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SPECIAL ISSUE: ABUSIVE HEAD TRAUMA

International issues in abusive head trauma

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Abstract In the decades since Dr. John Caffey described a series of children with chronic subdural hematoma and long bone fractures, there has been a substantial increase in the medical recognition of various forms child abuse. In the United States, the term shaken baby syndrome was coined to explain a constellation of injuries assumed to be the result of violent shaking of infants. After improved understanding of the variety of mechanisms that occur when children are abused, abusive head trauma (AHT) has become the recommended terminology. AHT is a more comprehensive term that reflects the brain injuries that children suffer as the result of abuse. AHT continues to include shaking as a mechanism of injury as well as shaking with impact, impact alone, crushing injuries or combinations of several mechanisms. The medical community in the United States has led the way in developing new terminology and research to describe this unique and devastating form of abuse. The globalization of medicine and rapid information transfer has resulted in AHT becoming well-recognized internationally as a form of serious and fatal child abuse. This paper will review the historical basis in the United States for the diagnosis of AHT. We will also review some of the current international issue in epidemiology, diagnosis, legal processes and outcomes in selected countries/regions where child abuse physicians are actively involved in the evaluation of AHT.

Keywords Abusive head trauma · Non-accidental injury · Child

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Introduction

The recognition of child abuse as a medical diagnosis in the United States was ushered in with the publication "The Battered Child" by C. Henry Kempe more than 50 years ago [1, 2]. This paper was a catalyst for much of the medical, legal and child welfare approach to child physical abuse in the United States. In the years since that important publication, many different forms of child abuse have been recognized and described. Researchers from a variety of disciplines within medicine have focused on the diagnoses, treatment, outcomes and medical-legal issues surrounding the diagnosis of child abuse.

One of the earliest descriptions in the medical literature describing brain injury resulting from abuse was that by the French pathologist Ambroise Tardieu in 1860 [3]. He described bloody effusions over the brain in children who had been subjected to severe violence. He attributed these injuries to blows to the head. Throughout the following century, descriptions of children in the medical literature with subdural hematoma, fractures and even retinal hemorrhages were often attributed to vitamin deficiencies or poor social environments. Foster care, lack of supervision and nurturance were often implicated in suboptimal social settings. Trauma was suspected, but abuse was not explicitly discussed [4].

Dr. John Caffey, an American pediatrician turned radiologist who had extensively studied the radiology and pathology of the skeleton in children, recognized a unique subset of children as early as 1946 with a combination of traumatic

long-bone injuries and chronic subdural hematoma [5]. These children had appeared to suffer from trauma to the brain and extremities, yet there was no history of such trauma provided by caregivers. He published his first analysis of these cases in that year without specifically ascribing those injuries to abuse. His continued study of this population was described in the Howland Award Address published in 1965. Caffey advocated that a trauma history was frequently lacking in children who presented with clear evidence of injury, and in those cases abuse was a likely diagnosis [6]. He gave significant credit to the work of another American pediatric radiologist, Dr. Fred Silverman, a coauthor with Kempe in "The Battered Child." Silverman went on to give a sentinel Rigler Lecture where he attributed the early works of Tardieu as contributing to the basis of his work in child maltreatment. In France, medical providers frequently referred to child abuse as "Le Syndrome de Silverman." Caffey also coined the term "the parent infant traumatic stress syndrome" (PITS) in 1972. In this paper, he described the actions of a baby nurse who violently shook, killed and permanently maimed several children in her care [7]. Further recognition of Caffey's work resulted in a 1972 Abraham Jacobi Award address entitled "On the theory and practice of shaking infants: Its potential residual effects of permanent brain damage and mental retardation" [8]. In 1974, Caffey described "The whiplash shaken infant syndrome: Manual shaking by the extremities with whiplash-induced intracranial and intraocular bleedings, linked with residual permanent brain damage and mental retardation" [9]. Hence, the term "infant shaken whiplash syndrome" was coined. Caffey continue to study and expand upon shaking as a mechanism of head trauma that was linked to developmental disabilities. A 1971 paper by British neurosurgeon Dr. Norman Gutkelch also reported on the relation of infant subdural hematoma to whiplash-type injuries caused by shaking an infant [10, 11]. The U.S. medical community referred to this condition as "shaken baby syndrome." The initial description included brain injuries associated with subdural hematoma, and with retinal hemorrhages, and no other accidental or medical explanation. Many children were also described as having skeletal and cutaneous injuries. As imaging technologies such as CT and MRI improved, not only were abusive head injuries better described but also a differential diagnosis of subdural and retinal injuries in children was developed. Head trauma due to abuse is recognized today as being caused by mechanisms including impact, shaking, crushing or a combination of several mechanisms. In 2009, the Committee on Child Abuse and Neglect of the AAP recommended that term abusive head trauma (AHT) replace mechanistically specific terminology such as shaken baby syndrome. The "syndrome" has implied that all of these children present with the same constellation of symptoms and therefore when a certain constellation is present the diagnosis is certain. It is well recognized that AHT encompasses the complex and varied ways that infants and children may present with brain and head injuries that are the result of abuse. Additional medical conditions have also been described which can confound or even "mimic" AHT. In reality, these conditions are often reviewed in the differential diagnosis and can be determined quite readily with radiological and laboratory studies by physicians knowledgeable in pediatric, radiology, neurology, neurosurgery, ophthalmology, pathology and other specialities.

Since Caffey's sentinel paper, hundreds of studies on various aspects of AHT have been published. Publications in pediatrics, radiology, neurosurgery, neurology, ophthalmology and pathology, to name a few, have expanded the knowledge base and demonstrated specialty specific areas that address AHT. With the globalization of medicine, rapid communication technologies and emerging networks of child abuse specialists, AHT is recognized worldwide. More recently, international groups have published papers in both U.S. and foreign medical journals that address AHT issues in their respective countries. This paper will focus on a selection of international issues that face physicians in selected countries/regions of the world.

In the United States, the child welfare system and criminal justice approach to AHT has influenced both the investigation and legal outcomes of children who are diagnosed with AHT as well as all forms of maltreatment. Medical and legal systems that mirror that of the U.S. and are based upon English common law, such as the United Kingdom, Australia and New Zealand, appear to have common approaches to the problem. In contrast, countries in northern and Western Europe may have a well-developed medical approach yet the legal systems may be less punitive and more restorative than that seen in the United States. Middle Eastern countries may have limited child welfare and investigative professionals but within their well-developed western medical system AHT is recognized and treated. Physicians practicing in different countries often approach the social and legal aspects of AHT differently based upon their respective laws, social welfare and law enforcement systems. Additionally, countries in the developing world may be experiencing such problematic yet basic issues that are a threat to childhood, such as infant mortality, clean water and vaccine preventable illnesses, and have yet to focus on child maltreatment.

Worldwide epidemiology of AHT

Measuring the incidence of AHT worldwide has limitations including errors in ascertainment and definitions. However, such analyses done in widely disparate regions have shown strikingly similar results. A New Zealand study by Kelly [12] retrospectively and prospectively reviewed cases that came to medical attention. The annual incidence of inflicted subdural hematoma in infants, ranged from a minimum of 14.7 to 19.6/

100,000. When Maori children were analyzed separately, the range was 32–38.5/100,000. A study from Scotland by Barlow [13] reported an incidence of 24.6/100,000 children younger than 1 year of age. A North Carolina study, which prospectively assessed Pediatric ICU patients in that state who had been diagnosed with AHT, reported 17/100,000 in children younger than 2 years. In this study, if only children younger than 1 year of age were included, the incidence increased to 29.7/100,000 person-years [14]. A small retrospective and prospective study of AHT from Estonia suggested that the incidence in that country during the study period 1997–2003 was 28.7/100,000 children up to age 1 year [15]. Such studies are likely an underestimate because any analysis requires that children first are recognized as having a head injury and secondly that injury is determined to result from abuse. Children who may be shaken in a manner that does not lead to symptoms may never be counted in such incidence studies. For example, a 1995 Gallup poll survey reported that 4.4% of parents of children younger than 2 years of age shook their children as a means of discipline [16]. A 2002 anonymous telephone study of parental discipline practices in North and South Carolina revealed that 2.6% of parents of children younger than 2 years of age said they had shaken their child as a form of discipline [17]. International surveys of parental discipline suggest that shaking is a frequent disciplinary strategy worldwide, and may be a leading cause of infant mortality and morbidity throughout the world [18].

The following section will review some aspects of international AHT that are specific to countries where leading pediatricians and other professionals have been instrumental in addressing AHT. Medical and legal aspects of AHT may pose challenges in these international settings.

New Zealand and Australia

Both Australia [19] and New Zealand [20, 21] have published series with the typical characteristics of abusive head trauma, including a series of perpetrator confessions [22, 23]. A prospective study from New Zealand described a national incidence similar to figures from the United States, although the rate was particularly high among Maori (the indigenous population) [12]. More recently, a study of autopsy findings over 20 years suggested that while the rate of accidental death from head injury in New Zealand infants is going down, the rate of death from AHT may be going up [24]. There are no national incidence figures for Australia. A recent study from Queensland reported an incidence somewhat lower than New Zealand, but again noted that the incidence may be significantly higher in the indigenous population, which (as in New Zealand) probably reflects the many downstream negative effects of colonization on indigenous populations [25].

Australia and New Zealand have both experienced high-profile cases of child abuse, many of which have involved abusive head trauma in infancy. The most high-profile case in recent years in New Zealand involved a pair of twins who were both fatally injured at the same time. Their father was acquitted in criminal court, but at the Coroners' Inquest it was determined that the twins sustained their injuries while in his sole care. This difference in outcome drew attention to the high standard of proof required to prove a criminal charge "beyond reasonable doubt" (http://www.stuff.co.nz/dominion-post/news/7342374/Coroner-blames-Chris-Kahui-for-twins-deaths), and contributed to a recent law change which created a new offence of "failure to protect" (http://www.legislation.govt.nz/bill/government/2013/0150/latest/DLM5501618.html). Research from New Zealand into the legal outcome for two separate cohorts (1988 to 1998, and 2004 to 2008) showed that criminal charges were brought in about half the cases, but the rate of conviction was only 36% [26, 27]. Similar legal outcomes are described in Australia (http://www.abc.net.au/news/2009-09-17/shaken-baby-cases-rarely-prosecuted/1433070). The same controversies seen in the United States are seen in New Zealand and Australian courtrooms (http://www.heraldsun.com.au/news/opinion/shaken-babies-room-for-doubts/story-e6frfhqf-1226073640796), with a variety of controversial witnesses being brought to both countries to appear for the defense. One of the most famous (or infamous) negative reviews of the orthodox scientific literature on AHT was written by an Australian doctor [28], and an Australian scientist has been a lead proponent of the idea that some cases of diagnosed AHT are actually a vaccine reaction (http://www.laleva.cc/choice/vaccines/vaccination_nexus.html). Conversely, Australian ophthalmologists recently produced a comprehensive systematic review supporting the strongly positive relationship between severe retinal hemorrhage and abusive head trauma [29].

New Zealand data suggest that many survivors are at risk of repeated renotification for other forms of child maltreatment for many years after their episode of AHT [26]. New Zealand has also provided the most comprehensive and precise estimate of the cost of AHT in the literature to date, with a minimum average cost to the nation per child of at least $1 million [27].

There are no published Australian or New Zealand studies on the number of missed cases of abusive head trauma, but one series from Sydney has been described in abstract form (http://www.conferencedesign.com.au/acem2012/abstracts/stephens2.html). Both countries have had highly publicized cases of missed cases of child abuse with the later death of the child involved. In New Zealand, one such case led to initiatives including national family violence screening strategy (http://www.scoop.co.nz/stories/PA0006/S00570/ministry-reacts-to-james-whakaruru-recommendations.htm) and a national Child Protection Alert system (http://www.paediatrics.org.nz/files/CPSIGNewsletterSeptember2012.pdf).

Shaken baby prevention programs have been initiated in Australia in New South Wales [30], South Australia, Queensland [31] and Western Australia (http://www.healthinfonet.ecu.edu.au/key-resources/promotion-resources?lid=14741), and a national Shaken Baby Prevention project is being rolled out in New Zealand (http://www.kidshealth.org.nz/shaken-baby-syndrome). There has not been any formal evaluation of outcome to date, but the program from New South Wales has been adapted for use in Hungary, Greece, Brazil and Turkey.

New Zealand recently introduced a new "Vulnerable Children's Bill," which will make major law changes (http://www.legislation.govt.nz/bill/government/2013/0150/latest/DLM5501618.html), including a requirement that the chief executives of the ministries of health, education, justice, police and social development develop a "Vulnerable Children's Plan" and report annually to the government on the progress they are making collaboratively to protect vulnerable children. New Zealand does not have mandatory reporting of child abuse, whereas Australia does. However, there is wide variation in child protection legislation across Australia. Australia has struggled with the issue of child maltreatment among aboriginal populations, especially in the Northern Territory [32]. A major challenge in both countries is the education of front-line staff in the recognition and response to child maltreatment and family violence, and it is clear that a formal "organizational change approach" is necessary if this is to be achieved [33].

United Kingdom

The United Kingdom has followed the United States in many ways and has a research foundation both in support of and against the concept that AHT, especially AHT caused by shaking. In the past decade there have been high-profile attacks on the science and clinical aspects of AHT as well as the physicians who work in child protection. The press in the United Kingdom has reported extensively questioning the validity of the diagnosis of shaken infant syndrome. The attack on this diagnosis, along with a few high-profile cases, resulted in an extensive review by the Court of Appeal of England of several hundred convictions due to shaken baby syndrome. The press had widely reported that this review would result in one of the biggest miscarriages of justice in British Legal History and that scores of convictions would be overturned. The Attorney General Lord Goldsmith's review of 88 cases resulted in just a handful of convictions that were examined and 3 were referred to the Court of Appeal where 2 were overturned. Intimidation of pediatricians involved in Child Protection work in the United Kingdom has been felt to discourage physicians from becoming trained and practicing in Child Protection work [34, 35].

Saudi Arabia

Abusive head trauma and shaken baby syndrome are often used interchangeably by medical and other professionals in Saudi Arabia to describe cases of inflicted head trauma regardless of the injury mechanism. It reflects the focus of professionals on the abusive nature of the injury rather than using the term describing its mechanism.

Abusive head trauma was first recognized in Saudi Arabia in 1994 [36]. At that time, several case reports were made describing the diagnostic challenges and social services and law enforcement responses [37–39]. Recently, hospital-based Child Protection Centers (CPCs) were established and became the main source of data on child maltreatment cases including abusive head trauma [40–42]. The annual reports from the national hospital-based registry showed that abusive head trauma represents 5% of reported physical abuse cases [43]. It is the most common internal injury and the leading cause of death in child maltreatment cases [40]. The incidence rate is 22 cases per 100,000 deliveries. The review of 24 cases of abusive head trauma (33% of them were shaken baby syndrome) reported during the past 5 years to one of the major CPCs showed the median age for children was 10 months with equal gender distribution. One-half of the children were admitted to intensive care units. Altered consciousness, seizure and vomiting were the most common presentations. Subdural hemorrhage was found in 50% of the cases and facial bruises and retinal hemorrhages were noted in one-third of the cases. The majority of suspected perpetrators were male (60%), unemployed and/or had low levels of education. The mortality rate was 25%, and 70% of surviving children were discharged with moderate to severe neurological deficits.

The diagnosis of abusive head trauma remains a challenge for medical professionals in Saudi Arabia due to lack of knowledge about diagnostic criteria. Moreover, professionals at CPCs only report highly suspected cases in which severe injuries were sustained, or in cases where allegations were made against a possible perpetrator. The lack of confession or serious allegation and the absence of external injuries usually make investigating agencies (social services and law enforcement) less intense in their investigations if reported at all by the CPCs. The above challenges with medical, social and law enforcement responses to abusive head trauma cases were predominantly due to the knowledge gap that the National Family Safety Program is trying to overcome through widespread multidisciplinary training courses as well as advanced courses directed at health care professionals, social workers, judges, prosecutors and law enforcement officials [42, 44].

Until now, abusive head trauma prevention programs did not exist in Saudi Arabia. Results of a pilot awareness program directed at new parents showed that 77% of participating parents had no previous knowledge of abusive head trauma and shaken baby syndrome risk factors, mechanisms and complications. They were able to recall at least 50% of the program's content after 6 months. At that time, none of the infants whose parents were educated had abusive head trauma [45].

Scandinavia (Sweden, Norway, Denmark)

The Scandinavian countries of Sweden, Denmark and Norway are characterized as having the most extensive and robust child welfare systems in the world. These countries, beginning with Sweden in 1979, led in enacting legislation banning the use of corporal punishment of children. The legislative context regarding child abuse in Scandinavian countries draws heavily on compliance with the U.N. Convention of the Rights of the Child (CRC). In Norway, the CRC was incorporated into national law in 2003, and there is an ongoing discussion and government evaluation on incorporation of the CRC into Swedish legislation. Health professionals are mandated by law in all three countries to report cases of suspected child abuse to child protective authorities.

Researchers in a recent publication reported lower rates of child physical abuse in Sweden in comparison with those in other developed countries, such as the United States [46]. The investigators attribute the lower rates to the fact that Sweden has a lower percentage of children living in poverty and provides higher levels of universal support for parents. There are no population-based studies that report the incidence of abusive head trauma, and no national incidence studies on abusive head trauma have been published in the peer-reviewed literature in any of the Scandinavian countries. In Norway, researchers published a retrospective case series of infants and toddlers admitted with traumatic head injury to a tertiary intensive care unit [47]. In this study, the investigators found, among the children studied, characteristics that distinguished inflicted from accidental injury consistent with those reported in the international literature.

In Denmark and Sweden, forensic physicians who are in the employ of a national forensic agency have the primary responsibility to conduct forensic medical investigations and to present evidence in criminal court proceedings, even with regard to living children. Pediatricians are challenging the concept that only forensic physicians can enter reports into the courts. A recent study out of Sweden shows that the proportion of children who undergo a medical or forensic evaluation when there is a police report of suspected child physical abuse is low, even in cases where there are allegations of severe injury. The rate of prosecution of these cases is concurrently low [48].

In a Swedish study, researchers retrospectively examined medical records of infants presenting to a large pediatric emergency department with head injury, and who had a CT of the head performed on admission [49]. The investigators found that 22 (54%) of 41 identified infants had a history that should have prompted suspicion of abusive head injury; only 5 children underwent an evaluation for abusive head trauma. The authors concluded that the front-line ED staff documentation concerning identification of abusive head trauma was deficient.

In a Swedish national survey of residency directors responsible for pediatric graduate medical education, researchers asked whether pediatric residents and recent graduates received training in child abuse and neglect [50]. The authors found that 35% of recent graduates and 27% of current pediatric residents had received child abuse training, suggesting insufficient in-service graduate education. The authors suggest that lack of training on child abuse and neglect may result in poor management and a low identification rate of vulnerable children within the Swedish health care system.

The supervisory health authorities to date in Sweden have published no national guidance on the medical evaluation and diagnosis of abusive head trauma. However, Stockholm County Council published clinical guidance on abusive head trauma and the document has been adapted for use in other parts of Sweden [51]. The term shaken baby syndrome is widely used among professionals and media in Sweden, though abusive head trauma has been gaining more acceptance.

As in other countries, legal challenges to the concept of shaking as a form of abusive head trauma have reached Scandinavia. In 2013, the Swedish Supreme Court overturned the conviction and granted a retrial in two high-profile cases of abusive head trauma [52, 53]. In both cases, defense experts from the United States and United Kingdom presented alternative theories.

Conclusion

The international challenges of diagnosis, legal interventions and outcomes and ultimately prevention depend upon the medical resources and training of medical professionals in that country, level of recognition of the problem. Many Western countries are faced with challenges to the diagnosis in the legal system that have not served the interests of abused children. Such challenges have only increased the adversarial nature of the such proceedings. Highly paid defense experts,

mostly from the United States and the United Kingdom, travel internationally to refute and challenge a diagnosis that has a strong history and evolution of research to support its basis. The focus should, however, be rooted in quality research from all fields, including comprehensive clinical assessments, using multidisciplinary approaches that results ultimately in protecting children who have been abused and preventing future abuse. If, internationally, we can accomplish this, much would be gained for children and families.

Conflicts of interest None

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