Parietal gray matter volume changes may be associated with early Parkinson's disease memory deficits

16 January 2014

Research by a team of investigators in Finland suggests that the free recall memory deficits common even in early stages Parkinson's disease (PD) are related to structural changes in the brain, specifically parietal cortical gray matter volume. Their findings are published in the current issue of the *Journal of Parkinson's Disease*.

"This study is one of the first to link a discrete area of the brain to a cognitive deficit in people at an early stage of PD, comments lead investigator Ulla Ellfolk, Department of Psychology and Logopedics of Abo Akademi University, and the Division of Clinical Neurosciences, Turku University Hospital, Turku, Finland. "Clinical studies have shown that free recall is more strongly affected than language, performance on simple attention tasks, and visuospatial functioning in newly diagnosed PD patients."

In the current study researchers are using very precise MRI data to localize small brain areas that underlie memory deficits associated with PD. While impaired memory in PD patients has been associated with volume loss in several temporal lobe structures, including the entorhinal cortex, few studies have looked at brain gray matter volume in relation to specific cognitive tasks and even fewer have been able to correlate structural changes with deficits in learning or memory at the earliest disease stages.

One of the reasons previous studies may have failed lies in the memory task chosen for testing. The investigators could not find any correlation between gray matter volume and visual and verbal memory in patients with newly diagnosed PD using conventional memory tasks, but were able to find a significant correlation using a novel, non-intentional incidental memory task that measures free recall. To their surprise, degenerative brain changes in the parietal region were found only on the right side of the brain.

Twenty-eight patients with early PD (disease duration less than 3 years) and 28 healthy controls underwent MRI imaging and neuropsychological testing within a four-week interval. None of the patients were clinically demented and none manifested cognitive deficits that significantly impaired their daily life.

Results from neuropsychological tests showed that the PD patients were significantly impaired compared to controls on tasks that measured incidental free recall, intentional free recall, wordlist learning, and visuospatial control tasks. No differences were found for wordlist delayed recall, wordlist savings percent, and executive control tasks.

The investigators used voxel-based morphometry (VBM) of MRI images, a neuroimaging analysis technique that allows measurement of focal differences in brain anatomy, to see whether they could find brain changes associated with memory impairment. Overall, they could find no statistically significant difference between PD patients and controls in local gray matter volumes, confirming that the PD patients were at early stages of disease.

However, significantly lower scores on the incidental memory task were associated with smaller local gray-matter volume in the right parietal cortex for the whole group and for the PD group alone. No such relationship was found in the control group and no other associations were found for any of the other memory tasks.

To interpret these findings, it is important to understand how the incidental free recall test differs

from other memory tasks. In this test, a participant is asked to name items 30-60 from the Boston Naming Test. Naming is followed by asking the subject to recall the previously named items. Unlike intentional memory tests, the subject is not told ahead of time that he will be asked to recall the items. Incidental memory tasks are therefore very similar to real life situations where we are able to recollect content, events, or contexts without a prior intention of memorizing them.

"The most prominent difference between the incidental task and the other memory tasks was the absence of an explicit instruction to memorize items. Thus, no external cues to focus attention on the visual items were available during encoding," says Ellfolk. "This free recall test in particular may be sensitive to right parietal deficits because the parietal region modulates attention to memory and the visual rather than semantic nature of the task is directed to the right side of the brain."

Provided by IOS Press