Injury Models

Blast-Induced Acceleration in a Shock Tube: Distinguishing Primary and Tertiary Blast Injury Mechanisms in Rat TBI

Discerning biomechanical underpinnings is crucial for an understanding of the etiology and mitigation of blast-induced TBI. Scientists and engineers at WRAIR are examining the interplay of blast overpressure and accelerative forces using an Advanced Blast Simulator, which is capable of producing high fidelity IED-like blast waveforms in the laboratory. This undertaking involves understanding the role that parameters, like areal density (the mass of an object divided by its projected 2-dimentional area), play in the scaling of acceleration and displacement (blast throw) due to blast. Experiments to date on inanimate objects and laboratory rats indicate that acceleration is not a major contributor to blast-induced mTBI and, to the extent it occurs, acceleration is imparted during the shock diffraction phase and not during the loading phase of the blast, as traditionally thought, for objects that are less than the shock wavelength in diameter. Objects reach peak maximum acceleration within 0.6 milliseconds of the shock front arrival. For objects much smaller than the shock wavelength (less than 6 feet in diameter), the object's terminal velocity appears proportional to the peak total pressure of the blast and the areal density of the object and not the impulse (area under the blast pressure curve) of the shockwave. These characterizations are yielding great insight into scaling issues in laboratory experiments, as well as into the mechanisms that cause blast overpressure TBI.