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IMMEDIATE AND ACUTE EFFECTS OF HEAVY WALL BREACHING ON COGNITIVE PERFORMANCE AND BLOOD BIOMARKERS

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There are military occupational specialties that involve routine and repetitive exposure to blast overpressure during training and operations. This presentation will examine data collected in conjunction with heavy wall breaching during an Urban Mobility Breaching Course (UMBC) taught by the 35th Engineers (Ft Leonard Wood, MO). Data were collected 5 times over the last 16 months and involved 157 volunteers who consented to participate in the study. UMBC includes large breaching charges designed to defeat concrete walls and chain-linked fences. Blast gauges (Black Box Biometrics, Rochester, NY) were attached to operators to estimate individual operator overpressure exposure. Neurocognitive performance using the Defense Automated Neurobehavioral Assessment (DANA) Rapid test battery was assessed before exposure (baseline), immediately after detonating the back-to-back charges, and at the end of the training day (acute). Symptom reporting and blood samples were collected at the beginning and at the end of the training day. Neurocognitive deficits (i.e., increased response time) identified immediately after blast exposure were associated with higher peak overpressures and seem to be more prevalent in higher memory demand tasks. Acute neurocognitive effects show association more with the sum of peak overpressure exposures over the training day rather than with cumulative impulse; acute effects related to peak overpressure are consistent with existing literature. Preliminary results for blood-based biomarker analyses (n = 18 from visit #4) resulted in no change (pre versus post) for glial fibrillary acidic protein (GFAP) and neurofilament light chain (NFL) in serum but there was a significant increase in tau. Updated biomarker data will be presented at the conference. Further, individual changes in biomarker levels will also be reported. During a number of the same breaching events, head/brain surrogates (NRL GelMan Head) containing pressure sensors under the helmet, on the head, and within the simulated brain were positioned at several standoff distances from the charge, the farthest standoff being equivalent to that used for training. These surrogates were designed to determine how the pressures experienced at these positions interact with the head and helmet and then penetrate into the brain. Biomechanical data collected using these biofidelic human head/brain surrogates will be presented. These studies advance the understanding of occupational blast exposure and associated neurocognitive and physiological effects. Results assist risk/benefit assessment and aid in developing appropriate response strategies for military personnel exposed to blast overpressure. This work was supported by the U.S. Army Medical Research and Materiel Command Military Operational Medicine Research Program (Research Area Directorate 3) and Office of the Assistant Secretary of Defense for Health Affairs, Broad Agency Announcement

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