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Commentary: One size fits some—additional pulmonary blood flow at the Glenn operation and patient-specific factors

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Preservation of additional pulmonary blood flow (APBF) at the Glenn operation is a controversial topic that has been discussed in the literature since the mid-1990s.¹ In this issue of the *Journal*, Baek and colleagues² perform a long-term, retrospective analysis of a cohort of more than 200 single-ventricle patients to further investigate. The authors found that the group of patients who received the Glenn operation with preservation of APBF had more than 2-fold greater risk of death or transplant (hazard ratio, 2.37) as well as a 3-fold greater probability of prolonged chest tube drainage and re-admission (odds ratio, 3.204) after Glenn—a striking result.

Overall, the authors should be commended for their work. Few publications on outcomes after the Glenn operation have a study period (15 years), follow-up length



A “one-size-fits-all” approach to additional pulmonary blood flow at the Glenn operation.

CENTRAL MESSAGE

Outcomes after the Glenn operation may improve by identifying quantitative criteria that define an individual patient's chance of survival if additional pulmonary blood flow is preserved or not.

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(mean 8.4 years after Fontan), cohort size (more than 200 patients), and distribution of cardiac diagnoses as robust as the study here. In addition, the use of propensity matching is thoughtful, as it controls for the presence of ventricular dysfunction, oxygen saturation, atrioventricular valve morphology, and other preoperative variables. However, the study is not without its limitations. For one, despite propensity matching, there is a high likelihood of selection bias with patients presenting at Glenn with smaller pulmonary arteries (PAs) more likely to be in the APBF group. This confounds the analysis, since the propensity score did not incorporate the key variable of pre-Glenn PA size. Furthermore, the supplementary data suggest that patients who

likely had pulmonary overcirculation at birth (ie, those that underwent PA banding or arch repair rather than systemic-pulmonary shunt) were represented more heavily in the no-APBF group.

Historically, proponents of preserving APBF have shown that the strategy makes patients better candidates for the Fontan procedure by increasing systemic oxygen saturations and the growth of pulmonary vasculature.³⁻⁵ However, APBF may be associated with increased loading on the single systemic ventricle and sequelae related to elevated pulmonary pressures such as prolonged chest tube drainage.^{4,6,7} While this framework is helpful, the reality is that whether a given patient will benefit from APBF depends on their individual anatomy and physiology. For instance, the patient with hypoxemia, pulmonary atresia, and intact ventricular septum with hypoplastic PAs will likely benefit from pulsatile APBF at Glenn more than the patient with common atrioventricular valve morphology and severe atrioventricular valve regurgitation who is at risk with ventricular volume overload.

Single-ventricle palliations such as the Glenn operation are nowadays indicated for an ever-increasing number of index diagnoses, many of which were nonsurvivable just a few decades ago. Future research in the optimization of single-ventricle palliation should focus on developing nuanced, quantitative criteria that define the “ideal” patient

for various operations, such as preservation versus elimination of APBF at the time of Glenn. For now, however, Baek and colleagues should be commended for their valuable contribution to the literature showing selective elimination of APBF at the time of Glenn can be beneficial for long-term survival.

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