Animal Model of Blast Induced Tinnitus: Transitioning from Continuous Noise to Blast Induced Ear Injury

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Blast exposure, impulse noise, and continuous noise are leading causes of hearing loss and tinnitus in the military. Recent data show that service-connected blast induced hearing loss and tinnitus are at the top of Veteran's disability claims. To date, the use of animal models to study tinnitus and its treatment have examined the consequence of noise over-exposure, with limited focus on blast induced hearing loss and tinnitus. Unlike excessive noise exposure, repeated blast waves can induce traumatic brain injury (TBI). Without a reliable animal model of blast induced tinnitus it is difficult to predict the comorbidity of tinnitus with TBI and its relationship to hearing loss. In an effort to extend our traditional rat model of unilateral noise exposure (126 dB SPL, 16 kHz centered narrowband noise), we constructed a blast wave generator capable of producing sound pressure levels of 175-198 dB SPL to investigate blast induced tinnitus. Blast wave exposure resulted in significant, permanent unilateral sensorineural hearing loss, evidenced by decreased or absent Distortion Product Otoacoustic Emissions (DPOAE) and behavioral measures of hearing. By modifying our traditional gap-startle reflex paradigm used to assess noise induced tinnitus, we are now able to confirm the presence of blast induced tinnitus in rats with profound high frequency hearing loss in the exposed ear (the contralateral unexposed ear is left functional to maintain perception of real sound). Preliminary data suggest that our paradigm can now be used to model the effects of pre-exposure susceptibility, co-morbidity with TBI, and post blast treatment efficacy for blast induced tinnitus.