

Pediatric Stroke and Recovery.

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Abstract

A stroke occurs when the blood supply to a part of the brain is disrupted or reduced, preventing brain tissue from getting oxygen and nutrients which causes brain cells to die in minutes and according to the part of brain affected, loss of function occurs. In more scientific terms, it is a clinical, radiological, or pathological evidence of ischemia or hemorrhage, involving a defined cerebral vascular territory (1). It is the leading cause of disability in the USA and a major cause of mortality worldwide (2).

Strokes can be categorized as ischemic (inadequate blood supply to the brain) or hemorrhagic (bleeding into the brain); which is the less common type. Although rare, pediatric stroke is the leading cause of morbidity and mortality in children. This is due to delayed diagnosis which is because of delay in seeking medical attention. Stroke, in pediatric patients is defined by the same criteria as adults, however in these patients, unlike adults, the acute presentation is missed. Population-based studies of arterial ischemic stroke (AIS) in children (age 29 days-18 years) estimate an annual incidence of 2.4 per 100,000 persons with a case fatality approaching 4(3), (4). Even amongst the survivors, there are very high chances of long-term disabilities. Over 50% of the survivors have persistent neurologic, cognitive, or psychiatric problems. The management of stroke in pediatric population is also highly challenging due to lack of literature, basing treatment solely on following adult stroke management.

There are different ways of classifying stroke in pediatric patients. By age: from 28 weeks of gestation to 28 postnatal days of life is generally called PERINATAL STROKE which present with focal seizures and sensorimotor deficits as the child ages(5),(6).Some authors have expanded this interval to begin from 20 weeks of gestation because lesions even before the 28th week of gestation has been documented(7). Stroke occurring after 28days of life to 18 years is CHILDHOOD STROKE which presents with acute focal neurological deficits e.g. hemiparesis(5), (6).Perinatal stroke occurs in 1 in 2300 live births while childhood stroke occurs in 2-3 per 100,000(8), (9). Acute perinatal stroke presents shortly after onset with focal seizures and encephalopathy. Presumed perinatal stroke are chronic infarcts, diagnosed in a delayed manner that are presumed to have occurred in the perinatal period (6). These patients exhibit no symptoms in the perinatal period, thus are not detected until a hemiparesis occurs later on within the first year (5). Infants with this present with pathologic early handedness or seizures, which subsequently leads to brain imaging and diagnosis (10).

Ischemic stroke constitutes arterial ischemic stroke (AIS) and venous thrombosis caused by cerebral sinovenous thrombosis (CSVT) and cortical vein thrombosis (6). About 80% of the lesions in perinatal stroke are ischemic (arterial ischemic stroke) and the rest, are due to hemorrhage or cerebral sinovenous thrombosis (CSVT)(11). The ratio of ischemic stroke is significantly higher in newborns, almost 6 times more than in older children (12).

Newborns with AIS typically present with seizures, specifically focal motor seizures involving only one extremity, and this is seen rarely in older children(13) (14). The left cerebral hemisphere is affected in 80% of neonates with unilateral infarctions(14).

In the adult patients, stroke is generally due to atherosclerotic risk factors like hypertension, diabetes mellitus, dyslipidemia, obesity etc. In children and adolescence, atherosclerosis is generally not a causative factor of stroke, but it's evident that the atherosclerotic process that ultimately causes stroke in adults begins from childhood and that dyslipidemia is more common in children with ischemic stroke than other children (15). Main risk factors in pediatric stroke include both maternal and neonatal factors. It is speculated that normal levels of coagulation factors in mothers and low levels of factors in the infant just before and after the time of delivery contributes to increased stroke risk in neonates (7).Neonates with Acute ischemic stroke sometimes have inherited thrombophilia (16). Other risk factors correlated with neonatal acute ischemic stroke are cardiac lesions, coagulation disorders, infection, trauma and asphyxia (7), (9) (17). Recently, COL4A1 mutations which is a subunit of type IV collagen that plays a role in angiogenesis has been recently linked to intrauterine stroke and porencephaly (18), (19). Some maternal factors, e.g., oligohydramnios, premature rupture of membranes; history of infertility, emergency cesarean section, and pre-eclampsia may be associated with perinatal acute ischemic stroke (AIS). Even though all the risk factors mentioned have been proven to increase the chances of AIS, no single cause has been isolated (20), (9). The most important thing needed for a full recovery in pediatric stroke is adequate management and prevention. The standard of care is certain interventions to obtain physical, occupational, speech and language therapy and neuropsychological interventions (5). Prevention can be done by targeting the risk factors. Therapy, rehabilitation, and recovery is a bit complex in pediatric patients because some deficits are not obvious till a long time after the stroke has occurred.

There is little known about the acute treatment and recovery techniques specific to pediatric patients. For management, there is supportive care which constitutes optimization of oxygenation, control of seizures, and the correction of dehydration and anemia (21). Antiplatelet therapy is considered only in neonates with high risk of recurrent AIS due to thrombophilia or congenital heart disease (22), (23). Thrombolysis has been approved for use only in children 18 years and older and not considered in neonates, although, there has been recent research that aims to establish the safety and feasibility of thrombolysis using tissue plasminogen activator (tPA) intravenously and intraarterially for AIS in younger children (ages 2-17) (6), (24). Endovascular procedures e.g. mechanical thrombectomy have been approved for in older children with occlusion but these are not used in neonates because of the small size of their arteries (21), (25). Most of the children with AIS experience residual neurological deficits including cerebral palsy, cognitive speech impairment, and epilepsy (26).

There have been promising therapies to aid in the recovery of pediatric stroke patients. Such therapies include Constraint induced movement therapy (CIMT) to improve motor outcomes. Use of noninvasive brain stimulation to aid in the prognosis or modify outcomes of children after pediatric stroke is beginning to look promising as an adjunctive treatment to promote recovery (5). Stem-cell based treatments have been explored but there is less evidence of its success in pediatric patients (5), (27). Outcomes after pediatric stroke are good, but moderate to severe neurological impairments are still seen especially between 28 days and 1 year because these are vulnerable ages (28), (29), (30), (31). Another research showed that most of the recovery occurs 2-3 months after stroke, and quality of functional recovery was better in pediatric than the adult population, and it's believed that the window for recovery is longer for children (32), (33). This could be due to the 'Kennard principle' by Margaret A. Kennard which is that younger brains naturally recover better than older brains (34). Generally, recovery of pediatric stroke depends on age/stage of development, presentation, speed of diagnosis.

Biography

Ms Habiba Abdullahi is currently a medical student from neurosurgery department at the north east University, Cyprus