



CORE - INFO:
**Head and spinal
injuries in children**

Introduction

This leaflet summarises what is currently known about the clinical presentation of abusive head trauma (AHT) and spinal injuries in children.

It will be of particular interest to:

- emergency department staff
- paediatricians
- general practitioners
- health visitors
- child protection conference chairs
- safeguarding leads
- children's services team managers
- independent reviewing officers
- local authority designated officers
- children's social workers
- police
- legal practitioners.

The information is based on a systematic review of all the quality work in the world literature about abusive head trauma and spinal injuries in children (1950-2013); full details are available at core-info.cardiff.ac.uk

What do we know about abusive head trauma in children?

Abusive head trauma, involving injury to the brain or bleeding within the structures around the brain is the most serious form of physical child abuse, and these have some of the most severe consequences for the child's future wellbeing. AHT is the leading cause of death among children who have been abused.

AHT may arise from shaking, shaking and impact, or impact injuries.

The condition occurs most commonly in children younger than two years of age, with an estimated prevalence of 1:3,000 in babies younger than six months. Boys appear to suffer more head injuries than girls, from any cause. Apart from children who die as a result of AHT, those who survive may have significant long-term disabilities: 31 to 45 per cent experience ongoing problems – including cerebral palsy, visual problems, epilepsy, learning and behavioural problems.

Physical abuse is rarely a single event. Many children who suffer AHT have suffered from previous episodes of physical abuse. It is vital that any suspicion of physical abuse to a baby or very young child is fully investigated to identify the condition and prevent future physical abuse of greater severity.

Once recognised, AHT must receive prompt and appropriate treatment to minimise the risk of death or serious long-term problems.



Head injury

How do I know if a child may have suffered from abusive head trauma?

Some children will present with clear signs of head injury, even if the cause is not immediately obvious. They will either be unconscious or show signs of brain injury such as fitting, paralysis or extreme irritability. However, some children may present with less obvious signs, such as increased head circumference, poor feeding or excessive crying.

Children who have suffered a traumatic brain injury from any cause may sustain a combination of injuries. Some clinical features are particularly indicative of AHT. These include rib fractures, bruising to the head and/or neck, seizures and apnoea (breathing difficulties).

It is important to look for other injuries, such as retinal haemorrhages, bruises, burns, bites, oral injuries or fractures. These need careful interpretation, as well as investigations for other possible causes of apparent brain injury, as part of the child's assessment.

Given the importance of these features, it is essential that any child where AHT is suspected should have a thorough examination to exclude such co-existing injuries. This should include an eye examination by a paediatric ophthalmologist and a skeletal survey with oblique views of the ribs, and consideration of a follow up skeletal survey (11-14 days later) if the original imaging is negative and concerns remain.

- Apnoea – periods of impaired breathing.
- Retinal haemorrhages – bleeding at the back of the eye.

What tests need to be performed to identify abusive head trauma?

If AHT is suspected in a child who is acutely unwell, then a CT scan should be performed, with a 3D reconstruction of the CT scan, to look for skull fractures. When performing this, a CT scan of the neck (cervical spine) may also be conducted. If the CT scan is abnormal, or it is normal but the child has ongoing symptoms or signs of brain injury, then an MRI scan should be performed. This will show detailed sectional images of the brain and give much more detailed information about any brain injuries present, and perhaps assist in predicting the timing of the injury (in broad terms) and the likely long-term outcome for the child.

These tests and their interpretation are highly specialised and should be reviewed by a neuroradiologist with clinical experience of these injuries.

- CT scan – computerised tomography: a radiological test to identify any acute brain injury or bleeding in or around the brain.
- MRI – magnetic resonance imaging: a detailed radiological investigation showing extent of brain injuries, including injuries due to hypoxia (low oxygen levels).

What findings on neuroimaging suggest abusive head trauma?

Brain injuries of all types are reported in AHT and accidental head injury. Studies of CT and MRI findings have shown that the features seen in AHT include areas of bleeding around the brain itself, most commonly subdural haemorrhages (SDHs), with or without subarachnoid haemorrhages (SAHs). The features that may distinguish AHT from accidental injury are:

- hypoxic ischaemic injury
- SDHs – particularly if multiple, over the surface of the brain, in the groove separating the two halves of the brain (interhemispheric), or at the back (posterior).

Damage to the brain itself from lack of oxygen and interrupted blood supply is more common in AHT than accidental head injury. This contributes to poor outcomes for these children. Extradural haemorrhages are more common in accidental head injuries.

Any child with an unexplained brain injury will, of course, require a thorough investigation – eg, for metabolic or haematological conditions, before it can be concluded that the abnormalities are due to abuse.

- Subdural haemorrhages (SDH) – bleeds over the surface of the brain between the dura mater and the arachnoid mater, the two membranes that surround the brain (the dura mater underlies the skull).
- Subarachnoid haemorrhages (SAH) – bleeds over the surface of the brain underlying the arachnoid mater.
- Extradural haemorrhages – bleeds outside the dura mater.

Spinal injury

What spinal injuries are caused by abuse?

There are increasing reports in the scientific literature of spinal injuries from physical abuse. Two patterns of injury are described:

- spinal neck injuries
- chest or lower back injuries.

When a child sustains a spinal neck injury from physical abuse they often have co-existing AHT and/or retinal haemorrhages. Neck injuries are more commonly reported in younger infants up to four months. In many cases, the spinal injury may not be immediately obvious as the injury to the brain may leave the child unconscious and difficult to assess. In some cases, the baby may be reluctant or distressed when its neck is moved, indicating the underlying injury. New research suggests that infants with abusive head trauma may have sustained injuries to the ligaments of the spine in the neck area also.

Spinal injuries to the chest or lower back are reported in older toddlers, from nine months upward, and are accompanied either by signs of spinal injury or an obvious deformity, such as spinal curvature or swelling of the lower back. Some of these children either die as a result of their injuries or are left with permanent paralysis. In addition, it is increasingly recognised that children with AHT have co-existing spinal subdural haemorrhages which extend all the way down to the lower end of the spine.

What tests should be done to identify spinal injury from physical abuse?

It is important that a child under two years with any suspected physical abuse has a full skeletal survey, which must include plain X-rays of the spine – including lateral views. If any fracture is seen or spinal cord injury is suspected, an MRI of the spine should also be performed. In light of the co-existence of spinal injury with AHT, clinicians should consider performing an MRI of the cervical spine as part of their routine assessment.

Implications for practice

- Excessive crying in babies can be difficult to manage and may make them more vulnerable to inflicted brain injury. All parents need to be advised on how to manage episodes of prolonged crying.
- Infants with abusive injuries – such as fractures, bruises, burns, oral injuries or retinal haemorrhage – should have neuroimaging for possible AHT.
- A child with abusive injuries and any signs or symptoms of brain injury – eg, if they have seizures or are unconscious – should have neuroimaging performed.
- Any child with suspected AHT must have their eyes examined by an ophthalmologist, and undergo a full skeletal survey to identify any possible occult fractures, such as rib or long bone fractures.
- Explicit recording of whether the child has suffered from apnoea or seizures should also be made.
- A child with a suspected head injury should be seen promptly by a doctor, as should any child with unexplained pain, neurological impairment, vomiting or associated injury.

National guidelines

- Standards for radiological investigations of suspected non-accidental injury. Royal College of Radiologists, Royal College of Paediatrics and Child Health. 2008: (undergoing revision 2014).
- Head Injury: triage, assessment, investigation and early management of head injury in children, young people and adults. National Institute for Clinical Excellence. 2014

Further support from the NSPCC

If you are worried about a child, the NSPCC is here to help, 24 hours a day, seven days a week, free of charge.

Phone 0808 800 5000

Email help@nspcc.org.uk

Text 88858 (Text 07786 200001 in Channel Islands, standard call rates apply)

Or visit nspcc.org.uk/help

NSPCC's information service

The NSPCC's library is the most comprehensive collection of specialist resources relating to child protection in the UK. It contains over 40,000 records and you can access it online at **nspcc.org.uk/inform**

You can also subscribe to CASPAR, a news service that signposts you to the latest policy, practice, and research in child protection.

Sign up at nspcc.org.uk/inform

To download this leaflet for free, or for printed copies of this leaflet, please go to **nspcc.org.uk/core-info** for price details.

Neurological injuries systematic review updated July 2013.

Spinal injuries systematic review updated November 2013.

Core-info leaflet updated May 2014.

For the most up to date information on this review and the project's other systematic reviews visit the Core info website **core-info.cardiff.ac.uk**

Further details of this review can be found by scanning the QR code below.

This is a collaborative project between the Early Years Research Programme, Cochrane Institute of Primary Care & Public Health, School of Medicine, Cardiff University and the NSPCC.

