CHOLINERGIC PATHWAY SUBCORTICAL HYPERINTENSITY VOLUME CORRELATES WITH EXECUTIVE FUNCTION AND HIPPOCAMPAL VOLUME

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BACKGROUND

The presence of subcortical hyperintensities (SH) strategically located within the cholinergic pathways is believed to reflect cerebrovascular compromise of the cholinergic system in dementia [1,2]. Hippocampal (HP) atrophy is a commonly used biomarker for Alzheimer’s disease (AD) and has been shown to be associated with cognition and memory dysfunction [3, 4, 5].

PURPOSE & HYPOTHESIS

To examine the relationships between vascular dysfunction [3, 4, 5]. We hypothesized that subjects who have poor cognitive function would have greater volumes of cholinergic SH (chSH) and hippocampal lacunes (hlacun) and that these volumes would be associated with HP atrophy.

METHODS

MRI-derived volumetrics:
- chSH and hlacun volumes were obtained using a modified version of Lesion Explorer (LE) [6]. HP volumes were obtained using the Sunnybrook Hippocampal Volumetry (SBHV) Tool [7].

Neuropsychological Assessment [8]:
- Executive: Verbal Fluency ’FAS’ Test
- Wisconsin Card Sorting Test
  - number of decisions correct overall
  - perseverative errors to previous response
  - perseverative errors to previous category

Analyses were performed with age, sex, education, brain parenchymal fraction (BPF), global SH and Dx included as covariates when applicable.

RESULTS

Table 1. Demographics and raw volume data: AD and NC

<table>
<thead>
<tr>
<th>Variable</th>
<th>NC [n=92]</th>
<th>AD [n=182]</th>
<th>p</th>
<th>Cohen’s d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age [years]</td>
<td>69.4±7.4</td>
<td>66.2±7.5</td>
<td>0.06</td>
<td>0.17</td>
</tr>
<tr>
<td>Sex (male)</td>
<td>50 (55)</td>
<td>102 (56)</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>Education [years]</td>
<td>15.3±3.7</td>
<td>14.6±3.5</td>
<td>0.07</td>
<td>0.09</td>
</tr>
<tr>
<td>Global SH [cc]</td>
<td>5.4±0.3</td>
<td>5.4±0.3</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>Total chSH [cc]</td>
<td>0.2±0.2</td>
<td>0.2±0.2</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>Left ch-lacune [mm³]</td>
<td>0.1±0.1</td>
<td>0.1±0.1</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>Right ch-lacune [mm³]</td>
<td>0.2±0.1</td>
<td>0.2±0.1</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>HP volume</td>
<td>3.7±0.3</td>
<td>3.7±0.3</td>
<td>ns</td>
<td>ns</td>
</tr>
</tbody>
</table>

Data are presented as mean±SD. *p<0.05, **p<0.01, ***p<0.001.

Figure 1. The chSH volume generated by LE was highly correlated with the CHolinergic Pathways Hypertensides Scale (CHIPS) [1].

Figure 2. Cholinergic pathways segmentation (left hemisphere=blue, right hemisphere=green), overlaid on T1 weighted MRI

Figure 3. Cholinergic pathways segmentation (left hemisphere=blue, right hemisphere=green), overlaid on T1 (left), proton density (PD) with lesion mask (deep white SH=red, periventricular SH=yellow), middle, and T2 (right)

Figure 4. SBHV Tool output: 3D rendering of NC (left) and AD (right) HP, right HPgreen, left HPred (Note: HP are depicted in neurological convention).

The current study also suggests that chSH may be related to memory dysfunction, as HP volume is inversely associated with chSH (in the right hemisphere).

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REFERENCES


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