



National Pediatric Cardiology
Quality Improvement Collaborative

Research Explained

Fetal Brain Volume Predicts Neurodevelopment in Congenital Heart Disease

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ABOUT THIS STUDY

The goal of this study was to explore whether the size of the brain before birth (fetal brain volume) could predict how children with congenital heart disease (CHD) would do developmentally after birth.

Why is this study important?

- Problems with development are common in children with CHD.
- These types of problems are called neurodevelopmental and can include: learning disabilities, attention deficit disorders, and other difficulties with learning, conduct, and behavior.
- The sooner we identify children with CHD who are at risk for developmental problems the better. We know that getting them help early, if they need it, can be helpful.
- This study wanted to see if small brain size before birth was linked to lower developmental test scores at 2 years old in children with CHD.

How was this study performed?

- This study enrolled fetuses with significant CHD and followed them for 2 years after birth.

- A smaller group of fetuses without CHD was used as a control group (normal group for comparison).
- Criteria to be included in the study:
 - Fetus with significant CHD.
 - HLHS, transposition of the great arteries, CHD-other
 - Mothers who were 18-45 years during pregnancy and at 18-30 weeks of pregnancy.
- Criteria to be left out of the study:
 - Mothers with heart disease themselves, pregnant with twins/triplets, or could not get an MRI.
 - Fetuses that had a brain or other significant abnormality, abnormal genes, or infection during pregnancy.
- Fetal MRIs to measure brain size were done during pregnancy.
- Children were then followed after birth and had developmental testing at 18-24 months of age. The developmental tests performed included the Bayley Scales of infant and toddler development and the Adaptive Behavior Assessment System (ABAS-3).
- Analysis was done to see if small brain size before birth as well as other factors could predict lower developmental test scores.

What were the results of the study?

- 90 babies entered the study. Of the 90 who had MRIs before birth, 78 followed up and completed the developmental tests at 18-24 months. This means that 87% of the original 90 babies had developmental data to review.
- Of the 78 babies with developmental testing done, there were 52 in the CHD group and 26 in the non-CHD (control) group.
- The CHD group babies had a lower birth weight, but other characteristics (race, ethnicity, mom's age, etc.), were similar between the groups.
- Overall, there was no difference in brain size between the CHD and control group.
- Overall, the CHD group had lower developmental test scores when compared to the control group.
- In the CHD group, babies with larger brains had higher developmental test scores.
- In the control group, larger brain size did not predict better development.
- This study is the first to show a direct relationship between brain size before birth and developmental outcomes in children with CHD.

What were the limitations of the study?

- Babies were only followed for the first two years of life, and testing at that age might miss developmental problems that could come later.

- This study did not try to figure out the reasons why the brains did not grow well and development was abnormal.
- The specific type of CHD that the baby had was not looked at because the numbers of patients was too small.
- The participants were only from one hospital and not a diverse group.

What it all means

- In babies with more than mild CHD, data in this study showed that smaller brain size before birth correlated with worse development at age 2 years.
- Fetal brain volume may be an important indicator that a baby will have developmental delay in the future. Knowing this early means that parents and providers can get children help more quickly, leading to better outcomes overall.
- Further studies are needed to see if these developmental problems continue after 2 years of age.