Case Study: Pediatric Stroke

Neurosciences Center at Nationwide Children’s Hospital
Geoffrey L. Heyer, MD, Attending Pediatric Neurologist
Warren D. Lo, MD, Attending Pediatric Neurologist

Pediatric stroke occurs more commonly than once thought. Stroke risk changes with the age of the child and with certain predisposing conditions such as congenital heart disease, cerebral vascular malformations and sickle cell disease. Stroke survivors often develop a range of chronic morbidities including motor and cognitive impairments, language dysfunction, and epilepsy. Fortunately, innovative techniques in brain and vascular imaging have improved stroke detection and enhanced our ability to determine stroke risk, while newer treatments have improved outcomes in certain disorders.

Children and adolescents with stroke have remarkable differences in presentation compared with adults. In newborns, the first symptoms of stroke are often seizures that involve only one arm or one leg. That symptom is so common that stroke is thought to account for about 10 percent of seizures in full-term newborns. Seizure is a much less common stroke symptom in adults.

Primary prevention—stopping the first stroke from occurring—is sometimes possible in children when we know of an underlying risk factor such as a heart problem or sickle cell disease. Aside from those conditions, an initial stroke is difficult to prevent because the stroke is often the first sign of a problem. Because of this, it is critical to promptly recognize and diagnose a stroke. Treating the cause reduces the likelihood of additional strokes.
Case Study: Pediatric Stroke in a 9-year-old Male

Presentation: While playing baseball, a 9-year-old boy developed sudden onset weakness and clumsiness of the left hand, and mild head and neck pain. Within 45 minutes he was evaluated in the emergency room of a local hospital. A CT scan of the head was done and interpreted as normal. With a normal scan, the treating physician diagnosed migraine headaches and sent the family home with ibuprofen and a recommendation for follow up with the child’s pediatrician. Three days after symptom onset, the hand weakness persisted, prompting referral to Nationwide Children’s Hospital for a pediatric neurology evaluation.

Examination and Treatment: The neurologic examination revealed decreased grip strength of the left hand, poor finger dexterity, and slowing of rapid alternating movements. The neurologist was unable to detect blood flow in the left vertebral artery by bedside ultrasonography. The patient was admitted to the Neurology hospital service for further examination and treatment of a presumed stroke. Magnetic resonance imaging (MRI) with MR angiography (MRA) demonstrated a left-cerebellar stroke and confirmed an abnormality of the left vertebral artery. Cather angiography revealed an arterial dissection causing left vertebral artery occlusion. Warfarin was started in hospital to prevent clot extension and further ischemic injury.

Outcome: Nearly nine months following the event, the child had no clinical or imaging signs of stroke recurrence, although the arterial occlusion persisted. He continued to be followed by Neurology, Hematology and Physical Therapy in the multi-disciplinary Pediatric Stroke and Vascular Anomalies Clinic.

Recognizing Pediatric Stroke

A population-based study demonstrated an incidence of symptomatic childhood ischemic stroke of 4-6/100,000 per year. The physicians at Nationwide Children’s analyzed a United States national database and found that the frequency of hemorrhagic stroke in children is similar to ischemic stroke rates. The incidence of stroke in the perinatal period is even higher, approximately 1 in 4,000, which is similar to the incidence of stroke in elderly adults for a similar period of time. The relatively low stroke rate after the neonatal period can result in a low level of suspicion and delayed diagnosis of acute stroke in children. Adding to the confusion and potential diagnostic delays is the high frequency of stroke mimics in childhood. Seizures, migraine headaches, intoxications and psychogenic disorders can present with signs and symptoms similar to stroke. The patient in this case study had an injury to the arterial wall, referred to as arterial dissection. Such an injury may cause stroke at any age. There is often a history of head or neck trauma preceding the stroke, such as sliding head-first into home base, but a trauma history may not be present. In some cases, early stroke diagnoses change treatment options and can improve outcomes. Before this family left the emergency room they were told not to worry because “kids don’t have strokes.” Unfortunately, this scenario is heard far too often from families whose children are referred to the Stroke and Vascular Anomalies Clinic at Nationwide Children’s.

Children at Risk

In many cases of pediatric stroke, the etiology is multifactorial. Known risk factors include congenital heart disease, recent cardiovascular surgery, sickle cell disease, central nervous system infection or inflammation, trauma, genetic disorders, vascular anomalies, and an alteration of the coagulation system. When thorough evaluations are performed, risk factors can be identified in most children who have had ischemic or hemorrhagic stroke. The hereditary thrombophilias such as Factor V Leiden deficiency, Factor II (prothrombin) mutation, antithrombin III deficiency, protein C and S deficiency, and the acquired thrombophilias such as the antiphospholipid antibody syndromes or l-asparaginase treatment are a rapidly expanding group of risk factors for ischemic stroke. A child with a new hemorrhagic stroke should be aggressively evaluated for an underlying bleeding disorder. Imaging of the craniovascular vessels is necessary to rule out a vascular cause of stroke. Notably, vasculopathies account for an increasing number of new ischemic strokes in previously normal children, and vascular lesions such as arterio-venous malformations (AVMs) are found in a number of hemorrhagic strokes. Several genetic disorders that are not thrombophilias are associated with ischemic strokes such as Fabry’s disease, homocysteinuria, and elevated lipoprotein A. Childhood malignancies including leukemia and lymphoma (and their treatments) are associated with an increased risk for ischemic stroke, and primary CNS malignancies can be associated with an increased risk of intracerebral hemorrhage. Finally, variella zoster infection has been linked with ischemic subcortical stroke as long as one year after the original infection. Although the list of potential risk factors can seem daunting, it is important to carry out a systematic and thorough diagnostic evaluation.

Conclusions

Identification of stroke risk factors and appropriate treatment to prevent recurrence are two essential steps in managing stroke. Medical and surgical treatments must be tailored to the specific causes of vascular incompetence. Children who have had a stroke should be referred to a pediatric neurologist who is familiar with stroke diagnosis and management.

Setting the Pace for Comprehensive Pediatric Care

Nationwide Children’s is one of the few centers in the United States that offers a multidisciplinary Stroke and Vascular Anomalies Clinic dedicated to the care of children who have had a stroke or are at-risk of stroke. We offer same-day evaluations by Neurology, Hematology, and Neuropsychology, as well as Physical, Occupational, and Speech Therapy (each as indicated). Additionally, the team collaborates closely with Neurosurgery, Physical Medicine, and Radiology to provide a comprehensive assessment and management plan for each referred child. Specialized care includes:

- Access to multiple specialists
- Comprehensive evaluations of new patients
- Long-term care of children with chronic disability
- Coordinated scheduling of diagnostic and treatment procedures
- Communication to referring physicians regarding diagnoses and treatment plans

The Stroke and Vascular Anomalies Clinic assists families in maneuvering through the health care system. We also assist patients and families in coping with the chronic effects of childhood stroke and advise schools with educational measures appropriate for each child. Members of the Stroke and Vascular Anomalies Clinic conduct clinical research studies in pediatric stroke and participate in the International Pediatric Stroke Study and other multi-institutional studies. We also provide clinical teaching for medical students, residents, graduate students and post-doctoral fellows, and teach pediatricians, pediatric neurologists and neurologists at regional and national conferences.

To learn more about pediatric stroke and the neurology team, visit NationwideChildrens.org/Neurosciences.

References:

When your child needs a hospital, everything matters.

At Nationwide Children’s, we are creating the future of pediatric health care. We consider every detail. Every decision. Every aspect of the care we provide. From the child who comes to us with Duchenne muscular dystrophy, spinal muscular atrophy, or refractory epilepsy. To those with a sprain, a broken bone, or a fever. Here, the future health and potential of all children is being shaped. Here, our doctors are revolutionizing your child’s health and the health of future generations. Learn more at NationwideChildrens.org.

Referrals and Consultations
Like all of the specialized Neurosciences clinics at Nationwide Children’s, the Pediatric Stroke and Vascular Anomalies Clinic accepts referrals from across the country.

Online: NationwideChildrens.org
Fax: (614) 722-4000
Phone: (614) 722-6200 or 1(877) 722-6220
Physician Direct Connect Line for 24-hour urgent physician consultations:
(614) 355-0221 or 1(877) 355-0221

Ranked among the best children’s hospitals in the U.S. in all 10 specialties