

March 2019 Volume 4 Issue 1

Innovative Research Studies

Progressive Brain Growth Impairment in Fetuses and Neonates with Congenital Heart Disease using Serial 3-D MRI

What is the study about?

Infants with complex congenital heart disease (CHD) are at increased risk for brain injury and associated neurodevelopmental impairments. Previous research from our program has shown that global brain growth is impaired in fetuses with CHD however the regional predilection and persistence of brain growth failure in the postnatal period remains unclear. In this study we aim to understand regional volumetric brain growth in CHD fetuses and neonates with healthy fetal-neonatal dyads using quantitative in-vivo 3D volumetric MRI.

What are the clinical implications of your research?

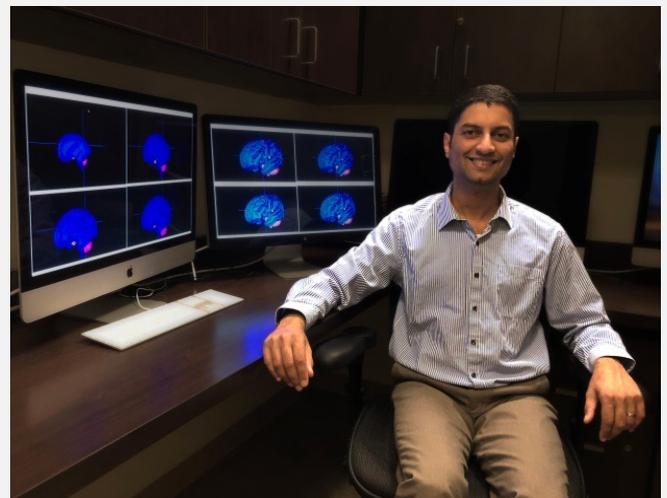
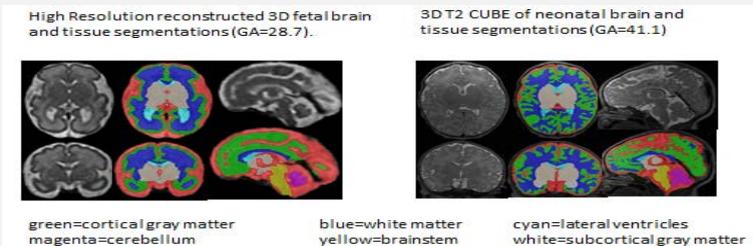
Neurological impairment in children with complex CHD may originate in the fetal period, before postnatal medical or surgical intervention. This hypothesis is supported by the present study, in which we compared third-trimester fetus-neonate dyads with complex congenital heart defects and normal controls by using quantitative magnetic resonance imaging. Fetal management and intervention strategies for CHD-specific defect may play a role in improving in-utero hemodynamics and increasing cerebral oxygen delivery to optimize brain growth and improve neurodevelopment outcomes.

How is your research relevant to the work we do in the Developing Brain Research Lab?

The Center for the Developing Brain focuses on the developing brain, both in utero and in the newborn stages of life. We are studying brain development during pregnancy in unborn babies with congenital heart disease. Most of these babies do not develop brain-related problems, but some do. This study reports for the first time that fetuses with CHD demonstrate persistent and divergent brain growth trajectories in utero and after birth, before cardiac surgery. This in turn will help develop treatments and ensure the best possible outcome for babies with congenital heart disease in the future.

Next Steps:

Evaluating the impact of early-life disturbances in fetal brain development on long-term neurodevelopment outcomes in CHD infants is currently underway.



**Kushal Kapse, MS
R&D Staff Engineer III**



Research Publications

Andescavage, N. In vivo textural and morphometric analysis of placental development in healthy & growth-restricted pregnancies using magnetic resonance imaging.

Brossard-Racine, M. Early extra-uterine exposure alters regional cerebellar growth in infants born preterm.

Krishnan, A. Clinical course of a fetus with hypoplastic left heart syndrome and premature ductal constriction.

Schlatterer, S. Placental Pathology and Neuroimaging Correlates in Neonates with Congenital Heart Disease.

Welcome New Team Members!



Andrea Fry
Data Support Coordinator



Natalie Friesen
Clinical Research Coordinator



Congratulations to Subechhya on the arrival of baby boy, Ayaan!



Congratulations to Li on the arrival of baby boy, Anson!

Welcome New Interns!



Laura Abella



Dhruv Patel



Emily Miller

Congratulations!

Aishwaryya Jayapal on your National Collegiate Research Conference poster, *Compromised region-specific brain development of fetuses and neonates with congenital heart disease.*

Upcoming Events

Maryland Neuro Imaging Retreat– April 2019. College Park, MD

PAS – April 2019. Baltimore, MD

Research and Education Week – April 2019. Washington, DC

ISMRM – May 2019. Montreal, Canada

March of Dimes – May 2019. Washington, DC

Research Presentations



Basu, Sudepta. Infant-Maternal Stress Influences In-vivo Neurometabolites in the Developing Preterm Brain

Cruz, Josepheen. Stronger regional functional brain connectivity in preterm infants compared to healthy in utero fetuses

Kapse, Kushal. Progressive Brain Growth Impairment in Fetuses and Neonates with Congenital Heart Disease using Serial 3-D MRI

Lu, Yuan-Chiao. Human placenta morphology correlates with fetal brain cortical folding features in healthy and CHD fetuses

Lu, Yuan-Chiao. In vivo quantification of fetal brain morphometry in healthy and CHD fetuses

Niforatos-Andescavage, Nickie. Small and large scale diffusion properties of the in vivo placenta in health and growth-restricted pregnancies.

Niforatos-Andescavage, Nickie. In vivo textural and morphometric analysis of placental development in healthy & growth-restricted pregnancies using magnetic resonance imaging.

Niforatos-Andescavage, Nickie. In vivo associations of placental development and fetal brain volumes in congenital heart disease

Ottolini, Katherine. Improved Cerebral & Cerebellar Metabolism in Breast Milk-Fed VLBW Infants

Ottolini, Katherine. Early Lipid Intake Improves Brain Growth in Premature Infants

Said, Mariam. Impact of Maternal and Preterm Infant Stress on Ex-utero third trimester brain growth

Wu, Yao. Progressive Brain Growth Impairment in Fetuses and Neonates with Congenital Heart Disease using Serial 3-D MRI

Wu, Yao. Maternal Psychological Distress during Pregnancy Impairs Hippocampal and Cerebellar Development in Fetuses with Congenital Heart Disease

You, Wonsang. Altered hemodynamic responses of the placenta and fetal brain to maternal hyperoxia in the fetus with congenital heart disease

Zhao, Li. Improved data availability in neonatal and placental BOLD studies with a fast correction of nonphysiological shift

Zun, Wesley. Longitudinal third trimester changes in regional cerebral blood flow in very preterm infants using arterial spin labeled MRI



Krishnamurthy, Dhinesh. Real-time Ultrafast Fetal Brain Localization using Convolutional Neural Networks

Zhao, Li. Automated CSF Detection for Post-hemorrhagic Hydrocephalus in Preterm Infants Using 3D U-Net

Zhao, Li. Fetal Brain Automatic Segmentation Using 3D Deep Convolutional Neural Network

Zhao, Li. SNR Comparisons of the Coils used for Neonatal Imaging

GEAR UP

For
Summer Internship
Starting June 3rd, 2019

