Disease statistics

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CELEBRAL PALSY

INTRODUCTION

- Cerebral palsy is considered a neurological disorder caused by a non-progressive brain injury or malformation that occurs while the child's brain is under development.
- Cerebral palsy primarily affects body movement and muscle coordination.
- While cerebral palsy is a blanket term commonly referred to as "CP" and described by loss or impairment of motor function, cerebral palsy is actually caused by brain damage.
- Current research suggests the majority of cerebral palsy cases result from abnormal brain development or brain injury prior to birth or during labour and delivery.
- Cerebral palsy affects body movement, muscle control, muscle coordination, muscle tone, reflex, posture and balance. It can also impact fine motor skills, gross motor skills and oral motor functioning. [1]

1. http://cerebralpalsy.org/about-cerebral-palsy/definition/

ORIGIN AND HISTORY OF CEREBRAL PALSY [1]

- Although cerebral palsy has affected humans since antiquity, the modern understanding of condition was first studied in the mid-1800's.

- English surgeon Dr. William John Little was the first person to study CP extensively when he came across a mystifying condition affecting young children. William Little wrote the first descriptions on cerebral palsy (which was unnamed at the time), which detailed a condition that caused stiff, spastic muscles in the legs and arms.

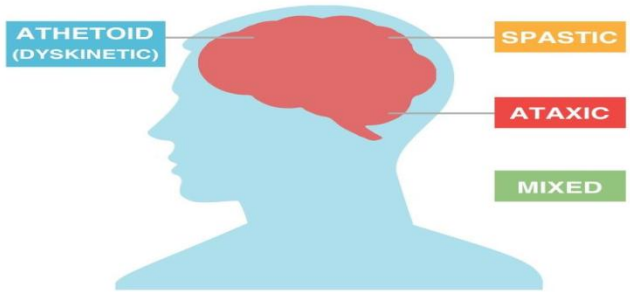
1. http://www.thecerebralpalsysite.co.uk/origin-history-cerebral-palsy/

TYPES OF CEREBRAL PALSY

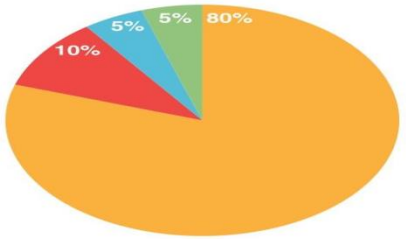
AND THEIR AFFECTED BRAIN REGIONS

Impairments to movement and function depend on which region of the brain is affected by injury.

Motor Types



Prevalence



SPASTIC

Spastic cerebral palsy occurs in 80% of all diagnosed cases of the condition, making it the most common form of cerebral palsy.

Spasticity refers to increased muscular tone. In cases of spastic CP, damaged regions of the brain send signals to the body that result in involuntary movements, stiffness, and mobility impairments.

ATAXIC

Ataxic cerebral palsy occurs in roughly 10% of all diagnosed cases of cerebral palsy.

Ataxic cerebral palsy results from damage to the cerebellum, which is the area of the brain responsible for balance and posture control, movement coordination, motor learning, and cognitive function. People with ataxic CP generally display hypotonia, tremors, motor impairments, imbalance, and visual and auditory processing problems.

ATHETOID

Athetoid/dyskinetic cerebral palsy accounts for roughly 5% of all diagnosed cases of cerebral palsy.

Athetoid and dyskinetic CP are characterized by mixed muscle tone--patients generally have hypertonia and hypotonia.

Side effects of athetoid and dyskinetic CP include postural impairments, fine motor function problems, and poor physical control.

MIXED

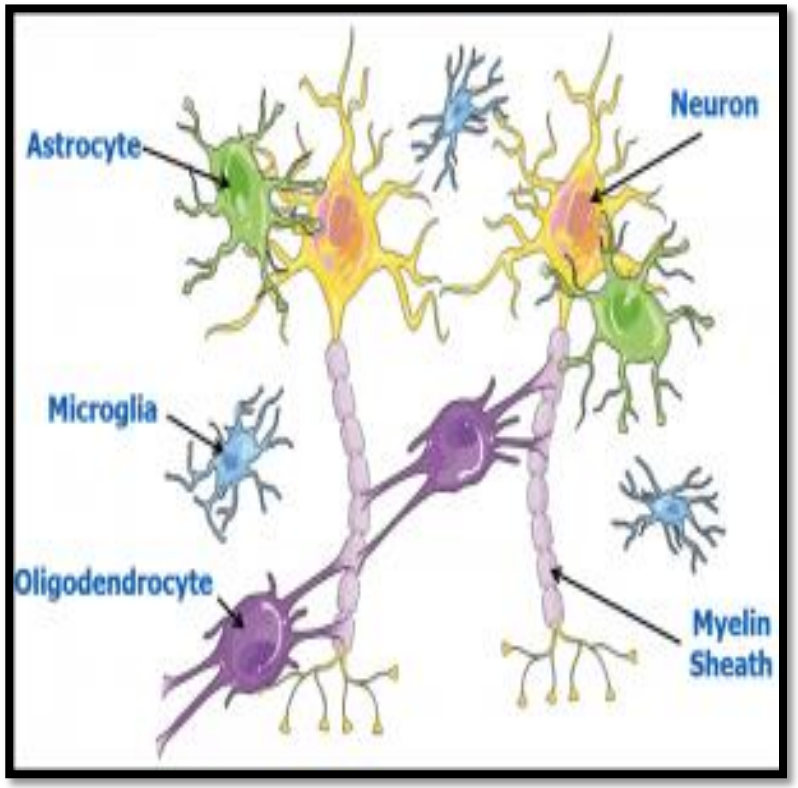
About 5% of people diagnosed with cerebral palsy have two or more forms of the condition.

Each type of cerebral palsy is the result of damage to a particular region of the brain, so when an injury or insult damages multiple parts of the brain, the result is often mixed cerebral palsy.

http://www.michigancerebralpalsyattorneys.com/about-cerebral-palsy/

CAUSES OF CP [1]

- Cerebral palsy may arise during pregnancy, but can also be caused by complications at birth, or following injury or illness after birth. It is often difficult to pinpoint exactly what has caused the damage to the brain because many different things can work together to create each person's unique set of symptoms, including:
- Changes in the genes inside the brain's cells can affect how the brain develops.
- The brain can sometimes develop in an unusual shape or structure.
- Infections during pregnancy or physical injury can cause damage to the brain.
- Complications of premature birth.
- Critical illness at birth (known as neonatal encephalopathy), which sometimes causes a shortage of oxygen to the brain.



Examples of cells found in the brain: Many different types of cells interact to carry signals around the brain and between the brain and body. Cerebral palsy is difficult to treat because it can involve damage to all of these types of cells and their connections.

1. http://www.eurostemcell.org/factsheet/cerebral-palsy-how-could-stem-cells-help

RISK FACTORS [1]

- Scientific research has discovered certain characteristics, or risk factors, which increase the possibility that a child may develop cerebral palsy.

1. Breech presentation at the time of childbirth
2. Complicated labour and delivery - complications during labour and delivery can potentially cause brain damage, which can lead to cerebral palsy.
3. Low birth weight and premature birth
4. Multiple births
5. Nervous system malformations – Problems with development of the nervous system while in the baby is in the womb are associated with cerebral palsy.

1. http://www.cerebralpalsysource.com/cp_quickfacts/risk-prevention/index.html

- Maternal bleeding or severe proteinuria late in pregnancy – The presence of excess proteins in the urine or of vaginal bleeding during the last trimester are linked to cerebral palsy.
- Maternal hyperthyroidism, mental retardation, or seizures – If the mother has any of these conditions, the child has a slightly increased risk for cerebral palsy.
- Seizures in the newborn
- Fetal anoxia – lack of oxygen to the brain during fetal development or delivery can contribute to cerebral palsy.

PREVALENCE OF CP

- Population-based studies from around the world report prevalence estimates of CP ranging from 1.5 to more than 4 per 1,000 live births or children of a defined age range. [1,2,3,4,5]

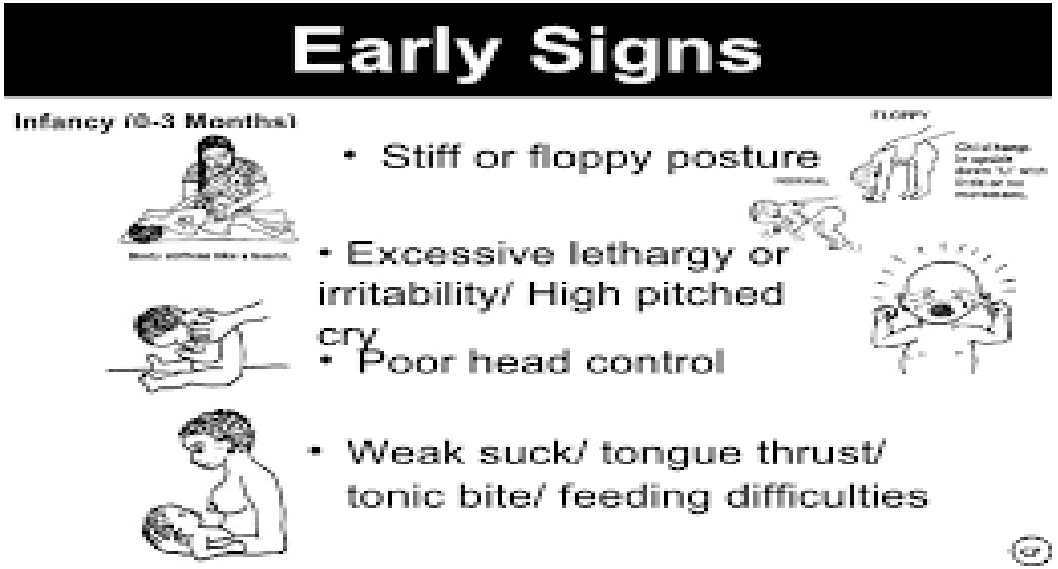
- In India, it is estimated at around 3 cases per 1000 live births; however, being a developing country the actual figure may be much higher than probable figures. There are about 25 lakh CP children in India as per the last statistical information. [6, 7]

1. Arneson CL, Durkin MS, Benedict RE, Kirby RS, Yeargin-Allsopp M, Van Naarden Braun K, Doernberg NS. (2009). Prevalence of Cerebral Palsy: Autism and Developmental Disabilities Monitoring Network, Three Sites, United States, 2004. Disability and Health Journal, 2(1), 45–48.
2. Bhasin TK, Brocksen S, Avchen RN, Van Naarden Braun K. (2006). Prevalence of four developmental disabilities among children aged 8 years – Metropolitan Atlanta Developmental Disabilities Surveillance Program, 1996 and 2000. MMWR. Surveillance Summaries, 55(1), 1–9.
3. Paneth N, Hong T, Korzeniewski S. (2006). The descriptive epidemiology of cerebral palsy. Clinics in Perinatology, 33(2), 251–267.
4. Surveillance of Cerebral Palsy in Europe. (2002). Prevalence and characteristics of children with cerebral palsy in Europe. Developmental Medicine and Child Neurology, 44(9), 633–640.
5. Winter S, Autry A, Boyle C, Yeargin-Allsopp M. (2002). Trends in the prevalence of cerebral palsy in a population-based study. Pediatrics, 110(6), 1220–1225.
6. Apexa G. Vyas, Virendra Kumar Kori *et al.,* Etiopathological study on cerebral palsy and its management by Shashtika Shali Pinda Sweda and Samvardhana Ghrita. Ayu. 2013 Jan-Mar; 34(1): 56–62.
7. Kathy Jones. Incidence of Cerebral Palsy Remains Constant in India on Indian Health News. Available from: http://www.medindia.net/news/Incidence-of-Cerebral-Palsy-Remains-Constant-in-India-74912-1.htm .

SYMPTOMS [1]

Common signs of severe CP that may be noticed shortly after birth include:

- Problems sucking and swallowing.
- A weak or shrill cry.
- Seizures.
- Unusual positions- Often the baby's body is either very relaxed and floppy or very stiff.



Even when the condition is present at birth, the signs of cerebral palsy may not be noticed until a child is 1 to 3 years old. Doctors and parents may not see that a baby's movements are unusual until the movements become more obvious as the baby grows.

1. http://www.webmd.com/children/tc/cerebral-palsy-symptoms

Signs that occur over time-

- Smaller muscles in the affected arms or legs- Nervous system problems prevent movement in the affected arms and legs.
- Abnormal sensations- Some people who have CP feel pain when touched lightly.

- Skin irritation- Drooling is common when facial and throat muscles are affected. Drooling irritates the skin, particularly around the mouth, chin, and chest.
- Dental problems- Children who have trouble brushing their teeth have a greater risk of getting cavities and gum disease (gingivitis). Seizure medicines may also lead to gum disease.
- Accidents- Falls and other accidents are a risk, depending on muscle control, joint stiffness, and general physical strength. And CP-related seizures can cause injuries.

DIAGNOSIS OF CP [1]

- Most children with cerebral palsy are diagnosed during the first 2 years of life. But if a child's symptoms are mild, it can be difficult for a doctor to make a reliable diagnosis before the age of 4 or 5.

- Doctors will order a series of tests to evaluate the child's motor skills. During regular visits, the doctor will monitor the child's development, growth, muscle tone, age-appropriate motor control, hearing and vision, posture, and coordination, in order to rule out other disorders that could cause similar symptoms.

- Lab tests can identify other conditions that may cause symptoms similar to those associated with CP.

1. http://www.ninds.nih.gov/disorders/cerebral_palsy/detail_cerebral_palsy.htm

- Neuroimaging techniques that allow doctors to look into the brain (such as an MRI scan) can detect abnormalities that indicate a potentially treatable movement disorder.

Neuroimaging methods include:

1. Cranial ultrasound - It is used for high-risk premature infants because it is the least intrusive of the imaging techniques.
2. Computed tomography (CT)- It uses X-rays to create images that show the structure of the brain and the areas of damage.
3. Magnetic resonance imaging (MRI)- MRI can show the location and type of damage and offers finer levels of details than CT.

HOW IS CEREBRAL PALSY TREATED? [1]

- **Cerebral palsy can't be cured, but treatment will often improve a child's capabilities.**

➢ Physical therapy, usually begun in the first few years of life or soon after the diagnosis is made, is a cornerstone of CP treatment.

Specific sets of exercises and activities can maintain or improve muscle strength, balance, and motor skills, and prevent contractures. Special braces (called orthotic devices) may be used to improve mobility and stretch spastic muscles.

➢ Speech and language therapy can improve a child's ability to speak, more clearly, help with swallowing disorders, and learn new ways to communicate.

➢ Assistive devices such devices as computers, computer software, voice synthesizers, and picture books can greatly help some individuals with CP improve communications skills. Orthotic devices help to compensate for muscle imbalance and increase independent mobility.

1. http://www.ninds.nih.gov/disorders/cerebral_palsy/detail_cerebral_palsy.htm

- Oral medications such as diazepam, baclofen, dantrolene sodium, and tizanidine are usually used as the first line of treatment to relax stiff, contracted, or overactive muscles.

- Orthopaedic surgery is often recommended when spasticity and stiffness are severe enough to make walking and moving about difficult or painful.

  Orthopaedic surgeries may be staggered at times appropriate to a child's age and level of motor development.

STEM CELLS AS ALTERNATIVE THERAPY

- **Stem cell therapy** is being investigated as a treatment for cerebral palsy. Scientists are hopeful that stem cells may be able to repair damaged nerves and brain tissues.
- Researchers have shown that Mesenchymal stem/stromal cells (MSCs) can stimulate neural precursors in the brain and provide physical scaffolding for nerves, but to date there is still little evidence that MSCs help repair neural damage.
- Scientists are still fine-tuning their pre-clinical stage studies using neural stem cells for CP.
- Researchers find cord blood advantageous because it is easy to obtain and comes with little risk to the donor and little chance of transmitting infectious viruses. [1]

1. http://stemcellfoundation.ca/en/diseases/cerebral-palsy/

CORD BLOOD TREATMENT

- The study conducted by *Mino Kang (2015)* evaluated the efficacy of umbilical cord blood (UCB) cell for patients with cerebral palsy.

Thirty-six children (ages 6 months to 20 years old) with CP were enrolled and treated with UCB or a placebo.

The UCB group showed greater improvements in muscle strength than the controls at 1 and 3 months after cord blood treatment.

The UCB group also showed greater improvements in gross motor performance than the control group at 6 months after cord blood treatment.

In this trial, treatment with UCB alone improved motor outcomes and induced systemic immune reactions and anti-inflammatory changes in the brain. [1]

1. Mino Kang, Kyunghoon Min *et al.*, Involvement of Immune Responses in the Efficacy of Cord Blood Cell Therapy for Cerebral Palsy. Stem Cells and Development, 2015 Jul 2.

- Retrospective study was conducted by *Feng et al., (2015)* to assess the safety of patients with severe cerebral palsy (CP), who received **allogeneic umbilical cord blood stem cells** (UCBSCs) treatment from August 2009 to December 2012 in Guangdong Provincial Hospital of Chinese Medicine. [1]

A total of 47 patients were evaluated No casualties occurred. Some adverse events during treatments were found, however, it disappeared after symptomatic treatment.

No treatment related serious adverse events were found in follow-up visits within 6 months.

It concluded that allogeneic UCBSCs treatment was relatively safe for severe CP patients.

1. Mei Feng,1 Aili Lu *et al.*, Safety of Allogeneic Umbilical Cord Blood Stem Cells Therapy in Patients with Severe Cerebral Palsy: A Retrospective Study. Stem Cells International Volume 2015 (2015), Article ID 325652, 7 pages.

- The largest cohort of **autologous cord blood transplantation** for cerebral palsy has been published by *Lee and co-workers (2012)*, who reported on an uncontrolled single arm pilot study of 20 children with cerebral palsy to assess the safety and feasibility of the procedure as well as its potential treatment efficacy.

In this carefully documented study, employing an array of neuro-developmental examinations and imaging techniques before and during follow-up, there were overall neurologic improvements in 5/20 children, ranging from 23 to 91 months of age, weighing 7.2–21.4 kilogram.

Interestingly, the type of cerebral palsy exhibited mattered, in that patients with diplegia or hemiplegia showed improvements rather than those with quadriplegia.[1]

1. Lee YH1, Choi KV *et al.*, Safety and feasibility of countering neurological impairment by intravenous administration of autologous cord blood in cerebral palsy. J Transl Med. 2012 Mar 23;10:58.

- *Papadopoulos and co-workers (2011)* first reported on two toddlers with diagnosed CP that received **autologous umbilical cord blood (UCB)** transfusion accompanied by low dose subcutaneous granulocyte colony stimulating factor (G-CSF) injections.

The toddlers presented spastic diplegia and were unable to walk at 19 months (case 1) and 15 months (case 2).

In both cases significant improvements in motor ability were noted at 7 weeks and at 36 months after cord blood transfusion with reduced spasticity bilaterally, allowing them to walk almost independently, to run and to swim.[1]

1. Papadopoulos KI, Low SSS, Aw TC, Chantarojanasiri T. Safety and feasibility of autologous umbilical cord blood transfusion in 2 toddlers with cerebral palsy and the role of low dose granulocyte-colony stimulating factor injections. Restorative Neurology and Neuroscience. 2011;29(1):17–22.

CORD BLOOD SUCCESS STORIES

BOY, 2, IS THE FIRST TO HAVE CEREBRAL PALSY 'SUCCESSFULLY TREATED' USING STEM CELLS, TAKING HIM FROM A VEGETATIVE STATE TO WALKING AND TALKING [1]

- Doctors have successfully treated pediatric Cerebral Palsy with Umbilical cord blood for the first time, on a patient known only L.B.
- After going into cardiac arrest in November 2008, L.B. was left paralysed with severe brain damage and in a vegetative state.
- On 27 January 2009, the doctors administered the prepared blood intravenously. In just two months after treatment with the cord blood containing stem cells, his symptoms improved significantly.

1. http://www.dailymail.co.uk/health/article-2330338/boy-cerebral-palsy-successfully-treated-using-stem-cells-taking-vegetative-state-walking-talking.html

Before his treatment, the patient had been in a persistent vegetative state for nine weeks due to having a heart attack.

Just weeks after being given an intravenous stem cell treatment the boy's symptoms improved considerably and within months he could talk and move.

PROMISING MEDICAL EFFECTS BROUGHT BY UMBILICAL CORD BLOOD STEM CELLS [1]

- Yuecheng jiang, a three year old boy with Cerebral Palsy, had received two courses of autologous umbilical cord blood stem cells therapy last October and this April.
- The little boy was born healthy, however his mobility skills developed very slowly by the time he was roughly three months old and exhibited respiratory problems.
- According to his mother, improvement emerged shortly after stem cell transplantation. “The next day, I could feel his physical progress. He was able to walk when I held his hand, which had never happened before. We were all very happy for his improvements.
- Though the language development was still limited, “he understood more and smiled more. I can feel that he is making progress every day.”

1. http://www.chinabiotherapy.com/hornetcornnews/2015/339.html

Thank you