Material specific memory impairment is associated with unilateral cingulum bundle structural integrity in intractable temporal lobe epilepsy

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OBJECTIVES

✓ To evaluate the relationship between verbal and visual memory and unilateral white matter tract integrity using diffusion tensor imaging (DTI) in individuals with intractable temporal lobe epilepsy (TLE).

BACKGROUND

✓ Verbal memory impairment is consistently found in individuals with left-sided TLE. Though less frequently replicated, visual memory impairment is found in individuals with right-sided TLE.[1]
✓ Decreased diffusion anisotropy has been demonstrated in white matter tracts of adults with TLE. Recently, two studies[2,3] reported an association between verbal memory impairment and decreased fractional anisotropy (FA) of the left uncinate fasciculus (UF), parahippocampal cingulum (PC), or inferior fronto-occipital fasciculus (IFOF) in patients with TLE.
✓ It is unclear whether visual memory is associated with right-sided white matter tract integrity.

PARTICIPANTS

Six patients diagnosed with video/EEG defined intractable TLE (3 left, 3 right) underwent neuropsychological assessment and DTI. FA was computed for all tracts involving the temporal lobe using AFNI and the ICBM WM Atlas (See poster #P09.065 for a detailed description of DTI analyses). Table 1 shows the demographic and disease-related data for the sample.

Table 1. Sample characteristics

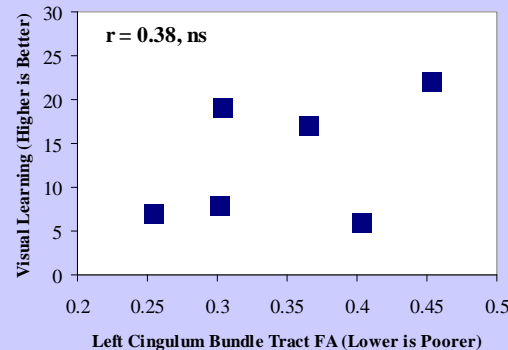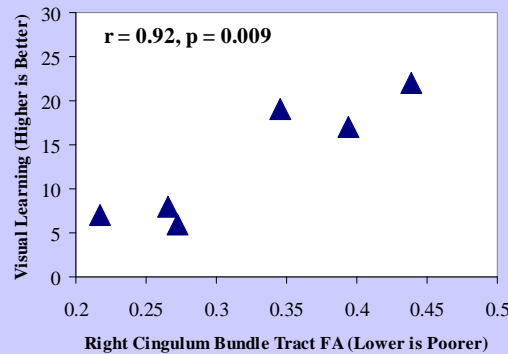|	Left-TLE		Right-TLE	
	M	SD	M	SD
Chronological Age (yr.)	38.3	14.9	28.0	8.8
Education (yr.)	12.3	1.6	12.7	1.2
Seizure Frequency (mo.)	6.7	4.2	21.3	15.0
Age at Onset (yr.)	22.7	4.2	10.7	8.4
Duration of Illness (yr.)	14.0	15.8	17.0	9.5

METHODS

Episodic memory tasks included the Rey-Osterrieth Complex Figure Test (Rey, 1941; Osterrieth, 1944) and Buschke Verbal Selective Reminding Test (Buschke & Fuld, 1974).
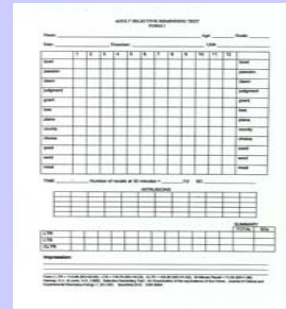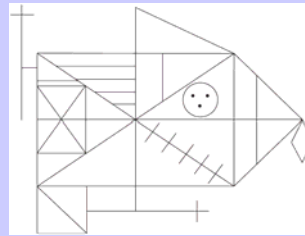

RESULTS (Figures 1 and 2)

Visual recall was not associated with FA of the right UF, PC or IFOF. However, poorer visual recall was significantly associated with decreased FA of the right cingulum bundle, but not the left cingulum bundle (CB).

r = 0.92, p = 0.009

Right Cingulum Bundle Tract FA (Lower is Poorer)

r = 0.38, ns

Left Cingulum Bundle Tract FA (Lower is Poorer)

RESULTS (Figure 3)

Poorer verbal recall was associated with decreased FA of the left CB, but not the right CB.

r = 0.96, p = 0.011

Left Cingulum Bundle Tract FA (Lower is Poorer)
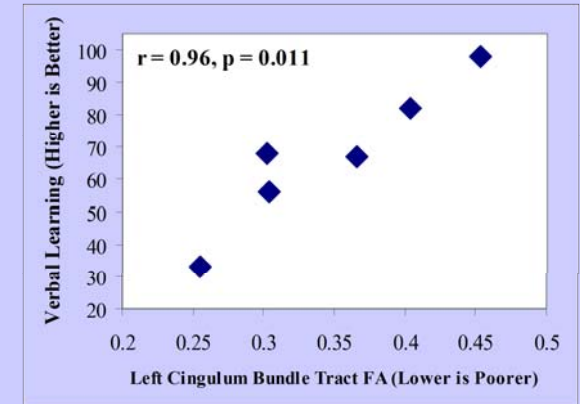
CONCLUSIONS / RELEVANCE

✓ Our findings constitute a double dissociation: reduced right CB integrity is related to impaired visual memory but not verbal memory, whereas reduced left CB integrity is related to impaired verbal memory but not visual memory.
✓ The cingulum bundle connects the frontal and temporal lobes, and is thought to be associated with attention, error detection, mental flexibility, problem solving, learning, and emotion regulation.[4]
✓ Results suggest that disturbances of white matter integrity of fronto-temporal pathways are related to material specific retrieval difficulties in TLE.

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