IMPLICATIONS OF END-JET TESTING OF BIOLOGICAL SPECIMENS IN BLAST INJURY STUDIES

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Abstract: The Iraq and Afghanistan conflicts raised awareness of the threat of blast-induced neurotrauma, also known as blast traumatic brain injury (bTBI), due to the unprecedented scale of enemy attacks by improvised explosive devices (IEDs). Furthermore, preliminary research suggests that soldiers routinely exposed to shockwaves from muzzle blast or breacher charges may also be vulnerable to bTBI. DRDC-SRC has taken a multidisciplinary approach to develop models of increasing complexity to understand this injury entailing laboratory simulation of both the blast-exposure conditions and the biological response.

An Advanced Blast Simulator (ABS) enables high-fidelity laboratory simulation of free-field blast waves, including tailored wave-shaping with true negative phase and secondary shock [1]. It is important to note that the dynamic pressure component of blast exposure, which is rarely measured, can play a significant role in specimen loading yet is often misrepresented in blast simulator devices. Testing near, and especially just beyond, the open end of a shock tube in the end-jet flow should be avoided since dynamic pressure conditions are highly exaggerated and extremely non-uniform, entirely unlike those of explosive blast [2,3]. Additionally, it has been shown that scale has a critical role in the development of the flow-field around targets such that the blast loading of objects the scale of a human head subjected to IED-scale blast is dominated by transient crushing action of the static overpressure with negligible throwing action from the dynamic pressure [4]. Computational simulations and experimental results are presented to demonstrate that failure to adequately account for all such aspects of a bTBI model, biological or otherwise, may lead to incorrect interpretation of the injury biomechanics.

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