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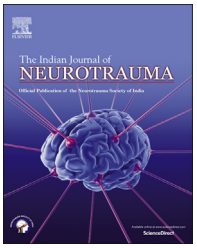

Review Article

The importance of recognizing abusive head trauma in the neurosurgical setting

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ABSTRACT

Abusive head trauma (AHT) occurs due to an intentional abrupt impact and/or violent shaking leading to an injury to the skull or intracranial contents of a baby or child, usually younger than 2 years of age. Without impact, there may be no external signs of head trauma. It is the leading cause of mortality in children who have suffered intentional physical abuse. It is more likely to occur in very young children with an estimated prevalence of 1 per 3000 in infants under 6 months of age. Studies have highlighted that distressed and exhausted parents can sometimes shake their infant in desperation and parental education has been shown to decrease the incidence of AHT. Clinicians dealing with children who presents with traumatic brain injury (TBI) should always consider the possibility of AHT. AHT is classically characterized by a triad of signs; subdural hematoma, brain edema, and retinal hemorrhage, however, non-specific features may also be seen in clinical practice both acutely or subsequently. Certain neuroradiological findings (subdural hemorrhages, multiple interhemispheric convexity and posterior fossa hemorrhages, hypoxic-ischemic injury and cerebral edema) are suggestive of AHT in young children. Associated spinal injuries can be easily missed and it is important to investigate for this. This review article includes 2 illustrative case studies and gives a comprehensive overview of AHT in children which we hope will be useful for neurosurgeons in their clinical practice. Child protection is everyone's responsibility and is best achieved when different specialties and professionals work together.

1. Introduction

Injuries are common in children and according to a report from the World Health Organization (2002) trauma is the 6th leading cause of morbidity and mortality in childhood.[1] Although most injuries are sustained accidentally, it is important that clinicians managing children's injuries remain aware of the possibility of a non-accidental cause. Research suggests that nearly 7% of children suffer from some form of physical abuse during their childhood[2] and abusive head

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trauma (AHT) is the leading cause of mortality amongst the victims of child physical abuse.[2,3]

The Centers for Disease Control and Prevention of the United States (CDC) has defined AHT 'as an injury to the skull or intracranial contents of a baby or child younger than 5 years due to intentional abrupt impact and/or violent shaking'.[4]

The concept of AHT in children is not new. It was Caffey in 1974 who first used the term whiplash-shaken infant syndrome to describe the association of intracranial injuries, retinal hemorrhage, and certain long bone fractures attributable to child abuse among infants (majority being under 1 year of age).[5–7] Over the last 40 years different terminologies has been used and this includes 'shaken baby syndrome', 'shaken impact syndrome', 'infant whiplash-shake injury syndrome', 'intentional head injury', 'non-accidental head injury'.[8,9]

While pediatricians in the developed world, and to a certain extent in developing countries, are alert to the possibility of inflicted trauma in children, it may not always be the case for other clinicians who infrequently deal with children in their clinical practice.[8] The electronic media and medical literature in India has recently highlighted reports of a number of serious cases of child physical abuse, some resulting in death, which have gained international attention.[10,11] This article aims to highlight some of the different presentations of AHT in children, illustrated by two cases, and gives some guidance on working together to keep children safe.

2. Incidence

Recent studies from the USA suggest that more than 120,000 children annually become victims of child physical abuse. This accounted for the deaths of more than 600 children in 2009 in the United States.[3] AHT affects ~ 1 in 4000–5000 infants every year. It is estimated that in the UK every year 20–24 per 100,000 infants under the age of a year are diagnosed with AHT.[8] This figure increases to 36/100,000 in infants aged <6 months[12] with an estimated prevalence of 1 per 3000 in infants under 6 months.[13] Similar incidence of 29.7 per 100,000 was also reported from the USA.[3]

In a study in Queensland, Australia over a 4 year period (2005–2008), the average annual incidence of AHT was 6.7 cases per 100,000 and infants under 12 months, and male infants were noted to be more vulnerable.[14] In a study of 3061 children (aged < 5 years) in China with traumatic brain injury studied over 10 years, AHT was suspected in 140 children and 68.6% of AHT occurred in infants aged less than 1 year.[15] In a prospective study of 225 pediatric injuries (aged 2 months–12 years) from the All India Institute of Medical Sciences, New Delhi (March 2006–February 2007), child abuse was identified in 7/225 cases (3.5%).[1] Although accurate figures are not available for the Indian subcontinent, it is presumed not to be too dissimilar.

The financial implications of AHT are immense; estimates showed that initial inpatient hospitalization costs averaged $18,000 to $70,000 per child, and long term management costs exceeded $1 million in 1 case.[9]

Some important and interesting statistics are highlighted in Box 1; this show that incidences of AHT are more common than we anticipate and this is also equally relevant to neurosurgical practice.[13,12,16–19]

Box 1
Important statistics and facts worth considering while dealing with TBI in children.

- A population-based study conducted in south Wales and the southwest of England found that the majority of subdural hemorrhages in children less than 2 years of age were due to child abuse.
- It is estimated that approximately 12 children per 100,000 under the age of 2 years suffer from non-accidental subdural hemorrhage, and at least half of these injuries are related to shaking.
- A survey of 83 mothers in east London found that as many as 1 in 9 mothers had shaken their baby and 2 in 9 had felt like shaking their baby.
- An American study reported that 2.6% of parents admitted to have shaken a child under the age of 2 years and 9% felt like shaking their infant.
- A study of AHT in the Lothian Region of Scotland (1998–2006) found that 64% cases of AHT occurred in the most deprived quintile of the region's population.
- An American study highlighted an increase in the overall rate of AHT noted during 19 months of economic recession from 8.9 per 100,000 (noted in preceding 47 months before recession) to 14.7 per 100,000.
- In a study of 715 autopsies in infants aged <1 year over 50 years in Germany, out of 15 trauma related subdural hemorrhage, 14/15 were related to AHT.

3. Why knowledge of AHT is important for neurosurgeons?

The structure for healthcare delivery differs between countries. The initial presentation of TBI (including cases of AHT) may not always initially present to pediatric services. It is possible that a significant proportion of children with TBI will present directly to neurosurgical teams, sometimes without the involvement of pediatricians. Clinical teams dealing with TBI, some of which may be due to an abusive cause, have a responsibility to undertake a comprehensive assessment of the child, always considering the possibility of a deliberately inflicted injury, and should remain familiar with the scientific evidence that will help enable them to put the pieces of jigsaw together to support their clinical opinion.[8] It needs to be remembered at all times that the welfare and safety of the child is of paramount importance and in cases where the history is suggestive of deliberately inflicted injury, or where the mechanism of injury remains unclear, it may be relevant that neurosurgical teams seek opinion from pediatricians with expertise in child protection.

4. When to suspect child abuse?

Clinicians working with children need to consider possibility of AHT if the mechanism of reported injury does not correlate

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