



### **G20 Retinal Hemorrhages Associated With Non-Abusive Sudden Unexplained Deaths in Infants**

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After attending this presentation, attendees will learn how ocular hemorrhages can occur in infants who are found unresponsive and have received cardiopulmonary resuscitation but have no evidence of abuse.

This presentation will impact the forensic science community by increasing the attendees' awareness of non-traumatic retinal hemorrhages in infants and emphasize that retinal hemorrhages can occur after cardiopulmonary resuscitation and are not specific for abusive head trauma.

Retinal hemorrhages (RHs), considered by many physicians as a key finding in abusive head trauma (AHT), have been reported in about 85% of fatal AHT cases. Published reports have stated that the number, location, and distribution of RHs are significant for differentiating RHs observed in AHT as compared to RHs occurring in accidental head injuries or natural disease processes. A number of studies have indicated that bilateral multiple RHs extending to the ora serrata have particular diagnostic specificity for AHT.

Ten cases are presented of sudden, unexplained infant deaths that had RHs following cardiopulmonary resuscitation (CPR) but no evidence of abusive or accidental head trauma. Postmortem monocular indirect ophthalmoscopy (PMIO) detected the RHs in all cases. Only one infant, who had bilateral RHs detected by PMIO, had a documental clinical fundal examination by a non-ophthalmologist 41 hours after CPR had been initiated. Investigative and autopsy findings revealed no natural diseases, craniocerebral trauma, or other injuries that caused or contributed to the deaths. The cause of death was certified as Sudden Infant Death Syndrome or unexplained infant death.

The infant ages ranged from seven weeks to ten months of age, with a median age of 18 weeks and a mean age of 16.7 weeks. Four infants were born premature at 32 to 36 weeks estimated gestational age. All but one infant was found unresponsive after being placed down to sleep; one was taken to the emergency department after a witnessed episode of loss of consciousness. Four infants who were placed to sleep in a bed or crib were found prone. CPR efforts lasted less than 15 minutes to one hour. Four infants experienced return of spontaneous circulation and survived for 6-56 hours after CPR efforts were started. Resuscitation-related rib fractures occurred in three infants. Ophthalmologic findings ranged from a single superficial retinal hemorrhage in one eye to diffuse retinal hemorrhages with extension to the ora serrata and optic nerve sheath hemorrhage. The four infants with multiple retinal hemorrhages with extension to the ora serrata all had spontaneous return of circulation and survived between 6-56 hours following the initiation of CPR. The infant with the optic nerve sheath hemorrhage had the longest survival time. Diffuse systemic ischemic and reperfusion injuries affecting the kidneys, adrenal glands, liver, myocardium, intestines, lungs and brain were observed in four cases; focal hypoxic-ischemic organ damage was present in three cases. Neuropathological findings included cerebral edema, intra-falcine and intra-dural extravasated blood, and focal subarachnoid hemorrhage.

Infants found unresponsive invariably undergo resuscitative efforts, often for prolonged periods of time. Forensic pathologists must be aware that RHs can be seen in infants who die suddenly and unexpectedly, following cardiopulmonary resuscitation, and are not specific for abusive head trauma. Infants found unresponsive without evidence of head trauma or natural disease processes that have had CPR, especially those with restoration of circulation, can have RHs that may be few in number or numerous with extension to the ora serrata. It is important for forensic pathologists to perform postmortem ocular examinations on all infants dying suddenly and unexpectedly to identify conditions associated with RHs and not equate RHs solely with AHT.

#### **Retinal Hemorrhages, Sudden Unexplained Infant Deaths, Cardiopulmonary Resuscitation**