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Hippocampal Dentation: Structural Variation and its Association with Episodic Memory in Healthy Adults

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Abstract:

While the hippocampus has long been identified as a structure integral to memory, the relationship between morphology and function has yet to be fully explained. We present an analysis of *hippocampal dentation*, a morphological feature previously unexplored in regard to its relationship with episodic memory. “Hippocampal dentation” in this case refers to surface convolutions, primarily present in the CA1/subiculum on the inferior aspect of the hippocampus. Hippocampal dentation was visualized using ultra-high resolution structural MRI and evaluated using a novel visual rating scale. The degree of hippocampal dentation was found to vary considerably across individuals, and was positively associated with verbal memory recall and visual memory recognition in a sample of 22 healthy adults. This study is the first to characterize the variation in hippocampal dentation in a healthy cohort and to demonstrate its association with aspects of episodic memory.

Keywords:

episodic memory; healthy adults; hippocampus; ultra high resolution MRI

Introduction

The role of the hippocampus in declarative memory has been implicated and extensively investigated since the surgical removal of the medial temporal lobe of Patient H. M. (Scoville and Milner, 1957). Although he suffered from severe declarative memory deficits, H.M.’s motor memory and working memory remained functionally intact, leading to the theory that these types of memory are processed separately (Corkin, 1984). Declarative memory is defined by the ability to recall everyday facts (semantic memory) and personal experience (episodic memory) (Eichenbaum, 2004; Squire, 1992), with consolidation occurring principally in the hippocampus (Duvernoy et al., 2013; Eichenbaum, 2000; Eichenbaum, 2004; Squire et al., 2004).

Regarding hippocampal structure, the dentate gyrus of the human hippocampus derives its name from its ridged, “tooth-like” appearance on its intraventricular aspect (also known as the margo denticulatus) that is unique to humans and higher primates (Duvernoy et al., 2013). Similarly, the CA1/subicular region of the hippocampus proper also may show an undulating contour that takes on a “dentated” appearance on MRI, though to a highly variable degree. In some individuals the undulations become quite prominent and form folds in the inferior aspect of the hippocampus (Duvernoy et al., 2013) as can be seen clearly in high resolution images in the sagittal plane through the body and tail of the hippocampus (Fig. 1). We have coined the term “hippocampal dentation” to refer to this morphologic feature of the inferior aspect of the

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