Brain Volume Differences in Adolescents with Prenatal Poly-Drug Exposure

K. Cacic 1, T. Riggins 2, S. Buckingham-Howes 3, M. M. Black 3, B.J. Salmeron 1

National Institute on Drug Abuse-IRP 1, Baltimore; University of Maryland 2, College Park; University of Maryland School of Medicine 3, Baltimore

Synopsis

Goal

Compare brain volumes involved in cognitive and affective processes in adolescents with prenatal drug exposure to their community comparisons.

Conclusions

Volume differences were found in right Brodmann Area 45, left lateral orbitofrontal, left rostral middle frontal, and bilateral hippocampi. Right BA 45 volume correlates to more cautious Go/No-Go performance and left hippocampal volume correlates to worse memory task performance.

Introduction

• Drug abuse among women of childbearing age is a serious public health problem 1,2.
  • The National Survey on Drug Use and Health indicates 9.3% of pregnant women age 18 to 44 use illicit drug 3.
  • Prenatal drug exposure (PDE) to illicit drugs has been shown to adversely impact physical, cognitive, and socio-emotional growth. 4 Longitudinal studies have reported that effects tend to be small and attenuated by child or environmental variables 5.
  • In spite of this variability, evidence suggests some effects of PDE in certain domains persist.
  • Recent neuroimaging studies show that PDE impacts neural development 6.
  • PDE Children and adolescents show differences in brain structure and function, including lower mean cortical gray matter 7 and small volumes of subcortical structures 8 versus comparison groups.

Based on previous literature, we hypothesized that PDE adolescents would have volumetric differences from community controls in frontal and subcortical brain regions involved in cognitive and affective process.

Methods

Participants

• Recruited at birth, age 5 and age 14 at hospital or primary care clinics
  • Eligibility for PDE group included: prenatal cocaine/heroin exposure, no ICU
  • PDE: 60.7% of mothers used 3-5 drugs at least 1x/month during pregnancy 9.
  • PDE, CC: matched on age, race, socioeconomic status, and maternal age.
  • Age: 14.42 +/- 1.4 months; Gender: 22 (42%) male, 29 (57%) female
  • Unmatched: number in prenatal care, prenatal cigarette/alcohol exposure

Go/No-Go Task

• Press spacebar as quickly as possible for all stimuli except "X"
  • Dependant measures: List A recall, List B recall, percent change List A to List B recall

CVLT-C Memory Task

• Recall list of 15 items (List A, List B) immediately after presentation of list
  • Analysed Data Acquisition and Analysis:
    • Siemens Allegra Scanner: whole brain volumes
    • Cortical reconstruction and volumetric segmentation completed in FreeSurfer

Analysis Models

• Five statistical models (total cortical gray matter covariated for all volumetric analyses):
  1. No behavioral covariates
  2. Age at scan, gender covariates
  3. Age, gender, IQ covariates
  4. Age, gender, IQ, prenatal alcohol/cigarette exposure covariates
  5. Age, gender, IQ, prenatal alcohol/cigarette exposure, caregiver depression and changes by age 10

Whole Brain Volumes

There were no significant differences on whole brain volumes between the PDE and CC groups. This is inconsistent with some previous studies which have found lower mean cortical gray matter but notably, significant head circumference differences are often present at birth between cohorts which were not present in 11.

Future Directions

We plan to investigate cortical thickness differences between groups, re-test volumetric differences at late adolescence (16-20 years old) and analyze volume differences across time.

Discussion

References

9. Supported by NIDA/NIMH, R01 DA07432 (Keci), R01 DA021059 (Black), and R01 DA025113 (Fujikawa).