Optical coherence tomography to assess the persistent effects of prenatal alcohol exposure on fetal brain vasculature

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Prenatal Alcohol Exposure

• Prenatal alcohol exposure (PAE) is the leading cause of developmental disabilities worldwide
• 20-30 percent of women have reported drinking at some point during pregnancy [1]
• 40% of pregnancies are unintended [2]
• Alcohol exposure during the fetal neurogenic period results in fetal growth restriction, microencephaly, and decrease in cranial blood flow

Alcohol exposure on first trimester

- PAE is higher during the early stages of pregnancy
- Risk factors depend on quantity, frequency and timing of pregnancy
- Focus on the exposure of teratogens at an early stage of pregnancy
  - Contribute to major effects on embryonic development
- Utilize optical imaging techniques to assess the effects of ethanol on neural morphology and neurovascular development
Importance of Gestational Day

Gestational Day

First Trimester:
• Fertilization
• Placentogenesis

Second Trimester
• Fetal and placental growth

Third Trimester
Experimental Design

• *In utero* imaging utilizing OCT
• C57BL/6J mice
• Dosed at GD 12.5, 13.5 and 14.5
• 1.5g/kg, 3g/kg, and 4.5g/kg of ethanol
• Imaged at GD 14.5
• Utilize correlation mapping-Optical Coherence Angiography to image cerebral blood flow
Experimental Design cm-OCA

- Utilize cm-OCA to image cerebral blood flow

System schematic

- Swept Source laser
- Central Wavelength: 1310nm
- Sweep Rate: 50kHz
- Power: 33.2mW
- Axial Resolution: 9.76µm in air
Results - GD14.5

Before and 45 minutes after 1.5g/kg of ethanol gavage on GD 14.5

Before and 45 minutes after 3g/kg of ethanol gavage on GD 14.5

Before and 45 minutes after 4.5g/kg of ethanol gavage on GD 14.5
Results - Sham

Before distilled water gavage on GD 14.5

45min after distilled water gavage on GD 14.5
Results-Quantifications
Future Work

• Synergistic effects of simultaneous alcohol and cannabinoid exposure (SAC)
  • Poly drug use that contribute to increased brain disabilities due to PAE
• Effects of concurrent cannabinoid antagonist exposure on SAC and PAE
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