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Abusive Head Trauma

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Synonyms

Inflicted childhood neurotrauma; Nonaccidental
or inflicted traumatic brain injury; Pediatric abu-
sive head trauma; Shaken baby syndrome

Short Description or Definition

Pediatric abusive head trauma (AHT) is a form of inflicted traumatic brain injury in an infant or small child due to blunt trauma, being shaken, or a combination of both. Rapid rotation and movement, acceleration and deceleration changes, of the brain within the cranial vault of a small child result in significant neural trauma. The National Center for Injury Prevention and Control defines pediatric abusive head trauma as “an injury to the skull or intracranial contents of an infant or young child (< 5 years of age) due to inflicted blunt impact and/or violent shaking.” This definition

excludes unintentional injuries and penetrating trauma (Parks et al. 2012).

Categorization

A form of child maltreatment or abuse, AHT occurs as a result of a baby's weak neck muscles in relation to its proportionally large head being unable to compensate for rapid shaking, accelerating and decelerating velocity changes, and/or impact to the head. While the injury itself can present with a wide variety of clinical sequela, the mechanism behind the injury is more extensive force than noted in accidental or neglectful events and different from penetrating injuries. The most common injuries related to AHT include subdural hematomas and retinal hemorrhage, with additional physical injuries such as fractures, signs of impact, and spinal injuries noted (Nadarasa et al. 2014).

Epidemiology

Determination of frequency, morbidity, and mortality is difficult because oftentimes no clear, visible injury occurs. In addition, given the abusive nature of the injury, significant motives to avoid detection often make investigating possible cases of AHT difficult. AHT likely occurs most often in children under 2 years of age, but can occur through 5 years of age. AHT can occur in the

context of additional abusive injuries, either current or historical. Among cases of nonaccidental pediatric trauma, more than half of deaths are a result of AHT (Ross and Juarez 2014). Many children had prior additional abusive injuries or nonspecific signs in the past of head trauma such that those nonfatal, non-life-threatening incidences were not detected. Overall mortality is estimated to range up to almost 40%, with upward of 60% of infants who have been shaken dying or experiencing profound long-term medical and cognitive consequences (www.dontshake.org). Incidence, according to research, is estimated to be as many as 39.8 per 100,000 in children under 1 year of age, with rates decreasing sharply as children age (Niederkröthenthaler et al. 2013).

Natural History, Prognostic Factors, and Outcomes

In the early 1970s, the term “whiplash shaken baby syndrome” was used to describe symptoms consistent with AHT, which had been identified over two decades prior (Caffey 1974). Over the last four decades, debate has centered on the methods for standardizing the diagnosis of AHT, as well as the implications of various nomenclature to describe the trauma. Identification of AHT generally includes neurological dysfunction (i.e., apnea), subdural hemorrhage, and retinal hemorrhage. As there are other possible causes for this triad that does not include inflicted trauma, it is difficult to correctly identify and to convict the suspected perpetrator of committing abuse. Formal definitions and nomenclature for AHT have been developed in order to drive diagnostic classifications. The CDC currently defines pediatric abusive head trauma “as an injury to the skull or intracranial contents of an infant or young child (<5 years of age) due to inflicted blunt impact and/or violent shaking” (Parks et al. 2012). This definition excludes unintentional injuries, such as from lack of supervision and any penetrating trauma. Research has indicated that medical signs such as the presence of intracranial injuries in coordination with a lack of specific signs of

impact assist in differentiating between inflicted versus accidental trauma (Vinchon et al. 2009).

Educational campaigns help new parents expect intense crying, to recognize frustration that is theorized to lead to abusive shaking, and to leave the baby in a safe place and walk away. Unlike other forms of abuse, risk for AHT cuts across all social classes, races, and gender although recent studies indicate that it may be more prevalent for babies in lower socioeconomic homes. Known risk factors of AHT include male sex (Keenan et al. 2003), age under 1 year (Keenan et al. 2003), having a young mother (Overpeck et al. 1998), having parents with low socioeconomic status (Christian and Block 2009), and some studies indicate a higher risk for racial/ethnic minorities (Bennett et al. 2006; Drake et al. 2011). However, research on prevalence of risk factors related to race or socioeconomic status is unclear and extremely variable, with possible reporting issues related to these same factors. Therefore, many authors urge caution when interpreting overall risk factors (Niederkröthenthaler et al. 2013).

Outcomes for children experiencing AHT are extremely variable and relate to the amount of damage inflicted and interventions received. More subtle signs of neurotrauma after injury can be mistaken for flu-like symptoms or other common presentations of childhood (i.e., colic), and in some cases when a child is shaken into a comatose state, the caretaker may believe that the child has gone to sleep or finally stopped crying. Such complicating factors may result in significant delays before a child is brought for medical attention and lead to significant mortality rates. Children who survive AHT may experience blindness if they have had retinal hemorrhaging, as well as significant long-term neurological conditions such as mental retardation, seizure disorders, muscular spasticity or cerebral palsy, and structural abnormalities such as microcephaly, hydrocephaly, cerebral atrophy, or encephalomalacia as a direct result of neural trauma.

Neural System Damage and Neuropsychology Outcomes of AHT

Symptoms of AHT vary with the severity of the inflicted neural trauma. The neural injury typically includes acceleration injury during shaking and deceleration when the shaking is stopped or the child is slammed or thrown into an object. Recent research indicate differences between AHT and accidental injury on retinal hemorrhages, suggesting AHT causes diffuse, multilayered hemorrhages, and additional research suggests AHT results in increased intracranial pressure, brain swelling, as well as possible rupture of bridging veins, often found in coordination with spinal injuries (Nadarasa et al. 2014). Subdural hemorrhage and subarachnoid hemorrhage are most often bilateral. Further, neuronal injury occurs with resultant cerebral edema. Additional pathology often includes spine and neck injuries, rib fractures, and fractures to the long bones of the infant (particularly, if they have been held by an appendage while shaken). As a result of neurological pathology, immediate observable symptoms can include lethargy, irritability, a high-pitched cry, poor sucking and feeding, problems breathing, a blue or pale pallor, vomiting, and seizures. Literature suggests that apnea and severe retinal hemorrhages are strongest indicators of AHT. Of those who survive, approximately two thirds are either moderately or severely impaired (Narang and Clarke 2014). Long-term outcomes of these injuries are difficult to study and quantify in a rigorous manner. Therefore, most descriptions of AHT are based on the case studies, indicating that children who survive are more severely impaired as they experience more severe injuries, including lacerations of brain tissue, excessively elevated intracranial pressure, infarcts, and hemorrhage. A study of a small number of children with inflicted head trauma that were followed post-injury indicated over half experienced significant cognitive impairments, as well as language delays (Barlow et al. 2005). Limited research indicates that comparisons to children experiencing non-abusive or accidental head trauma indicate far greater incidences of long-term cognitive impairments (Ewing-Cobbs et al. 1998). Those with

AHT more likely experienced deeper, more extensive cortical injury, more often resulting in impairments in cardiorespiratory functioning or consciousness and resulting in more frequent bilateral and ischemic injuries and lower developmental scores postinjury (Hymel et al. 2007).

Evaluation

Diagnosis of AHT requires extensive medical evaluations including radiology studies as well as sociological evaluations of the caregivers. Evidence of additional physical injuries indicative of abuse on the child should be documented. The presence or absence of retinal hemorrhages should be evaluated by a pediatric ophthalmologist or neurologist. Laboratory values can indicate the presence of blood in the cerebral spinal fluid, coagulation changes following cerebral injury, and possible pancreas and liver damage. X-ray can reveal rib injuries. Most significantly, CT scan is the primary method of evaluation for brain injury. Consecutive CT scans can reveal ongoing changes in a recently injured child as well as the evidence of older brain injuries. Utilizing MRI as an adjunct in longer-term diagnosis can reveal more subtle white matter changes related to injury.

Treatment

Treatment of AHT most often involves life-saving measures initially, including neurosurgery to address active bleeding and excessive intracranial pressure. Medical life support may be required for some time while swelling subsides. Long-term treatment of AHT involves addressing the most salient of the resulting neurobiological symptoms. Children with more significant injuries often begin rehabilitation therapies immediately, much like other children who experience accidental brain injuries. Neuropsychological evaluations across development are often useful to detect specific cognitive, functional, or educational impairments, with the most common believed to be attention, executive, and visual perceptual deficits.

Cross-References

- ▶ [Cerebral Edema](#)
- ▶ [Subarachnoid Hemorrhage](#)
- ▶ [Traumatic Brain Injury](#)

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