Inflicted Brain Injuries: Don't Discard Differential Diagnosis

Michael D. Innis, M.B.B.S.

The great enemy of the truth is very often not the lie: deliberate, contrived and dishonest; but the myth: persistent, persuasive, and unrealistic.
–John F. Kennedy

There are, in fact, two things: science and opinion. The former brings knowledge, the latter ignorance.
–Hippocrates of Cos

The concept of shaken baby syndrome is an unfortunate example of a theory being adopted by consensus rather than being supported by science and clinical observation.

The proposed causative mechanism, shaking, is often contaminated by incidents involving actual head trauma. Flaws in the biomechanical theory underlying the concept,[1] and flaws in the "confessional" literature used to support the concept have been reviewed by others.[2]

In recent years, the concept of shaken baby syndrome has taken on increasingly pejorative labels, such as "abusive head injury," and now "inflicted brain injury." One group of authors, Maguire et al.,[3] claim that their systematic review, the largest of its kind, offers for the first time a valid "statistical probability" of inflicted brain injury when certain key features are present.

One of the "key features" upon which Maguire et al. base their opinion, retinal hemorrhages, has long been known to be associated with raised intracranial pressure from any cause,[4] as in Terson's syndrome[5] and following vitamin C or vitamin K deficiency.[6-10] Relying solely on this "key feature" can have disastrous consequences for the child's caregivers.

Under these circumstances, inappropriate accusations of child abuse could be appropriately avoided by doing the recognized, accepted, and pertinent laboratory tests for deficiency of vitamins C or K.[6,9] It is likewise pertinent to ask in how many cases, in the "largest review of its kind," was the modified prothrombin time known as the PIVKA test (proteins induced by vitamin K antagonism or absence) performed? And, how often was serum level of vitamin C estimated?

In light of what is now known about the effects of nutritional deficiencies, the diagnosis of inflicted brain injury should not be accepted unless pertinent nutritional disorders have specifically been excluded.

In a recent case, the Dublin city coroner, ignoring the opinions of specialists involved in the case, recorded the cause of death in an infant as "natural causes," saying: "there is no evidence of cerebral trauma or 'shaken baby syndrome,' despite the radiological and clinical findings of subdural hemorrhage and retinal hemorrhages."[11]

Despite pronouncements about "rotational cranial injuries" in shaken baby syndrome,[12] these conclusions are based on opinion and consensus, not science.

Apnea is also rated high on their list of statistical markers of inflicted brain injury, and Maguire et al.[3] claim that it is a distinguishing feature. As evidence for this opinion, they cite 2003 article by one of their group, A.M. Kemp,[13] and an article by Geddes et al.,[14] in which it is assumed, without proof, that the injuries associated with apnea were inflicted. Kemp et al. conclude that "at this point in time we do not know the minimum forces necessary to cause NAHI [non-accidental head injury]."[3]

These authors disregard the fact that apnea is a feature of the condition known as an apparent life threatening event (ALTE), which can be caused by prematurity, gastroesophageal reflux, cardiac arrhthymia, laryngomalacia, tracheomalacia, infection, metabolic disorders, seizure, and other conditions.[15]

ALTE was defined by the 1986 National Institutes of Health Consensus Development Conference on Infantile Apnea and Home Monitoring as follows:

> [ALTE is] an episode that is frightening to the observer and is characterized by some combination of apnea (central or occasionally obstructive), color change (usually cyanotic or pallid but occasionally erythematous or plethoric), marked change in muscle tone (usually marked limpness), choking or gagging. In some cases, the observer fears that the infant has died. ALTE is not so much a specific diagnosis as a description of an event.

In 2003, Geddes et al. reported that apnea associated with an ALTE resulted in severe cerebral hypoxia, brain swelling, and intracranial hemorrhage.[16] Maguire et al. do not mention this article by Geddes, in which she stated: "We emphasize…that the literature to support a diagnosis of shaken baby syndrome/inflicted head injury is based on imprecise and ill-defined criteria, biased selection, circular reasoning, inappropriate controls, and conclusions that overstep the data. If it is the questioning of the criteria that is worrisome, we will continue to do so and to cause worry." Maguire et al. did not mention that Geddes changed her view between 2001 and 2003. In fact, ALTE is associated with all of the signs and symptoms hitherto attributed to shaken baby syndrome,[10] which Maguire, Kemp, and their coauthors now refer to as inflicted brain injury.

When fractured vertebrae, ribs, skull, and limbs are associated with bruises or missing teeth that parents or caregivers are unable to explain, nutritional deficiencies should be ruled out before concluding that physical violence was the cause of such findings.

Even when a child has clinical findings that resemble "bite marks" or "ligature marks on hands and feet," missing fingernails, or tissue tears that suggest lacerations or avulsive injuries, the possibility of microscopic polyarteritis should be ruled out by tests for neutrophilia; lymphopenia; and elevated levels of aspartate aminotransferase (AST), alanine aminotransferase (ALT), C-reactive protein (CRP), and lactate dehydrogenase (LDH) before accusing the caregiver of committing a crime.

Referring to the use of orthodox medical evidence, at the re-trial of a woman whose life sentence was quashed after she had already served three years for the alleged murder of a child in her care, Lord Justice Toulson said, "Today's orthodoxy may become tomorrow's outdated learning."[17]

Although pattern recognition is important and efficient in making diagnoses in medicine, physicians must always remember that symptoms and findings typically have a differential diagnosis, and when the differential diagnosis is bypassed, errors can be made, causing harm to both patient and caregivers.

Michael D. Innis, MBBS, DTM&H, FRCPA, FRCPath, is honorary consultant hematologist, Princess Alexandra Hospital, Brisbane, Queensland, Australia. Contact: 1 White-Dove Court, Wurtulla, Queensland, Australia 4575. Phone +61 (0)7.5493.2826. Fax +61 (0)7.5493.2826. E-mail: micinnis@bigpond.com.

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Potential conflict of interest: Dr. Innis has been paid consulting fees in three cases of alleged child abuse. He has given his opinion *pro bono* in several other cases.

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