Pediatric cerebrovascular disease epidemiology

The incidence of pediatric stroke is 1 in 5000, and if hemiplegic cerebral palsy due to vaso-occlusive stroke is included, the number could be as high as 1 in 3000. Additionally, cerebrovascular disease is 1 of the top 10 causes of death in infants younger than 1 year. Finally, 20% to 30% of children with arterial ischemic stroke will have recurrent strokes, even with treatment. Stroke in children differs from stroke in adults. Not only is it rare, but its presentation is subtle—particularly in infants—and even with a focal hemiplegia there is a wide differential diagnosis. Coagulation mechanisms, the arteries, and the neurological systems are all different in children, and each of these plays a large role in stroke. The causes of pediatric stroke do not include atherosclerosis, so a myriad of other risk factors and associations exist and are unique for each age group. The causes of pediatric stroke are poorly understood, and although this is a fertile area of research, clinical trials in the field are lacking. Currently, any treatment guidelines or tools being used to treat children with stroke either come from the field of adult stroke or are based on empirical information.

More than 95% of children with ischemic stroke have an underlying thrombus occluding an artery or a vein, and our understanding of clot pathogenesis in children is increasing. Whereas in adults, platelet clots predominantly form secondary to atherosclerosis, in children and infants there is likely a higher fibrin composition, which may require a different treatment strategy. Although anticoagulation is typically used, it is not known whether anticoagulation is more effective than aspirin. There are also major clinical challenges, the most significant of which is that the diagnosis is not made and the stroke is missed entirely or that the diagnosis is severely delayed and by the time the diagnosis is made, the infarct is much larger [1)].

In 1978 A 10-year review of the Mayo Clinic experience with childhood cerebrovascular disease unrelated to birth, intracranial infection, or trauma identified 69 patients (38 with ischemic stroke, and 31 with subarachnoid or intracerebral hemorrhage). Although children with cerebral infarction had better survival, they experienced more residual disability than children with cerebral hemorrhage. The medical records-linkage system for Rochester, Minnesota residents made it possible for the first time to study cerebrovascular disease in a well-defined childhood population. Records from all medical facilities serving this population (average of 15,834 resident children) showed four strokes over 10 years (average annual incidence rate of 2.52 cases per 100,000 per year) [2)].

In 2018 a study reported the period prevalence, incidence, and risk factors of pediatric stroke in Taiwan.

All Taiwan inhabitants aged 1 month to 18 years registered in the National Health Insurance Research Database between 2010 and 2011 were enrolled in this study. Factors including age, sex, location, and household income levels were collected. Incidence, period prevalence, mortality rate, and the possible risks were completely evaluated. Outcomes and results: Hemorrhagic stroke has a significantly higher mortality rate than ischemic stroke (27.6% vs. 10.2%, $P<0.05$). Risk factors or underlying diseases for stroke were identified in 77.8% of the patients and 16.2% had more than one risk factor. The most common risk factors were vascular diseases (26.3%), infection (14.0%), and

cardiac disorders (9.1%).

Infants younger than 2 years, boys, and children in lower socioeconomic status have a significantly higher risk of stroke. Hemorrhagic stroke has a significantly higher mortality rate than ischemic stroke. More than half of the children with stroke had underlying diseases and the causes of hemorrhagic stroke are significantly different from ischemic stroke [3].

In 2019 Surmava et al. sought to evaluate in -Ontario, the incidence and characteristics of pediatric stroke and TIA including care gaps and the predictive value of International Classification of Diseases (ICD) codes.

A retrospective chart review was conducted at 147 Ontario pediatric and adult acute care hospitals. Pediatric stroke and TIA cases (age < 18 years) were identified using ICD-10 code searches in the 2010/11 Canadian Institute for Health Information's Discharge Abstract Database (CIHI-DAD) and National Ambulatory Care Reporting System (NACRS) databases in the Ontario Stroke Audit.

Among 478 potential pediatric strokes and TIA cases identified in the CIHI-DAD and NACRS databases, 163 were confirmed as cases of stroke and TIA during the 1-year study period. The Ontario stroke and TIA incidence rate was 5.9 per 100,000 children (3.3 ischemic, 1.8 hemorrhagic, and 0.8 TIA). The mean age was 6.4 years (16% neonate). Nearly half were not imaged within 24 h of arrival in emergency and only 56% were given antithrombotic treatment. At discharge, 83 out of 121 (69%) required Healthcare services post-discharge. Overall positive predictive value (PPV) of ICD-10 stroke and TIA codes was 31% (range 5-74%) and yield ranged from 2.4 to 29% for acute stroke or TIA event; code I63 achieved maximal PPV and yield.

This population-based study yielded a higher incidence rate than prior North-American studies. Important care gaps exist including delayed diagnosis, lack of expert care, and departure from published treatment guidelines. Variability in ICD PPV and yield underlines the need for prospective data collection and for improving the pediatric stroke and TIA coding processes [4].

It is believed that the incidence in the Hospital Universitario “Dr. Jose Eleuterio Gonzalez,” Universidad Autonoma de Nuevo Leon, Monterrey, Nuevo Leon, Mexico is higher than it appears.

A study by Garza-Alatorre et al. aimed to assess the incidence and characteristics of pediatric stroke in this university hospital. Likewise, this study seeks to evaluate if a longer symptoms-to-diagnosis time is associated with mortality in patients with ischemic stroke.

Methods: A retrospective study including children with stroke admitted to the UANL University Hospital from January 2013 to December 2016.

Results: A total of 41 patients and 46 stroke episodes were admitted. About 45.7% had an ischemic stroke and 54.3% had a hemorrhagic stroke. Mortality of 24.4% and morbidity of 60.9% were recorded. Regarding ischemic and hemorrhagic stroke, and increased symptoms-to-diagnosis time and a higher mortality were obtained with a relative risk of 2.667 (95% confidence interval [CI]: 1.09-6.524, p = 0.013) and 8.0 (95% CI: 2.18-29.24, p = < 0.0001), respectively. A continuous increase in the incidence rate, ranging from 4.57 to 13.21 per 1,000 admissions comparing the first period (2013) versus the last period (2016), p = 0.02, was found in our center.

Pediatric stroke is a rare disease; however, its incidence shows a continuous increase. More awareness toward pediatric stroke is needed [5].

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