Magnetic resonance imaging outcomes from a comprehensive magnetic resonance study of children with fetal alcohol spectrum disorders

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ABSTRACT

Background: Magnetic resonance (MR) technology offers non-invasive methods for in vivo assessment of neuroabnormalities.

Methods: A comprehensive neuropsychological/psychiatric battery, coupled with MR imaging, (MRI), MR spectroscopy (MRS), and functional MRI (fMRI) assessments, were administered to children with fetal alcohol spectrum disorders (FASD) to determine if global and/or focal abnormalities could be identified, and distinguish diagnostic subclassifications across the spectrum. The four study groups included: 1. FAS/Partial FAS; 2. Static Encephalopathy/Alcohol Exposed (SE/AE); 3. Neurobehavioral Disorder/Alcohol Exposed (ND/AE) as diagnosed with the FASD 4-Digit Code; and 4. healthy peers with no prenatal alcohol exposure. Presented here are the MRI assessments used to compare the sizes of brain regions between the four groups. The neuropsychological/behavioral, MRS, and fMRI outcomes are reported separately.

Results: Progressing across the four study groups from Controls to ND/AE to SE/AE to FAS/PFAS, the mean absolute size of the total brain, frontal lobe, caudate, putamen, hippocampus, cerebellar vermis, and corpus callosum length decreased incrementally and significantly. The FAS/PFAS group (the only group with the 4-Digit FAS facial phenotype) had disproportionately smaller frontal lobes relative to all other groups. The FAS/PFAS and SE/AE groups had disproportionately smaller caudate regions relative to the ND/AE and Control groups. The prevalence of subjects in the FAS/PFAS, SE/AE, and ND/AE groups that had one or more brain regions, two or more standard deviations below the mean size observed in the Control group was78%, 58%, and 43%, respectively . Significant correlations were observed between the size of brain regions and level of prenatal alcohol exposure

Conclusions: MRI provided further validation that ND/AE, SE/AE, and FAS/PFAS, as defined by the FASD 4-Digit Code, are three clinically distinct and increasingly more affected diagnostic subclassifications under the umbrella of FASD. Neurostructural abnormalities are present across the spectrum. MRI could importantly augment diagnosis of conditions under the umbrella of FASD, once population-based norms for structural development of the human brain are established.