

W10 Child Abuse: A Multidisciplinary Approach

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After attending this presentation, attendees will be able to: (1) identify the neuropathological findings of abusive head trauma, understand how the biomechanical mechanisms of inertial brain injury create these injuries, and recognize how the distinction between focal and diffuse brain injury determines the clinical presentation of timing of symptoms, such as level of consciousness; (2) properly perform a gross and microscopic examination of the eye and document the significant pathological features of retinal hemorrhages; (3) properly perform and document the evaluation of a child's fracture; and, (4) identify and exclude cases of abusive trauma to children using all relevant clinical and pathological data and information.

This presentation will impact the forensic science community by assisting in the evaluation of head injuries in infants and young children as well as assisting in the evaluation of traumatic injuries to the chest, abdomen, extremities, and bones of young children. Child abuse deaths are fairly common deaths seen by forensic pathologists in jurisdictions of all sizes. These cases are extremely complex and represent some of the most difficult cases handled by forensic pathologists. Forensic pathologists can be assisted in their work on these cases by input from other medical specialties and areas of interest, including child abuse pediatrics, pediatric ophthalmology, pediatric neurosurgery, neuroradiology, as well as a general knowledge of developmental pediatrics. Familiarity with these other areas of expertise will allow forensic pathologists to better decide upon cause and manner of death and to answer questions about forensic issues such as timing of injuries and onset of unconsciousness.

Head injury is the leading cause of death and disability in children. Of childhood deaths resulting from head injury, inflicted neurotrauma accounts for the greatest number. Sixty-four percent of head injuries serious enough to warrant admission to the hospital (excluding uncomplicated skull fractures) and 95% of serious intracranial injuries are the result of inflicted trauma. It is estimated that in the United States, 2,000 children die each year from abuse and neglect. Head injury is the leading cause of death from inflicted trauma and accounts for a large number of nonlethal abusive injuries. Falls are frequent occurrences in childhood and most head injuries in young children are caused by falls; yet, the great majority of these fall-related head injuries are trivial and only a few are lethal. Making the distinction between inflicted and accidental head injury is a common problem in the pediatric population and concerns pediatricians, forensic pathologists, neurosurgeons, and other medical specialties. The distinction between accident and inflicted is however an exceedingly important distinction to make. The features and issues necessary in distinguishing abusive head injury from accidental injury as well as from non-traumatic conditions such as genetic causes of subdural or retinal hemorrhages will be closely considered. Certain issues in

abusive head injury have caused intense discussion among the various physicians and engineers who have examined these cases. Two areas of “controversy” include the debate over shaking as a mechanism of head injury in young children and the role that hypoxia might play in the causation of subdural bleeding. These topics will be considered in this workshop.

Traumatic brain injury can be classified into static and dynamic injuries depending upon the rate at which force is loaded onto the head. Static injuries occur over longer periods of time, usually greater than 200 milliseconds, and result in crushing head injuries. Crushing head injury refers to actual crushing of the facial skeleton and skull by a heavy weight. While relatively rare in the overall number of head injuries at all ages, it is an injury seen in some accidental childhood head injuries. At all ages, the greater number of head injuries result from dynamic forces that occur when force is rapidly loaded onto the head (in less than 200 milliseconds) and imparts an impulsive motion to the head either as a result of impact to the head, which is free to move, or as a result of an action to the body, which causes the head to move such as the collision of two athletes or the violent shaking of an infant. Impulsive loading of significant degree may create inertial movement of the brain within the cranial cavity which causes differential movement between the brain (with its attached arachnoid) and the skull (with the attached dura). This inertial movement of the brain within the cranial cavity is the cause of bridging vein failure and results in subdural and subarachnoid hemorrhage and traumatic diffuse axonal injury. Inertial brain motion is also considered to be the cause of retinal hemorrhages of the type found in abusive head trauma. Brain injuries may also be classified as either focal or diffuse injuries. Focal injuries result from direct contact injury to the head and are visible to the naked eye. Focal injuries include scalp contusion and laceration, skull fracture, epidural hemorrhage, focal subdural hemorrhage, and brain contusions. Focal injuries become clinically symptomatic by causing increasing intracranial pressure which takes place over time and may have a fatal outcome from herniation. Focal brain injuries typically have a lucid interval. Accidental head injuries in young children with sufficient focal injury may lead to fatal outcomes and need to be recognized by all medical specialists. Diffuse injuries result from inertial forces and include interhemispheric subdural hemorrhage and traumatic diffuse axonal injury. Diffuse injuries may not be visible to the naked eye and these injuries may become clinically evident by the onset of immediate traumatic unconsciousness and tend not to have a lucid interval. Inflicted head trauma is most often of the diffuse brain injury form. Multiple medical specialists will discuss their unique approaches and perspectives in examining and evaluating head injuries in young children including how each specialty can assist the others in the interpretation and appreciation of the forensic and legal implications of these injuries. This workshop is intended to provide sufficient detail and depth to be of use to forensic pathologists in particular as well as other physicians who are concerned with child head injuries.

Fractures, Child Abuse, Subdural Hemorrhage