[N-73] Consequences of Early Exposure to General Anesthetics on Brain Functions: A Functional Magnetic Resonance Imaging (fMRI) Study

[1]Taghon T, [2]Kashou N, [3]Small R

[1]Nationwide Children's Hospital , Columbus , Ohio, USA; [2]Wright State University , Dayton , Ohio, USA; [3]The Ohio State University , Columbus , Ohio, USA

Background: Anatomical magnetic resonance imaging (MRI) studies have suggested that brain structures utilized in response inhibition may be sensitive to ethanol toxicity (1). Subjects with a history of prenatal ethanol exposure showed greater activation across prefrontal cortical regions and diminished right caudate nucleus activation on functional MRI (fMRI) imaging when performing a go/no-go response inhibition task (2). Pharmacologically, ethanol and general anesthetics have similar receptor-level activity in the brain (3). The present study utilized fMRI to examine brain activation patterns in children with early exposure to general anesthesia.

Methods: After obtaining Nationwide Children’s Hospital IRB approval, we utilized a surgical database to identify and recruit children ages 10-16 years with a history of a minimum one-hour exposure to general anesthetics when they were between 0-24 months of age. We also recruited age and gender matched children without anesthesia exposure as a control group. Subjects were presented with a standard computer generated go/no-go response inhibition paradigm (Psychology Software Tools, Inc., Sharpsburg, PA). The fMRI data processing was carried out using FEAT Version 5.98 (FMRIB’s Software Library, www.fmrib.ox.ac.uk/fsl). Time-series statistical analysis was carried out using FILM with local autocorrelation.

Results: When comparing mean voxels of activation, results between the two groups during the Go signal versus NoGo (rest), areas of activation in the cerebellum (declive, culmen and tuber) are observed in patients but not controls (P=0.01). Fig 1. Similarly, the anesthesia exposed group (mean) showed areas of activation at the anterior cingulate, corpus callosum, and cingulate gyrus during the NoGo versus Rest comparison (P=0.01), but this was not noted in controls. There were no significant differences noted in mean activation in prefrontal cortex and caudate nucleus.

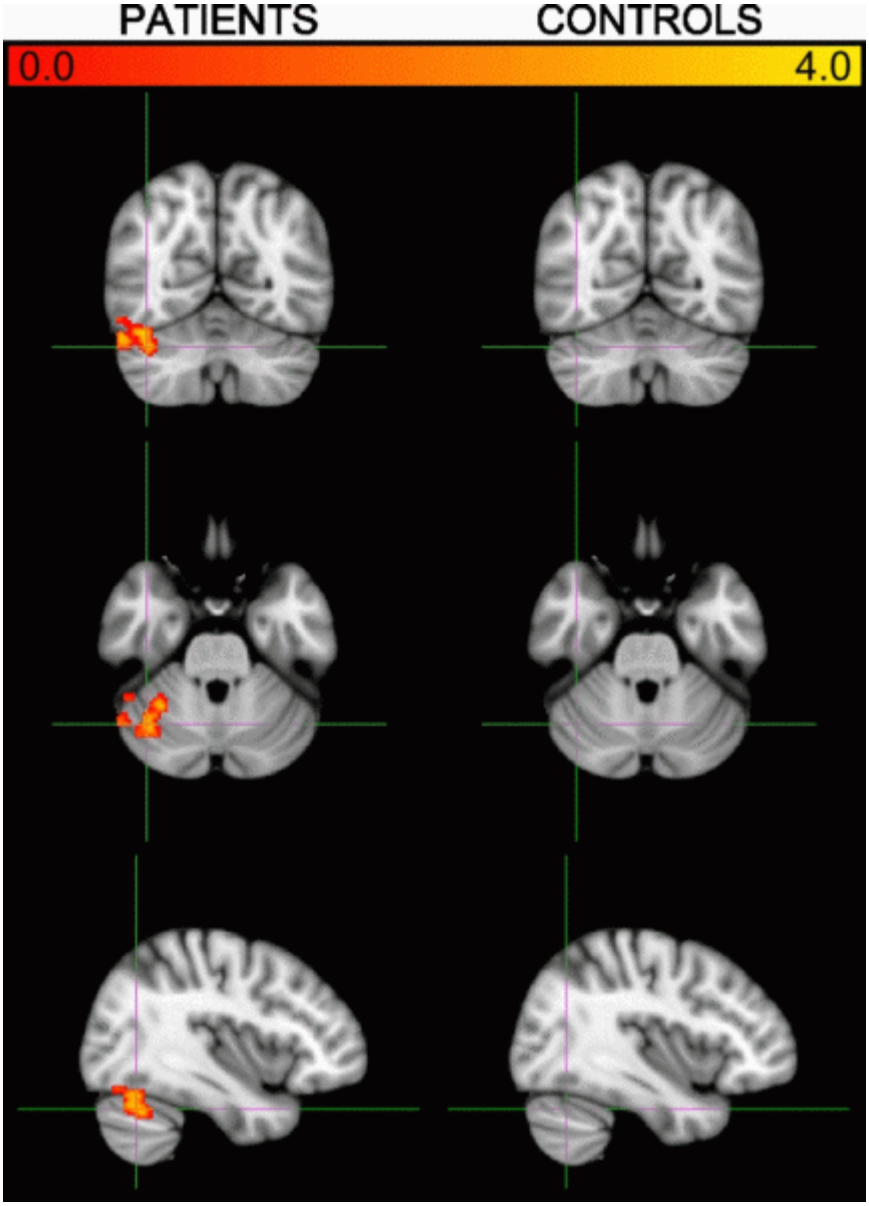
Conclusions: Our data demonstrate significant differences in brain activation patterns in the cerebellum and certain deep brain structures, but the primary areas of interest (prefrontal cortex and caudate nucleus) showed no significant difference. The fMRI may be a useful tool to evaluate the long-term effects of general anesthetics on brain functions after exposure during early brain development.

References

1.Mattson SN, Riley EP, Sowell ER, Jernigan TL, Sobel DF, Jones KL. A Decrease in the Size of the Basal ganglia in Children with Fetal Alcohol Syndrome. Alcohol Clin Exp Res 1996;20:1088-93.

2.Fryer SL, Tapert SF, Mattson, SN, Paulus MP, Spadoni, AD, Riley EP. Prenatal Alcohol Exposure Affects Frontal-Striatal BOLD Response During Inhibitory Control. Alcohol Clin Exp Res 2007;31:1-10.

3.Olney JW, Wozniak DF, Faber NB, Jevtovic-Todorovic V, Bittigau P, Ikonomidou C. The Enigma of Fetal Alcohol Neurotoxicity. Ann Med 2002;34:109-19.


PATIENTS
CONTROLS
0.0
4.0