Cortical neuroanatomical changes related to specific neuropsychological deficits in subcortical vascular cognitive impairment

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Abstract
Background: Neuropsychological test-specific neural substrates in subcortical vascular cognitive impairment (SVCI) are expected to differ from those in Alzheimer’s disease-related cognitive impairment (ADCI) but the details are unclear. To determine neural substrates related to cerebral small vessel disease, we investigated the correlations between cognitive dysfunctions measured by standardized neuropsychological tests and cortical thickness in a large sample of participants with amyloid negative (Aβ (-)) SVCI.

Method: One hundred ninety-eight participants with Aβ (-) SVCI were recruited from the memory clinic between November 2007 to August 2018. To acquire neural substrates, we performed linear regression using the scores of each neuropsychological test as a predictor, cortical thickness as an outcome, and age, sex, education years, intracranial volume and white matter hyperintensity (WMH) as confounders.

Result: Poor performances in each neuropsychological test were associated with cortical atrophy in certain brain regions regardless of WMH. Especially, not the medial temporal but the frontal and posterior cingulate regions with cortical atrophy were mainly associated with memory impairment. Poor performance in animal fluency was more likely to be associated with cortical atrophy in the left hemisphere, while poor performance in the visuospatial memory test was more likely to be associated with cortical atrophy in the right hemisphere.

Conclusion: Our findings suggested that cortical atrophy was an important factor of cognitive impairment in Aβ (-) SVCI regardless of WMH. Furthermore, our findings might give clinicians a better understanding of specific neural substrates of neuropsychological deficits in patients with SVCI.
| Subtests           | Correlation Maps | Al   | Subtests  | Correlation Maps | Al   |
|-------------------|------------------|------|-----------|------------------|------|
| Digit span        | Backward         | 0.08 | RCFT      | copying          | 0.03 |
| K-BNT             |                  | 0.03 | COWAT     | animal           | -0.41|
| SVLT delayed recall |                | 0    | COWAT     | phonemic fluency | 0    |
| RCFT delayed recall |              | 0.23 | Stroop    | test colour reading | -0.08 |

**FIGURE 1**