G128 Correlation of Antemortem and Postmortem Retinal Hemorrhages in Children

Kathryn H. Haden-Pinneri, MD, Harris County Medical Examiner's Office, 1885 Old Spanish Trail, Houston, TX 77054*

After attending this presentation, attendees will gain information about retinal hemorrhages with regards to length of survival, cardiopulmonary resuscitation, level of intracranial pressure, coagulation parameters and presence of trauma.

This presentation will impact the forensic science community by providing a better understanding of the evolution of retinal hemorrhages in the pediatric population.

Retinal hemorrhages have been recognized as an important indicator of abusive head trauma for many decades. The ability to document the presence of intraocular injuries has greatly improved through the use of wide-field digital retinal imaging. Accurately describing the number, location, and morphology of retinal hemorrhages in children is extremely important for diagnostic as well as legal purposes.

Peripheral retinal hemorrhages are often asymptomatic and may be discovered incidentally during an ophthalmologic examination. Many systemic and ocular disorders are known to be associated with a mild nonspecific hemorrhagic retinopathy, such as hypertension, blood cell disorders (i.e., leukemia, anemia, idiopathic thrombocytopenia), sepsis, vasculitis, cerebral aneurysms, vitamin deficiencies (thiamine, vitamin C), retinal infections, increased intracranial pressure, prematurity and alterations in sodium, oxygen and glutaric acid levels. Also included in the differential for a few posterior pole retinal hemorrhages is abusive trauma. In most of these situations; however, the historical, systemic, or ocular findings allow for the correct diagnosis.

Birth related retinal hemorrhages have also been well documented in the literature, with an occurrence rate ranging from 3 to 50 percent. Vacuum-assisted vaginal delivery is a known risk factor for birth related retinal hemorrhages while delivery by cesarean section has a low rate of retinal hemorrhages. It is important to realize; however, that infants delivered by cesarean section may have failed prior vaginal delivery attempts. The retinal hemorrhages associated with birth may occur in all retinal zones, similar to that seen in suspected abusive head trauma. Over 90 percent of birth related intraretinal hemorrhages resolve within two weeks and none were detectable after four weeks in one study. Researcher and clinicians tend to agree that extensive confluent retinal hemorrhages identified in a child over the age of one month are not birth related.

Proper identification and description of retinal hemorrhages is crucial for developing an appropriate differential diagnosis. Traditionally, the gold standard for retinal examinations required the use of an indirect ophthalmoscope through neurologically or pharmacologically dilated pupils. Images could be taken through the ophthalmoscope; however, many times the hemorrhages seen by the ophthalmologist were crudely drawn in the patients chart. Wide-field digital retinal imaging with a RetCam is being increasingly utilized over the indirect ophthalmoscope, particularly in pediatric patients. Images can be stored as part of the electronic medical record and therefore are available for evaluation at later dates.

Different techniques have been employed at the time of autopsy to visualize and document retinal hemorrhages. The "gold standard" and most commonly employed procedure is removal of the eyes and adjacent periorbital tissues. The eyes are subsequently fixed in formalin for a minimum of two weeks, sectioned into superior, inferior and middle segments, photographed and embedded into paraffin blocks which are made into glass slides. This process allows for the distribution, location and number of retinal hemorrhages to be assessed. Additionally, hemosiderin deposition, an indicator of prior hemorrhage, into the retina, around the optic nerve or in the periorbital tissues can be assessed. Postmortem monocular indirect ophthalmoscopy has been used by some as an inexpensive adjunct to enucleation; however it can be a challenging technique to master and is not widely used.

A large part of the problem in determining the significance of retinal hemorrhages is that their pathophysiology is not well understood. Several hypotheses exist; including raised intraocular venous pressure due to a sudden rise in intracranial and central venous pressures, hypoxia, single blunt impact, and increased intrathoracic pressure. Vitreoretinal traction due to cycles of rapid acceleration and deceleration is thought to be the causative process by some researchers.

In this presentation, antemortem documentation of retinal imaging (photographs and/or chart diagrams) will be compared to the postmortem retinal findings of children whose deaths fell under the jurisdiction of the Harris County Institute of Forensic Sciences from 2005 - 2011. Only cases with both antemortem and postmortem data will be analyzed. Progression or non-progression of hemorrhages will be described with regards to age, survival period, cardiopulmonary resuscitation attempts, intracranial pressure (when available), presence or absence of intracranial trauma, presence or absence of extracranial trauma, optic nerve sheath hemorrhage, coagulation parameters and cause of death. As intracranial pressure increases and patients become coagulopathic, it seems logical that the number of hemorrhages would increase; however this type of correlation in a large medical examiner's office has not been reported in the literature.

Ophthalmologists are often consulted to examine the retinas of children who present to the hospital with evidence of trauma and/or hypoxic encephalopathy. The time frame for the examination varies – depending on the degree of suspicion for abuse by the treating physician. Should these results indicate progression of retinal hemorrhages with increasing time and intracranial pressure, clinicians may opt for a "sooner-rather-than-later" approach to ophthalmologic examinations in order to properly interpret the results.

Retinal Hemorrhages, Pediatrics, RetCam Images

 ** Presenting Author*