DTI measures of forniceal injury correlate with episodic memory dysfunction in MS.

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Introduction; An estimated 50% of patients with MS show cognitive impairment, with 30-40% of MS patients demonstrating specific deficits in episodic memory. [1, 2] Recent pathologic data demonstrates significant hippocampal demyelination in a subset of patients with MS, however, hippocampal white matter changes are difficult to evaluate using DTI due to the underlying structure of the hippocampus. The fornix is the primary efferent of the hippocampus and well suited for evaluation with DTI. The fornix has been strongly linked to memory function in a variety of disease processes. [3-6] [7-10] [11] [12, 13] Recently, two studies demonstrated DTI changes associated with memory deficit in Alzheimer's disease. [5, 6]. We hypothesize episodic memory dysfunction in MS patients will be correlated with forniceal damage demonstrated by DTI changes, specifically, increased axial diffusivity (λ_2) and reduced fractional anisotropy (FA).

Methods: 14 patients with relapsing remitting MS were studied using diffusion tensor imaging and a battery of neuropsychological tests including the California Verbal Learning Test (CVLT) and Brief Visual Memory Test (BVMT). Diffusion-weighted imaging used 71 non-collinear diffusion-weighting gradients (2.5x2.5x2.5mm voxels, b=2000sec/mm^2, 8 b=0 acquisitions). Anatomical imaging was performed for localization and co-registration of the fornix. Regions of interest were drawn in the crus of the fornix, and average values for FA, mean diffusivity (MD), λ_2, and longitudinal diffusivity λ_1 were measured.

Results/Discussion: Scatter plots comparing DTI parameters in the left, right and bilateral fornices to measures of episodic memory are shown in Figure 1. Verbal episodic memory dysfunction measured by the CVLT demonstrated a strong correlation with reduced FA (r=0.652, p<0.01) and increased λ_2 (r=-0.630,p<0.008) within the left fornix. Interestingly, a measure of spatial memory dysfunction, the BVLT, demonstrated strong correlation with FA in the right fornix (r=0.766, p<0.001).

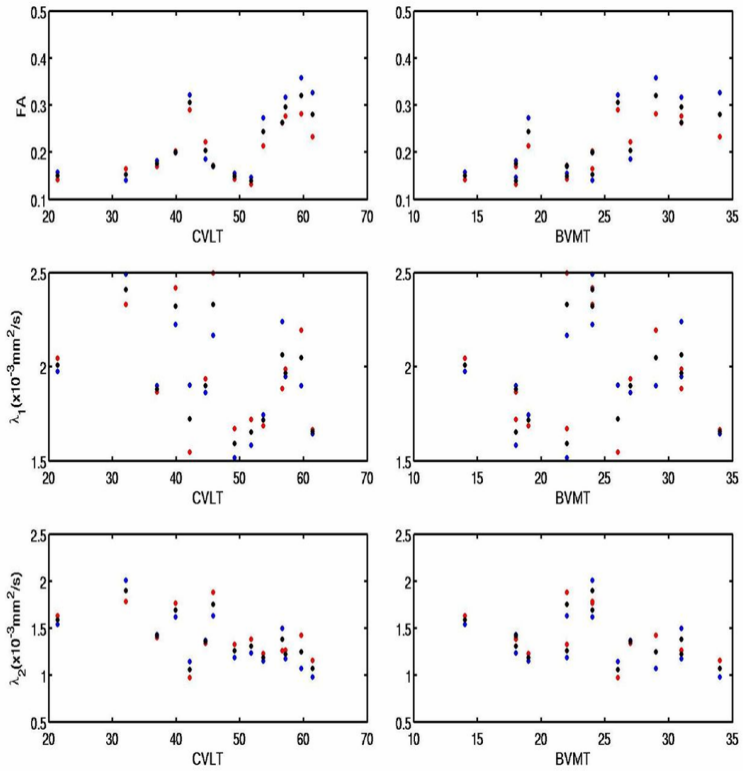

Figure 1: Scatter plots for the DTI measures FA, λ_1 and λ_2 for the right side (red), left side (blue), and total (black) hippocampus as a function of CVLT and BVMT performance.

Conclusion: Deficits in episodic memory in MS subjects are strongly correlated with DTI measures of forniceal damage. Findings suggest that DTI may provide a potential imaging biomarker for episodic memory dysfunction in MS.

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