Research Explained

School Age Test Proficiency and Special Education After Congenital Heart Disease Surgery in Infancy

About the study

Muley et al. have just published a study in the Journal of Pediatrics looking at the school performance of children who had congenital heart disease surgery as infants.

Why is this study important?

- Congenital heart disease (CHD) has been associated with long term neurocognitive changes. Prior studies have shown that children with CHD have a higher chance of being in special education.
- Why patients with CHD have neurocognitive changes and poor school performance is not completely known but has been linked to brain injuries at the time of surgery, young age at surgery, genetics, low saturations, pre-operative acidosis, type of CHD, and anesthetic exposure.
- The group from this study previously reported decreased academic performance in children who had CHD surgery during infancy (less than 12 months). This study looks at children born with a CHD over a 9 year period, which is 3 more birth years than was previously studied.

How was the study performed?

- In this study, they studied children in the state of Arkanas who took the state's standardized 3rd and 4th grade testing, and compared the scores of children with CHD to grade matched children without CHD.
- They looked at birth factors and maternal education level as well as how many children in each group required special education.
- Their hypothesis was that children who underwent surgery for CHD in infancy would be less proficient on the achievement tests and more likely to require special education than children without surgery, and that maternal education level would be an important factor in their performance. (Maternal education level has been shown an important predictor for children's school performance).
- They used an Arkansas state database for school performance data and another Arkansas database for birth certificate and maternal education data, and got their clinical data from the Arkansas Children's Hospital database.
- This study excluded children who were not able to take the standardized testing, that had a genetic syndrome or that had only a PDA, or weighed less than 1500 grams at birth, or

had a known neurologic problem like a stroke. The study group was therefore healthier than their prior study. They were able to match the children's records across the databases. Between 1996 and 2004, 568 children had surgery for CHD when they were less than 1 year old, and survived to school age. They excluded children with genetic syndromes such as Down's syndrome, as well as congenital brain anomalies.

- They then had 458 children, and of these 362 matched with the educational databases, and 285 children had test scores. 77 children or 21% of the total group matched to educational data but did not have test scores; of these children 23 or 30% had special education codes for intellectual disability or for multiple disabilities, consistent with cognitive impairment.
- The 285 children with CHD surgery and test scores are the basis for the study.

What were the results of the research?

Fewer children with CHD achieved proficient scores on the 3rd or 4th grade reading and math tests. In the children with CHD, any special education codes, such as Autism or intellectual disability, was strongly associated with not achieving test proficiency when compared to children without special education codes. They assessed which factors were associated with lack of test proficiency and the need for special education. Longer hospitalization, lower 5 minute Apgar scores, lower maternal education levels, receipt of free lunch at school, and a closer distance to ACH were associated with not achieving grade level proficiency in literacy. Nonwhite race, use of cardiopulmonary bypass, longer duration of hospitalization, and receipt of free school lunch were associated with not achieving grade level proficiency in math. Gestational ages, birth weight, sex, CHD diagnosis, weight at surgery, duration of surgery and number of surgeries in infancy were not associated with non-proficiency in literacy or math. Hospitalization $\geq$ 24 days when compared to < 7 days was associated with the receipt of special education; the other factors above were not.

Almost 1/3 of the children with CHD did not achieve proficiency in Literacy or Math. There was more than 2x increased rate of special education in the children with CHD

What are the limitations?

- The study looks as infants that underwent surgery in another surgical era instead of babies born today.
- The authors of the study did not have access to all anesthetic and sedative medication exposure in the infants.
- The cohort did not have neuroimaging data to explain the cognitive impairments.
- Genetic testing was not performed in most of the infants, so the research does not reflect how genetics may have contributed to the outcomes.

What are findings considering the results and limitations of this study?

In summary, they say that their study shows that children with CHD surgery in infancy have significantly reduced school proficiency and increased special education services. They believe that focus should be placed on studying if there are any modifiable clinical factors and early intervention strategies that can improve these outcomes. They also suggest that neurodevelopmental evaluations be standard in all children with CHD.