Memory Ability and Hippocampal Volume in Adolescents with Prenatal Poly-Drug Exposure


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INTRODUCTION

- Drug abuse among women of childbearing age is a serious public health problem
- Prenatal drug exposure (PDE) to cocaine, heroin, methamphetamine, or multiple illicit substances has been shown to alter the course of development and adversely impact physical, cognitive, and socio-emotional development
- Longitudinal studies have reported that effects tend to be small and attenuated by child or environmental variables
- Given the changes that take place throughout the adolescent years, it is reasonable to expect that the effects of PDE may also change over time

GOALS

- Compare memory performance between PDE and CC adolescents
- Compare hippocampal volumes between PDE and CC adolescents
- Correlate memory performance with hippocampal volumes

METHODS

Participants

Participants were part of a longitudinal follow-up of drug-using women and their infants. Recruitment at hospital of birth, at age 5, and at age 14. Eligibility for PDE group included prenatal drug exposure and/or history of exposure, gestational age > 32 weeks, no ICU admission. CC group matched on age, race, and socioeconomic status.

- 28 PDE, 24 CC: Demographically similar on all variables except number of caregivers
- Age: 14.42 years +/- 14 months
- Gender: 29 (56%) female, 23 (44%) male
- PDE: 60.7% of mothers used 3-5 drugs at least 1x/month during pregnancy.

Memory Task and Analysis

California Verbal Learning Test – Child Version (CVLT-C)

- List A: “shopping list” of 15 items; List B: new “shopping list” of 15 items
- Recall/retell list A (x5), recall/retell list B, recall list A
- Dependent measure: number of items recalled for List A and List B

Anatomical Data Acquisition and Analysis

- 3 T Siemens Allegra
- Whole-brain oblique axial T1-weighted images (TR = 2.5 s, TE = 4.38 ms, FA = 80°)
- Cortical reconstruction and volumetric segmentation in FreeSurfer

Analysis Models

1. No behavioral covariates (only total cortical gray matter (GM))
2. Covary age, gender, IQ (+ total cortical GM)
3. Covary frequent gestational exposure to tobacco and alcohol (+ total cortical GM)
4. Covary CES-D and number of caregiver changes (+ total cortical GM)

RESULTS

No group differences were apparent between PDE and CC on List A-Trial 5. Group differences were significant for performance on List B as CC adolescents recalled more items than PDE adolescents. This group difference was significant with model 1 and 2.

VOLUME SEGMENTATION

None of the models (1-4) found any significant differences between PDE and CC total cortical gray matter, total white matter, total subcortical gray matter or total intracranial volume.

Conclusions

- Memory differences were not found on CVLT-C List A but there was a significant difference between groups on the subsequent list CVLT-C List B.
- This pattern of performance may reflect proactive interference.
- Memory impairment may emerge under increased demands.
- The differences on List B diminished with exposure and quality of care covariates.
- Direct and indirect effects through characteristics commonly associated with PDE.

Correlation

- Hippocampal size was negatively correlated with CVLT-C List B memory performance.
- This finding is consistent with previous research.
- Collapsed across groups, hippocampal volume was significantly correlated with memory performance in models 1-2 and at trend level significance in model 3.

Future Directions:

- Re-test memory performance at late adolescence (age 16-20)
- Perform volume segmentation on late adolescence anatomical (age 16-20)
- Analyze differences between subject at late adolescence and across time with in-subject

REFERENCES