



Evaluation Of Prognostic Factors and Tools for Prediction of Ambulation in Children with Cerebral Palsy: A Review

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Article History	Abstract
Received: 22 June 2023 Revised: 21 Sept 2023 Accepted: 01 Dec 2023	Cerebral Palsy is the leading cause for pediatric chronic disability and parents' caregivers, neurologists and pediatric rehabilitation specialists would find it difficult to predict the prognosis of ambulation in children with cerebral palsy. The prediction of ambulation in children with cerebral palsy is of utmost importance still there is no definitive tool available to predict their ambulation. Gross motor skill achievements like age of achievement of neck holding as 9 months, sitting independently by the age of 2 years, crawling and all other milestones achievement by 30 months, along with postural reactions, infantile reflexes, cognitive, visual and hearing functions are proven to be the prognostic factors for prediction of ambulation. Even good upper extremity functions are positive prognostic factors for prediction of ambulation in cerebral palsy. Thai ambulation chart is also available which claims to guide the prognosis of ambulation in children with cerebral palsy. The reliability and validity of this tool is yet to be studied to use it as a prediction tool for ambulation in cerebral palsy. Further research is needed in this field to get an appropriate tool for prediction of ambulation in cerebral palsy which considers all the factors other than above mentioned factors.
CC License CC-BY-NC-SA 4.0	Keyword: Pragnostic, Cerebral Palsy

Introduction

Cerebral palsy was first reported long back in 1861, initially it was also called as Little's disease or cerebral paresis. Later on based on presentations and etiologies there were different definitions of cerebral palsy. Peter Rosenbaum and et al had defined cerebral palsy comprehensively as "Cerebral palsy (CP) describes a group of disorders of the development of movement and posture, causing activity limitation, that are attributed to non-progressive disturbances that occurred in the developing fetal or infant brain. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, cognition, communication, perception, and/or behavior, and/or by a seizure disorder." In this definition they have appropriately mentioned about all issues related to cerebral palsy.^{1,2}

Classification of cerebral palsy is really a very difficult task as each child with cerebral palsy may have unique presentation and so on the mixed presentation makes it difficult to classify cerebral palsy. Rosenbaum et al has mentioned about different component for classification of cerebral palsy, these includes motor abnormalities anatomic and radiological findings, causations and timings.

Prevalence

A population based study estimates the prevalence of CP ranging from 1 to nearly 4 per 1,000 live births globally.³ In India, it is estimated at around 3 cases per 1000 live births; however, because India is a developing country, enough appropriate data is not available related to exact current prevalence rate of CP but there may be nearly 25 lacs of children are there in India who are suffering from CP.⁴

Etiology

Cerebral palsy is a result of damage to a developing brain which may be during or after the birth. Brain development continues at faster rate during first year of life hence cerebral palsy can be present due to prenatal, perinatal or post natal causes. Out of these, the prenatal causes counts for nearly 70-80% of all cases. Prolonged labour and delayed or absent birth cry with asphyxia is the major cause for development of cerebral palsy. Other causes includes premature birth before 32 weeks of gestation, low birth weight, neonatal jaundice etc also contributes significantly for development of cerebral palsy. During first year of life other causes could be of brain damage from infections like bacterial or viral encephalitis, hyperbilirubinemia, road traffic accidents, falls, meningitis, high grade fever etc. Persistent seizures also contribute significantly to the development of cerebral palsy.^{5,6}

Signs and symptoms of cerebral palsy

Children with cerebral palsy often have multiple impairments rather than single one. Predominantly motor impairments, neurological impairments, musculoskeletal impairments, oro-motor, speech and hearing, visual impairments, altered proprioception, reduced or altered two point discrimination and other cortical sensations, learning disabilities etc.

These multiple impairments lead to delay in achievement of all motor milestones. Neck holding, rolling, sitting, crawling, standing, walking etc are achieved very late. Even there is delay in fine motor skills, personal grooming and activities of daily living.⁷

Importance of ambulation

According to World Health Organization, physical activity can be defined as 'any bodily movement produced by skeletal muscles that requires energy expenditure', such as for example walking for daily work or playing some sport etc.⁸ As it has been proved that physical activity is important for all children to stay fit and healthy, but for children with cerebral palsy (CP), ambulation is much more important as its difficulty halts the activities of daily living in a child. Ambulation in cerebral palsy is classified using a well known objective tool called as (GMFCS) i.e. Gross motor function classification system which has five levels out of which level I, indicates that child is walking without assistance, and level V, totally dependent in a manual wheelchair. One of the studies has also found that school-age children with CP have poorer fitness as compared to age appropriate typically developing normal children. Independent ambulation without support, though it may be of a little distance, may surely impact independence of the child in activities of daily living at home or school, as well as financial independence based on scope of future employment of an individual with cerebral palsy who will be able to move within working place independently or with or without assistance.⁹

Importance of Prediction of ambulation

Cerebral palsy is an umbrella term which includes impairments of posture and movement.

Once the child gets diagnosed with cerebral palsy, most of the parents want to get an idea whether their child would ever walk or not. The parents want to identify the future needs of their child and lifetime management of their child. Parents will have to manage resources efficiently so that they can fulfill the needs of their special child based on his capabilities. Hence prediction of ambulation is prime most important thing from parent's perspective.¹⁰

As far as rehabilitation specialists are concerned, prediction of ambulation is also important for them to identify the needs of the child so that accordingly therapeutic and rehabilitative goals can be set. Once the prediction of ambulation is identified, it becomes more appropriate to plan rehabilitative and therapeutic management of the child.^{10,11} As per WHO World health organization, the therapist should focus more on level of activity of child and his participation in society. Hence prediction of ambulation is very much important from therapist

and health care professional's perspectives in order to provide more appropriate services to the child according to his need to improve his participation in society.

Literature on prediction of ambulation

The efforts were made long back to identify the prognostic factors for ambulation in children with cerebral palsy. A review of literature was presented by Sola D Grant et al where they have included all related article since last 50 years and found that there are factors which predict the ambulation in children with cerebral palsy. They have identified that type of cerebral palsy primitive or infantile reflexes persistence, achievement of gross motor skills and postural reactions are the prognostic factors for predicting ambulation in children with cerebral palsy. But till their review none of the tool was available which can predict the ambulation in cerebral palsy. Bleck in 1975 had presented a scoring system to predict the ambulation in cerebral palsy where he had given scoring from 0 to +2 in which 0 indicates good prognosis and +2 indicates poor prognosis. But again it has considered only postural reactions and reflexes. Other factors are not considered here. Kifune N, Hamazato S (2010) conducted a correlational study and found that Bleck's score was not differentiating between ambulatory and non ambulatory group of quadriplegic cerebral palsy.

Most of the researchers had found that the achievement of developmental milestones played an important role in predicting prognosis of ambulation. Few retrospective studies had found that achievement of sitting milestones before or at the age of 2 years is the positive prognostic factor for prediction of ambulation in children with cerebral palsy. One of the studies had mentioned that achievement of neck holding by the age of 9 months is also a prognostic factor to predict ambulation in children with cerebral palsy. Weight bearing on upper extremity while in prone was also proved as an important prognostic factor by one of the researchers. Achievement of all other motor milestones till crawling by the end of 30 months can also be considered as positive prognostic factor for prediction of ambulation in cerebral palsy. But none of these studies have proposed any tool which can be generalized and applied to all types of cerebral palsy to objectively predict the ambulation in children with cerebral palsy. Gross motor function measures and Gross motor function classification system are the tools to identify the current functional and gross motor status of the child but it cannot be used as a prognostic tool and neither it considers the factors other than gross motor milestones for prediction of ambulation.^{11,12,13,14,15}

In the systematic review and meta-analysis on prognostic factors of ambulation in cerebral palsy, it was found that achievement of gross motor milestones before 30 months, neck holding by the age of 9 months, independent sitting by the age of 2 years, weight bearing on upper extremity while in prone by the age of 20 months, good upper extremity functions, good visual and hearing along with preserved intellectual functions are the positive prognostic factors for prediction of ambulation in cerebral palsy.¹⁶

Efforts were made by Keeratisiroj O, Buntragulpoontawee M. (2016) to present a ambulation chart for prediction of ambulation in Thai children with cerebral palsy.¹⁷ The chart has scoring system for each item but the chart included only gross motor functions and ability to eat with hands and infantile reflexes but other factors like environmental, familial support, socioeconomic status, availability of orthotics etc were not considered in predicting ambulation. As these secondary factors also play an important role in prediction of ambulation as well as appropriate measures can be taken if we found lacking in these secondary modifiable factors. Furthermore, there is a definite need of development of such tool which considers both primary and secondary factors which have an impact on ambulation of child with cerebral palsy. Such a tool may be used as an objective measure which can be used by neurologist and rehabilitation professionals to predict the ambulation and guide parents and plan appropriate therapeutic as well as rehabilitation measures according to the need of child with cerebral palsy.

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