



H170 The Diagnostic Accuracy of Unexplained Intracranial Hemorrhage as an Indicator of Abusive Head Trauma in the Context of a Coagulopathy

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Learning Overview: The goal of this presentation is to present an analysis of the accuracy of the diagnosis of abusive head trauma when it is based solely on findings of intracranial and retinal hemorrhage and in the absence of any collateral evidence of abuse in a pre-mobile infant with a bleeding disorder.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating the utility of a risk-based (i.e., epidemiologic) analysis when the cause of death determination in an infant is entirely dependent on a pathological finding with an unknown positive predictive value for intentional abuse and, thus, an unknown false positive (i.e., error) rate.

The case involved a 4-month-old male infant with no personal or family history of abuse, who was discovered pale, unresponsive, and not breathing by his father, around three days after he had been found to have a bump on the back of his head. Computed Tomography (CT) scan revealed an acute or chronic subdural hematoma and cerebral edema, with no skull fracture. By the time he had died five days later, the child had developed retinal hemorrhage. During the five-day hospitalization, it was found that the child had Factor VII deficiency, and months-later testing of his father revealed the same condition.

An autopsy conducted two days later noted a chronic subdural and subarachnoid hemorrhage, cerebral edema, optic nerve sheath hematoma, and retina hemorrhage. The cause of death was given as “blunt force injuries of the head,” despite an absence of any external sign of trauma. A child abuse pediatrician deemed the finding of both retinal hemorrhage and unilateral shin bruising (from intraosseous catheter) to be consistent with abuse.

Based solely on the fact that he was the caregiver who discovered the child in a non-responsive state, the father was charged with first degree reckless homicide. When confronted with the evidence of Factor VII deficiency, the pediatrician opined that this was secondary to, rather than a result of, the intracranial hemorrhage, noting that extensive personal experience with such injuries was the basis for the conclusion. The pediatrician also claimed that the injuries in the deceased infant, specifically the intracranial hemorrhage and retinal hemorrhage, are only possible due to physical abuse (i.e., shaking with or without impact) or a high-speed traffic crash or fall from at least a two-story height.

A forensic epidemiologic analysis of national hospital data was undertaken to assess the reliability of the claims made by both pediatrician and pathologist.

Data were abstracted from the Kids’ Inpatient Database (KID) and the National Inpatient Sample (NIS). The analysis included all children aged 1 year and under who were admitted to the hospital with intracranial and retinal hemorrhage from 2000 to 2014, inclusive. There were an estimated 9,493 children who met these criteria, approximately 633 infants per year. Coagulopathy was present in 406 (4.2%) of the hospitalized infants, or around 27 per year.

Of the 9,493 hospitalized infants, there were 5,014 (52.8%) who had no other diagnosed injuries that would be consistent with abuse (fractures, burns, internal injuries, etc.), or around 334 per year. Abuse was diagnosed or designated as a cause in 70.9% of the cases where there was no other diagnosed injury. Among the children who did not have a diagnosis of abuse, in the majority for which there was a cause specified, the injury resulted from a low-energy event, such as a ground-level fall or a fall from furniture or a bed.

The analysis revealed the fact that among pre-mobile children who are hospitalized for intracranial and retinal hemorrhage, both with and without coagulopathy, the injury did NOT result from abuse in at least one out of every five cases. Thus, the assertion by the pediatric specialist that, in the absence of a history of a high-speed traffic crash, etc., the injury must have resulted from abuse, was demonstrably false. The conclusion by the pathologist that the injury resulted from “blunt force trauma” was also rejected as factually baseless.

After being presented with the above evidence, in combination with the familial evidence of a coagulopathy, the state dismissed the homicide charge against the father.

Abusive Head Trauma, Retinal Hemorrhage, Factor VII Deficiency