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Review Article

Are Adult Cerebral Palsy Receiving Optimal Medical Care and is There an Unmet Need for Physiatrists Input?

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Abstract

Cerebral Palsy is taught in all medical schools as a major paediatric disease but the adult complications are not emphasized in medical schools. As students enter residency programs, the concept of cerebral palsy is re-introduced but emphasized from the paediatric condition and adult complications are not emphasized. There exists a paucity of adult clinics devoted to the management of cerebral palsy partially due to resources and also due to the emphasis on acute diseases with chronic disease management and less on congenital disease transitioning to adult care. Residents in Physical Medicine and Rehabilitation have the opportunity to study adult cerebral palsy. Physiatrists should be leaders in the field of adult cerebral palsy management.

Keywords: Cerebral palsy; Adult; Rehabilitation; Education

Introduction

Cerebral Palsy is the leading cause of childhood disability affecting function and development [1, 2, 3]. The incidence of the condition has not changed in more than 4 decades, despite significant advances in the medical care of neonates. Magnesium sulphate has been studied as a technique to prevent the development of cerebral palsy but the burden of management of cerebral palsy continues to persist and requires considerable resources in paediatrics. [4, 5, 6, 7, 8, 9, 10, 11). In developed countries, the overall estimated prevalence of cerebral palsy is 2-2.5 cases per 1000 live births. The prevalence of this disorder among preterm and very preterm infants is substantially higher [12, 13, 14, 15]. All races are affected by this disorder. Lower socioeconomic status and male sex may be increased risk factors for cerebral palsy [16, 17]. Life expectancy for adults with cerebral palsy continues to improve with medical advances, yet medical training for Physiatrists has been focused on the child and not on the medical needs of adults. As a child with cerebral palsy in all countries there exists a large opportunity and resource allocation for treatment in the fields of education, bracing, Imaging (e.g.MRI), medication, neurosurgical and orthopedic procedures and allied health-social work, psychology, physiotherapy, occupational therapy, and recreation therapy. Children are seen in specialized clinics and have access to a variety of health care medical professionals- neurology, physiatrists, orthopedic surgeons, neurosurgeons, gastroenterologists, psychiatrists and urologists [18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30). After age 18, the adult with cerebral palsy is managed by primary care with only emergency intervention provided as needed. Residency training programs in North America does not focus on the adult with cerebral palsy but with increased life expectancy, the physiatrist is the best professional trained to recognize and coordinate the delivery of care of this complex population.

Rapp and Tores in 2000 found that 65% to 90% of children survive until adulthood. The authors postulated that there is a lack of post-graduate training programs for physicians in the adult health system. Fifteen years later despite advances in longevity of the adult population, there remains a persistent lack of postgraduate training programs and a paucity of adult cerebral palsy clinics [31]. The present author was confronted with a 92 year male with cerebral palsy, although living in supported living was seeking medical care but frustrated by the lack of a health care system supporting ageing and functional independence of cerebral palsy. There exists a major challenge in performing detailed history and examination on adult cerebral palsy that may represent challenges in communication and also be uncooperative. As well the medical examination suite may lack the proper facility to effectively transfer the patient safely and conduct a detailed examination. The history and examination of an adult cerebral palsy will take a significant amount of physician time and the technique of history and examination would be shortened with an emphasis placed on proper training of health professionals. Although this paper highlights the lack of physician training there exist a gap of training for adult cerebral palsy in all health disciplines including physiotherapy, occupational therapy, speech language pathology and psychology. The lack of training emphasis on adult cerebral palsy management results in a decreased quality of life and further morbidity in the adult population group.

Definition of Cerebral Palsy

Cerebral palsy has been described as follows:

"A group of disorders of the development of movement and posture causing activity limitations 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 a seizure disorder" [32, 33].

The brain lesions of cerebral palsy occur from the fetal or neonatal period to up to age 3 years. However, although insults to the brain after age 3 years through adulthood may manifest clinically as similar or identical to cerebral palsy, by definition, these lesions are not cerebral palsy. Some children have been diagnosed with cerebral palsy at an early age, only to have the symptoms resolve later or to be reclassified as a different disease.

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Cerebral palsy is generally considered a static encephalopathy (i.e., non-progressive in nature). However, the clinical presentation of this condition changes as children and their developing nervous systems mature.

The changes continue into adulthood resulting in a loss of functional independence in adult cerebral palsy. Decreased physical activity and participation in physical therapy and fitness programs, along with loss of strength, contractures and pain are common factors in the loss of functional weight bearing, self-care and daily performance over time. Murphy in 2010 postulated that early identification and intervention in the child and younger adult remain the ideal in the pursuit of optimal musculoskeletal function and lifestyle throughout the adult years [34]. Physiatrists who are uniquely trained to recognize function and optimize gaps are in the best position to treat the adult with cerebral palsy and maintain the quality of life. However, even with recognition of functional gaps, there exists a lack of recreational facilities and gyms that meet the challenges with adult cerebral palsy.

Etiology of Cerebral Palsy

The clinical presentation of cerebral palsy may result from an underlying structural abnormality of the brain; early prenatal, perinatal, or postnatal injury due to vascular insufficiency; toxins or infections; or the pathophysiologic risks of prematurity. These may include preterm birth, multiple gestation, intrauterine growth restriction, male sex, low Apgar scores, intrauterine infections, maternal thyroid abnormalities, prenatal strokes, birth asphyxia, maternal methyl mercury exposure, and maternal iodine deficiency. Evidence suggests that prenatal factors result in 70-80% of cases of cerebral palsy. In most cases, the exact cause is unknown but is most likely multifactorial [2, 3, 35, 36]. The prevalence of cerebral palsy was highest in children with a low birth weight; however, the odds ratio of this order being associated with a low Apgar score (< 4) was highest in normal weight children. Nonetheless, most children with cerebral palsy had Apgar scores higher than 4 at 5 minutes [36].

There exists an increased risk for cerebral palsy in children born after IVF (level 2 evidence) attributable in part due to increased risk for multiple gestations.

General Classification of Cerebral Palsy

Cerebral palsy is classified according to resting tone and what limbs are involved (called topographic predominance). Spastic cerebral palsy, due to cortex/pyramidal tract lesions, is the most common type and accounts for approximately 80% of cases; this type of cerebral palsy is characterized by spasticity (velocity-dependent increase in tone), hyperreflexia, clonus, and an up- going Babinski reflex [2].

Extrapyramidal or dyskinetic cerebral palsy comprises 10-15% of this disorder and is characterized more by abnormal involuntary movements. Ataxic cerebral palsy comprises less than 5% of cerebral palsy.

Many patients have characteristics of both spastic and extrapyramidal cerebral palsy.

The typical types of cerebral palsy are as follows:

Spastic hemiplegia (20-30%)-Cerebral palsy affecting 1 side of the body, including an arm and a leg, with involvement of upper extremity spasticity more than lower extremity spasticity.

Spastic diplegia (30-40%) – Cerebral palsy affecting bilateral lower extremities more than upper extremities; in some cases, the lower extremities are solely involved.

Spastic quadriplegia (10-15%) – Cerebral palsy affecting all 4 extremities and the trunk (full body). If both arms are more involved than the legs, the condition can be classified as a double hemiplegia.

Dyskinetic cerebral palsy (athetoid, choreoathetoid, and dystonic) – Cerebral palsy with extrapyramidal signs characterized by abnormal movements; hypertonicity is often associated.

Mixed cerebral palsy – Cerebral palsy with no single specific tonal quality predominating; typically characterized by a mixture of spastic and dyskinetic components.

Hypotonic cerebral palsy – Cerebral palsy with truncal and extremity hypotonia with hyperreflexia and persistent primitive reflexes; thought to be rare.

Monoplegia - Rare; involvement is noted in 1 limb, either an arm or a leg. If a patient has monoplegia, an effort should be made to rule out causes other than cerebral palsy.

Functional Classification of Cerebral Palsy

The gross motor skills (e.g. sitting and walking) of children and young people with cerebral palsy can be categorized into 5 different levels using a tool called the Gross Motor Function Classification System (GMFCS).An effort has been made to emphasize children's function rather than their limitations. Thus as a general principle, the gross motor function of children who are able to perform the functions described in any particular level will probably be classified at or above that level; in contrast the gross motor functions of children who cannot perform the functions of a particular level will likely be classified below that level. Although initially described for children, the GMFCS classification is now also available as a tool for adult classification. The progression of independence (level 1) to complete wheelchair dependence (level 5) remains independent on the type of cerebral palsy [37].

The Manual Ability Classification System (MACS) describes how children with cerebral palsy (CP) use their hands to handle objects in daily activities. MACS describe five levels. The levels are based on the children's self-initiated ability to handle objects and their need for assistance or adaptation p to perform manual activities in everyday life. MACS spans the entire spectrum of functional limitations found among children with cerebral palsy and covers all sub-diagnoses. Certain sub-diagnoses can be found at all MACS levels, such as bilateral CP, while others are found at fewer levels, such as unilateral CP. This system is used for children 4-18 years but is not referenced or considered for adult cerebral palsy [38].

Cerebral Palsy may also be categorized more comprehensively by their abilities and limitations, as was proposed by the World Health Organization in 2001 using the International Classification of Functioning, Disability and Health (ICF).

The functional classifications have been well developed in children and need to be sustained and studied in adult cerebral palsy. Interesting research projects could explore if classifications change as adult cerebral palsy age. It remains an opportunity for research scientists to develop unique and functional classification for adult cerebral palsy which would also be different from children classifications and would assist in advancing the field.

Prognosis Cerebral Palsy

Cognitive impairment occurs more frequently in persons with cerebral than in the general population. The overall rate of mental retardation in affected persons is thought to be 30-50%. Some form of learning disability (including mental retardation) has been estimated to occur in perhaps 75% of patients. However, standardized cognitive testing primarily evaluates verbal skills and may result in the underestimation of cognitive abilities in some individuals.

Approximately 25% of children with cerebral palsy have mild involvement with minimal or no functional limitation in ambulation, self-care, and other activities. Approximately half are moderately impaired to the extent that complete independence is unlikely but function is satisfactory. Only 25% are so severely disabled that they require extensive care and are non-ambulatory.

Patients with severe forms of cerebral palsy may have a reduced life span, although this continues to improve with improved health care and gastrostomy tubes. Patients with milder forms of this disorder have a life expectancy close to the general population, although it is still somewhat reduced [39, 40, 41, 42].

The author by personal experience has met adult cerebral palsy who is living in their 90's. As well the author is aware of several physicians who have cerebral palsy. A greater majority of adult cerebral palsy despite expensive resources expended as children for education encounter barriers as adults with lack of vocational guidance and stigma in society. There are also a lack of opportunity for socialization which results in greater dependence and a history of depression. Specialized housing is scant and when present do meet all the needs required. The role of continuation of therapy in adults and the type of therapy offered as well as frequency and duration needs to be further studied.

Adult Complications of Cerebral Palsy

The adult complications represent an opportunity in an adult cerebral palsy run both multidisciplinary and interdisciplinary to further the quality of life. In addition it is a fertile field to encourage research about outcomes. Several potential complications are highlighted.

Osteoporosis has been shown to be present in cerebral palsy especially if mobility is compromised or adults are on prolonged anti-convulsant therapy and also have difficulty in feeding. Physiatrists are trained to recognize impact of immobility and consider appropriate investigations and subsequent treatment [43].

There exist a number of gastrointestinal problems and nutritional problems that requires to be addressed in adult cerebral palsy. Maintaining weight close to ideal body weight is important for wheelchair-bound patients or those with ambulatory dysfunction. Constipation is another problem associated with immobility. Adult Cerebral Palsy may require a gastrostomy tube (G-tube) or a jejunostomy tube (J-tube) to augment nutrition and prolong survival.

Dental problems also include enamel dysgenesis, malocclusion, and gingival hyperplasia. Malocclusion is twice as prevalent as in the normal population. The increased incidence of dental problems is often secondary to the use of medications, especially drugs administered to premature infants and antiepileptic agents.

Respiratory complications are common and these include:Gastroesophageal reflux and associated aspiration pneumonia; Increased risk of aspiration pneumonia because of oromotor dysfunction; Chronic lung disease/bronchopulmonary dysplasia; and Bronchiolitis/asthma.

The most common neurological complication includes epilepsy which would require frequent monitoring of medication and in rare instances neurosurgical intervention.Epilepsy occurs in 15-60% of cerebral palsy and is more common in patients with spastic quadriplegia or mental retardation.

Hearing may be affected. Strabismus is common as well as visual field deficits.

Orthopedic complications include hip subluxation/dislocation, progressive scoliosis, and contractures interfering with activities of daily living.

Cognitive/psychological/behavioral complications include: mental retardation (30-50%), most commonly associated with spastic quadriplegia; attention-deficit/hyperactivity disorder; autism and depression.

Skin conditions present in the immobile adult cerebral palsy include pressure sores (decubitus ulcers) which may require antibiotics, changes in wheelchair and seating and occasionally plastic surgery skin flaps.

Incontinence of urine, difficulty to communicate verbally and even with augmentative communication devices as well as sleep disorders is increasingly common in adult cerebral palsy.

Bracing (e.g. AFO-Ankle Foot Orthosis) needs to be considered for adult cerebral palsy to improve ambulation and reviewed regarding efficacy. Other orthotic devices for adult cerebral palsy need to be explored.

Coping with effects of aging and deterioration of function are common concerns for adults with cerebral palsy. The role of occupational therapy and physiotherapy with use of exercise has not been fully studied in adult cerebral palsy. Brief studies have been done but largely involving children and further adult studies need to be done. Evidence for the effect of physiotherapy on adolescents and adults with cerebral palsy is sparse, and therefore there is an urgent need for well-designed physiotherapeutic trials for these people [44].

Stretch not associated with clinically meaningful benefits in joint mobility in patients with or at risk of contractures (level 2 evidence) [45]. Regular stretching may not result in clinically significant improvements in joint mobility, pain, spasticity, or activity limitation in patients at risk of contractures due to neurologic conditions (level

2evidence) [46]. Muscle strength training might improve gait in adolescents and adults with cerebral palsy (level 2 evidence) [47]. Functional resistance strength training may not increase mobility but appears to increase strength in children with cerebral palsy (level 2 evidence) [48]. Muscle strength training may improve short term muscle function in ambulatory children with cerebral palsy (level 3 evidence) [49]. Constraint induced movement therapy (CIMT) may improve spontaneous use of affected upper limbs in children with hemiplegic cerebral palsy (level 2evidence) [50]. Exercise training program may improve quality of life in children with cerebral palsy, but effect disappears after discontinuation (level 2 evidence) [51].

Botulinum toxin A injection may improve function in children with CP and lower extremity spasticity (level 2 evidence) [52]. Addition of botulinum toxin type A injections to physical therapy might improve gait in children with cerebralpalsy (level 2 evidence) [53]. Botulinum toxin injection may decrease leg spasticity (level 2 evidence) [54]. Botulinum toxin is shown to have supplemental benefit for upper limb dysfunction in children with congenital hemiplegia (level 1 evidence) [55, 56, 57, 58, 59, 60, 61].

Pain may be associated with increased spasticity but may also be present due to gastrointestinal reflux and musculoskeletal pathology such as contractures and pressure sores. There exists further research opportunities to explore the role of pain in adult cerebral palsy and partner for funding with other established diseases initially such as brain injury. Insito et al in 2014 recognized the magnitude of spasticity both in adults with brain injuries and cerebral palsy as a severe disabling condition. Higher doses of a new botulinum toxin type A (NT-201) was injected up to 840 IU in both upper and lower limb in adults with brain injury and cerebral palsy. Subjects were studied 4 and 16 weeks after botulinum toxin type A (BOTN-A) was injected. Although spasticity and pain were reduced, global functionality and arm dexterity were unchanged. Further research of pain and spasticity management will help reduce the burden of care in adult cerebral palsy [62].

Dorsal rhizotomy is a neurosurgical procedure often done in the pediatric population to improve function in cerebral palsy with spastic diplegia. It is extensively studied in paediatrics but needs to be further evaluated if long term function persist into adulthood [63, 64].

Drooling is important for adults and children with cerebral palsy. There are a number of interventions considered both medical and surgical e.g. scopalamine patch, anticholinergics, Botox A injection in both parotid and submandibular gland as well as salivary duct relocation but further studies are required [65].

Spasticity management has been and continues to be extensively studied with the view to improvement of function. Neurosurgery such as deep brain simulation and orthopedic procedures such as tendon transfer or tendon release are done with some improvement in function and quality of care. Medications with side effects need to be evaluated as well as the current trend to injection therapy e.g. Botox A and the long term effect on function. The role of hippotherapy, therapeutic electrical stimulation, acupuncture, electrical stimulation, casting as well as the increasing use of alternative and complimentary therapy may improve the quality of life in adult cerebral palsy but needs evidence to support continued use.

Conclusion

Physiatrists are uniquely trained to recognize the importance of function and provide recommendations how to continue and sustain function. Adult cerebral palsy requires be seen at comprehensive multidisciplinary clinics led by physiatrist to identify and treat the common problems facing adults including ageing. In addition to recognizing a gap in service availability there likely also exists a lack of a funding model to address this need. Research in adult cerebral palsy is also lacking. The payer of health care should be involved in the health care delivery model which will assist both with the morbidity and improve the mortality in adult cerebral palsy.

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