G35 Axonal Injury in Pediatric Head Trauma: A Study of the Interpretation of ß-Amyloid Precursor Protein (ß-APP) Expression in Trauma and Non-Trauma Cases

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After attending this presentation, attendees will understand that although beta amyloid precursor protein expression (β-APP) can be useful in confirming axonal injury, its presence or absence cannot in and of itself, prove or disprove traumatic injury.

This presentation will impact the forensic community by illustrating the complexities of interpretation of amyloid precursor protein expression as evidence of axonal injury

The purpose of this presentation is to illustrate the utility of β-APP immunohistochemistry as morphologic evidence of traumatic brain injury. Often special studies are suggested and/or warranted to rule out the possibility of occult trauma in cases of sudden unexpected death of young children. A number of reports, over the past decade, have described various patterns of β-APP expression in axonal injury. Brain material from a group of twenty-seven young children in order to test the application and interpretation of β-APP immunohistochemical staining were examined.

In 1999, the State of Maryland Office of the Chief Medical Examiner (OCME) investigated 153 deaths of subjects three years of age or younger. Of these, 97 deaths were natural [including 56 cases attributed to Sudden Infant Death Syndrome (SIDS)], 24 were accidental, 18 were homicides, and 14 were undetermined. Among the homicides, seven children sustained blunt force injuries to the head. The staining pattern of β-APP in multiple brain regions (frontal, temporal, and parietal cortices, cingulate cortex/corpus callosum, and the cervicomedullary junction) was evaluated. Compared, in a blinded fashion, the β-APP staining of the homicide cases to similar brain regions from seven age matched cases, in which death was due to a non- traumatic disease (other than SIDS), and ten cases with similar ages, from the same calendar year in which death was attributed to SIDS.

Three reviewers achieved consensus regarding the β-APP staining by using a simplified semi-quantitative scoring method based on 1) staining density per high power microscopic field and 2) the presence or absence of multifocal staining within a single microscopic slide from a single brain region. Upon consensus interpretation, the reviewers agreed that significant β-APP axonal expression was present in five of the seven homicides (71%). Subsequent unblinded review of autopsy records demonstrated that in these cases there was gross evidence of intracranial hemorrhage at the time of autopsy. In the other two homicides cases, the reviewers agreed there was not evidence of axonal injury by immunohistochemistry. These two homicide cases had superficial cranial injuries with significant traumatic injury only to the thoracic spinal cord, determined at autopsy. Two (2) of the SIDS cases and one of the non-trauma cases displayed axonal immunostaining with density and pattern similar to that in the traumatic cases, and the reviewers could not, with certainty, differentiate these cases from the five homicides by immunohistochemical staining alone.

The specifics of the cases to illustrate the complexities involved in interpreting β-APP deposition in cerebral tissues and to make recommendations regarding the use of adjunct immunohistochemical studies in suspicious infantile deaths will be discussed. Perspective of trends, since 1999, in the evaluation of SIDS versus sudden unexplained death of an infant (SUDI)—especially with regards to co-sleeping factors that might result in asphyxia and hypoxic ischemic injury will also be discussed. Data confirms that while β-APP staining can be useful and corroborative, immunohistochemistry cannot be used independently to determine the presence or absence of traumatic injury

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