

Abstract: Effects of Blast Exposure on Sensory Gating and Speech Perception in Noise

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Objectives: To assess the fidelity of sensory gating in Veterans exposed to high-intensity blasts within the past twelve years compared to non-blast-exposed previously-deployed Veteran control participants. To determine if electrophysiological measures of sensory gating are correlated with speech-in-noise understanding.

Plan: Conduct electrophysiological tests targeting sensory gating at multiple levels of the auditory pathway as well as tests of speech understanding in noise in blast-exposed Veterans and non-blast-exposed control individuals including Veterans and non-Veterans. Sensory gating measures can then be compared between blast-exposed and control participants in order to determine if exposure to high-intensity blasts impairs sensory gating. Sensory gating measures will also be analyzed in light of speech understanding in noise measurements in order to assess possible relationships between poor sensory gating and poor speech comprehension in noise.

Methods: Up to 60 participants will be recruited to fill the two following subject groups (30 subjects per group): Veterans with high-intensity blast exposure incurred during service in OEF/OIF/OND conflicts; Veterans age- and gender-matched to blast-exposed participants with no history of blast-exposure or traumatic brain injury (TBI), and with levels of PTSD similar to members of the blast-exposed group. Following audiometric assessment, all participants will complete a case history and a structured interview detailing their audiological, mental, and physical health history as well as questions about prior head injuries. Following the case history, multiple surveys and questionnaires will be completed which probe cognitive and emotional status. Participants will then undergo behavioral speech-in-noise testing using word and sentence tokens of speech. In addition, neurophysiological measures will be completed on all participants including P300 responses to speech and tones in quiet and noise, cortical sensory gating, and sensorimotor gating. Lastly, participants will complete surveys designed to assess self-perceived difficulties with understanding speech in noise as well as sensory gating-related issues. Measures will be compared across subject groups using repeated-measures ANOVA and the results of the various tests will be related to one another using multiple regression and correlation (MRC) analysis. It is anticipated that each subject will participate in up to seven hours of testing, spread over 2-3 sessions.

Clinical Relevance: As reported by Dennis (2009), the estimated prevalence of TBI from blast exposure among Veterans who have served in OEF/OIF is 11.4%, using a fairly conservative methodology. Studies currently underway at the NCRAR are providing strong evidence that central auditory processing deficits, including difficulty processing speech in noise, persist for several years following initial blast exposure. However, to date, no study has focused on specific neurological changes associated with speech understanding in noise in spite of the fact that previous studies have indicated that this is a longstanding complaint of many blast-exposed Veterans. The sensory gating hypothesis may explain both difficulty with speech in noise understanding as well as other common chronic blast-related conditions, and thus help to inform rehabilitation efforts for this population.

Relevance to the VA's Mission: The inability to effectively communicate with others is a huge detriment to quality of life in any population. The fact that so many Veterans are returning from recent conflicts with longstanding problems with communication in challenging but common listening environments indicates the need for the VA to take the lead on developing the appropriate diagnostic and rehabilitative tools for addressing this issue. In addition, rehabilitative measures for other injuries and deficits among this Veteran population may be negatively impacted by difficulties in communicating with health care professionals.

Medical Subject Heading Keywords: Blast Injuries, TBI, Auditory Processing Disorder