STUDY TITLE: Neurodevelopmental Implications of Heterotaxy Syndrome: A Multi-Case Study

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BACKGROUND:
Heterotaxy Syndrome (HS) is characterized by complex congenital heart defects (CHDs) and abnormalities across other organs. Right Isomerism (RI) is an HS subtype that involves dextrocardia, malpositioned heart, trilobed lungs, asplenia, intestinal malrotation, and general left-right reversal of organs. In contrast, more common CHDs can result in isolated deficits such as too much blood passing through the lungs (e.g., patent ductus arteriosus [PDA], ventricular septal defect [VSD]), or too little blood traveling to the body (e.g., coarctation of the aorta [CoA]). Children with CHDs are at increased risk of neurodevelopmental delays and later cognitive impairment due to decreased blood flow to the brain and chronic oxygen desaturation. With the current case studies, examples of the potential impact of HS-RI on neurodevelopmental functioning compared to more commonly understood and evaluated non-syndromic CHDs are provided. Due to the complexity of HS-RI, additional anesthesia exposure from multiple surgeries (including early palliative surgeries), and the more significant associated disease burden, it is likely that HS-RI patients will show greater deficits than their non-syndromic CHD counterparts.

PATIENT CASE:
Two cases of HS-RI (Patients A [8 months old] & B [17 months old]) were recently evaluated within our clinic, and age-matched non-syndromic CHD patients (Patients C [PDA] & D [VSD & CoA]) were selected from a clinical database for comparison. Patients were matched by age, sex (male), and gestational age (full term). Evaluation included a performance-based measure of neurodevelopment (The Mullen Scales of Early Learning) and parental report of adaptive functioning (Adaptive Behavioral Assessment system—3rd Edition). Patients C and D showed intact neurodevelopment and adaptive skills, while patients A and B showed significant impairments in multiple domains. Only patient B's parent reported significant adaptive impairments

CONCLUSIONS:
Greater impairment in patients with HS-RI could be related to disease characteristics (e.g., chronic cyanosis, increased infections with multi-organ defects, greater anesthesia exposure at very young ages). Neither patients A nor B were receiving early intervention services, which should be standard of care. These patients remind us of the importance of considering how the complex interaction of all organs impact brain functioning. Furthermore, given organ reversals in HS-RI, questions arise regarding functional brain lateralization reversal.

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