

Is your hospital ready to care for a child with an acute stroke?

Most current pediatric stroke care is based on experience and consensus among pediatric stroke providers with careful extrapolation from adult stroke literature, recognizing the major differences between pediatric and adult stroke. To be “pediatric stroke ready,” a hospital should review published consensus-based recommendations, establish local consensus, develop an institutional pediatric stroke pathway and provide regular education regarding pediatric stroke to front-line providers.

The American Heart Association (AHA) has no pediatric stroke guidelines due to insufficient evidence but published an AHA Scientific Statement on pediatric stroke management in 2019 (Ferriero DM, et al.; PMID: 30686119). Australian guidelines were published in 2019 and provide an example of a pediatric stroke pathway of care (Medley TL, et al.; PMID: 30284961). Both the AHA Scientific Statement and the Australian guidelines advocated for hospitals to establish pediatric hyperacute stroke pathways including criteria for consideration of thrombolysis and endovascular thrombectomy in children with large vessel occlusion.

Pediatric Stroke Quick Facts:

1. In children, stroke mimics are more common than stroke.
2. Children often present with seizure or severe headache at the onset of ischemic or hemorrhagic stroke, leading to delays in stroke diagnosis if symptoms are initially attributed to post-ictal Todd's paresis or migraine with aura.
3. Half of childhood strokes are hemorrhagic, half are ischemic.
4. Most childhood strokes occur in previously healthy children.
5. Disorders that increase risk of arterial ischemic stroke: complex congenital heart disease, sickle cell disease, cancers, systemic lupus erythematosus (SLE).
6. Most hemorrhagic strokes in children are due to vascular malformations; aneurysms also occur in children.
7. All acute stroke treatment trials (thrombolytics, endovascular thrombectomy) excluded children (<18 years).
8. Alteplase (tPA) is approved for other pediatric indications, but not for stroke. - Pediatric dosing of tPA for stroke has not been established, but weight-based dosing of alteplase in accordance with adult protocols has been reported in series of older children with hyperacute stroke.
9. Pediatric dosing of TNK has not been established for any indication. Observational data regarding TNK use for pediatric stroke is limited.
10. AHA Guidelines suggest endovascular thrombectomy with stent retrievers may be reasonable for some children with ischemic stroke and large vessel occlusion within six hours of symptom onset.

Whom to Engage in Developing Institutional Consensus:

- Pediatric neurologists
- Vascular neurologists (pediatric or adult)
- Emergency medicine physicians and nurses
- Critical care physicians and nurses
- Diagnostic neuroradiologists
- Interventional neuroradiologists or endovascular neurosurgeons
- Neurosurgeons

- Pharmacy
- Hematologists

Considerations for Institutional Pediatric Stroke Pathways:

1. *What should trigger a pediatric stroke alert (i.e., entry into a pediatric stroke pathway)?*
 - a. Typically: Acute onset focal neurological deficits such as face, arm or leg weakness, aphasia, ataxia, diplopia, dysarthria or vertigo. Symptoms may be with or without seizures or headache.
2. *Who should be called for a pediatric stroke alert? How should pediatric stroke alert be reached?*
3. *What should trigger transfer to higher level of care for pediatric stroke? What diagnostic imaging can we obtain emergently at our hospital?*
4. *What emergent imaging should be performed?* MRI generally preferred in children due to high proportion of stroke mimics (CT sensitive for blood but insensitive for acute infarction) and radiation exposure with CT imaging. Pediatric stroke centers often have MRI-based focused stroke protocols that include key sequences (diffusion weighted imaging for infarct detection, iron sensitive imaging for hemorrhage detection, MRA for large vessel occlusion detection), are short (~10 minutes), and relatively motion-resistant to allow imaging at young ages without anesthesia. Consider different approaches for young children versus teens.
 - a. Brain imaging for hemorrhage
 - b. Brain imaging for acute infarction
 - c. Vascular imaging for large vessel occlusion
5. *If an acute infarct is identified, what will we offer at our institution?*
 - a. Will we offer off-label thrombolytics to adolescents? Younger children?
 - b. Can we provide simple or exchange transfusion for children with sickle cell disease?
 - c. What will trigger transfer to a pediatric stroke center?
6. *If an acute large vessel occlusion is identified, what will we offer at our institution?*
 - a. Will we offer endovascular thrombectomy to adolescents? Younger children?
 - b. What will trigger transfer to a pediatric stroke center?
7. *What are our local neurosurgery capabilities?* If we do not have a pediatric neurosurgeon, is an adult neurosurgeon willing to place an extraventricular drain (EVD) in a child with acute hydrocephalus from a hemorrhagic stroke? Are they willing to perform hemicraniectomy in a child with large hemorrhage or malignant infarct?
8. *Where is the closest pediatric stroke center?* There is no formal pediatric stroke center certification process. As part of a pathway of care, establish criteria for transfer to regional centers with pediatric stroke expertise, capabilities to perform emergent and elective endovascular therapies in children, pediatric neurosurgeons, and a pediatric ICU. How can this center be reached urgently for advice or for transfer?
9. *What supportive care will be included during transport?*

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