G69 Retinal Hemorrhages Associated With Partial Submersion (Near Drowning)

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After attending this presentation, attendees will learn that retinal hemorrhages can occur in cases of partial submersion (near drowning) with cardiopulmonary resuscitation and should not be considered specific for abusive head trauma in young children.

This presentation will impact the forensic science community by illustrating that retinal hemorrhages in young children must be interpreted with caution, particularly in the setting of extended cardiopulmonary resuscitation.

Aggressive, prolonged Cardiopulmonary Resuscitation (CPR) often occurs in partial submersion (near drowning) in young children. A literature review did not reveal any reports of Retinal Hemorrhages (RHs) associated with partial submersion or drowning, and there have been only a few studies looking at RHs associated with resuscitation in children. Two cases of RHs in young children who died following partial submission (near drowning) were presented. In both cases the decedents received cardiopulmonary resuscitation and advanced life support.

Case 1: A 7-year-old male experienced a partial submersion (near drowning) incident at a hotel swimming pool. He was witnessed flailing, choking, and struggling to stay above water. His mother and another adult helped him to the side of the pool. Emergency Medical Services (EMS) arrived and reported that he was breathing spontaneously and was in normal sinus rhythm. During transport to the Emergency Department (ED), he became bradycardic and then asystolic. CPR was started and continued for 25 minutes after arrival at the ED before he recovered spontaneous circulation. Cranial Computed Tomography (CT) showed profound global hypoxic-ischemic injury with cerebral edema. He was in the hospital for two days during which time his neurological status continued to decline and a repeat CT showed worsening cerebral edema with transtentorial and tonsillar herniation. Clinical brain death was pronounced. No clinical fundal examination was documented in the medical record. At autopsy, Postmortem Monocular Indirect Ophthalmoscopy (PMIO) revealed 50-100 bilateral flame-shaped and dot-blot retinal hemorrhages extending over the posterior poles and focally abutting the ora serrata. No optic nerve sheath hemorrhages were identified. Neuropathological examination confirmed severe, diffuse hypoxic-ischemic brain injury with cerebral edema and cerebellar tonsillar herniation.

Case 2: A 6-year-old male was found submerged in a swimming pool at a campground. He was estimated to have been submerged for approximately ten minutes. Bystander CPR was performed at the scene and EMS was alerted. EMS reported that the decedent was cold, unresponsive, and asystolic upon arrival. CPR was continued and Pediatric Advanced Life Support (PALS) was initiated en route to the nearest hospital. Aggressive resuscitation was continued in the ED until a circulating rhythm was established. He was admitted to the Pediatric Intensive Care Unit (PICU) with a preliminary diagnosis of anoxic brain injury. His temperature was normalized, but he remained comatose throughout this course in the PICU with a Glasgow Coma Score of three. His pupils were fixed, dilated, and nonreactive. He had no cough, corneal, gag, or deep tendon reflexes. A head CT showed diffuse edema with global hypoxic/ischemic injury, and a nuclear medicine brain scan showed no intracranial blood flow confirming brain death. No clinical fundal examination was documented in the medical record. At autopsy, PMIO revealed four flame-shaped retinal hemorrhages in the right eye, and no abnormalities in the left eye. No optic nerve sheath hemorrhages were identified. Other findings included acute bronchocentric pneumonia, pulmonary edema, and diffuse hypoxic-ischemic brain injury with cerebral edema and tonsillar herniation.

These two cases further expand the spectrum of retinal hemorrhages in children with cerebral edema. RHs in children have typically been viewed as a hallmark for abusive head trauma, but routine postmortem ocular examination has revealed increasing numbers of cases with RHs not associated with AHT. RHs have not been previously associated with partial submersion (near-drowning). The RHs in these two cases are most likely attributable to resuscitation efforts and ischemia-reperfusion injury, but further investigation is required to determine the cause of retinal hemorrhages following partial submersion (near-drowning) with resuscitation.

Retinal Hemorrhages, Near Drowning, Resuscitation

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