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

Mario F. Dulay, PhD.1, Amit Verma, M.D.1, Christof Karmonik, Ph.D.1, Zhong Xue, Ph.D.1, Adriana M. Strutt, Ph.D.2, Michele K. York, Ph.D.2, Hani Haykal, M.D.1, Robert G. Grossman, M.D.1

The Methodist Hospital Neurological Institute1 and the Department of Neurology, Baylor College of Medicine2

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. Decreased diffusion anisotropy has been demonstrated in white matter tracts of adults with TLE. Recently, two studies2,3 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.

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 (Figure 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).

RESULTS (Figure 3)

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

RESULTS (Figure 3)

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.

REFERENCES