

Solid-fluid interaction in force and energy transmission in shaken baby syndrome

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Current injury thresholds for shaken baby syndrome are empirical combinations of angular velocity and angular acceleration based on single cycle events. These thresholds are nearly impossible to exceed by shaking a baby, yet injuries are reported resulting from such abuse. This disparity between threshold and injury has led to controversy in the courts.

In reality, shaking is a multicycle event, with motion and loading of the brain coupled through a fluid layer of cerebrospinal fluid (CSF). There is the possibility for energy accumulation and resonance. A simple model of a brain within a skull separated by a layer of fluid which can be cyclically accelerated linearly and rotationally would be an excellent tool. It would be possible to the sensitivity of the system to material properties of brain and CSF; convert current single cycle linear and rotational injury thresholds to thresholds based either on strain energy within the brain or relative motion between skull and brain; create new, realistic injury thresholds that incorporate the cyclical nature of the injury.

It will be possible to provide information about suitable simplified geometries, brain tissue and CSF properties, and estimates of loading amplitudes and frequencies.