Evaluating Alternate Motor Pathway Changes following a Stroke

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Background: Stroke is the fifth cause of death in the United States. Not only is stroke a leading cause of death but it is also a leading cause of long-term disability in the United States. Long-term impairments after stroke include gait instability, upper limb paralysis, sensory deficits, pain, depression, and cognitive impairments. The most common impairment is motor paresis of the upper and lower limb. Rehabilitation remains the gold standard in addressing motor paresis with the goal of enabling subjects to regain independence and daily living skills. Strokes often impact the crossed lateral corticospinal tract, by damaging the tract or the neighboring pathways. The damage within these pathways results in motor deficits. Detailed understanding of changes to the corticospinal tract, major neuronal pathway providing voluntary motor function, after stroke has resulted in the use of targeted therapies to improve rehabilitation outcomes. Alternate motor pathways also give a significant role in stroke recovery. This may be because many of the pathways work independently or work together with the corticospinal tract to trigger motor and sensory function. The overall goal of the project was to evaluate neurodegeneration and neuroregeneration in alternate motor pathways in patients who have suffered an acute ischemic stroke.

Methods: Within this study 30 subjects who have suffered an acute stroke and 10 healthy control patients will be enrolled into the study. We will conduct motor function exams and collect neuroimages at two, twelve, and twenty-four weeks after the initial stroke event in each subject. Ten healthy age-matched controls will also be enrolled for a single MRI collection visit. We collected T1-weighted magnetic resonance images (MRI) and diffusion weighted imaging (DWI). When analyzing the images we used DSI studio to shade in our regions of interest. FSL was utilized to extract integrity of evaluated tracts.

Results: We observed neuroanatomical differences at the level of the cerebral peduncle and posterior limb of internal capsule in both the affected (stroke-side) and unaffected hemispheres of the brain. Our preliminary data suggests that immediately after a stroke event, minimal changes are noted that become more dramatic over time.

Conclusions: Our results suggest that alternate motor pathways undergo dynamic changes post-stroke. Our pilot work has found that while the corticospinal tract remains a critical component in recovery, other pathways may also be impacted post-stroke in a time dependent manner. Future work will evaluate advanced neurite imaging modalities, like NODDI, to evaluate microstructural property changes post-stroke.