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REPLY FROM AUTHORS: WHEN IS A HYBRID NO LONGER A HYBRID?

Reply to the Editor:

We appreciate the insightful response by Drs Schranz and Akintuerk to our hybrid review,¹ “Apples to Oranges: Making Sense of Hybrid Palliation for Hypoplastic Left Heart Syndrome.”² Their pioneering work in using hybrid strategies for palliation of neonates with hypoplastic left heart syndrome (HLHS) and related variants has advanced the field of congenital heart surgery. It is not surprising, therefore, that they have added to the armamentarium of stage I palliation strategies by successfully treating 6 children using a total catheter-based approach (Figure 1).³ While groundbreaking, this novel approach raises a new question; when is a hybrid no longer a hybrid?

As we discussed in our review, the contemporary use of the hybrid has evolved into a heterogeneous strategy, both in terms of procedural approach and patient application. Commonly, hybrid strategies are described as the initial

palliation for “high-risk” neonates, felt to be unsuitable for a stage I Norwood. Hybrid strategies are also used in a subset of patients as bridge to transplant, or as the initial intervention to delay decision making between single-ventricle and biventricular repair. In the contemporary era, only a few centers use hybrid strategies as a primary Norwood alternative for stage I palliation of neonates with HLHS.⁴

The Giessen group has remained a proponent of the stage I hybrid strategy for all-comers with HLHS. Over the years, they have become a pre-eminent program that has demonstrated success after hybrid strategy palliation.^{4,5} In a continued effort to improve care for children with HLHS, they have used innovative strategies to limit the invasiveness of neonatal palliation. Their objective has been not only to limit the physiologic stress caused by cardiopulmonary bypass with associated altered cerebral perfusion (ie, deep hypothermic circulatory arrest or antegrade cerebral perfusion) but to avoid the physiologic stress of neonatal surgery all together.

In their recently published case series, the Giessen group describe a total interventional approach for stage I palliation of neonates with HLHS or related variants, whereby patients remained spontaneously breathing and a median sternotomy was avoided.³ Specifically, a modified Medtronic Micro Vascular Plug was positioned in each branch pulmonary artery to act as a pulmonary flow restrictor. In the majority of neonates, ductal patency was maintained via a ductal stent. In 1 patient with an extremely hypoplastic ascending aorta, ductal patency was initially maintained with prostaglandin infusion before a subsequent ductal stent was placed. Of the 6 patients who underwent total catheter-based stage I palliation, 4 went on to a comprehensive stage

FIGURE 1. Total catheter-based stage I palliation. Reprinted with permission.³

II, 1 transitioned to biventricular repair, and 1 underwent transplantation.³

It is safe to say that these outcomes can be considered a success. Moreover, despite having a small sample size, the postoperative pathway after their total catheter-based approach was comparable with the pathway followed by children after a conventional hybrid strategy. That is, this less-invasive strategy does not place limitations on the ultimate surgical strategy for these children, allowing the intervention to be performed in a wide spectrum of patients.

Although total catheter-based palliation is a novel technique, there is no doubt this will gain traction as a viable approach for stage I intervention. Similarly, this new strategy will also raise new questions. For example, should this procedure still be considered a hybrid? What patients will benefit most from avoiding surgery? What are the limitations that will arise from the procedure? For now, many of the answers will be speculative. However, as a starting point, it may be reasonable to consider a total catheter-based approach as the next iteration of the hybrid strategy. In any case, it will remain to be important for institutions to continue to accurately categorize initial indications and

techniques to achieve the most reliable outcomes for evolving hybrid strategies.

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