Chapter 3

Diagnosis, treatment, and prevention of cerebral palsy

1. Diagnosis

Accurate and early diagnosis of CP is important for medical reasons. In particular, children who are at high risk for premature or low birth weight should be evaluated periodically for effectiveness in the diagnosis as early as possible. In any case, it is hard to analyze CP in the first 1 to 2 years of age, except in severe cases. This problem is compounded by the fact that some normal infants may show signs of obvious nature.[1-3] The diagnosis of CP is mainly based on detailed clinical assessment by history taking and physical examination rather than relying solely on neuroimaging or laboratory tests.[4, 5, 6, 7] However, two things should be remembered that the treatment should not be delayed to wait for the diagnosis or assessment of the cause. And the family is very important to know that CP may be possible.[6]

1.1 Pathology or Pathophysiology of cerebral palsy

Most children with CP (>80%) have been found by the neuroimaging methods; In particular, MRI is increasing its capacity in the diagnosis of CP.[8-12] The findings of these disorders can provide valuable clues to pathogenesis. One large study found that only 11.7% of these children showed normal MRI findings.[9] MRI can possibly envision the morphological, physiological and neurotic changes during the brain development. The human brain has sophisticated development both in and outside the womb. Stages of brain development affects disorders or lesions of the brain. Cortical neurogenesis happens mostly amid the first and second trimester. From the late second and early third trimester onwards, when "grossarchitecture" of the cerebrum (neural cyto- and histogenesis) is set up, development and separation occasions (axonal and dendrite development, neurotransmitter arrangement, and myelination), which was commanded until the postpartum period. On the off chance that this is meddling with mental health amid this period will bring about a deformity or sore of the cerebrum.[10, 13]

The most widely recognized anomalies on neuroimaging is found in the white matter close to the lateral ventricles, frequently called periventricular leukomalacia (PVL), with reports of up to 56% in all cases, trailed by the cortex and deep gray matter lesions (18%), and cerebrum maldevelopments (9%), respectively.[10] PVL happens more regularly in premature babies (90%) than in term newborn children (20%) and is a typical result of intraventricular drain in premature babies,[10, 14, 15] since the corticospinal tract filaments to the lower limbs points are average to

those of the furthest points in the periventricular white matter, so children with PVL is regularly a sort of spastic diplegic CP.[3, 16] Dystonic CP related to deep gray matter lesions of the basal ganglia and thalamic region, most of which occurred 75.6% of the ganglia infarcts. Both focal cortical gray matter and white found in almost all patients with hemiparesis and is often associated with middle cerebral artery stroke. For hemiplegia have a focal infarct on neuroimaging is 27.5%.[9] And finally, brain malformations were most common in the hemiplegia group and term infants but were found across all clinical subtypes.[9-11] Under the determination of CP has been questionable because of brain malformation syndromes, for example, neural tube imperfections are not generally as CP, even within the sight of engine incapacity. Be that as it may, the current global meeting on the definition and arrangement of CP has chosen to incorporate mind abnormalities in the classification of CP in the event that they deliver the clinical components of motor disorders.[17] In summary, neuroimaging is not necessary for the diagnosis of CP because of disease depends on clinical findings. The major advantage of the imaging is to understand the etiology and pathogenesis.

1.2 Clinical features

Despite the advances in technology, the clinical diagnosis of CP is still an ongoing of medicine.[6, 7] The disorder itself is not progressive, however the presence of neuropathologic lesions and their clinical expression may change over time due to brain maturation. The essential findings include: [5, 6, 18, 19]

(1) Delayed motor milestones: Infants with CP often have delayed developmental milestones such as rolling, crawling, sitting, or walking and the success of these events should be evaluated according to normal baby developmental age (Table 3.1).[5, 19] Examination using motor milestones as an effective screening process for CP. The result is a testament to this is an assessment of six motor milestones at the age of 18 months (roll prone to supine, roll supine to prone, sit with support, sit independently, crawl, and cruise) in 173 high risk infants, of whom 31 (18%) developed CP.[20]

Table 3.1 Normal developmental milestones

Gross motor skill	Mean age of development (month)	Abnormal if not present by age (month)
Lifts head when prone	1	3
Supports chest in prone position	3	4
Rolls prone to supine	4	6
Sits independently when placed	6	9
Pulls to stand, cruises	9	12
Walks independently	12	18
Walks up stair steps	18	24
Kicks a ball	24	30
Jumps with both feet off the floor	30	36
Hops on one foot with holding on	36	42

Data from: Miller F (2007)[21]; Berk LE (2006)[22]; Scherzer AL (2001)[23]

(2) Abnormal neurologic examination: Abnormal neurologic findings are increased or decreased muscle tone, muscle weakness, brisk deep tendon reflexes, clonus holding on past 12 months of age, and side to side asymmetries in muscle tone or utilitarian capacities.[24] However, the early diagnosis of CP is difficult for infant neurologic examination because of a problem with false positives. As in the large prospective multicenter study, infants were followed until the age of 7 years, and have been compared to infant neurological status. The study found that only 23% of children with CP at the age of seven years to detect abnormal neurologic examination from age newborn. And up to 43% of children with CP at the age of seven years undetected abnormalities of neurologic in newborn. The neurological examination in early diagnosis alone is not sensitive or specific enough for the diagnosis of CP. Diagnosed by neurological examination together with primitive reflexes and postural reaction will make it even more effective.[25]

(3) Persistence of primitive reflexes: Reflexes are movements that the body is automated by a particular form of stimulation and the requirement for the advancement of head control and muscle tone and in addition tactile and motor improvement.[5, 22] The remains of a primitive reflexes are the problem of the central nervous system. The persistence of primitive reflexes is an impression of the surprising parts of the focal sensory system. Most primitive reflexes are coordinated inside the typical 4-8 months as palmar grasp reflex, moro reflex, asymmetric tonic neck reflex, and tonic labyrinthine reflex (Table 3.2), yet for children

with CP, they may hold on until adulthood.[16, 18] The persistence of primitive reflexes effect on the development of the voluntary motor movements and cause a change in muscle tone and position of the limbs. It additionally brought about a failure in the formation of postural reactions or protective reflexes.[16, 18] Sometimes, distinguishing between postural reactions and primitive reflexes is difficult, making some reflexes are still a controversial issue.[26]

(4) Absence of postural reactions: Postural reactions are fully developed by the first year of life. They form the basis for a successful motor skill. Commonly tested postural reactions in infants include parachute reaction (Table 3.2). These rapid movement of the muscle by keeping the body in an upright position through changes of muscle tone in response to the position of the body. Postural reactions respond to stimuli rather than primitive reflexes.[26, 27]

Table 3.2 Some primitive reflexes and postural reactions associated with cerebral palsy

Reflex	Method	Response	Age of disappearance
Palmar grasp reflex	Supine - place finger in infant's hand and press against palm	Flexion of fingers, fist making	3 – 4 months
Galant reflex (Trunk incurvation reaction)	Prone - Scratching the skin of the infant's back from the shoulder downwards, 2-3 cm lateral to the spinous processes	Incurvation of the trunk, with the concavity on the stimulated side	4 months
Asymmetric tonic neck reflex (ATNR)	Supine - Turning head to one side; this stimulates nerves in the neck (do bilaterally and note any asymmetry of response)	Infant lies in a "fencing position." One arm is extended in front of eyes on side to which head is turned, other arm is flexed	4 – 6 months
Tonic labyrinthine reflex (TLR)	Drop the head 45 degrees from the plane of the body; after the response is observed, actively flex the head to the chest; both maneuvers stimulate the labyrinth	Extension: tonic retraction of the shoulders and extension of the body; an exaggerated response would be opisthotonus, arching, or decorticate posturing; flexion: tonic flexion of the body	6 months
Moro reflex	Supine - hold infant horizontally on back (≈30°) and let head drop slightly, or produce a sudden loud sound against surface supporting infant	Symmetric abduction /extension of arms; fingers fan out; arms then adduct, which is followed by relaxed flexion; legs may follow a similar pattern	6 – 7 months

Table 3.2 Some primitive reflexes and postural reactions associated with cerebral palsy (Continue)

Reflex	Method	Response	Age of disappearance
Symmetrical tonic neck reflex (STNR)	Quadruped / crawling – hold infant on leg; press the head down and looked up.	Extending the arms and bending the knees when the head and neck are extended	9 – 11 months
Neck righting reflex	Supine - turn head when infant is in supine	Body log rolls towards the same side	10 months
Babinski (Plantar) reflex	Supine - Stroke sole of foot from toe toward heel	Toes fan out and curl as foot twists in	8 – 12 months
Primary Walking (Stepping) reflex	Upright - Hold infant under arms and permit bare feet to touch a flat surface	Infant lifts one foot after another in stepping response	12 – 24 month
Foot placement reaction	Upright - Drag dorsum of foot against edge of table	Get placing of foot unto table top	Should appear at aged 6 months
Parachute reaction	Prone - hold child in prone position and simulate falling forward	Should be forward extension of the arms	Should appear at aged 10-12 months

Data from: Jones MW et al. (2007)[18]; Berk LE (2006)[22]; Zafeiriou DI (2004)[26]; Zafeiriou DI et al. (1995)[28]

1.3 Differential diagnosis of cerebral palsy

CP is a group of syndrome and may be seen as a component of other clinical entities in early childhood. Many disorders of the central nervous system cause floppy infant, especially during newborn period. Most common disorders (other than CP) include myopathy, neuromuscular, genetic and metabolic disorders. This easily causes confusion in diagnosis. For example, in order to differentiate CP from progressive white matter disorders such as inherited leukodystrophies, laboratory testing may be necessary.[29, 30] Signs indicate neuromuscular disorder, including lessened deep tendon reflexes, weakness, or genetic history. Careful observation points out that in CP, movement of the limbs are preserved while the trunk is predominately hypotonic. Children with developmental delays are not only found in CP children, but normal in children with severe malnutrition. In addition, patients with intellectual disability without motor deficits are often diagnosed as CP because patients have delayed motor milestones. Children with intellectual disability may have hypotonia, but do not have abnormal motor or posture; and disabilities prominent in terms of language and social adjustment than

impaired motor.[2, 16] Therefore, it is necessary to distinguish between disorders of the CP from progressive disorders of childhood, seeking in children with evidence of progressive disorders or loss of previously obtained motor milestones. The progression of these conditions, the diagnosis can be confirmed by relevant investigations.

1.4 Assessment

(1) Physical examination: General physical examination in infants with CP did not provide a specific diagnosis except in cases of motor asymmetry. The physical exam environment is important to both parents and children to relax and plan to make appropriate. These examinations should be screened for health problems that are common in childhood and monitoring of growth and nutritional disorders. CP children are often found to interfere with growth, such as the asymmetric growth in hemiplegia or absence of development of the lower appendages in diplegia.[2, 23]

(2) Neurological examination: Knowledge of the developmental stages of the nervous system, for example, gross and fine motor, speech and language, cognitive, and socialization is essential in assessing neurologic. Neurological assessment should evaluate these, including cranial nerves, posture, muscle tone of limbs, trunk and neck, deep tendon reflexes, primitive reflexes, and postural reaction.[2, 29]

(3) Screening instrument: Neurodevelopmental assessment can be made up by the use of appropriate screening tools. The Denver Developmental Screening Test (DDST) is a simple screening tool for infants and preschool children with developmental delay, which is commonly used and developed for a long time. The test covers four functions: gross motor, language, fine motor-adaptive, and personal-social.[31] The Hammersmith Infant Neurological Examination is a simple method for evaluating infants aged 2 to 24 months, including three sections, the Neurological Examination, the Development of Motor Functions, and the State of Behaviour. First, it is necessary to evaluate the cranial nerves, posture, movement, tone, and reflexes to these items does not depend on age. Second, valuation control the head, sitting, voluntary grasping, rolling, crawling and walking. Finally, assess the level of consciousness, emotional, and social orientation.[32, 33]

(4) Investigation: Although laboratory tests will be necessary in the diagnosis of CP, however, the results of physical and neurological examination, and children historical

development is more than necessary. For example, in children born premature or low birth weight, and a history of delayed developmental motor milestones should have been more laboratory tests to support the diagnosis of CP.[23] Investigations, including complete blood count and urinalysis, serum lead level, TORCH titer, thyroid function studies, creatine phosphokinase, urinary amino acid scan, fragile X testing, EEG, ultrasonography, cerebral CT, and MRI.[2, 5, 23, 29] For the diagnosis of CP children, MRI is preferred to CT. Additionally, MRI is particularly important in the differential diagnosis of neurological disease progression can also provide clues to the diagnosis to distinguish between genetic-metabolic causes from asphyxia in children with extrapyramidal CP.[2, 8]

2. Treatment

The motor disorder of children with CP will lead to limitations of movement in later times. At present CP cannot yet be cured; however, the treatment can help improve a child's ability. Therefore, the early diagnosis of an infant or child should be assessed. These problems should be evaluated by a multidisciplinary rehabilitation team in order to contribute to the process of treatment. With current medical advances, many patients with CP can have near-normal lives if properly managed.[5, 16, 23] Appropriate treatment is essential to reduce the deficit, help in the motor progression, and to maintain suitable level of physical fitness. Management of CP requires multidisciplinary team, including physiatrist, developmental pediatrician, neurologist, orthopedist, physical therapist, occupational therapist, speech and language pathologist, therapeutic recreation specialist, orthotist, psychologist, social worker, and nutritionist who want to cooperate with parents or caregivers and teachers to create an individual treatment plan for a child to develop to his full potential.[5, 16, 34-36] The consideration of three areas[34]: (1) Troubleshooting movement; (2) the medical issues involved; And (3) to provide rapid treatment. At this time will only describe the treatment of movement problem, which is the main problem of CP.

2.1 Pharmacologic

Therapy needed to improve or correct motor deficits in CP is an important medication to treat symptoms of spasticity and dyskinesia. There are many pharmacological treatments using the following method.[3, 5, 16, 23, 34-37]

2.1.1 Oral

Drugs used for several years to reduce spasticity and increase function in children with CP are diazepam (Valium™), which fills in as a general relaxant of the mind and body; baclofen (Lioresal™), which pieces signals sent from the spinal string to the muscle compression; and dantrolene (Dantrium™), which meddles with the procedure of muscle constriction.[3, 5, 23, 34, 35, 37] However, an oral medication to reduce spasticity in the short term but the long-term control of spasticity symptoms remains unclear. And may have significant side effects such as drowsiness, generalized weakness, increased drooling also, may have long haul impacts on the creating sensory system.[5, 36, 38, 39] Most studies on the use of drugs not studied in childhood. Therefore, physicians should follow up of children from parents who have noticed changes in their children closely after they have been administered. Typically, the child will be considered for drugs aged not less than 3 years. Due to oral medications are limited, so the pump to deliver baclofen directly into the spinal cord through it to be successful because of the higher concentration of drug in the central nervous system, while the dose decreased. It can reduce the side effects caused by the central nervous system.[3, 23, 35] Athetosis CP may get drugs that lessen the movement uncommon impact by diminishing the action of acetylcholine, a substance that helps some cerebrum cells convey and can bring about withdrawal of the muscle. Medicines in this gathering incorporate trihexyphenidyl, benztropine, and procyclidine hydrochloride.[5]

2.1.2 Focal (neurolysis)

Nerve blocks are utilized to influence the muscle tone localizedly. Cases of chemicals utilized is alcohol, phenol, and botulism toxin A. Alcohol and phenol blocks temporarily acting for 9 to 12 months, and also cause pain and discomfort, so this technique was used on medical need correct a developing contracture.[3, 5, 23, 37] Botulinum toxin A injection is a method that has recently been introduced to treat muscle tightness or spasticity. It is most commonly used on tightness in the gastrocnemius or soleus muscle interfere with the learning of movement.[40-42] The consequence of this system can make it less demanding to position the child, to fit the orthosis, to enhance execution, or to give data about the proper length of the muscle.[42] Botulinum toxin A does not effective to cause permanent changes in the structure and the injection repeated every 3 to 6 months as long as they are still active.[39]

2.2 Surgical

2.2.1 Neurosurgery

Selective dorsal rhizotomy (SDR): Spasticity can be steadily tended to with the SDR. This neurosurgical technique includes segmenting of the dorsal segment rootlets to intrude on the spinal reflex circular segment, hindering afferent contribution from the muscle and ligaments, and decreasing efferent action at the level of the spinal cord. Operative procedure includes the execution of single or multilevel osteoplastic laminectomies, uncovering the L2 to S2 roots. The determination of rootlets for cutting depends on the lower furthest point strong reaction to electrical incitement of the rootlets. SDR is generally pondered proper for the preschool age child at the earliest.[16, 23, 34, 36, 37, 42] The results of the SDR suggests that it helps relieve spasticity and has positive effects on the gross motor function.[43] So this process is a long period of rehabilitation, which require a longer period.

2.2.2 Orthopedic surgery

Orthopedic surgery is the best treatment for musculoskeletal problems in children with CP. The principal procedures are lengthening, muscle releases, split tendon transfers, osteotomies, tenotomies, and arthrodeses. Surgery is regularly suggested when contractures and disfigurements are sufficiently serious to bring about development issues, including sitting, standing, and walking. The standard objective of surgery in a child with ambulation potential is to enhance utilitarian ambulation. A good walking pattern in the ambulatory child, the feet should be plantigrade and stable, the hips should extend well and be stable, and the knees should have good extension. The objective of surgery for non-walking children is to relieve the burden of care through encouraging sitting, enhancing cleanliness, and preventing pain. Orthopedic surgery is fundamentally embraced on the lower limbs, yet sporadically in the upper limbs. Some of the time children with CP require orthopedic surgery in a few distinctive piece of body (e.g. hip, knee, and lower leg). Oftentimes this now includes a single hospitalization and is called "multilevel surgery". Multilevel surgery is of most advantage to children who walk freely or with the help of braces. Timing of surgery depends on central nervous system maturation, ambulation potential, and rate of deformity development. The

surgery can be delayed until children aged 4 to 12 years because of in younger children with high risk of recurrence of tightness and contracture formation.[3, 5, 16, 34, 39, 42, 44, 45]

2.3 Rehabilitation

The main objective in the rehabilitation of children with CP is to develop physical, social, and vocational functions. The goal of rehabilitation is the independence to do the activities at home, school or work and social life.[29] Physical therapy plays an important role in the rehabilitation of children with CP.[46] In lower extremities rehabilitation, basic techniques, such as strengthening, stretching, passive range of motion, massage, balance, endurance, weight bearing, and many others, are frequently used. Neurodevelopmental treatment, Vojta therapy and Peto therapy treatment is a type of treatment that has become more complex, which is generally based on different principles of motor learning and the need for specialized training.[46] Other methods used in CP rehabilitation are partial body weight support treadmill training, hippotherapy, aquatic therapy, and electrical stimulation. Children should begin to receive physical therapy when he or she is a baby. When the child was two years old should begin to practice occupational therapy to teach everyday activities. For toddlers should use assistive devices for movement by the bracing may be necessary for the child begins to walk.[29]

2.3.1 Physical therapy

Physical therapy is the restoration of physical weaknesses by enhancing and reinforcing the patient's muscles large. The general objectives of active recuperation is to boost utilitarian control of the body, or increment the gross motor function. Physical therapy techniques for children with CP are widely used, including neurodevelopmental treatment, strengthening exercises, partial body weight support treadmill training, stretching technique, hippotherapy, aquatic therapy, electrical stimulation, and vojta therapy.

(1) Neurodevelopmental therapy: neurodevelopmental treatment or Bobath therapy (Karl & Bertha Bobath, 1943) is a method of rehabilitation is most often used for children with CP. The aims are to make the muscles normally, inhibit abnormal primitive reflexes, and encourage normal movement.[29, 47] Philosophy of treatment is based on a hierarchical view of central nervous system function.[21, 48, 49] This approach is reflected through the inhibition to reduce spasticity and stimulating key points of regulation to promote the development of

advanced flat reaction, which is believed to have been developed. There is one thing that should be emphasized to parents on how to position the child at home during the baby is feeding and other activities should be held in antispastic position to prevent the contracture.[29]

(2) Strengthening exercises: Children with CP often have weak muscles, especially in the lower limbs are also hip flexors and plantar flexors.[16] It limits functional performance in children with CP, but can improve through strength training.[49, 50] These exercise that helps strengthen, including isotonic strength training, isokinetic strength training, isometric strength training, functional strengthening exercises, and mixed forms of strength training.[46] In the past, strength training has been considered as controversial and inappropriate because of concerns of adverse effects such as increased spasticity.[16, 48, 51] However, some studies shown that strengthening can be achieved in children with CP, without any side effects.[52-54] Evidence from a systematic review of strength training for children with CP support the strengthening exercises can improve muscle strength in children and young adults with CP without any untoward effects.[55]

(3) Partial body weight support treadmill training (PBWSTT): In the recent years, treadmill preparing has turned into an extremely well known recovery strategy in CP.[46] PBWSTT intervention is a theory of motor learning and the importance of training and the importance of early task-specific training. This approach will help the patient ambulation on a treadmill, using the control system consists of an artificial balance. Children on a treadmill at a speed appropriate ambulate while there is support in the harness. PBWSTT provides balance and postural stability for a child while practicing gait with decreased load on the lower limbs.[16, 48, 56] In non-ambulation children, PBWSTT can help children develop in standing and walking function to measure gross motor (GMFM) and functionality gains, including the ability to transfer. from a standing position without using arms and stopped walking, walking and stopping, and climbing the stairs.[57] Randomized controlled trial of 34 children classified level III or IV by the GMFCS indicates that PBWSTT is safe and feasible to use in special schools; it may be no more effective than walking on the ground for enhancing ambulation velocity and continuance.[58, 59]

(4) Stretching technique: Children with CP have a higher risk of muscle contractures due to muscles imbalances and maintain the position which has contributed to the loss of range of motion and reduce movement.[16, 60] Stretching is an important physical therapy for children with CP who have this problem. Stretching techniques include: (1) passive stretching

(stretching is performed by a third party and not the patient); (2) active stretching (stretching exercise with their patients); (3) prolonged positioning (positioning is utilized to accomplish a long extend of a specific muscle or gathering of muscles). Although the stretching technique is widely, but knowledge about the effectiveness of this technique in the treatment of children with CP is limited for two reasons. To start with, instrument and the etiology of muscle contractures in children with CP is not surely knew, making it hard to figure out if the fundamental hypothesis of muscle extend appropriately. Second, clinical research assessing the adequacy of extending strategies for children with CP is uncertain and does not have any significant bearing to clinical treatment choices.[60] Notwithstanding, there is some proof to propose that maintained extend of longer term is desirable over enhance range of motion and to reduce spasticity.[61]

(5) Hippotherapy: Hippotherapy has been utilized for more than 30 years in the treatment of children with spastic CP. The North American Riding for the Handicapped Association[62] has defined hippotherapy as "the use of the movement of a horse as a tool by physical therapists, occupational therapists, and speech-language pathologists to address impairments, functional limitations and disabilities in patients with neuromusculoskeletal dysfunction. This tool is used as part of an integrated treatment program to achieve functional outcomes." The fundamental objective of hippotherapy is to enhance adjust, posture function, and mobility. The treatment plan is individualized by an interdisciplinary group. The horse is an animal that can create better coordination and increased control of the trunk and improved gait to a group of children with CP as well.[63] Because of the gait the horse has a precise, smooth, rhythmic, and movement patterns of the ride is similar to the mechanism of human gait. In addition, warmth of the horse along with the rhythmic movement is useful to reduce muscle tone and promote relaxation of the rider with spastic CP.[64] Clinical research revealed; physical advantages, including change in balance, quality, coordination, muscle tone, joint scope of developments, weight-bearing, pose, step, tangible preparing, and gross motor function; psychological effects, including enhanced fearlessness, self-regard, inspiration, ability to focus, spatial mindfulness, fixation, and verbal aptitudes.[46, 63, 65-67]

(6) Aquatic therapy: Reducing spasticity in children with CP is one of the main advantages of aquatic therapy. Practicing in water is proper for children with CP than practice ashore because of lightness, thickness, turbulence, and hydrostatic weight of the water can give help or imperviousness to the body. Additionally, aquatic exercise enhances adaptability,

respiratory capacity, muscle quality, gait, and gross motor function.[47, 49, 68, 69] However, there are many factors to consider when performing aquatic exercise in children with CP, including: (1) guaranteeing adequate power, duration and frequency of practice in advancing viable; (2) on the environment than the intervention group may be useful to the individual; and (3) to ensure that the pool condition is fitting and safe for exercise.[68]

(7) Electrical stimulation: There are three fundamental sorts of electrical stimulation used to change debilitations and action constraints in children with CP.[16, 48, 70] First, neuromuscular stimulation is characterized as surface electrical incitement to the muscles that is high in force and short in term with the end goal of beginning withdrawal and consequent development.[71] Second, functional stimulation is characterized as surface electrical incitement to the muscles or potentially nerves have hindered engine control with the end goal of beating the failure to play out the agreement and the utility.[72] Finally, therapeutic (threshold) stimulation is characterized electrical incitement at low power (subthreshold level) that might be utilized ceaselessly for drawn out stretches of time.[73] Advocates of electrical incitement propose that it enhances the strength and motor function, and it is an appealing choice for fortifying in children with CP.[74] The meta-analysis showed that electrical stimulation of the production of medium effects on the gait of children with CP.[70]

(8) Vojta therapy: Vojta Therapy is a new specialized type of physical therapy method that was developed by Professor Vojta in year 1950 to 1970. It is designed to primarily enhance the motor improvement of a child by depends on the principle of isometric via tactile stimulation to encourage the development of normal movement patterns. Therefore, Vojta therapy is different from other physiotherapy techniques and methods because of no practice. After Vojta treatment in a child, the normal movement patterns which are fed to the child repeatedly is recorded in the brain to prevent evasion practices.[75, 76]

2.3.2 Occupational therapy

Occupational therapy can help children with CP in everyday activities at home, school, public places, and at work, such as dressing, eating, bathing, and toileting. Treatments for children with CP focus on improving the ability of children to play and learn, which is important for the development and autonomy.[77, 78] Occupational therapy is useful for these children in enhancing the upper body function and enhance the coordination of little muscle. In

addition, occupational therapy can help children with CP ace the fundamental exercises of everyday living by home program approach. This strategy depends on family instead of wellbeing experts, similar to the best set to decide, organize mediations, and plan their child's medicinal services.[79, 80] Occupational therapy and physical therapy may have some goals of therapy are similar, such as to improve muscle tone.

2.3.3 Orthotic and assistive devices

Children with CP are limited functionality in different levels as a result of their diminished focal control and coordination of the movement. Consequence of development in children with neurological issue brought on by an issue with the muscle contractures, bone deformities, and gait variations from the norm. Health care program aims to prevent deformity and promote the development of skills and abilities and independence.[81] Lasting medical equipment is a category of devices that are set to improve with rehabilitation of the motor impairment.[21, 49] Defined by the ISO mobility aids such as wheelchairs, cane, and crutches, it is as a kind of accessories as well. But as usual in practice are not included in the orthotic which are classified as a separate group.[82]

(1) Orthotic: Orthotic devices for use in children with CP, who is better known as braces. Targets for decisions about the use of orthoses vary but include: (1) support, or an expansion in joint range of movement; (2) security or adjustment of a joint; (3) advancement of joint arrangement; or (4) advancement of capacity.[48] These keep on playing an imperative part in treatment for some children with CP, yet there are contrasts in the outline of orthoses recommended for basic issue of spastic equinus.[81] Orthoses most often categorized by the four organ types: (1) head orthosis; (2) spinal orthosis; (3) upper-extremity orthosis; and (4) lower-extremity orthosis.[82] For children with CP, this is the movement disorder in that it describes only lower-extremity orthosis, because it is important for children to ambulate. Orthoses were determined by joints over which they act. For instance, an orthosis that covers the ankle and the foot is called a ankle-foot orthosis (AFO), full leg calipers as knee-ankle-foot orthoses (KAFO) and, if reaching out over the hip, as hip-knee-ankle-foot orthoses (HKAFO).[21, 29, 49, 83]

AFO is the most widely used in children with CP, especially children with spastic diplegia who have ankle equinus. AFO's main function is to keep the foot in place plantigrade. The AFO also provides a stable base to support walking and reduce muscle tension in the process

of walking. During the swing phase, it will help support the foot and prevent foot drop. Be careful of the AFO is not to be used continuously as it may result in loss of sensory and muscle atrophy.[3, 21, 29, 49]

The KAFO applies a three-point leverage system about the knee to support the leg in extension. It can be used to control hyperextension or flexion of the limb. Knee orthotics is additionally utilized sparingly in children with CP in light of the fact that they exasperate the step design by securing the knee augmentation in the swing stage. Once in a while, in children with back-kneeing that is bringing on knee pain or a declining distortion, however, the best orthotic to utilize is a KAFO with a stage bolt or dial-lock knee pivot so the knee can keep on expanding continuously as endured by the kids.[21, 29, 49, 83]

Foot orthoses are not acting avert distortion, but rather they reach of the sole of the foot with the ground. The foot orthoses are not acting control dorsiflexion and plantar flexion of the ankle. The duty of these devices is controlling the physical deformities of the foot, mainly equinovarus and planovalgus disabled.[21, 29, 49]

(2) Assistive devices: Children with CP need to move around and investigate their condition and cooperate with their companions keeping in mind the end goal to enhance their mental, social, and psychologic completely.[29, 36] A variety of assistive devices to help them or caregiver. The objective for the utilization of assistive technology devices is to enhance the stability and support and/or enhance the function and the involvement of people in their family, school and community settings.[48] Transfer aids such as lift systems, a system that allows the administrator to move the child. Passive standing devices called standers permit children to get to know the stand and keeping a standing position. Some children with CP to use a gait aids. In addition, the orthoses may be useful in deformity of the foot to compensate and stabilize the foot. These devices are walkers, crutches and canes. Most devices are utilized to enhance balance, decrease energy expenditure, diminish the heap on the joints, and improve posture and pain. Non-ambulatory children need wheelchairs to move around. There are various types of wheelchairs to be given the right to choose the child. They are very agile and easy to handle for parents, together with improved stability for the child. [16, 23, 29, 36, 84]

The concept of disability, The International Classification of Functioning, Disability and Health (ICF),[85] plays a huge role in the assessment and intervention for people with disability. In particular, the ICF for children and youths (ICF-CY)[86] is important for management of children with CP. The ICF-CY gives a system to depict the wellbeing status of CP

regarding capacity and handicap inside the three segments of body structures and functions, activities and participation. ICF-CY framework may help to optimize the common goal of the rehabilitation plans and goals. Santos et al.[87] have been studied for evaluation of children with CP and their clinical implications, using ICF framework. They concluded that the process of assessment and rehabilitation should be focused on improving the quality of life by focusing on what they can and want to take action within the environment. In addition, environmental factors should be considered in order to reduce obstacles and adapt to the environment to succeed.

2.3.4 Speech and language therapy

Speech and language impairment are more common in children with CP.[88] Speech and language therapy expects to help children with CP boost their relational abilities. Speech and language therapists enhance correspondence and discourse, as well as enhance gulping and absorption, and they work intimately with respiratory specialists, enlisted dietitians, and gastroenterologists.[89, 90]

2.3.5 Robotic training

Robotic training is an effective tool for the compensation and rehabilitation of the functional skills of children with CP. The most important of robotic training is lower and upper limb rehabilitation.[91] Robotic training is a method that is both active and passive forms for children who non-ambulant can experience of walking using a robotic training device.[92]

2.3.6 Recreational therapy

Recreation therapy concentrates on planning courses in which an individual kid can completely partake in recreational exercises, for example, music, equine, creature, game, and play treatment. Recreation therapists work to recognize the intrigue level, capacities, versatile methodologies, and now and again changed procedures required to effectively entire. Therefore, recreation therapy is an important in helping children with CP are individuals who have experienced physical, mental, and social.[93, 94]

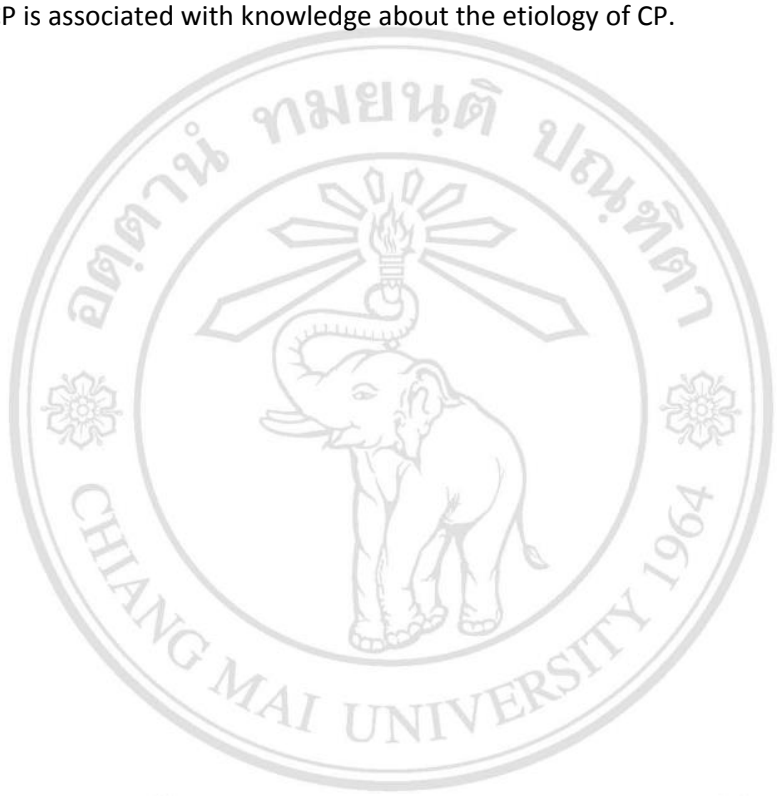
3. Prevention

To prevent the occurrence of CP may be associated with knowledge about the etiology of the disorder or disability.[88] A key indicator of success in the prevention of CP, there is a decrease in the prevalence of it.[95] However, the prevalence of CP has not diminished regardless of changes in perinatal medication, including the utilization of fetal observing and cesarean segment.[96] This suggests that the prevention of CP is not effective enough. This might be because of the prevention of CP is a huge and complex undertaking because of various etiologies.[37] In addition, the proportion of cases of idiopathic CP was still high, at least 30%, so in most cases cannot be prevented. But when the cause is known, the possibility of protection still exists.[97, 98] And the multifactorial also is often found in the case of CP. For instance, it is conceivable to remark a course of unfriendly occasions, for example, the danger of hereditary, maternal age (>38 years), multiple births, congenital heart defects.[88]

Head injuries lead to lesions in the brain, these injuries can be prevented by consistent utilization of seat kid and helmets during cycling and expulsion of child abuse.[5, 88] Phototherapy can retain jaundice of the newborn. By phototherapy on the infant is presented to extraordinary blue lights that separate bile, keeping them from working up and undermining cerebrum. Sometimes, medicinal treatment is insufficient to settle the issue in light of the fact that there is an exceptional type of blood transfusion.[5] Rh incompatibility can be easily identified by a blood test during pregnancy. However, a blood incompatibility usually not a problem during the first pregnancy of a woman's body does not produce antibodies from the mother generally undesirable until after the birth. In most cases, serum specially after having been delivered, each producing antibodies that can block unwanted.[5] Rubella, or German measles, can be protected by inoculating ladies before pregnancy.[5, 99] It is clear that preterm birth is the most common risk factor for the development of the CPI, therefore, preventing premature birth is important.[37, 88, 95, 98, 100]

It is good to maintain a normal pregnancy, prenatal health, and nutrition to refrain from smoking, consuming alcohol, and drugs. Although there are efforts in the prevention of CP, as well as children are still born with CP. So pay attention to some factors that are associated with an increased risk of CP may help prevent the development of CP.[5, 99, 95]

In summary, the content of this chapter discuss the diagnosis of cerebral palsy, which requires precision and early diagnosis. Most importantly, treatment should not be delayed until the diagnosis or evaluation of the cause and the family is very necessary to know that their child is likely to have a child with CP. The treatment and rehabilitation measures for children with CP include the use of oral and focal, surgery, and rehabilitation with physical therapy techniques, occupational therapy techniques, the use of orthotic assistive devices, etc. In addition, prevention of CP is associated with knowledge about the etiology of CP.



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