



Recognizing and preventing head injury secondary to suspected child maltreatment

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Introduction

Head injury secondary to suspected child maltreatment represents a diagnostic challenge for clinicians. These injuries to children are preventable but when they occur, the outcomes are often devastating. Child abuse is the most common cause of serious head injury in children under one year of age,¹ and head injuries are the leading cause of death among abused children under two years of age.^{2,3} However, abusive head injuries can also occur in older children.^{4,5}

Although inflicted head injuries are believed to be uncommon, the rates of these injuries in Canada are not known. In a retrospective chart review of children hospitalized for shaken baby syndrome over a ten-year period, 364 cases were identified.⁴ The goal of the CPSP study on *Head injury secondary to suspected child maltreatment (abuse or neglect)* is therefore to collect data on these injuries in order to describe their incidence and characteristics, educate health professionals about them, and improve prevention of them. This article will focus on information that will help clinicians to recognize and prevent inflicted head injuries in children.

What types of head injuries occur with child maltreatment?

A wide variety of head injuries can occur with child maltreatment, including intracranial bleeding, cerebral contusions and other brain tissue injuries, skull fractures, subgaleal hematomas, retinal hemorrhages, and scalp hematomas, lacerations or bruises. However, certain injuries occur more commonly with inflicted injuries, while others occur more commonly in non-inflicted ("accidental") scenarios.

Fortunately, simple infant and toddler falls generally have benign consequences. Falls from beds, couches, and down stairs rarely cause injury, and when a

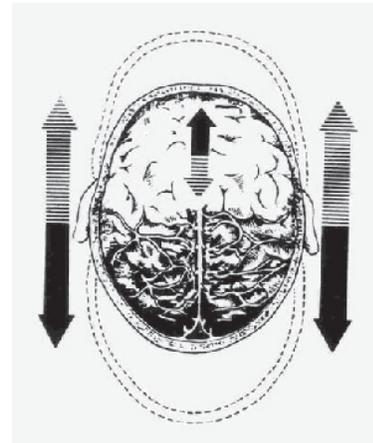
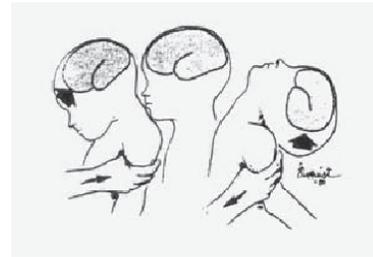
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head injury is sustained it is likely to be a scalp bruise or a single linear skull fracture.⁶⁻⁹ Symptomatic intracranial hemorrhages are almost never seen in simple low-level falls, although epidural hematomas can occur.^{10,11}

Subdural hemorrhage (SDH) in infants and toddlers has been closely linked with child abuse. SDH occurs when the bridging veins that run between the surface of the brain and the dura are torn, causing bleeding into the subdural space. It is generally recognized that tearing of the bridging veins requires rotation and acceleration-deceleration forces such as when an infant's head undergoes vigorous back and forth motion (with or without impact to the head) as is believed to occur in shaken baby syndrome.^{3,12-14} However, there is growing recognition that focal SDH can also be caused by direct impact forces.¹³⁻¹⁵

Subdural hemorrhages, and other serious intracranial injuries, are uncommonly seen in non-inflicted injury. When they are seen, they are the result of major trauma such as a motor vehicle collision or a fall from a significant height.^{2,16} As a result, any infant or toddler with SDH who does not have a corroborated history of major trauma should undergo evaluation for maltreatment.



How do head injuries present and are they easily recognized?

Part of the challenge of recognizing inflicted injuries in young children is the non-specific manner in which they present. Common presenting features are:

- vomiting
- irritability
- lethargy
- poor feeding
- decreased level of consciousness
- respiratory difficulties and
- seizures

Unfortunately, these are also the presenting features for many other common childhood illnesses. As a result, physicians frequently miss the diagnosis of inflicted head injury at first presentation. In a study of missed cases (where 31% of cases were initially missed) the most common incorrect diagnoses were viral gastroenteritis or influenza, accidental head injury, or rule out sepsis.¹⁷ Infants presenting with an apparent life-threatening event should also be carefully evaluated for the possibility of abusive head injury.^{18,19}



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An additional challenge that clinicians face in detecting inflicted head injury is that the child may have no obvious signs of injury and no associated neurological signs. In a study of high-risk abused children under two years of age, 37% had an occult head injury despite having a normal neurological examination.²⁰ This was supported by a second study of children in the same age group, which found that 29% of patients with suspected physical abuse had a traumatic intracranial injury on imaging with no neurological signs.²¹ In the Canadian review of cases of shaken baby syndrome 40% had no external sign of injury.⁴

Finally, while clinicians are used to relying on a history to help guide them, an inaccurate history of minor trauma or no history of trauma is common in inflicted head injury.

Given these diagnostic challenges, clinicians must be aware of the possibility of inflicted head injury and must include it in their differential diagnosis when children present with the non-specific signs listed above. Being alert to features of a presentation that may not fit the usual pattern (e.g., presumed gastroenteritis with ongoing vomiting but no fever or diarrhea), an injury that is not consistent with the history (e.g., history of minor trauma with a severe injury), or a mechanism that is not developmentally possible (e.g., a two-month-old sustaining injuries from rolling off a bed) may also help to identify inflicted head injuries. In young children suspected of physical maltreatment, clinicians should have a low threshold for neuroimaging even when the child has no neurological signs.²²

What investigations are recommended?

The diagnostic test of choice when acute inflicted head injury is suspected is an unenhanced CT scan of the head with bone window settings. CT has a high sensitivity and specificity for detecting acute intracranial hemorrhage and is also able to detect other features that could require acute intervention, such as skull fractures, edema, shifts, and herniations.²³ In comparison to MRI studies, CTs are also more readily available.

However, MRI scans often provide additional information by identifying smaller or convexity collections of blood (especially SDH), soft tissue injuries and diffuse brain injury. They are also better able to delineate the approximate age of hemorrhages, based on the characteristic appearance of blood as it breaks down on the T1 and T2 weighted images.²³ As a result, CT is generally recommended in the acute phase and MRI is recommended for more complete evaluation after the acute phase.^{24,25}



Many children presenting with head injury have sustained other injuries, including fractures.^{16,26} Therefore, in children less than two years of age, or in those who would not be able to communicate a history of prior injury, studies to look for occult fractures are recommended.^{24,25} These studies may include a skeletal survey and bone scan or two skeletal surveys done at least 10-14 days apart. A single skeletal survey done at the time of presentation of acute trauma may not identify new fractures that have not yet begun to heal (i.e., there is no callous formation around the fracture site). An ophthalmologic examination to look for retinal hemorrhages is warranted. It is advisable to undertake investigations to rule out medical causes that could account for the injuries or would make the child more susceptible to such injuries (e.g., coagulopathy for intracranial hemorrhage, metabolic bone disease for fracture, urine organic acids to rule out SDH secondary to glutaric aciduria type 1).

What are the outcomes?

Head injury is the most common cause of death in young abused children.^{2,10} Mortality rates in abused children range between 10% and 30% and infants have a worse prognosis than do older children. In the recent Canadian study of hospitalized children with shaken baby syndrome, death occurred in 19%, neurological injury occurred in 55%, and visual impairment was present in 65%.⁴ At the time of discharge, only 22% showed no signs of impairment. Other studies support these high rates of morbidity and mortality.^{27,28}

While permanent neurocognitive deficits are believed to be extremely common, data on the long-term effects of these injuries are lacking.²⁹ In a study evaluating disability at one month following injury, 15% of children had severe disability and 65% had moderate disability.³⁰ In a small case series that followed survivors of “whiplash shaken infant syndrome” for a minimum of five years, only one of thirteen children showed no neurological impairment.³¹

What can you do to prevent head injuries from maltreatment?

Children who are diagnosed with inflicted head injury frequently have sustained physical abuse on more than one occasion.³² Missing the diagnosis can cost the child their life and can place siblings at great risk.^{17,28} Therefore, by recognizing and reporting a head injury secondary to suspected child maltreatment, a clinician may be able to prevent subsequent abuse or even death of one or more children.

Although legislation differs from province to province, all physicians have a duty to report suspicions of abuse or neglect. When such suspicions arise, physicians should document the details of the history (with verbatim responses from the historian where possible), and a full physical examination (with line diagrams for



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any injuries). A report should be made immediately with child welfare authorities, and evaluation of the siblings should be undertaken.

Physicians are also in a position to increase awareness of the risks of injury to young children. Among high school students, college students, adults, pregnant teens, and parenting teens, 25% to 50% are unaware that shaking can harm a baby.³³⁻³⁶ Providing simply worded written information on the dangers of shaking and on alternatives to dealing with a crying infant leads to changes in parents' knowledge and understanding of appropriate child behaviour management techniques. Almost half of mothers who received this information while in hospital following delivery stated that they were "not as likely to shake my baby now".³⁷ Parents must also be counseled to be cautious in choosing babysitters and other caregivers. Children should not be left, even for a short time, with caregivers who have difficulty controlling their anger or who harbour resentment toward the child.³⁸

By taking the time to deliver basic parenting information, and by learning to recognize inflicted head injury early in its presentation, clinicians can help to prevent this devastating form of child abuse.

Handouts for parents on the dangers of shaking and strategies for dealing with a crying infant are available at www.caringforkids.cps.ca/babies/SBS.htm or in *Paediatr Child Health* 2001; 6(9):668-9.

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Quiz

1. Head injuries secondary to suspected child maltreatment can be associated with:

- a) vomiting
- b) poor feeding
- c) respiratory difficulties
- d) no symptoms and no neurological findings
- e) all of the above

2. Simple falls from low heights can cause:

- a) no injury
- b) bruising
- c) a linear skull fracture
- d) subdural hematomas
- e) a, b, and c

3. In inflicted head injuries, work-up includes:

- a) CT head
- b) skeletal imaging
- c) ophthalmology examination
- d) investigations for underlying disorders
- e) all of the above

4. Studies have shown that the outcomes of shaken baby syndrome include:

- a) mortality in up to 30%
- b) neurological compromise in < 50%
- c) visual impairment in 25%
- d) no neurological deficit at discharge in 50%
- e) minor disability in 75%

5. A physician's role in suspected child maltreatment includes:

- a) documenting a detailed history
- b) using line diagrams to document physical findings
- c) reporting to child welfare authorities
- d) evaluating the siblings
- e) all of the above

6. Inflicted head trauma in children can be prevented.

- a) True
- b) False

Answers:
1-e, 2-e, 3-e, 4-a, 5-e, 6-a