

SBS Controversy

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Introduction

The shaken baby controversy has been developing since the mid-1970's (Caffey, 1974) with little regard for basic physics. The central issue revolves around the fact that impacts to the head resulting from short falls can produce accelerations at least 10 times greater than those generated by violently shaking realistic dummies. The inherent danger of low-level falls is documented by government statistics stating that 117 US children under 5 years of age died from falls in 1986 (Baker, 1992 p. 140). Seven of these involved stairs, 37 were from another level such as chair or bed, and 5 were from the same level, basically the height of the child. These data both testify to children's durability and remind us of the reality of the danger. For comparison, 640 under age 5 (148 under age 1) died as occupants in motor vehicles and 660 (278 under age 1) were murdered (Baker, 1992 p. 300, 305).

In an independent study, a California pediatric group considered 317 children who had reportedly fallen and correlated fatalities with estimated distance fallen (Chadwick, 1991). However, these researchers did not include the more dominant factors of contact surface and point of impact. They expressed disbelief that 7 deaths were reported in 100 children who fell from 4 feet or less, but only 1 death among 182 falling from 5 to 45 feet. The latter was found beneath an open second story window. Significantly, all fatalities were from head injuries. Rather than consider other factors including normal self-defensive maneuvers possible for longer duration falls such as protective arm movements or even stiffening the neck, the researchers astoundingly concluded that false histories were reported in **all** of the low-level cases. No mention was made of follow-up on those accusations, but some in the medico-legal community now deny the potential for fatal low-level falls in spite of contrary evidence, including a video of a fatal fall of only 42-inches from a play structure (Goldsmith and Plunkett, 2004). Consequently, the tragedy of a child's death or serious injury from a low-level fall is frequently compounded by prosecution and often conviction of the caregiver.

Caffey's originally proposed symptoms of SBS included retinal hemorrhages (RH), subdural and/or subarachnoid hematoma (SDH/SAH), diffuse axonal injuries (DAI), brain swelling (cerebral edema or CE), and whiplash injuries to the neck. However, many medical doctors currently diagnose SBS based on the "triad" of RH, SDH and CE.

Some will even accuse based on a single symptom, particularly RH. After examining globes that exhibited bilateral RH and Papilledema, one MD commented, “These ocular abnormalities are most consistent with and essentially diagnostic of nonaccidental trauma (shaken baby syndrome).” However, there is mounting evidence that the triad may evolve from a SDH/SAH common cause that, in turn, results in CE followed by increased intracranial pressure (ICP) and RH (Ommaya, 2002 p. 233). Sufficient ICP would cut off blood circulation through the brain resulting in oxygen deprivation (hypoxia) and ultimately death.

Proper diagnosis requires attention to **all** of the symptoms. When asked by private correspondence in 1999 if bilateral retinal hemorrhages caused by a single blow to the head were distinguishable from those due to shaking, Russian medical examiner V. V. Sidorov replied,

No, ... because the injuries are of the same nature. Therefore, the investigations of all the inner organs are urgently needed. The main distinguishable symptom of the body's shaking and the single blow to the head is: the body's shaking is followed by hemorrhages not only in the retinas, but without fail, in the supporting apparatus of all the internal organs—in the roots of the pulmonis (lungs), nephros (kidneys), lienis (spleen), mesentery of the bowel, diaphragma, vascular stem of the heart, etc. Were these symptoms found at the autopsy?

Furthermore, violent shaking should be accompanied by bruise marks from gripping the chest or upper arms along with severe neck injury (whiplash). On the other hand, head impacts from falls might be accompanied by related bruising and possibly skull fractures, unless contact is made with a sufficiently padded surface.

Threshold values

Past studies involving live monkeys and chimpanzees quantify the effects of extreme rotational acceleration and predict injury thresholds scaled to a young child (1.0 kg brain). Fifty percent likelihood occurs at about 2000 *radians/s²* for concussion, 20,000 *radians/s²* for SDH, and 25,000 *radians/s²* for mild DAI (Ommaya, 2002 and Goldsmith, 2004). Such values can be achieved during head impacts resulting from low-level falls, but not from shaking alone. Computer simulations illustrating this are available at <https://physics.boisestate.edu/reimann/forensicphysics> .

References

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