Longitudinal associations between negative parenting during early childhood and hippocampal resting-state networks three years later

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Introduction

• Extreme negative parenting (i.e., maltreatment) during childhood has been associated with a wide range of cognitive, emotional, and neural deficits (for review, see Belsky & Haan, 2011)
• The hippocampus, a medial temporal lobe structure implicated in a number of cognitive processes such as memory and spatial navigation, is particularly sensitive to the effects of stress
• Little is known about how normative early life stressors, such as negative parenting, may influence hippocampal development
• To date, two studies have provided evidence for early associations between normative levels of parenting and later hippocampal volume (Luby et al., 2012, Rao et al., 2010)
• Together, these studies provide evidence of an association between hippocampal structure and normative parenting behaviors, but importantly, no studies have investigated the relation between early negative parenting and hippocampal function

Resting-state functional connectivity provides a useful method to examine how negative parenting may affect the functional organization of the brain, in contrast to studying the hippocampus as an isolated entity
• The present study sought to explore this gap in the literature by prospectively comparing negative parenting behaviors measured observationally at 3-5 years with hippocampal resting-state connectivity at 5-8 years

Methods - Wave 1

Participants
• 174 children (85 male) aged 3-5 years (M=49.72, SD = 9.93 months) participated in the first wave
• Children were recruited based on their mother’s history of Major Depressive Disorder (MDD)
• No Maternal MDD (n=83)
• Maternal MDD (n=85)

Behavioral Assessment
• Children and their parents worked together to complete six episodes (e.g., Book readings, Maze, Blocks) modified from the Teaching Tasks Battery (Egelund et al., 1995)
• Each episode was coded on a 5-point scale
• Maternal Intrasubservience, Maternal Hostility, and Maternal Support (reverse-scored) were combined across episodes and converted to t-scores for a composite measure of Negative Parenting

Methods - Wave 2

Participants
• To date, 40 children have completed the Wave 2 Imaging session. 15 participants were excluded from current analyses due to motion in any direction exceeding 2mm. Data from 25 children (13 male) aged 5-8 years (M = 7.23 ± 6.66 years) are included here.

MRI Data Collection
• Functional and anatomical data were collected at the Maryland Neuroimaging Center using a 12-channel coil in a Siemens’ Tesla scanner. Participants watched a video of abstract patterns/shapes during the 6-minute acquisition of functional data.

Data Processing
• All functional analyses were conducted using AFNI (Cox, 1996).
• BOLD signal from white matter and CSF masks and continuous motion regressors from 6 directions (roll, pitch, yaw, x, y, z) were included as noise covariates.
• Data were band-pass filtered at .005<fc<1.
• Correlation coefficients were computed between bilateral hippocampal regions of interest and the whole brain using the Negative Parenting Composite as a covariate.
• Hippocampal volumes for each participant were obtained using Freesurfer (Fischl et al., 2002)

Right Hippocampal Connectivity (n=25)

• Greater negative parenting was associated with increased connectivity between right hippocampus and right Superior Frontal Gyrus.
• Left hippocampus shows the same association (not shown here)

Left Hippocampal Connectivity (n=25)

• Greater negative parenting was associated with increased connectivity between left hippocampus and left Angular Gyrus.

Discussion

• This is the first study to provide evidence that early normative levels of negative parenting predicted individual differences in hippocampal functional networks
• Left and right hippocampal resting networks were differentially associated with negative parenting
• In the regions presented here, greater negative parenting was associated with increased connectivity
• Greater negative parenting was associated with decreased hippocampal volumes - replicating Luby et al., 2012
• Convergent interpretations of this data are limited due to our small sample size
• It will be important for future examinations to investigate the behavioral significance of the functional changes associated with parenting behaviors (e.g., memory, emotion regulation, stress reactivity)
• Exploratory analyses suggested that the relation between hippocampal networks and negative parenting may be driven by maternal MDD status
• Future analyses will have the added power of an increased sample and allow the statistical comparison of groups

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