Specific White-Matter Connectivity Alterations In Posttraumatic-Patients: Correlation To Associative Memory Deficits

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Introduction

1. Memory deficits are a common complaint among posttraumatic stress disorder (PTSD) patients. Despite vivid trauma-related memory, PTSD studies confirm memory impairment for non-trauma related stimuli, specifically in associative memory (Guez et al., 2011, 2013).

While functional magnetic resonance imaging (fMRI) studies in healthy populations suggest hemispheric asymmetry and lateralization of memory related functions (see hemisphere encoding/retrieval asymmetry [HERA] model by Tulving, Kapur, Craik, Moscovitch, & Houle, 1994), and neuroanatomical studies suggest a key role of the CC in inter-hemispheric communication (Gazzaniga, 2000, Rongo, Doty, Demeter, & Simard, 1994), thus far no studies have examined the role of the CC in memory performance of posttraumatic patients.

Thus, in this study we measured the volume of the CC in PTSD patients recruited 6-36 months after the traumatic event and healthy controls, and tested the correlation to memory performance. Exclusion criteria included pre-existing/comorbid psychiatric or neurological disorders (including TBI), alcohol abuse or the use of illicit drugs.

Methods and Results: I. Behavior

Pictorial Task

- Participants were presented with a study list of 19 unrelated (visually or semantically) emotionally neutral pairs, comprising either 38 words or line-draw pictures, one at a time (4 seconds per pair).
- Subjects performed two repetitions for each task (words and pictures) item and associative memory recognition. In the item task, participants viewed 12 stimuli (words or pictures), and were instructed that the list included 6 targets and 6 distractors.
- Participants were instructed to respond to each stimulus on the keyboard with a designated “yes” key (=1) for targets and a “no” key (+0) for distractors.
- In the associative task, participants viewed 12 stimulus pairs (words or pictures) and were informed that the list included 6 intact and 6 recombined pairs of stimuli, and were instructed to respond on the “yes” key for intact pairs (targets), and on the “no” key for the recombined pairs (distractors).

Methods and Results: II. Anatomy

MRI Data Acquisition & Analysis: 3-dimensional structural MRI scans were acquired on a 1.5 T scanner (Philips Medical Systems). Two complete T1-weighted whole brain anatomical scans were collected per subject with the following parameters: TR (repetition time)=15ms, TE (echo time)=4-6ms. FA (flip angle) = 30°. Matrix size 256x256, field of view 25.6 cm, 150 sagittal slices (1x1x1 mm resolution). Images were pre-processed using FreeSurfer software (3.0.2) on a linux platform (Fischl et al., 2002; Fischl et al., 2004).

Analysis of whole brain white and gray matter did not reveal significant differences between the groups. Analysis of CC portions revealed significant volume reduction in the PTSD group for the anterior (p<0.04), mid-anterior (p<0.008), central (p<0.01), and the mid-posterior (p<0.03) portions. A trend was found for the posterior portion (p=0.08, n.s.). The total volume was also found significantly reduced in the PTSD group (p<0.01).

Conclusions

The current study synthesizes often disparate findings from individual studies by combining cognitive assessment and evaluative MRI measurements of CC volume. Our results highlight structural changes in inter-hemispheric white-matter as a potential substrate for the associative-memory deficits found in PTSD. We suggest that the fragmented trauma processing seen in PTSD may be related in part to an altered cognitive processing as seen in the current study. This hypothesis is in line with therapeutic approaches to PTSD that target the integration of the fragmented memories into a cohesive episode and narrative.

The Authors declare no potential conflict of interest

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