



# UNDERSTANDING ABUSIVE HEAD TRAUMA IN INFANTS AND CHILDREN

Answers from America's Pediatricians

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™



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# ABOUT US

## AMERICA'S PEDIATRICIANS

The American Academy of Pediatrics (AAP) is a professional membership organization of 64,000 primary care pediatricians, pediatric medical subspecialists, and pediatric surgical specialists dedicated to the health, safety, and well-being of infants, children, adolescents, and young adults.

## POLICY AND CLINICAL GUIDANCE

AAP recommendations form the basis of pediatric preventive health care. The AAP issues policy statements, clinical reports, technical reports, and practice guidelines on a broad range of topics.

## ADVOCACY

Advocating for all infants, children, adolescents, and young adults, the AAP works with government, community, and other stakeholders to promote child health and safety.

## PUBLIC EDUCATION

The AAP produces numerous patient education resources and books, as well HealthyChildren.org, which offers health advice for parents and caregivers. The AAP works extensively with the media and carries out public information campaigns to ensure that timely, accurate messages and information reach families and professionals engaged in the care and well-being of children.

## PROFESSIONAL EDUCATION

Ongoing education of pediatricians is a cornerstone of promoting optimal care for children. Continuing medical education (CME) is a major activity of the AAP. Member pediatricians participate in a variety of educational formats, including live, print, and online lifelong learning activities.

## AUTHORS

Based on AAP policy and the most up-to-date research on this issue, this resource was developed by:

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## WHAT IS ABUSIVE HEAD TRAUMA (AHT)?

- Abusive head trauma (AHT) is a well-recognized constellation of brain injuries caused by the directed application of force to an infant or young child, resulting in physical injury to the head and/or its contents.<sup>1</sup> Approximately 20/100,000 children sustain AHT annually.<sup>2,3</sup>
- Physicians from distinct fields including pediatrics, neurology, neurosurgery, ophthalmology, critical care medicine, radiology, neuroradiology, and physiatry have contributed to the scientific data that support AHT as a firmly established medical diagnosis.<sup>4,5,6,7,8,9,10,11</sup> The clinical diagnosis of AHT has been confirmed by pathologists, forensic pathologists, and neuropathologists through autopsies and postmortem research.<sup>12,13,14,15,16</sup>
- Extensive peer-reviewed medical literature regarding AHT over the past 50 years<sup>17</sup> and clinical experience and reasoning by thousands of physicians leave no doubt that infants and young children sustain head and brain injury—sometimes severe, sometimes fatal—by caregivers.
- In 2009, the AAP published a policy statement, “Abusive Head Trauma in Infants and Children,” that briefly reviewed the mechanisms and pathophysiology related to AHT and called for physicians “to use the term abusive head trauma rather than a term that implies a single injury mechanism, such as shaken baby syndrome (SBS), in their diagnosis and medical communications.”<sup>18</sup> The goal of the statement was “not to distract 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.” This policy statement has been mischaracterized in subsequent legal and medical literature and in court testimony to suggest that the AAP no longer recognizes shaken baby syndrome as a legitimate diagnosis.<sup>19,20</sup> On the contrary, the AAP reinforces the fact that shaking is an important contributor to abusive head injuries and that shaken baby syndrome is a subset of AHT. Additionally, since the release of this statement, peer-reviewed medical literature—including case reports in which adults have admitted shaking an infant or child—has been published and further underscores the significance of shaking as an important contributing mechanism of injury.<sup>5</sup>

## WHAT IS ABUSIVE HEAD TRAUMA (AHT)?

- There is no legitimate medical debate among the majority of practicing physicians as to the existence or validity of AHT/SBS. The only real debate and controversy appear to be in the legal system and the media. Claims that shaking is not dangerous to infants or children are not factual and are not supported by AAP policy, despite being proffered by a few expert witnesses in the courtroom. Alternative hypotheses have been offered by a few physicians and others, but the evidence for these hypotheses is lacking. Several experts who have published and testified regarding alternative theories of AHT causation have conceded in recent medical publications that infants can be damaged or killed by violent shaking or abuse.<sup>21,22</sup>
- It is unequivocally clear that inflicted head injury is a relatively common and clearly defined entity and that a differential diagnosis, including medical diseases that can mimic AHT/SBS, can be evaluated by physicians objectively.

# IDENTIFICATION OF AHT-RELATED INJURIES

- AHT in children is diagnosed through a thorough history, physical examination, laboratory tests, and imaging studies. Experienced pediatricians have been trained in making these diagnoses; often they consult with specially trained, board certified child abuse pediatricians.
- Infants who have sustained AHT typically present for medical care with symptoms of their injury, with or without a history of preceding trauma. Physicians rely on information provided by parents and caregivers in their diagnostic process, and in cases of child abuse, the history is often incomplete or incorrect. In all cases, the history provided is critically important, because it is the first step in a thorough diagnostic evaluation. The identification of injury, either by physical examination or radiography, often alerts the physician to the possibility of injury to the child.
- Subdural hematomas (SDHs), with concomitant brain injury, and retinal hemorrhages (RHs), with or without additional injury, including spinal,<sup>23</sup> skin, and skeletal injuries,<sup>24,25</sup> are the hallmarks of child abuse and AHT, although individually these findings are not specific for the diagnosis.
- Children sustaining AHT may be injured in a number of ways, including shaking, blunt impact, suffocation, strangulation, and others. Children with minor injury may never receive medical care; some are harmed repeatedly before they receive medical attention<sup>5</sup>; others present for medical care with mild or nonspecific symptoms but are misdiagnosed by unsuspecting physicians, only to return with more severe or fatal injury.<sup>10,26</sup>

## SUBDURAL HEMATOMA (SDH)

- Subdural hematoma is the medical term for bleeding inside the skull but outside the brain. SDH, most commonly attributable to trauma in infants, children, and adults, is found in the majority of victims of AHT,<sup>2,13,27</sup> and the majority of neurologically symptomatic SDHs identified in infants and toddlers are the result of child abuse.<sup>28</sup> The extent, location, and size of SDHs are variable, and SDHs can result from accidental or abusive trauma and secondary to medical disease.<sup>29</sup> A thorough medical evaluation typically includes the consideration of known mechanisms.

## IDENTIFICATION OF AHT-RELATED INJURIES

- Although SDHs are not exclusive to abusive trauma, a number of prospective studies have demonstrated a significant and strong association of SDH with abuse compared with accidental injury,<sup>30,31</sup> and additional support is found in a number of retrospective clinical and radiologic peer-reviewed studies.<sup>32,33,34</sup> Multiple studies examining SDH and abuse found in the pediatric, pathologic, and radiologic literature have produced similar results showing a robust statistical association of SDH with child abuse, and there is no published, peer-reviewed clinical study that concludes differently.<sup>17</sup>

### RETINAL HEMORRHAGES (RH)

- Bleeding in the back of the eye, known as retinal hemorrhages, are often found in infants with AHT. RHs can result from medical disease or trauma, including accidental or birth trauma, and AHT.<sup>35</sup> RHs can vary in size, number, and location within the retina itself. The physical mechanism(s) leading to the development of RH are likely multifactorial, with traction forces on the retina coupled with other factors, contributing to the severe RH often seen in victims of AHT.<sup>36,37</sup>
- Although mild and moderate RHs are seen in a number of medical and traumatic conditions in children,<sup>38</sup> clinical and pathological studies have shown strong associations of severe RH with AHT.<sup>8,39</sup> In recent years, 2 systematic reviews of the literature, comprising more than 30 clinical studies and thousands of children, confirm the strong association of severe RH with AHT.<sup>6,40</sup> Additionally, studies examining the contributions of cardiopulmonary resuscitation,<sup>41,42</sup> seizures,<sup>43,44,45</sup> Valsalva pressure from coughing or vomiting,<sup>46,47</sup> and increased intracranial pressure attributable to medical disease<sup>48</sup> in children have failed to identify any association with severe RH.
- When severe RH is identified in a child, the cause is almost always severe head trauma leading to neurologic compromise and brain injury. Like SDH, robust literature supports the association of severe RH and AHT, and although there are medical diseases that can rarely lead to extensive RH,<sup>38</sup> there is no published literature that refutes the association of severe RH and AHT.

# IDENTIFICATION OF AHT-RELATED INJURIES

## **HYPOXIC ISCHEMIC ENCEPHALOPATHY (HIE)**

- Hypoxic ischemic encephalopathy, injury to the brain caused by lack of oxygen and blood flow to the brain, is a common feature of AHT and is largely responsible for the poor outcomes of victims.<sup>49</sup> The pathophysiology for HIE in victims of AHT is multifactorial and includes traumatic axonal injury to the brainstem and spinal cord, apnea (inadequate breathing) attributable to injury, seizures, alterations in blood flow to the brain after trauma, unmet metabolic demands of the injured brain, secondary cerebral edema (brain swelling), and others.<sup>50</sup> Potential causes of HIE in infants and children include birth asphyxia, accidental or intentional trauma or suffocation, infection, metabolic disease, congenital anomalies, drowning, and choking.
- Over the past decade, a few researchers have postulated that SDH in victims of AHT results from hypoxia, brain swelling, and raised intracranial venous pressure leading to vascular leakage from immature dural vessels,<sup>51,52,53,54</sup> although clear evidence to support this hypothesis is lacking. Other investigators who have tested this hypothesis have not found SDH in children with HIE from known causes,<sup>55,56,57,58</sup> including neonates who have sustained perinatal asphyxia.<sup>59,60,61</sup>



## AHT AND THE TRIAD

- Arguments against the validity of AHT/SBS have recently focused on the specificity of a “triad” of subdural hematoma, retinal hemorrhage, and encephalopathy that is claimed to be diagnostic of AHT. This controversy regarding a triad is a “straw man” created for legal arguments against the diagnosis of AHT/SBS. The diagnosis of AHT is made following detailed medical examinations and testing and is not made automatically on the basis of the presence of these 3 findings, nor can it be excluded if 1 or more of these elements is missing.
- In all cases, a diagnosis of child abuse requires careful consideration of all clinical facts, including the medical history, physical examination findings, and laboratory and radiologic testing. For some children, the identification of additional injury confirms the diagnosis of injury and child abuse. In others, known medical diseases are identified and abuse is eliminated from consideration. In some cases, additional investigation by law enforcement or child protective services uncovers information that supports or refutes accidental or abusive injury. In many cases, adult caregivers confess that they injured the infant themselves; these cases do not garner media attention.
- Children who are victims of AHT require protection. Adults who injure children sometimes require prosecution, and courts are then faced with the challenge of weighing medical testimony to find justice. In this, like other scientific arenas, the courts must be careful to distinguish between scientifically supported evidence and evidence based on untested hypotheses.
- In medicine, astute clinical observation and careful research advance our modern understanding of the human body. This is true in every field of medicine, including child abuse pediatrics. Studies to improve the understanding of causation, pathophysiology, and treatment of AHT are ongoing, and clinically tested hypotheses continue to lead to improvements in treatment and prevention. The medical research regarding AHT is extensive and comprises more than 1000 peer-reviewed clinical medical articles written by over 1000 medical authors from more than 25 different countries.<sup>17</sup>
- Alternative medical diseases requiring consideration have been identified, are known to practitioners, and are diagnosed by history, physical examination, and adjunct testing. On the other hand, the new hypotheses presented to refute the diagnosis of AHT are, to date, largely untested and unconfirmed. Some are presented only in the courtroom as alternative diagnoses, not in clinical practice in children’s hospitals throughout the country. Although there is always “new science,” the accumulating evidence underscores, rather than refutes, the reality of AHT.

## AHT AND THE TRIAD

- The validity of AHT in all of its various forms has been established. The diagnosis is recognized by the following organizations:
  - The American Academy of Pediatrics
  - The American Academy of Family Physicians
  - The American Academy of Ophthalmology
  - The American Association for Pediatric Ophthalmology and Strabismus
  - The American Association of Neurologic Surgeons
  - The American College of Radiology
  - The American College of Surgeons
  - The Canadian Paediatric Society
  - The Centers for Disease Control and Prevention
  - The Royal College of Ophthalmologists
  - The Royal College of Paediatrics and Child Health
  - The Royal College of Radiologists
  - The World Health Organization

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