



# Abusive Head Trauma in Infants and Children

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Cindy W. Christian, MD, Robert Block, MD, and the Committee on Child Abuse and Neglect

## ABSTRACT

Shaken baby syndrome is a term often used by physicians and the public to describe abusive head trauma inflicted on infants and young children. Although the term is well known and has been used for a number of decades, advances in the understanding of the mechanisms and clinical spectrum of injury associated with abusive head trauma compel us to modify our terminology to keep pace with our understanding of pathologic mechanisms. Although shaking an infant has the potential to cause neurologic injury, blunt impact or a combination of shaking and blunt impact cause injury as well. Spinal cord injury and secondary hypoxic ischemic injury can contribute to poor outcomes of victims. The use of broad medical terminology that is inclusive of all mechanisms of injury, including shaking, is required. The American Academy of Pediatrics recommends that pediatricians develop skills in the recognition of signs and symptoms of abusive head injury, including those caused by both shaking and blunt impact, consult with pediatric subspecialists when necessary, and embrace a less mechanistic term, abusive head trauma, when describing an inflicted injury to the head and its contents. *Pediatrics* 2009;123:1409–1411

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### Abbreviation

AHT—abusive head trauma

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## HISTORY

The recognition of child abuse in modern medicine began in the 19th century, with the work of the French forensic physician Ambroise Tardieu,<sup>1,2</sup> who described a wide array of physical and sexual injuries to children, including meningeal hemorrhage and brain injuries in fatally abused infants. More than 80 years later, American physicians began describing the clinical and radiologic manifestations of child abuse. Pediatrician and radiologist John Caffey<sup>3,4</sup> first described the association of chronic subdural hemorrhages and long-bone fractures in 1946, but it was not until 1972 that he published a seminal paper describing the radiologic and clinical features attributed to shaking injuries. Ludwig and Warman<sup>5</sup> first published the term “shaken baby syndrome” in their review of 20 infants and young toddlers injured by shaking, none of whom showed evidence of impact injury to the head. In 1987, Duhaime et al<sup>6</sup> reported that victims of fatal shaken baby syndrome, and many of those who survived their trauma, showed evidence of blunt impact to the head at the time of diagnosis. The importance of impact in acceleration/deceleration injury was supported by their basic biomechanical models, and they concluded that most serious abusive head injuries required an impact to the head. The relative importance of impact as a contributor to the head injury sustained by abused children became a source of controversy. Biomechanical modeling has since been used to both support and refute the contributions of shaking or impact to abusive head trauma (AHT).<sup>7,8</sup> In reality, all models and theories have known limitations, and many clinicians and researchers acknowledge that precise mechanisms for all abusive injuries remain incompletely understood.<sup>9</sup> Efforts to better understand the mechanisms and causations of injury have improved the gathering of objective data in the clinical realm. Case investigations, including meticulous medical history taking, examinations, and medical workups, have expanded and improved. Medical diseases that can mimic the presentation of AHT are recognized, and screening is performed when indicated. Social welfare, law enforcement, and legal professionals have become better educated about AHT. Clinical research has expanded, and biomechanical modeling of injuries has improved.

Case histories clearly support the conclusion that shaking occurs in some injury scenarios. Shaking was the most commonly reported mechanism of injury described in a series of AHT cases in which perpetrators admitted abuse (68% of 81 cases).<sup>10</sup> Shaking alone was described in 32 cases, and only 4 of the victims showed evidence of impact injury. Although this indicates incomplete admission to the injury mechanism in some cases, the commonality of a described shaking mechanism along with the infrequency of impact evidence supports shaking as an important mechanism of AHT. In addition, blunt impact trauma or impact combined with shaking can result in infant head injuries.<sup>11</sup> In severe and fatal cases, concomitant cervical spine injury can sometimes be found.<sup>12</sup> Secondary brain injury resulting from hypoxia, ischemia, and metabolic cascades contributes to poor outcomes.<sup>13,14</sup> Shaken baby

syndrome is a subset of AHT. Injuries induced by shaking and those caused by blunt trauma have the potential to result in death or permanent neurologic disability, including static encephalopathy, mental retardation, cerebral palsy, cortical blindness, seizure disorders, and learning disabilities. Medical and biomechanical research, clinical and pathologic experience, and radiologic advances have improved our understanding of the range of mechanisms that contribute to brain injury from AHT, yet controversy remains.

## DISCUSSION

Few pediatric diagnoses engender as much debate as AHT, in part because of the social and legal consequences of the diagnosis. The diagnosis can result in children being removed from their homes, parents losing their parental rights, and adults being imprisoned for their actions. Controversy is fueled because the mechanisms and resultant injuries of accidental and abusive head injury overlap, the abuse is rarely witnessed, an accurate history of trauma is rarely offered by the perpetrator, there is no single or simple test to determine the accuracy of the diagnosis, and the legal consequences of the diagnosis can be so significant.<sup>15</sup> Because the civil and criminal justice systems are often involved in cases of AHT, the scientific debates related to mechanism and causation of injury often are argued during courtroom proceedings. On occasion, the courtroom allows for scientific theory to be confirmed or refuted,<sup>16</sup> but in reality, the American justice system is not designed to determine scientific truth but, rather, to balance contested facts and bring closure to a dispute. Medical terminology should accurately reflect the medical diagnosis. The term “shaken baby syndrome” has become synonymous in public discourse with AHT in all its forms.<sup>17</sup> The term is sometimes used inaccurately to describe infants with impact injury alone or with multiple mechanisms of head and brain injury and focuses on a specific mechanism of injury rather than the abusive event that was perpetrated against a helpless victim. Legal challenges to the term “shaken baby syndrome” can distract from the more important questions of accountability of the perpetrator and/or the safety of the victim. The goal of this policy statement is not to detract from shaking as a mechanism of AHT but to broaden the terminology to account for the multitude of primary and secondary injuries that result from AHT, some of which contribute to the often-permanent and significant brain damage sustained by abused infants and children.

The term “shaken baby syndrome” has become recognized by the public; prevention strategies for curtailing the incidence of AHT have been developed and researched, and some states have mandated shaken baby syndrome education for parents of all newborn infants.<sup>18</sup> Because it may not be obvious to parents that shaking can be harmful to infants, the newborn nursery is an appropriate venue for this education. The American Academy of Pediatrics supports prevention efforts that reduce the frequency of AHT and recognizes the utility of maintaining the use of the term “shaken baby syndrome” for prevention efforts. Just as the public com-

monly uses the term “heart attack” and not “myocardial infarction,” the term “shaken baby syndrome” has its place in the popular vernacular. However, for medical purposes, the American Academy of Pediatrics recommends adoption of the term “abusive head trauma” as the diagnosis used in the medical chart to describe the constellation of cerebral, spinal, and cranial injuries that result from inflicted head injury to infants and young children.

## THE ROLE OF THE PEDIATRICIAN

As mandated reporters of suspected child abuse and neglect, pediatricians carry the burden of recognizing and responding to medical manifestations of AHT. The diagnosis is sometimes obvious, but injuries in many symptomatic infants are unrecognized by unsuspecting physicians.<sup>19</sup> In addition, physicians do not always report to child welfare agencies injuries that are highly suspicious for abuse, which puts children at further risk for injury.<sup>20,21</sup> To protect abused infants and prevent future severe neurologic injury, pediatricians must remain cognizant of the possibility of AHT in infants who present with both subtle and overt neurologic symptoms and take seriously the ethical and legal mandates to report suspected child abuse to governmental agencies for investigation. Pediatricians also have a responsibility to consider alternative hypotheses when presented with a patient with findings suggestive of AHT. A medical diagnosis of AHT is made only after consideration of all the clinical data. On some occasions, the diagnosis is apparent early in the course of the evaluation, because some infants and children have injuries to multiple organ systems that could only be the result of inflicted trauma. On other occasions, the diagnosis is less certain, and restraint is required until the medical evaluation has been completed. However, as physicians, we have an obligation to make a working diagnosis, as we do with many other diagnoses, and take the legally mandated steps for further investigation when indicated. Pediatricians often find it helpful to consult a subspecialist in the field of child abuse pediatrics to ensure that the medical evaluation has been complete and the diagnosis is accurate. Subspecialists in radiology, ophthalmology, neurosurgery, neurology, and other fields should also be consulted when necessary to ensure a complete and accurate evaluation. When child protective services or law enforcement is involved in an investigation, the pediatrician is required to interpret medical information for nonmedical professionals in an understandable manner that accurately reflects the medical data. Pediatricians also have a responsibility to the family of the abused child. The diagnosis of child abuse has enormous social, psychological, and legal implications for families. The role of the pediatrician is not to apportion blame or investigate potential criminal activity but to identify the medical problem, treat the child’s injuries, and offer honest medical information to parents and families. Finally, pediatricians can work to prevent AHT by supporting prevention efforts in the community and in practice. Pediatricians may help prevent AHT by providing anticipatory guidance to new parents about the dangers of shaking or impact and providing methods for dealing

with the frustration of a crying infant. They can also stress the importance of leaving a young infant or toddler in the care of adults whom the parents trust will not harm their child and can participate in comprehensive community-based prevention efforts. AHT commonly results in permanent neurologic damage and carries tremendous family and societal costs. With an aim toward prevention, the American Academy of Pediatrics recommends the following.

## RECOMMENDATIONS

1. Pediatricians should be alert to the signs, symptoms, and head injury patterns associated with AHT.
2. Pediatricians should know how to begin a thorough and objective medical evaluation of infants and children who present for medical care with signs and symptoms of potential AHT. Consultants in radiology, ophthalmology, neurosurgery, and other subspecialties are important partners in the medical evaluation and can assist in interpreting data and reaching a diagnosis.
3. Pediatricians should consider consulting a subspecialist in the field of child abuse pediatrics to ensure that the medical evaluation of the patient has been complete and that the diagnosis is accurate.
4. Pediatricians should use the term “abusive head trauma” rather than a term that implies a single injury mechanism, such as shaken baby syndrome, in their diagnosis and medical communications.
5. Pediatricians should continue to educate parents and caregivers about safe approaches to calming and coping with crying infants and the dangers of shaking, striking, or impacting an infant’s head.

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## REFERENCES

1. Tardieu A. A Tardieu, Étude Médico-légale sur les sévices et mauvais traitements exercés sur des enfants [in French]. *Ann Hyg Publique Med Leg.* 1860;13:361–398
2. Roche JA, Fortin G, Labbe J, Brown J, Chadwick D. The work of Ambrose Tardieu: the first definitive description of child abuse. *Child Abuse Negl.* 2005;29(4):325–334
3. Caffey J. Multiple fractures in long bones of infants suffering from chronic subdural hematoma. *AJR Am J Roentgenol.* 1946; 56:163–173
4. Caffey J. On the theory and practice of shaking infants. *Am J Dis Child.* 1972;124(2):161–169
5. Ludwig S, Warman M. Shaken baby syndrome: a review of 20 cases. *Ann Emerg Med.* 1984;13(2):104–107
6. Duhaime AC, Gennarelli TA, Thibault LE, Bruce DA, Margulies SS, Wisner R. The shaken baby syndrome: a clinical, pathological, and biomechanical study. *J Neurosurg.* 1987;66(3):409–415
7. Cory CZ, Jones BM. Can shaking alone cause fatal brain injury? A biomechanical assessment of the Duhaime shaken baby syndrome model. *Med Sci Law.* 2003;43(4):317–333
8. Ommaya AK, Goldsmith W, Thibault L. Biomechanics and neuropathology of adult and paediatric head injury. *Br J Neurosurg.* 2002;16(3):220–242
9. Wolfson DR, McNally DS, Clifford MJ, Vloeberghs M. Rigid-body modelling of shaken baby syndrome. *Proc Inst Mech Eng [HJ].* 2005;219(1):63–70
10. Starling SP, Patel S, Burke BL, Sirotiak AP, Stronks S, Rosquist P. Analysis of perpetrator admissions to inflicted traumatic brain injury in children. *Arch Pediatr Adolesc Med.* 2004;158(5):454–458
11. Feldman KW, Bethel R, Shugerman RP, Grossman DC, Grady MS, Ellenbogen RG. The cause of infant and toddler subdural hemorrhage: a prospective study. *Pediatrics.* 2001;108(3): 636–646
12. Brennan L, Rubin DM, Christian CW, Duhaime AC, Mirchandani HG, Rorke-Adams LB. Neck injuries in young pediatric homicide victims. *J Neurosurg Pediatr.* 2009;3(3):232–239
13. Ichord RN, Naim M, Pollock AN, Nance ML, Margulies SS, Christian CW. Hypoxic-ischemic injury complicates inflicted and accidental traumatic brain injury in young children: the role of diffusion-weighted imaging. *J Neurotrauma.* 2007;24(1):106–118
14. Bayir H, Kochanek PM, Kagan VE. Oxidative stress in immature brain after traumatic brain injury. *Dev Neurosci.* 2006; 28(4–5):420–431
15. Christian CW. The influence of career experience in defining head injuries: challenges for research. *Child Abuse Negl.* 2007; 31(4):325–327
16. Jenny C. The intimidation of British pediatricians. *Pediatrics.* 2007;119(4):797–799
17. Lazoritz S, Baldwin S, Kini N. The whiplash shaken infant syndrome: has Caffey’s syndrome changed or have we changed his syndrome? *Child Abuse Negl.* 1997;21(10):1009–1014
18. Dias MS, Smith K, DeGuehery K, Mazur P, Li V, Shaffer ML. Preventing abusive head trauma among infants and young children: a hospital-based, parent education program. *Pediatrics.* 2005;115(4). Available at: [www.pediatrics.org/cgi/content/full/115/4/e470](http://www.pediatrics.org/cgi/content/full/115/4/e470)
19. Jenny C, Hymel KP, Ritzen A, Reinert SE, Hay TC. Analysis of missed cases of abusive head trauma [published correction appears in *JAMA.* 1999;282(1):29]. *JAMA.* 1999;281(7):621–626
20. Jones R, Flaherty EG, Binns HJ, et al. Clinicians’ description of factors influencing their reporting of suspected child abuse: report of the Child Abuse Reporting Experience Study Research Group. *Pediatrics.* 2008;122(2):259–266
21. Flaherty EG, Sege RD, Griffith JL, et al. From suspicion to report: primary care clinician decision-making. *Pediatrics.* 2008; 122(3):611–619

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