# Biochemical and Behavioral Analyses Reveal Sex-Dependent Differences in Mice After Mild Blast Traumatic Brain Injury

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**Background:**
As military conflicts persist around the world, traumatic brain injury caused by blasts (bTBI) continues to be a health concern in the soldiers and civilians affected. After bTBI, small changes in oxidative stress and neuroinflammation are hypothesized to cause neuropsychiatric disorders, including PTSD and memory deficits. Further, although 15.7% of the U.S. army is female, there is little known about the differences between the two sexes. In this study, a repeated mild bTBI model was used to observe the disease-induced changes in mice of either sex.

**Methods:**
Adult male and female C57BL/6 wildtype mice were used. To model bTBI, mice were anesthetized, and a pneumatic shock tube was employed to deliver three sequential blast exposures. Following injury, brains were sectioned into 25μm slices for histological evaluation of acrolein. Behavioral assessments began one week post-injury, with mice undergoing fear conditioning in two distinct contexts over multiple days to evaluate learning and memory of fear-associated cues. All data are expressed as mean ± SEM ($n \geq 6$), and statistical significance was determined using unpaired two-tailed t-tests or one-way/two-way ANOVA, with $p < 0.05$ considered significant.

**Results:**
The results showed significant differences in behavior and cellular activity after bTBI between not only the tested and control group, but also the male and female mice. Male mice displayed an extended retention of fear memory, in contrast to the early loss of fear memory observed in female mice. Another key difference was acrolein-lysine adduct elevation between male and female mice, which indicates a correlation between sex and the brain regions vulnerable to bTBI.

**Conclusion:**
Collectively, the results demonstrated that while bTBI caused behavioral and functional deficits in all mice, the nature of these impairments varied depending on sex. This study aims to inspire additional research which explores bTBI pathophysiology and sex-specific treatments.