Optical coherence angiography to evaluate concurrent changes in the fetal brain and maternal extremities due to maternal ethanol exposure

Raksha Raghunathan[1], Chih-Hao Liu[1], Manmohan Singh[1], Rajesh C. Miranda[2], and Kirill V. Larin[1,*]

[1]Department of Biomedical Engineering, University of Houston, Houston, TX, USA
[2] Department of Neuroscience and Experimental Therapeutics, TAMHSC College of Medicine
*Contact author: University of Houston, 2026 SERC, Houston, TX 77204.
Email: klarin@uh.edu

Abstract

Prenatal alcohol exposure causes a spectrum of neurodevelopmental, cardiovascular, and behavioral deficits in humans, collectively termed as fetal alcohol spectrum disorders (FASD). The severity of the defect depends on the amount of ethanol consumed and the period of gestation during which the exposure happens. The second trimester marks the peak period of fetal neurogenesis and angiogenesis. Hence, exposure to teratogens during this period affects brain development. While several studies have evaluated the changes in behavioral, morphological, and cognitive aspects of development, our previous study evaluated acute changes in fetal brain vasculature 45 minutes after maternal ethanol exposure. However, not much has been done to assess concurrent changes on both the fetal and maternal side. This study uses correlation mapping optical coherence angiography (cm-OCA) to evaluate concurrent changes in fetal brain vasculature and the maternal hindlimb after maternal exposure to ethanol. Pregnant mice at embryonic day (E) 14.5 were anesthetized and placed on a heated surgical platform to maintain body temperature. A small incision was made in the abdomen and a fetus was selected for imaging. Initial cm-OCA measurements were made. Ethanol (16.6%, dose: 3 g/kg) was administered via intragastric gavage and another cm-OCA measurement was taken 30 minutes after exposure. Results showed a dramatic vasoconstriction in the fetal brain, while vasodilation was observed in the mother. Results from the fetal brain was similar to what was seen in our previous studies.