

Final report for Aging in Traumatic Brain Injury (No. 10-3221-BIR-E-0)

1. Original aims of the project.

The present proposal has the following specific aims:

Aim 1. Examine the impact of aging on the cognitive deficits commonly seen in TBI. Specifically, older individuals with TBI will be compared with younger individuals with TBI on specific tasks shown to be sensitive to the changes associated with aging. Domains examined will include working memory, information processing speed, and executive functions.

Aim 2. Evaluate the cerebral substrates of cognitive performance of older individuals with TBI. We will examine patterns and levels of cerebral activation on several fMRI tasks designed to assess working memory, processing speed, and executive abilities, all of which have been previously used with healthy older persons in fMRI studies. This methodology will allow us to directly compare patterns and levels of cerebral activation in each of these tasks in older individuals with TBI to younger individuals with TBI as well as older healthy individuals

2. Project successes.

All data has been collected, scored and entered into the database. The fMRI data are preprocessed and checked for significant movement in the scanner that could impact the quality of the data. We are now in the process of analyzing our data and determining directions for future grant submissions. We are also in the process of manuscript preparation. We will also submit our findings to national conferences for presentation once finalized.

3. Project challenges.

As in many research organizations there can be turnover of Research Assistants during a grant cycle. During this grant as a Research Assistant left the organization to attend graduate school a new Research Assistant was hired and trained.

Recruitment of older participants was more challenging as many were hesitant to undergo an fMRI primarily due to being physically uncomfortable (citing problems of back, joint, hip pain). This required extra recruitment methods to enroll participants into the study. To address this problem, as mentioned in previous progress reports, we allowed a few older individuals to take part in the study completing only the neuropsychological portion, without undergoing an MRI, so that we can capture the cognitive profile of these individuals behaviorally. We allowed such an accommodation for a maximum of 5-7 participants with TBI and 5 older healthy individuals in order to maintain the integrity of the fMRI portion of the study and assure adequate power for the fMRI analyses.

4. Implications for future research and/or clinical treatment

TBI can result in lasting cognitive impairments. Understanding the relationship between TBI and effects of aging can help in the development of clinical and community based programs to provide services for this growing population. Given that persistent cognitive deficits are common following TBI and that healthy aging carries with it cognitive changes as well, a clear understanding of the impact of aging on cognitive functioning in persons with TBI is essential to our ability to effectively understand, treat, and maximize function in those aging with TBI. Additionally, the cognitive impairments evidenced in older persons with TBI have been attributed to the brain injury itself, without considering the contribution of normal aging or a possible comorbid dementia such as Alzheimer's Disease or multi-infarct Dementia. This pilot study will therefore address this void in the literature in examining aging in TBI using functional neuroimaging. We used fMRI to examine the effects of aging TBI in three cognitive areas known to be susceptible to age-related changes; working memory, processing speed, and executive abilities, using paradigms that have been established in healthy older individuals. Information gained from our findings can then improve our ability to most effectively provide remediation either through cognitive interventions (i.e. retraining) or pharmacological interventions (i.e. medications), thus improving cognitive abilities in individuals with TBI and impacting overall quality of life.

5. Plans to continue the research, including applications submitted to other sources for ongoing support.

We plan on continuing this line of research and using the pilot data obtained in the NJCBIR study to apply for larger research grants. We intend to use the preliminary data to demonstrate study feasibility in two important regards. First, the preliminary data will demonstrate that the current research team has the expertise and instrumentation when we apply for future funding. Our laboratory has a significant amount of behavioral data and neuroimaging data which clearly demonstrate that individuals with TBI have chronically altered neurocognitive changes, relatively to healthy controls, during cognitive tasks however we did not have such data on older individuals with TBI. The current grant has allowed us to collect data on older individuals with TBI giving us the opportunity to more our research into understanding aging in individuals with TBI. Second, this pilot study allowed us to collect data on a task previously used in aging (i.e., Stroop) not previously utilized in our lab. Through these pilot funds we were able to program and collect data on tasks not previously performed in the scanner in individuals with TBI which will help us understand how the cerebral correlates of the cognitive functions that we know change in aging appear in older individuals with TBI.

6. Explain how you have leveraged NJCBIR funding to obtain additional federal or other support for brain injury research and list the appropriate funding organizations.

We submitted a pre-application "Comparison of Cognitive and Cerebral Profiles of TBI and AD" to the Department of Defense in September, 2012. While we were not invited to submit for a full application we plan on continuing this line of research and will actively pursue additional funding mechanisms. Our goal is to have our imaging data fully analyzed to

submit a grant by June 2014 using the NJCBIR funding for a full research grant application to the NIH.

7. List and include a copy of all publications emerging from this research, including those used in preparation.

“Comparison of aging in TBI and healthy older individuals” Lengenfelder, J., Genova, H., Wylie, G., & Chiaravalloti, N.D. (in preparation)

“Learning using the Rey Complex Figure” Lengenfelder, J., Chen, P., Smith, A., & Chiaravalloti, N.D. (in preparation)

8. Financial summary.