Positive, but not negative, parenting behavior in early childhood predicts both hippocampal volume and episodic memory ability in middle childhood

Morgan Botdorf, Sarah Blankenship, Lea Dougherty, & Tracy Riggins
University of Maryland, College Park

Introduction

• Early childhood experiences associated with parenting are critical for healthy development.
• Research has linked early maltreatment to differences in brain volume as well as a range of behavioral outcomes in children.
• However, more research is needed to elucidate the effect of typical variations in caregiving experiences on the developing brain and subsequent behavior.
• Research points to the hippocampus as being a main region impacted by the stress of early caregiving experiences.
• The present study seeks to extend this research by investigating implications on behavioral outcomes. Specifically, we investigate a link between normal variations in parenting in early childhood, hippocampal volume, and subsequent episodic memory ability, a type of memory reliant on the hippocampus.

Methods

MRI Data Collection
• T1-weighted high resolution (1mm³) anatomical images were acquired from a Siemens 3T scanner with a 32-channel coil at the Maryland Neuroimaging Center using a standard structural MRI scan sequence.

Hippocampal and Whole Brain Volume Extraction
• Freesurfer v5.1 was used to derive hippocampal and intracranial volumes (ICV).
• Automatic Segmentation Adapter Tool was used to refine hippocampal volumes.
• Hippocampal subregions were manually identified using standard anatomical landmarks.
• Volumes were adjusted for total brain size.

Results: Parenting-Memory Associations (n=96)
• T1/T2 Positive and Negative Parenting were entered as predictors in a multiple regression to test associations between parenting and composite memory scores.
  • Covariates: Age, gender, maternal depression, and IQ
  • T1 Positive Parenting was a significant predictor of memory performance, whereas the other parenting measures were not.

Discussion

• These results provide support for the influence of parenting, within the typical range, on cognitive abilities, specifically episodic memory ability, and the development of the hippocampus.
  • Greater T1 Positive Parenting is associated with increased bilateral hippocampal head volume and episodic memory ability.
  • Greater T2 Positive Parenting is associated with decreased left hippocampal body and tail volume. Although results did not reach significance, T2 Positive Parenting shows a positive association with episodic memory ability.
  • T1/T2 Negative Parenting exhibits a negative association with episodic memory, although not significant.
• These results suggest that the timing of parenting is important for both subsequent brain development and behavioral outcomes.
• Results suggest that early parenting may impact memory more than later, concurrent parenting.
• Additionally, early and concurrent positive parenting may differentially impact different subregions of the hippocampus.
• Exact timing and specificity of the impact of parenting on memory and the hippocampus should be investigated further.
• Although our research did not support a mediation model linking parenting, hippocampal volume, and episodic memory ability, future research should continue to investigate the mechanism through which early experiences of parenting affect memory.
• Once this link has been elucidated, research can focus on deriving interventions to target children who may be at an increased risk of memory impairments.

Acknowledgements

We would like to thank the families for participating in this study and members of CSEL, NCDL, and the NIMH for assistance with subject recruitment and testing. This research was supported by the University of Maryland (UMD) College of Behavioral and Social Sciences Dean’s Research Initiative Award, the OMB Research and Scholars Award, and the National Science Foundation (NSF) in partnership with the University of Maryland ADVANCE Program for Inclusive Excellence Award.

References

For questions or comments, please contact mbotdorf@terpmail.umd.edu