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A novel device to simulate traumatic Brain injury

Krystle Karoscik
Neuro StartUp Challenge, USA

Traumatic brain injury (TBI) is a major health concern in children and adults as it has been proposed as a risk factor for the development of subsequent neurologic diseases that often lead to irreversible brain damage or death. A meta-analysis of TBI identified several key associations, notably etiological pathology and complications from the nature of the injury, and various clinical presentations. The exact mechanism of cellular injury is not well understood. This novel device allows for varied shockwave propagation to simulate cellular injury and independently study the role of shockwave pressure change and shear force damage. The purpose of this device is to determine the overall consequences of traumatic exposure to brain tissue, and to provide a system in which tissue could be directly observed during and immediately after exposure to shockwave propagation. The pneumatic air-gun based device delivers a blast via a quick release valve directly to the 96-well culture plate positioned on top of a microscope. Modulating the volume of fluid in the well allows for independent control over shear forces generated by the blast shockwaves. The device is used in a laboratory controlled system with high temporal and spatial resolution. Novelties include real-time cellular imaging and analysis of explosive shockwaves, screening for pharmacological compounds that may ameliorate the effects of a brain trauma, testing materials capable of protecting cells from trauma, and identifying the best treatment and diagnostic path based on injury from head trauma. Future applications will be used to study pharmacological effects of calcium signaling in response to trauma, search for additional signaling pathways in response to varying intensities, and expand the system to allow for study of entire organs.

e: krystle.kar@gmail.com