Perinatal arterial ischemic stroke

Perinatal arterial ischemic stroke (PAIS) is a focal brain injury in term neonates that is identified postnatally but is presumed to occur near the time of birth. Many pregnancy, delivery, and fetal factors have been associated with PAIS, but early risk detection is lacking; thus, targeted treatment and prevention efforts are currently limited.

Risk Factors

Risk factors of primiparity, emergency cesarean section, birth asphyxia, and Apgar score ≤7 after 5 min were significantly associated with perinatal stroke. More studies with a larger number of patients and with prolonged follow-up are required to establish more clearly the associated risk factors involved in this pathology [1].

In a diagnostic study, a prediction model was developed using multivariable logistic regression with registry-based case data collected between January 2003, and March 2020, from the Alberta Perinatal Stroke Project, Canadian Cerebral Palsy Registry, International Pediatric Stroke Study, and Alberta Pregnancy Outcomes and Nutrition study. Criteria for inclusion were term birth and no underlying medical conditions associated with a stroke diagnosis. Records with more than 20% missing data were excluded. Variable selection was based on peer-reviewed literature. Data were analyzed in September 2021.

Exposures: Clinical pregnancy, delivery, and neonatal factors associated with PAIS as common data elements across the 4 registries.

Main outcomes and measures: The primary outcome was the discriminative accuracy of the model predicting PAIS, measured by the concordance statistic (C statistic).

Results: Of 2571 term neonates in the initial analysis (527 [20%] cases and 2044 [80%] control individuals; gestational age range, 37-42 weeks), 1389 (54%) were male, with a greater proportion of males among cases compared with controls (318 [60%] vs 1071 [52%]). The final model was developed using 1924 neonates, including 321 cases (17%) and 1603 controls (83%), and 9 clinical factors associated with the risk of PAIS in term neonates: maternal age, tobacco exposure, recreational drug exposure, preeclampsia, chorioamnionitis, intrapartum maternal fever, emergency cesarean delivery, low 5-minute Apgar score, and male sex. The model demonstrated good discrimination between cases and controls (C statistic, 0.73; 95% CI, 0.69-0.76) and good model fit (Hosmer-Lemeshow P = .20). Internal validation techniques yielded similar C statistics (0.73 [95% CI, 0.69-0.77] with bootstrap resampling, 10-fold cross-validated area under the curve, 0.72 [bootstrap bias-corrected 95% CI, 0.69-0.76]), as did a sensitivity analysis using cases and controls from Alberta, Canada, only (C statistic, 0.71; 95% CI, 0.65-0.77).

Conclusions and Relevance: The findings suggest that clinical variables can be used to develop and internally validate a model to predict the risk of PAIS in term neonates, with good predictive performance and strong internal validity. Identifying neonates with a high probability of PAIS who could then be screened for early diagnosis and treatment may be associated with reductions in lifelong morbidity for affected individuals and their families [2].

Pathophysiology

The incidence of perinatal stroke is high, similar to that in the elderly, and produces a significant morbidity and severe long-term neurologic and cognitive deficits, including cerebral palsy, epilepsy, neuropsychological impairments, and behavioral disorders. Emerging clinical data and data from experimental models of cerebral ischemia in neonatal rodents have shown that the pathophysiology of perinatal brain damage is multifactorial. These studies have revealed that, far from just being a smaller version of the adult brain, the neonatal brain is unique with very particular and age-dependent responsiveness to hypoxia-ischemia and focal arterial stroke [3].

Clinical features

Perinatal arterial ischemic stroke (PAIS) is a common cause of seizures, encephalopathy, altered mental status, and focal neurologic deficits in the neonatal period. It is the leading known cause of cerebral palsy. Other long-term risks include the development of epilepsy and impairment in cognition, language, and behavior [4].

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