Hemispheric hypodensity

Hemispheric hypodensity (HH) is a radiological indicator of severe brain injury that encompasses multiple vascular territories, and may develop in the hemisphere(s) underlying the subdural hematoma (SDH). In some instances where the SDH is predominantly unilateral, the widespread-damage is unilateral underlying the SDH. To date, no animal model has successfully replicated this pattern of injury. We combined escalating severities of the injuries and insults commonly associated with hemispheric hypodensity including SDH, impact, mass effect, seizures, apnea, and hypoventilation, to create an experimental model of HH in piglets aged 1 week (comparable to human infants) to 1 month of age (comparable to a human toddlers). Unilateral hemispheric hypodensity evolved over 24 hours when kainic acid was applied ipsilateral to the SDH to induce seizures. Pathological examination revealed a hypoxic-ischemic injury type pattern with vasogenic edema through much of the cortical ribbon with relative sparing of deep gray matter. The percentage of the hemisphere that was damaged was greater on the ipsilateral vs. contralateral side and was positively correlated with SDH area and estimated seizure duration. Further studies are needed to parse out the pathophysiology of this injury and to determine if multiple injuries and insults act synergistically to induce a metabolic mismatch or if the mechanism of trauma induces severe seizures that drive this distinctive pattern of injury [1].

Although both histopathological examination and magnetic resonance (MR) image/diffusion weighted image (DWI) studies showed that the hypodensity lesion was cerebral infarction, the pathophysiology of this cerebral infarction and its relationship to the ASDH are poorly understood [2].

Insights from both clinical observation and experimental studies have helped to clarify the probable causes of this injury pattern, which appears to require a combination of stressors during a particular period of maturation [3].

1)
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2) , 3)
Duhaime AC, Durham S. Traumatic brain injury in infants: the phenomenon of subdural hemorrhage with hemispheric hypodensity (“Big Black Brain”). Prog Brain Res. 2007;161:293-302. Review. PubMed PMID: 17618985.