Neurocognitive and Psychological Health Outcomes

Blast Exposure Accelerates Brain Aging Processes

Anecdotal evidence indicates that brain injury predisposes victims to age-related neurodegenerative conditions like Alzheimer's and Parkinson's disease. A recent clinical study used diffusion tensor imaging to describe signs of rapid brain aging in victims of blast exposure (*Trotter et al. 2015*). To test whether this phenomenon could be established in a preclinical model to study blast-accelerated brain aging processes at the cellular level, researchers at the Walter Reed Army Institute of Research (Silver Spring, Maryland) have undertaken a study using an advanced blast simulator to expose rats to single and repeated blasts. Brains were collected on days one and 28 after blast exposure and histological sections were prepared using the senescence marker stain. Data obtained to date indicate that cells in several brain regions undergo rapid aging after blast exposure. The changes were minimal on day one, but very prominent at 28 days (Figures 1 and 2). The senescence positive cells were much greater in number after repeated blasts compared to a single blast exposure (Figures 3 and 4). These preliminary data are consistent with the clinical findings cited above in which blast exposure accelerated the brain aging process. Thus, this preclinical model can potentially be used to understand the neurobiological mechanism(s) of rapid brain aging after blast exposure and to develop effective countermeasures.

This work is funded by the Military Operational Medicine Research Program (Award 19210).

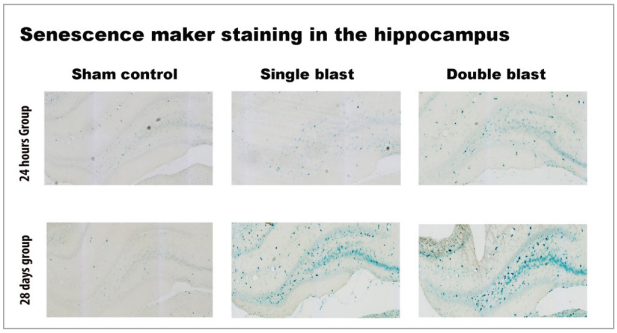

FIGURE 1: Senescence Merker Staing in the Hipposcumapus (Figure 2 from Trotter, Robinson, Milberg, et al. (2015) used with permission from the authors)

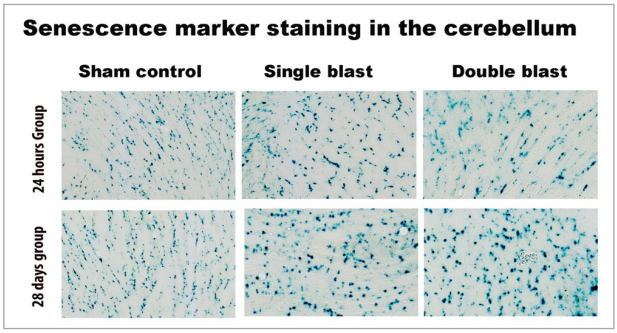

FIGURE 2: Scenescence Marker staing in the cerebellum (Figure 2 from Trotter, Robinson, Milberg, et al. (2015) used with permission from the authors)

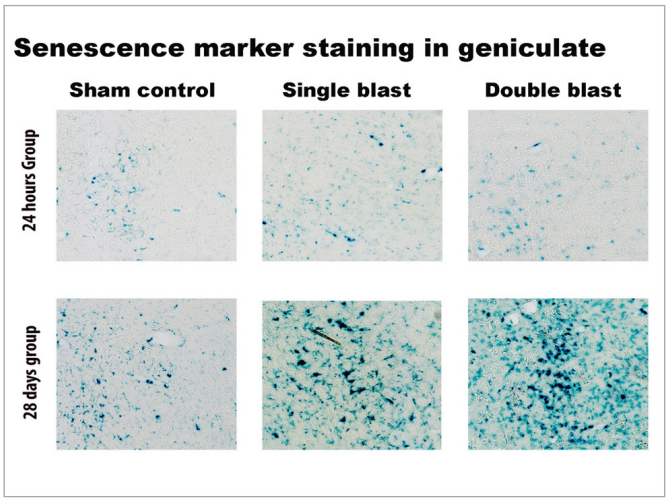

FIGURE 3: Senescence marker staing in geniculate nucleus (Figure 2 from Trotter, Robinson, Milberg, et al. (2015) used with permission from the authors)

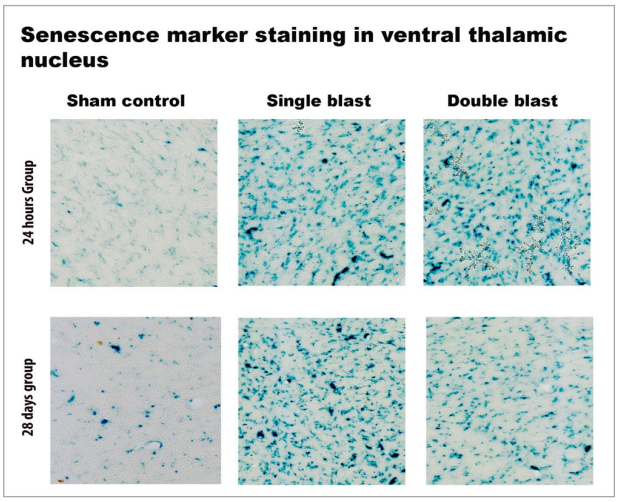

FIGURE 4: Senescence Marker staining in the ventral thalimia nucleus (Figure 2 from Trotter, Robinson, Milberg, et al. (2015) used with permission from the authors)

REFERENCES:

Trotter, B. B., Robinson, M. E., Milberg, W. P., McGlinchey, R. E., and Salat, D. H. 2015. "Military Blast Exposure, Ageing and White Matter Integrity." Brain 138 (Pt 8):2278-92. doi: 10.1093/brain/awv139.