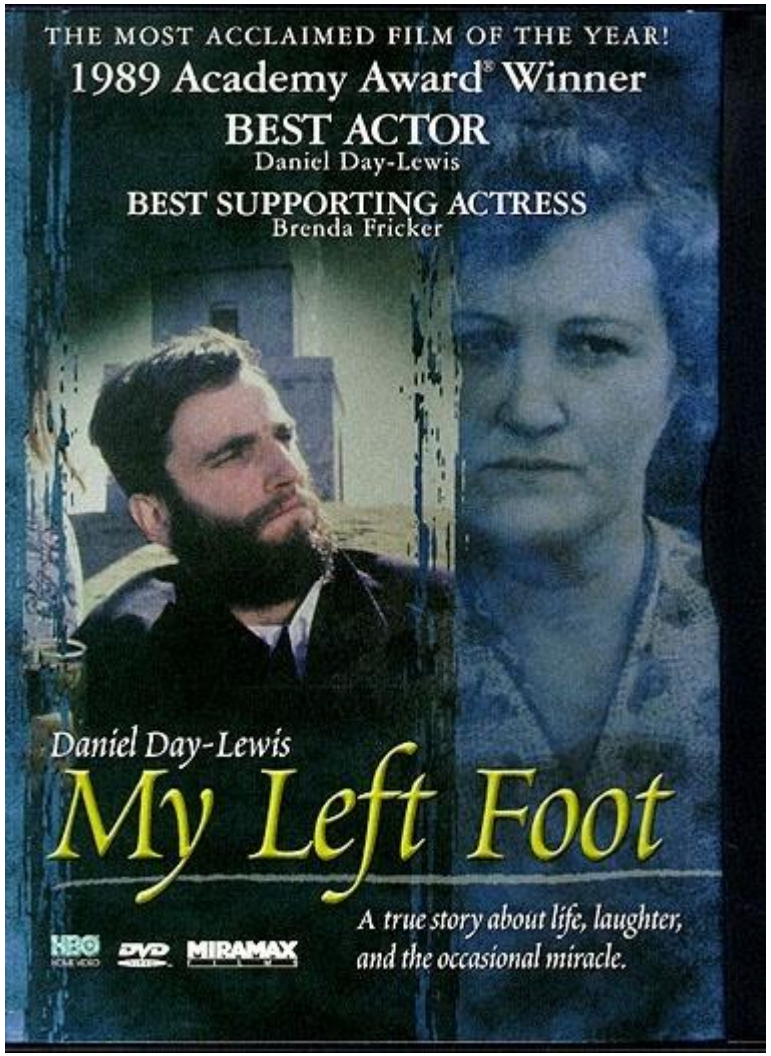
Low level evidence indicates that 45-min sessions hippotherapy and THR, once weekly for 8–10 weeks, result in significant effects on gross motor function in children with spastic CP.

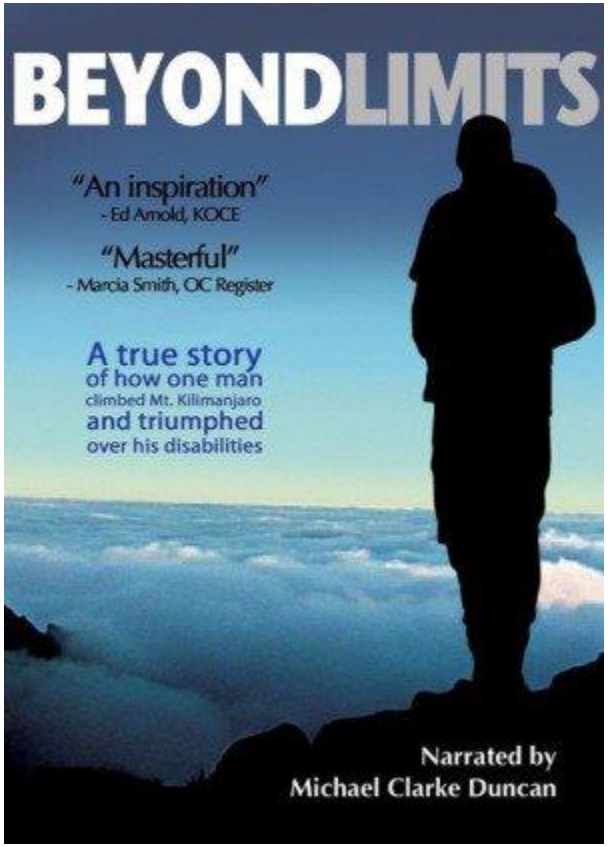
Whalen CN. Physical & Occupational Therapy in Pediatrics, 32(3):229–242, 2012

Toys for Children with Cerebral Palsy

Activity, Activity, Activity

Cerebral Palsy in the Movies





https://neurologicaldisordersinthemovies.wordpress.com/cerebral-palsy/

Cerebral Palsy- Pearls or Perils

- 1. Although prematurity is a major risk factor for CP, most children with CP were not premature infants.

- 2. Hand preference prior to the age of 18 months may be an indication of hemiparetic CP.
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- 3. Additional workup for an etiology other than CP should be undertaken in any child who has lost developmental milestones.

- 4. Sensory impairments, especially in hemiparesis, can be an important contributing factor to decreased functional hand use.
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- 5. Children with severe motor impairments related to CP can have normal cognition.
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- 6. Periods of rapid growth in children with CP may be associated with worsening contractures because spastic muscles fail to grow as quickly as bones.
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Cerebral Palsy- Pearls or Perils

•7. Children who have a sudden increase in spasticity should be evaluated for constipation, urinary tract infection, esophagitis, musculoskeletal pain, or other potential sources of noxious stimulation.

• 8. Oral baclofen should be titrated up slowly to minimize sedation and titrated off slowly to minimize the likelihood of withdrawal symptoms, including increased tone and seizures.

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• 9. When evaluating toe walking due to equinus, always evaluate and address spasticity and contractures of more proximal muscles, in particular, the iliopsoas and the hamstrings.

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• 10. Not all children who walk on their toes have CP. Toe walking can also be idiopathic or due to proximal muscle weakness, as is the case with Duchenne muscular dystrophy.

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• 11. Children with CP who sit independently by age 2 years are likely to be functional ambulators, while those who fail to walk by age 4 years are unlikely to be a functional ambulatory

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Glossary of Terms

In order to more fully understand the diagrams and descriptions of classification and symptoms, the following terms should be helpful.

Spasticity (spastic)- at rest muscles are resistant to passive stretch; during movement the resistance is velocity dependent; resistance is asymmetric about the joint, meaning either the flexors or extensors will be too tight, but not both

Rigidity- increased muscle tone at rest; resistance to passive stretch; resistance is independent of velocity; resistance is symmetric about the joints with both flexors and extensors resisting

Tone- tension and firmness present in muscle tissue when at rest

Ataxia (ataxic)- inability to coordinate voluntary muscle movements

Dystonia (dystonic)- muscles contracting abnormally to produce involuntary twisting movements

Dyskinesia (dyskinetic)- difficulty with performing voluntary movements

Athetoid (choreo-athetoid)- referring to involuntary writhing, twitching, or jerking