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Memory Performance and Mammillary Body Volumes in Patients with Hypothalamic-Pituitary Tumors

Introduction: In the last decade, the relevance of the mammillary bodies (MB) for episodic memory performance gained increased attention. While there is some evidence for their relevance from animal studies, the role of this small hypothalamic structure for memory in humans is still under debate. Based on anatomical considerations, we hypothesized that a significant proportion of patients with hypothalamic-pituitary tumors would show clinically relevant impairments in episodic memory performance, but no such abnormalities in recognition and working memory performance. In addition, we hypothesized a positive correlation between patients' episodic memory performance and the size of their MB on MRI.

Methods: A total of 107 survivors of childhood-onset craniopharyngioma (age 8 to 49 years) were recruited from the trials of the KRANIOPHARYNGEOM Registry in Oldenburg. Patients travelled from all over Germany for two-day neuropsychological, physical and MRI examinations at the University of Oldenburg. Memory performance was assessed with standardized neuropsychological tests (Verbal Learning and Memory Test, Digit Span). For manual delineation and subsequent computation of the MB volumes, the image computing platform 3D Slicer was used by two independent assessors. We performed binominal distribution analyses to assess whether the proportion of individuals exhibiting impaired performance significantly exceeded a specific proportion that would be expected for the general population (clinical cut-off value $\leq 10^{\text{th}}$ percentile). Spearman correlation was used to test for the relation between the size of the MB (corrected for intracranial volume) and episodic memory performance. A two-tailed p-value < 0.05 was considered statistically noticeable.

Results: As hypothesized, a significant proportion of patients with craniopharyngioma presented with episodic memory performance below the predefined clinical cut-off value (23,6%). In contrast, the proportion of patients with performance in the clinically abnormal range was not significantly increased for recognition and working memory. As further hypothesized, MB volumes in patients were significantly correlated with episodic memory performance: The larger MB size, the better episodic memory performance. Noteworthy, we also observed that some of the patients with a substantial volume loss in the MB showed unexpectedly good episodic memory performance whereas others, with obviously unimpaired MB, had conspicuously poor performance.

Conclusion: Our results suggest that the MB may also play an important role in episodic memory performance in humans. Nevertheless, the following questions need to be examined further: a) How much damage the MB can tolerate before losses in memory performance become apparent and b) What role potential additional damage (e.g. in frontal, limbic and medio-temporal brain areas) plays in episodic memory impairments of patients with craniopharyngioma.