**Dissociating Functional Brain Activity in Blast-Related Traumatic Brain Injury and Post-Traumatic Stress Disorder**

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**Introduction**

The clinical presentation of OEF/OIF Veterans with blast-related traumatic brain injury TBI and post-traumatic stress reactions can be very similar [1], and often include cognitive impairment (e.g., memory, attention, concentration, mental organization), and somatic (e.g., fatigue, insomnia, dizziness, headache) and affective complaints (e.g., irritability, anxiety, depression). Differential diagnosis can be further complicated by a number of other overlapping symptoms, such as noise sensitivity, anger, and poor affect regulation [2]. Evidence from functional neuroimaging has demonstrated that the anterior cingulate cortex (ACC) is composed of sub-regions that are differentially involved in “emotional” versus “cognitive” tasks [3]. The rostral ACC is thought to mediate aspects of emotional processing and, therefore, has been referred to as the “affective division” of the ACC (ACad) [3]; the caudal ACC has been shown to be activated by a number of cognitive-task manipulations, most often involving conflict processing, and, therefore, has been referred to as the “cognitive division” of the ACC (ACcd) [3]. Of particular relevance to this research, these regions can be probed using functional neuroimaging methods in the context of specially-designed tasks to reveal altered activity in patients with TBI, on the one hand, and PTSD on the other. Specifically, using a “cued task-switching Stroop” task designed to engage a network of regions supporting cognitive control, we have shown that TBI survivors show significantly reduced activation of the left dorsolateral prefrontal cortex (dlPFC) and ACcd. Additionally, we and others have shown, using an “emotional-counting Stroop” task that we can engage the ACad in addition to the emotion-critical amygdalae, both of which have exhibited altered activation in patients with PTSD. Given the widely overlapping symptomatology seen in these two disorders, and findings from our two tasks [4], we are probing dlPFC and subdivisions of ACC, amygdalae and related circuitry to determine if we can dissociate mTBI and PTSD, and their neural overlap on the basis of their neural activation patterns. Our central hypothesis is that we can dissociate blast-related mTBI and PTSD on the bases of neural activity reflecting dissociable divisions of the ACC, and activity in the dlPFC and amygdalae, in the context of two novel brain activation tasks, and determine associations of brain activity with a range of neurocognitive and affective symptom measures.

**Experimental**

All participants undergo a neuroimaging protocol, consisting of acquisition of anatomical and functional MRI data. All scans are acquired at UF’s Advanced Magnetic Resonance Imaging and Spectroscopy (AMRIS) facility at the McKnight Brain Institute using a 3.0 Tesla, 32-channel Phillips MR research scanner.

**Results and Discussion**

To date, 26 participants have completed the experimental protocol. Our preliminary data based on health participants has demonstrated that our fMRI probe tasks are effective. Additional analyses of data for TBI and PTSD participants awaits acquisition of the final proposed sample size.

**Conclusions**

Findings may serve to enhance our understanding of the neural bases of symptom overlap between TBI and PTSD in Veterans suffering from these disorders. Based on these methods, we believe that relationships between fMRI and symptom measures may assist in differential diagnosis and treatment.

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**References**

[1] Belanger, H.G., *et al.* Journal of the International Neuropsychological Society, **16**, 194-199 (2010)

[2] Kennedy, J.E., *et al.* Journal of Rehabilitation Research & Development, **44**, 894-920 ((2007)

[3] Bush, G., *et al.* Trends in Cognitive Sciences, **4**, 215-222 (2000)

[4]. Tyner, C.E., *et al*. The Clinical Neuropsychologist, **24(4)**, 607 (2010)