The relationships between hippocampal cerebrovascular reactivity, hippocampal volume, and episodic memory in healthy ageing

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Abstract

Background

Cerebrovascular biomarkers such as cerebrovascular reactivity (CVR) have previously been associated with episodic memory. However, the relationship between memory and regional CVR within the hippocampus is not well studied. Moreover, whether this association is affected by hippocampal volume remains to be investigated. This study investigated the associations between hippocampal physiology, structure, and memory in ageing.

Method

Data from 104 participants (Age: Mean = 77±4.9 years) of the ongoing Oxford Heart and Brain Study was analysed for this study. CVR was assessed by a compensatory change in the blood oxygenation level dependent magnetic resonance imaging (MRI) signal in response to a 5% CO_2 challenge, hippocampus volume was measured by structural MRI, and episodic memory was assessed with the Hopkins Verbal Learning Test Revised (HVLT-R).

Result

Mean hippocampal CVR decreased with age (β = -0.004, p = 0.006). Mean hippocampal CVR was positively associated with mean hippocampal volume (β = 0.11, p = 0.010), and this association was driven by the left hippocampus after correcting for age and sex. Higher hippocampal CVR was also associated with better performance on the HVLT (β = 13.8, p = 0.035). This association was fully mediated by hippocampal volume, suggesting a path from cerebrovascular reactivity to episodic memory (Sobel's z = 2.16, p = 0.030, see Figure 1).

Conclusion

This study presents novel findings showing that hippocampal CVR was associated with episodic memory, and this association was mediated by hippocampal volume. This suggests a pathway by which impairments in hippocampal CVR are associated with worse episodic memory via smaller hippocampal volumes.

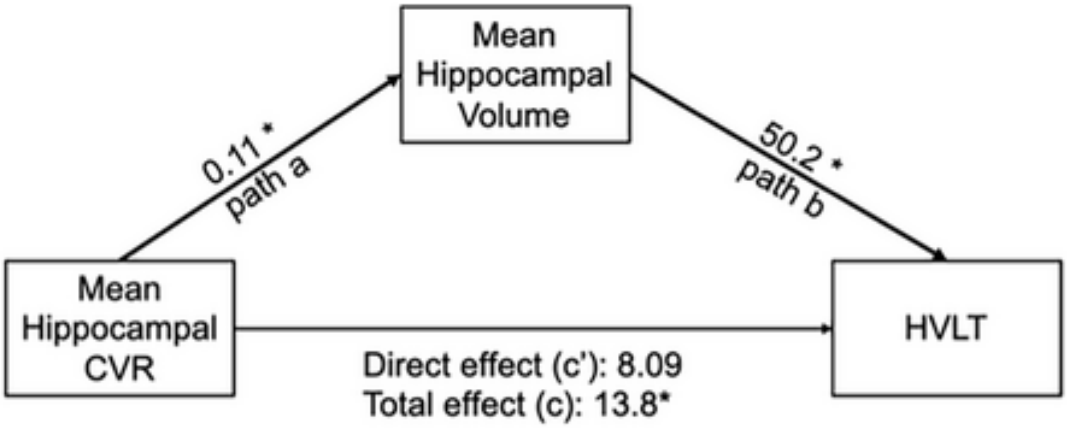

Figure 1: Unstandardised regression coefficients for the relationship between mean hippocampal CVR and HVLT (episodic memory) as mediated by mean hippocampal volume.
*p<0.05.