



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

This leaflet summarises what is currently known about the clinical presentation of inflicted head and spinal injuries in children and will be of particular interest to A&E 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 and legal practitioners.

The information is based on a systematic review of all the quality work in the world literature about inflicted head and spinal injuries in children; full details are available at: www.core-info.cardiff.ac.uk

What do we know about inflicted head injuries in children?

Inflicted head injuries that involve injury to the brain or bleeding within the structures around the brain are the most serious form of physical child abuse, and they have some of the most severe consequences for the child's future well-being. They are the leading cause of death among children who have been abused.

Brain injury may arise from shaking, shaking and impact, or impact injuries. The condition occurs most commonly in children less than two years of age, with an estimated prevalence of 1:3,000 in babies of less than six months. Boys appear to suffer more head injuries than girls, from any cause. Apart from children who die as a result of an inflicted head injury, 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 inflicted head injury 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, an inflicted head injury 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 an inflicted head injury?

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. Those who have a brain injury in association with a skull fracture are more likely to have a non-inflicted injury. This is due to the nature of serious head injuries after falling from a height or motor vehicle crashes. However, some features are particularly indicative of inflicted brain injury, even when a skull fracture is present. These include retinal haemorrhages, rib fractures, bruising to the head and/or neck, and apnoea.

However, it is also important to look for features such as other injuries – eg, bruises, burns, bites, oral injuries or fractures. These need careful interpretation, as well as investigations for other possible causes, as part of the child's assessment.

Given the importance of these features, it is essential that any child where an inflicted head injury 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.

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

What tests need to be performed to identify inflicted brain injury?

If an inflicted brain injury is suspected in a child who is acutely unwell, then a CT scan should be performed, with a skull X-ray or a 3D reconstruction of the CT scan, to look for skull fractures. If the CT scan is abnormal, or it is normal but the child has ongoing symptoms or signs of brain injury, then MRI (a medical imaging technique) with DWI 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 likely long-term outcome. 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
- DWI – diffusion weighted imaging

What findings on neuroimaging suggest an inflicted brain injury?

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

- multiple SDHs/SAHs
- SDHs over the surface of the brain or in the groove that separates the two halves of the brain.

Damage to the brain itself from lack of oxygen and interrupted blood supply is more common in inflicted than non-inflicted head injury. This contributes to poor outcomes for these children. Extradural haemorrhages are more common in non-inflicted 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 isolated reports in the scientific literature of inflicted injuries to the spine in children. Two patterns of injury are described:

- neck injuries
- chest or lower back injuries.

When a child sustains a neck injury from physical abuse they often have a co-existing inflicted brain injury 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.

The chest or lower back injuries 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. Many of these children either die as a result of their injuries or are left with permanent paralysis.

What tests should be done to identify an inflicted spinal injury?

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. Clinicians should consider the possibility of co-existing spinal injury in children with an inflicted brain injury and perform an MRI of the spine if they have concerns about co-existing spinal injury.

Implications for practice

- Infants with abusive injuries – such as fractures, bruises, burns, oral injuries or retinal haemorrhage – should have neuroimaging for possible inflicted brain injury.
- 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.
- 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.
- 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.

The information in this leaflet was current in January 2008.
This is a collaborative project between the Department of Child Health,
Cardiff University and the NSPCC.

Information about this and the project's other systematic reviews can be
found at the CORE-INFO website: www.core-info.cardiff.ac.uk

If you are worried about a child who is at risk of abuse or in need of help,
the NSPCC Helpline is here to help, 24 hours a day, seven days a week.

- Call: **0808 800 5000** to speak to a helpline adviser.
 - If you are deaf or hard of hearing, you can access the service in the
following ways (Monday to Friday from 9am to 5pm):
 - Textphone: **0800 056 0566**
 - Via British Sign Language interpreters on video phone: **020 8463 1148**
 - Via British Sign Language interpreters on IP videophone or webcam:
nspcc.signvideo.tv
 - The service is also available in Welsh (Monday to Friday from 10am to 6pm)
and Asian languages (Bengali/Sylheti, Gujarati, Hindi, Punjabi and Urdu,
Monday to Friday from 10am to 6pm). Outside the operating hours calls will
be answered by the main NSPCC Helpline.
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