Apparently, size matters...in congenital heart disease and brain injury

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Previous studies have demonstrated an association with smaller total and regional brain size and neonates with congenital heart disease.^{1,2} An association with smaller brain volume and worsened neurodevelopmental outcome has been demonstrated in adolescents with congenital heart disease.^{3,4} In this issue of the *Journal*, investigators from the University of California, San Francisco sought to further identify patients with congenital heart disease at highest risk for neurodevelopmental impairment using quantitative measures (size and volume) from brain magnetic resonance imaging (MRI).

The authors investigated perioperative brain growth in a cohort of patients diagnosed with transposition of the great arteries (TGA) or hypoplastic left heart syndrome (HLHS). In this study, 79 patients underwent brain MRI before and after surgery to determine the severity of brain injury and the total and regional brain volumes. MRI scans were obtained shortly after birth (preoperatively) and just before discharge (mean interval difference of 15 days).

There were 49 patients with TGA and 30 patients with HLHS. Preoperative brain injury was present in both groups but not statistically significant between the 2. Patients with HLHS exhibited a slower rate of brain growth compared with patients with TGA (looking at brain volume, growth of white matter, and gray matter). Patients with HLHS also had a higher prevalence and severity of postoperative injury, mainly stroke. The authors concluded that brain growth is influenced by cardiac subtype and that patients with HLHS exhibit a slower rate of perioperative brain growth.

This is an interesting and complex study with some intriguing findings. However, it is difficult to draw definitive conclusions from a study such as this. Fifteen days in the perioperative period seems like a short time to see any changes in brain growth. It would also seem that the perioperative period would be the time when acute changes in brain volume would be most influenced by the surgical

Size matters.

Central Message

Brain volume and injury may be associated with congenital heart disease.

See Article page 291.

procedure and postoperative care itself. Operative strategies (ie, perfusion techniques, selective cerebral perfusion/circulatory arrest vs “normal” perfusion) are vastly different in the 2 lesions, and so it would seem intuitive that brain size and growth likely could be affected by these techniques. Brain growth would also mirror somatic growth, which is likely to be different between the 2 groups.

There are many potential influences on neurodevelopmental outcome in the perioperative period. What happens in the operating room is just a small piece of the perioperative period. Persistent cyanosis, malnutrition, and “palliation” versus “corrective surgery” all play a role in a child's development and outcome. With all these confounding factors, it is difficult to tease out any particular contribution and its significance to the overall neurodevelopmental outcome of a child. Is brain growth related to the lesion itself or to the differences in perioperative care that each lesion requires? The best we can do is take it all as a package and realize that patients with HLHS, TGA, or any other form of congenital heart disease will each have to undergo different pathways to adulthood. We can identify that certain pathways may lead to higher risk of adverse outcome, but finding the relative contribution of each factor is the real challenge.

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