

A MRI, MRS, fMRI, neuropsychological, and psychiatric assessment of children with fetal alcohol spectrum disorders.

Part II. MRI

Susan J. Astley^a; Elizabeth H. Aylward^b, Allison Brooks^a, Heather Carmichael Olson^c, Truman E. Coggins^d, Julian Davies^e, Susan Dorn^a, Beth Gendler^a, Tracy Jirikowic^f, Kimberly Kerns^g, Paul Kraegel^a, Kenneth Maravilla^b, Todd Richards^b

^a Department of Epidemiology, University of Washington, Seattle, WA, 98195, USA

^b Department of Radiology, University of Washington, Seattle, WA, 98195, USA

^c Department of Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, 98195, USA

^d Department of Speech and Hearing Sciences, University of Washington, Seattle, WA, 98195, USA

^e Department of Pediatrics, University of Washington, Seattle, WA, 98195, USA

^f Department of Rehabilitation Medicine, University of Washington, Seattle, WA, 98195, USA

^g Department of Psychology, University of Victoria, Victoria, BC, V8P 5C2, Canada

ABSTRACT

Magnetic resonance (MR) technology offers non-invasive methods for in vivo assessment of neuroabnormalities. A comprehensive neuropsychological/psychiatric, MR imaging, (MRI), MR spectroscopy (MRS), and functional MRI (fMRI) assessment was administered to children with fetal alcohol spectrum disorders (FASD) to determine if global and/or focal abnormalities could be identified 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) diagnosed with the FASD 4-Digit Code; and 4) healthy controls with no prenatal alcohol exposure. Results are presented in a series of four reports: Part 1: FASD diagnostic and neuropsychological/psychiatric contrasts; Part II: MRI (presented here); Part III: MRS, and Part IV: fMRI. Part II, MRI: Contrasts in size of brain regions (frontal lobe, caudate, putamen, hippocampus, corpus callosum, and cerebellar vermis) were assessed across the four study groups. All brain regions (except the corpus callosum) became significantly smaller as one advanced from controls to ND/AE to SE/AE to FAS/PFAS. The frontal lobe was disproportionately smaller in the FAS/PFAS group, the only group with the 4-Digit FAS facial phenotype. The frontal lobe and FAS facial features share a common embryologic origin; the frontonasal prominence. The caudate was disproportionately smaller in FAS/PFAS and SE/AE groups. Subjects with FASD and the 4-Digit FAS facial phenotype had more severe brain abnormality than subjects with FASD and no FAS facial features. The prevalence of subjects in each FASD group with one or more brain regions, two or more standard deviations below the mean of the control group, was 43% among ND/AE, 58% among SE/AE and 78% among FAS/PFAS. Significant correlations were observed between the size of brain regions and prenatal alcohol exposure, severity of the FAS facial phenotype, and neuropsychological impairment. This study confirmed that FAS/PFAS, SE/AE, and ND/AE, as defined by the 4-Digit Code, are three clinically distinct diagnostic groups. MRI could greatly augment diagnosis of FASD, once population-based norms are established.