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Authors' Response

Sir,

We stated in our case report that "although an experimental model suggested that shaking alone may not be sufficient to produce the angular acceleration necessary to cause the classic triad, most authors believe that this model was faulty and that pure shaking (without an associated impact) can cause death in infants and young children." In their letter, Thibault and Thibault criticize that this statement was naïve at best. Those divergent scientific opinions are not new and are part of an ongoing controversy that go back to the publication of the Duhaime (1) model in 1987.

In the Duhaime model, the head of a doll was filled with cotton and water to stimulate the weight of an infant's head (1). Upon violent shaking of those dolls, the calculated angular acceleration did not achieve the degree of angular acceleration necessary to cause the pattern of injury seen in shaken baby syndrome (SBS). However, those degrees were achieved when dolls were shaken and their head struck against padded or metals objects. From this model, they proposed that shaking was not the primary mechanism of injury in SBS.

This model is still controversial today but most authors agree that the Duhaime model is not a satisfactory model of the infant head and brain (2–4). It is not naïve to point out that this model is faulty because the cotton-water model is of homogeneous composition and fails to simulate the various densities and inertial forces of different parts of the brain and intracranial vessels (2).

Despite subsequent effort in model development (4–6), there is not yet a satisfactory model of the infant head and brain (2). Roth et al. (7) recently emphasize that "studies using dummies or analytical models have compared child head injuries as a function of angular and linear acceleration, but this scientific approach is insufficient when the local behavior of biological tissues must be taken into account." To maximize biofidelity of their model, Roth et al. used a finite element model. Using this model, they compared a vigorous shaking and an inflicted impact as the terminal portion of a vigorous shaking. Whereas the calculated values in terms of brain pressure and shearing stresses were lower for shaking than for impact, the calculated relative brain and skull motions that can be considered at the origin of a subdural hematoma showed similar results for shaking and impact. In their conclusion, they stated "in the past years, biomechanical studies have focused on the comparison of velocity and acceleration between different scenarios of head injuries to children. This extreme simplification has led to wrong ideas concerning the consequences of shaking a baby. Based on a detailed finite element model of the 6-month-old child head, it has been demonstrated that vigorous shaking can have the same consequence as an impact in terms of subdural bleeding."

Biomechanical models are not to be eliminated, but they are to be improved. As clinicians, we cannot disregard case observations and perpetrator's confessions because they do not fit with biomechanical models. On the contrary, biofidelity of models have to be refined to fit our clinical observations. Until that day, this controversy will probably go on.

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