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**Title:** DTI analysis in patients with sickle cell disease

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***Introduction*** - Sickle cell disease (SCD) is a genetic disorder characterized by a mutation in the beta hemoglobin gene causing hemoglobin to polymerize upon deoxygenation, leading to chronic microvascular damage and strokes. Furthermore, recent studies have demonstrated that cognitive impairment occurs even in the absence of overt stroke on conventional imaging. We hypothesized that subtle cerebral injury might be visible with diffusion tensor imaging (DTI) in these patients.

***Methods*** - DTI scans were obtained in 30 directions using an EPI sequence with a b-value of 1000s/mm<sup>2</sup>. 3D T1 and T2 images were collected for volumetric assessments and detection of white matter strokes. The population sample consists of 18 SCD patients and 20 healthy controls (CTL) subjects. The DTI data were processed with the Diffusion Imaging in Python (DiPy) toolbox. Images were processed to provide fractional anisotropy (FA) and mean diffusivity (MD) maps. All maps derived from the DTI images of the SCD and CTL groups were compared by paired Student's t-test. White matter strokes were found in 5 patients.

***Results*** - Right hand figures demonstrate the cumulative white matter stroke map across all patients as a binary mask. Across frontal and parietal lobes, SCD patients had significantly higher MD and lower FA than controls. In the frontal lobe, the distribution of reduced FA matched regions of increased MD, and corresponded brain regions at high risk for stroke.

***Conclusions*** - Although silent strokes are common in SCD, their number and location are highly variable. In contrast, our DTI data showed widespread systematic white matter abnormalities in patients with SCD in regions at risk for stroke. This suggests chronic axonal injury is occurring, even in patients who don't have overt strokes. Interestingly, regions of increased FA and decreased MD were also found in regions of the brain typically spared by silent strokes. These may represent axonal remodeling in compensation for the frontoparietal damage. We are currently exploring the impact of these lesions on neurocognitive function.