TACSM Abstract

Brain Volumes, Gait kinematics, and Dual-Tasking: A Pilot Study

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ABSTRACT

Dual tasking is an experimental paradigm where a motor task and a cognitive task are completed simultaneously, which is useful in determining whether the tasks share neural processing. Set shifting is a cognitive task where participants switch their behavior based on predefined rules. **PURPOSE:** Investigate the effects of cognitive set shifting and regional brain volume on gait performance during a dual-task. **METHODS:** Two older adults participants (mean age 70 years) were asked to walk on a treadmill at a self-selected speed during four different trials: 1.) single-task, 2.) set-shifting, 3.) number naming, 4.) letter naming. During single-task participants walked with no concurrent cognitive task. During all cognitive tasks, a letter-number combination (e.g. V7) appeared on the screen with either a blue or orange background. If the background was blue, they verbalize the number, if it was orange, the letter. During set-shifting the background changed randomly, while during number and letter naming the background stayed the same. Each trial was two-minutes in duration, with each prompt appearing for two-seconds, a total of 60 prompts. Gait stride length and cadence were calculated using foot position relative to pelvic position. During a second visit, high resolution T1 weighted magnetic resonance images of subject's brains were collected. T1 weighted images were processed using VolBrain to obtain regional volumetric data of two pre-defined regions of interest (ROI), which are associated with set-shifting (i.e. frontal pole and anterior cingulate gyrus). Data were checked for normality using the Shapiro-Wilk test. Repeated measures ANOVAs were used to determine the differences between task conditions, and multiple linear regression was used to determine the relationship between ROI volume and gait measures while controlling for trial. **RESULTS:** Normality assumptions were violated in about half of the variables, due to low sample size. Results of the repeated measures ANOVAs showed no significant differences between trials (all $p>0.05$). Results of the multiple linear regressions showed a significant relationship between both ROIs and both gait metrics (all $p<0.001$). Frontal pole volume showed a significant positive relationship with both cadence and stride length, while anterior cingulate gyrus volume showed a significant negative relationship with both cadence and stride length. **CONCLUSION:** These preliminary data indicate a relationship between regional brain volume and gait parameters during a set shifting dual-task. However, these pilot results must be interpreted with caution. Low sample sizes cause regression coefficients to become inflated, thus artificially lowering the calculated p-values. Similarly, ANOVA estimates from low sample sizes are less likely to detect small to medium effect sizes. In both cases the likelihood of error is high due to a sample size of two. This pilot work provides a proof-of-principal in determining the effect of brain regional differences on gait performance during a set shifting dual-task. If these pilot results are indicative of the larger population, then the reason for differing relations between ROIs in the multiple regression may be due to the frontal pole and the anterior cingulate having different responsibilities during set shifting.