

Pediatric Stroke Rehabilitation

This section is specific to children aged newborn to 18 years old that have experienced a stroke. Recommendations are only included for areas where there is research evidence or strong expert consensus on approaches to assessment or treatment of children who have experienced a stroke. General principles and the organization of stroke rehabilitation that have been described in earlier sections of this module also apply to children undergoing stroke rehabilitation, and are therefore not repeated here.

Introduction

Stroke happens at any age. Current rates for stroke in children are >1 in 2,500 live births (among newborns, defined as age 0 to 28 days), and 2-5 / 100,000 among children age 28 days to 18 years. Stroke in infants and children has become increasingly recognized and their care specialized in some areas of Canada. The primary cause of stroke in children, unlike in adults, is not cardiovascular disease or atherosclerosis, and outside of the neonatal period is less likely to be embolic in origin than in the adult population. There are very different pathophysiologies that lead to stroke in neonates and children, as well as developmental factors that are involved in the growing and maturing brain.

Stroke in children is a different disease process than in adults and children affected by stroke require an individualized rehabilitation approach that is ongoing throughout their entire development. This means that the outcomes of individual strokes in children cannot simply be determined by location of damage and the initial physical manifestations of the damage, but also must be evaluated with a developmental lens in mind. The long-term outcomes of children who have had a stroke must be monitored for many years, as infants and toddlers may not have the full impact of the stroke realized until their adolescence or young adult years.

Rehabilitation services for children post-stroke have certainly not been subjected to the depth and breadth of research that is so clear in the adult literature. There are limited studies on such things as functional electrical stimulation, botulinum toxin Type A treatment for dystonia and spasticity, and the necessity for constraint induced movement therapy and its appropriate dosing. There is a lack of clarity regarding timing of rehabilitation interventions, intensity of interventions and duration of therapy in children. While the limitations in the literature are clear, it is also encouraging to see that quality research is beginning to surface in these key areas of therapeutic intervention and long-term outcomes. There is a larger body of evidence that has emerged in the pediatric cerebral palsy literature addressing some of the same issues around rehabilitation, and some of this evidence may be applicable to children with stroke. As part of future editions of these stroke best practice recommendations, an in-depth review will be conducted of the cerebral palsy literature to determine applicability and generalizability to pediatric stroke.

A key message emerging from the current literature is that it is now increasingly clear that children have an important frequency of physical, cognitive and mental disability after stroke. It is important now that systems of care be developed to meet the ongoing rehabilitation needs of children who have had a stroke.

In addition, the psychological well being of the entire family is an important component of pediatric stroke rehabilitation. In perinatal stroke, and many childhood strokes, a definitive cause can usually not be identified and diagnosis is often delayed. Mothers are also bombarded with information (and misinformation) during pregnancy on what they should and should not do. This combination leads many mothers of children with perinatal stroke to assume that they are somehow responsible for their child's brain injury and its consequences. Such misplaced guilt is very common and can be extremely disabling. Misplaced blame on doctors and others is also common. Such psychological complications in the parents add to the overall morbidity incurred by the family. Therefore, parents and family members should be included in goal-setting and developing individualized rehabilitation plans for each child who has had a stroke, and offered appropriate support throughout this journey.

This pediatric stroke section of the Canadian Stroke Best Practice Recommendations Stroke Rehabilitation module provides a description of the current state of evidence for pediatric stroke

rehabilitation, to assist in treatment planning and goal setting, and also to raise awareness of the gaps in knowledge that should drive ongoing research efforts in this area. The goal of stroke research in children is to build upon the key studies that have already begun in the field of pediatric stroke rehabilitation, and to generate evidence to guide best practice for efficacious stroke treatment and recovery. This section also highlights the need for stroke systems of care to be built to support children with stroke, support families, and to address issues of initial and ongoing access to rehabilitation services to meet the changing needs of children with stroke as they grow and develop.

Pediatric Definition

There are three populations of pediatric patients with brain injury due to a cerebrovascular lesion (stroke) to consider for rehabilitation, based on age and presentation:

- Children (1 month - 18 years) with acutely diagnosed arterial ischemic stroke, cerebral sinovenous thrombosis or hemorrhagic stroke (diagnosed acutely and hospitalized at an acute care hospital);
- Neonates (term birth to 1 month age) with acutely diagnosed arterial ischemic stroke, cerebral sinovenous thrombosis, or hemorrhagic stroke (diagnosed acutely as stroke and hospitalized at an acute care hospital);
- Presumed Pre-perinatal Ischemic Stroke (PPIS) with diagnosis in later infancy, typically with recognition of congenital hemiparesis (usually diagnosed as out-patient).

Considerations in Planning for Stroke Rehabilitation in Children:

- Many of the principles and recommendations contained in earlier sections of the Canadian Stroke Best Practices Stroke Rehabilitation module apply to people with stroke at any age and should be reviewed for their relevance to treating children with stroke.
- It is important to emphasize that children who have had a stroke may 'grow into their disability'. The full impact of a stroke in a child may not be known for years as the child grows and matures and reaches various developmental stages. There may be ongoing and emerging rehabilitation needs throughout growth and development. Therefore children who have experienced a stroke require long-term monitoring and follow-up throughout maturation to ensure optimal achievement of developmental, functional and psychosocial potential.
- Childhood stroke affects the whole family and parental guilt or blame is common. The whole family unit should be considered in setting up pediatric stroke rehabilitation programs and support networks.
- Dedicated pediatric stroke rehabilitation programs are scarce in Canada and globally. In areas where stroke rehabilitation programs are not available for children, they often have their rehabilitation needs addressed in cerebral palsy clinics (younger children) or acquired brain injury rehabilitation programs (older children). Where possible, stroke specific services should be accessed.
- Rehabilitation goals are similar to those for adults with stroke (such as walking and communication); they also include additional goals such as educational and vocational rehabilitation, re-integration into play roles, growth and development, and developmental psychology. The focus in rehabilitation of children with stroke is more often 'new' learning (habilitation) rather than relearning (rehabilitation) depending on age at time of stroke.
- The child with stroke may often be able to reside at home with their parents/ guardians and attend outpatient rehabilitation.
- Many stroke rehabilitation approaches defined for adults are applicable to children, with adaptations to the younger age.
- Newer evidence-based techniques, such as constraint induced movement therapy and some of

the emerging robotic therapies. are appropriate for children as well as traditional function-oriented therapy and splinting as needed.

- Pediatric programs should integrate closely with the child's school for continuity of programs and therapy plans, as well as with other coaches and extracurricular activities (both inpatient and outpatient options).