CONFERENCE REPORT

National Australian conference on shaken baby syndrome

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In 1974, Caffey suggested the label "whiplash shaken infant" to describe infants who had subdural haemorrhages without evidence of external injury.[1] Much has been learned about inflicted head injury since that time. In September 2001 a conference was held in Sydney to share this knowledge among people from many disciplines who work with, or are affected by, children thought to have been injured in this manner. It was jointly organised by the US National Center on Shaken Baby Syndrome, the Children's Hospital, Westmead, and the Sydney Children's Hospital, Randwick.

Definition and controversies

Shaken baby syndrome (SBS) is a form of child abuse that occurs when someone violently shakes an infant, most often an infant younger than six months, resulting in brain, eye and skeletal injuries.[2] Subdural haemorrhage on CT scan is frequently used as a marker for SBS. In a 1999 population-based study in the United Kingdom, the incidence of subdural haemorrhage due to child abuse was found to be 21 per 100 000 in children under the age of one year and 12.8 per 100 000 in children under the age of two years.[3] There is wide variability in the clinical presentation, ranging from non-specific symptoms, such as vomiting, to coma or death. In its less severe forms the diagnosis is often missed, being confused with viral illness or gastrointestinal upset.[4] The long-term prognosis in survivors is very poor, with a high incidence of intellectual impairment, cerebral palsy, epilepsy and cognitive/behavioural problems.[5]

The mechanism of injury is inferred from a possible triad of signs:

- severe brain swelling and/or diffuse axonal injury;
- subdural/subarachnoid haemorrhage; and
- bleeding in the retina,

in the absence of a history of significant accidental injury or other medical conditions sufficient to explain the findings.

There may also be other evidence of abuse, such as rib or long-bone fractures.[6]

SBS is a well established diagnosis in paediatrics and paediatric neurosurgery, yet some doctors and lawyers express doubts about its validity. The important question arises as to whether it is possible to differentiate this abusive form of head injury from accidental head injury or disease.

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Is this constellation of injuries unique to shaking?

Injury to the eye. Retinal haemorrhages are present in at least 80% of cases of SBS.[7] The critical importance of the role of injuries within the eye, which distinguish inflicted head injury from accidental injury and disease, was emphasised. The importance of accurate description, in terms of number and types of haemorrhages and their distribution within the retina and other parts of the eye, was noted.

Only SBS (not accidental injury or disease) can result in a pattern of multiple haemorrhages distributed throughout the retina to the periphery, especially if these are in the presence of preretinal, vitreous or subhyaloid haemorrhage. Haemorrhages in the eyes may be unilateral or absent, depending on the severity of the injury.[7]

Bleeding in the optic nerve sheath, retinal folds, retinoschisis and retinal detachment are highly associated with severe rotational forces.[7] Examination by an ophthalmologist after pupillary dilatation is critical for diagnosis.

Brain injury. The mechanisms of brain injury were reviewed. It was contended that abusive head injury results from severe rotational inertia injuries (due to shearing from acceleration–deceleration forces) and secondary (mainly hypoxic) injuries. The resultant symptoms and signs reflect the severity of these forces. Shearing injuries frequently lead to subdural haemorrhage and apnoea,[8] with or without diffuse axonal injury; these disturbances can lead to cessation of breathing and concussion or prolonged traumatic coma.[9]

In contrast, accidental injuries resulting from common household falls cause mainly contact injuries (due to direct mechanical forces) or translational inertia injuries (due to linear acceleration–deceleration), which are usually not life-threatening.[10] Most short falls do not reach the rotational velocity threshold to cause even concussion, let alone more serious injury. Short falls do not cause serious injury or death, except in most unusual circumstances, such as with extradural haemorrhage, mass-effect subdural haemorrhages, secondary effects of injury, or in falls from swings, which have a significant angular velocity component. Impact injuries sufficient to cause immediate serious injury or death are commonly associated with evidence of external injury and are seen with motor vehicle accidents and long falls.

Subdural haemorrhage. The most common lesion seen in SBS is subdural haemorrhage (SDH). Trauma is the cause of virtually all SDH. There are conditions in which the brain does not fill the space available within the cranial cavity, and this may cause SDH to occur with lesser degrees of trauma than would normally be expected. Benign enlargement of the CSF spaces, which is physiological, has not been shown to predispose to SDH, whereas pathological conditions that enlarge the subarachnoid or subdural space, such as old

SDH, post-traumatic hydrocephalus or atrophy, may predispose to haemorrhage with lesser degrees of trauma.[11] Different densities seen within an SDH on x-ray may also cause confusion about timing of injury.[12] The rapidity with which symptoms develop, the presence of acute brain injury and the presence of retinal haemorrhages will assist in correct diagnosis.

Excluding alternative causes for medical findings

All known disease states simulating abuse need to be excluded, but these are few. Coagulopathy is an important one. Accidental injury, including obstetric injury, needs to be excluded. Common forms of courtroom defence in cases of alleged SBS include that the constellation of injuries seen is due to (i) reaction to vaccination, or (ii) metabolic disorders secondary to vitamin or other deficiencies. However, large-scale studies have shown that vaccines never reproduce the findings seen in SBS.[13] Vitamin C deficiency has been hypothesised as a cause for the signs seen in SBS, on the basis of bench research showing that deficiency may predispose to bleeding. But, even if it did, coagulopathy due to other causes does not reproduce the signs found in SBS.[7] There is no disease or condition that fully mimics the complete diagnostic picture of SBS.

Is impact required for serious or fatal injury?

A single study, based on experiments with biomechanical dolls implanted with accelerometers, has suggested that impact is always necessary for serious brain damage or death to occur, but this is disputed.[14] The authors of the study measured impact at the end of shaking. The thresholds used to predict injury were generated from adult primates subjected to single-impulse rotational events. There are no equivalent thresholds for shaking injury in adult or immature laboratory animals. The forces generated during whiplash-shaking are different from those seen in falls or other forms of impact. Evidence from the shaking of adults,[15] together with numerous articles in peer-reviewed journals and confessions by perpetrators, refute the suggestion that impact is necessary for severe or fatal injury.

Prevention

Epidemiological research has shown that preventive efforts should target young men and daycare providers as well as parents, particularly fathers.[16] Starling et al found that biological fathers inflict the injuries in 45% of cases, and the mother's boyfriend, with no paternal relationship to the child, inflicted the injuries in 25% of cases. Female babysitters and mothers were each responsible for 15% of cases. Another study found very similar results.[17] The need to educate people about positive ways of dealing with crying babies was emphasised. "Dads 101", a program for new and expectant fathers that teaches them about the dangers of shaking babies as well as educating them on how to bond with their child, was presented as an example.

Challenges

It is clear that SBS is a preventable form of abuse and that it has dire consequences for the child, the family, the perpetrator, and society at large. Its recognition is important.

The recognised episode is frequently not the first episode of shaking. Training of professionals, particularly doctors, to improve recognition of the milder manifestations of SBS would perhaps prevent later manifestations of severe injury and death. Prevention has been shown to work in pilot studies done in maternity hospitals in the United States. The challenge is to reach those most at risk. There needs to be a concerted education campaign involving all those who have the responsibility of caring for very young children.

More research still needs to be done, particularly on prevention of shaking and on long-term management of children who have suffered SBS.

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