Mini Review

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Axonal Transport Blockade in Abusive Head Trauma Suspects; A Mini Review

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ABSTRACT

Abbreviations: APP-A4: Amyloid Beta Protein; AHT: Abusive Head Trauma; IHC: Immunohistochemistry; LC: Lamina Cribrosa; EBS: End Bulb Swellings; IOP: Intraocular Pressure; CNSp: Central Nervous System Pressure

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This report summarizes the application of Amyloid Beta Protein (APP-A4) immunohistochemistry to the study of ocular tissues from victims of suspected child abuse, aka Abusive Head Trauma (AHT). The two referenced publications summarize the history of AHT, its confusing terminology and tortured medico-legal issues. Additionally, they describe the ocular histopathology and Immunohistochemistry (IHC) utilizing (APP-A4), the only available antibody for human tissue analysis of orthograde axonal transport. The two publications include findings from 76 autopsied cases of suspected child abuse concentrating on retinal and optic nerve findings, especially the Lamina Cribrosa (LC) portion of the optic nerve. The first paper published discussed five cases judged to have unusual IHC findings, compared to prior personal experience [1].

1. Case1: APP-A4 was strongly positive in ocular tissues even after formalin fixation and 40 years in paraffin [1].
2. Case 2: Demonstrated expected block in orthograde transport at the margins of an optic nerve infaction [1].
3. Case 3: An optic nerve contusion, was bracketed by APP-A4 End Bulb Swellings (EBS), suggesting that some reversal of orthograde transport distal to the injury had occurred [1].
4. Case 4: Demonstrated temporal EBS bilaterally in Lamina Cribrosa (CL) axons consistent with macular inputs [1].

The second paper, describing a larger series of cases, also utilized APP-A4 and importantly included similar IHC from a non-traumatized infant whose optic nerves offered controls for background APP-A4 staining. 2 94% of the 72 eyes studied demonstrated EBS in LC axon bundles far exceeding background, including most cases with known survival after trauma (1-1588 days). This study included digital analysis after thresholding in 21 cases allowing such quantification of axonal block [2]. In one bilateral case surviving 16 days, quantitation differed across the companion LCs by only 0.76% attesting to the accuracy of the measurements. We speculated that either or both increased Intraocular Pressure (IOP) and increased central nervous system pressure associated with head trauma could explain LS block of axonal transport, most likely by a mechanical effect of LS fibrous beams on flexible axons. Either mechanism could alter

the translaminar gradient of pressure and result in transport block. To our knowledge, IOP has never been reported in AHT and lumbar puncture Central Nervous System Pressure (CNSp) is often not always performed on these patients. Obtaining related CNS system clinical imaging (CT or MRI) at hospital admissions were frustrated by no co-operation from medical record departments. Review of such imaging might contribute to our understanding of the mechanism and location of transport block in AHT. IOP measurements, in our view, should be routine for AHT suspects.

References

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