Hybrid of a hybrid: A story in evolution

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The submission by Nassar and colleagues¹ is a thought-provoking contribution to the evolving story of hybrid palliation for hypoplastic left heart syndrome (HLHS). The authors propose a strategy of providing pulmonary blood flow by way of a modified Blalock–Taussig shunt (MBTS) at the time of “stage II” palliation (so-called 2-stage Norwood I) rather than the cavopulmonary connection usually incorporated into the “comprehensive stage II” operation. The clinical issue driving this novel strategy is the increasingly well-documented problem of branch pulmonary artery stenosis associated with hybrid palliation of HLHS.²⁻⁴ The authors’ premise that use of an arterial shunt at the time of arch reconstruction may result in improved pulmonary artery architecture is reasonable, and supported, albeit modestly, by a higher lower lobe index score in patients undergoing the MBTS. Nearly all surviving patients who underwent the MBTS have proceeded to a successful cavopulmonary shunt. However, there are several confounding issues that strongly modulate the import of this experience.

First, of course, is the difficulty of claiming “noninferiority” of one strategy over another when the sample size is small, the study design is retrospective, and the therapies being compared are applied noncontemporaneously. However, more important is the complex and heterogeneous nature of patient selection in this series. There are significant differences in age at operation (and presumably, therefore, clinical indications for intervention), a broad and variable array of patient factors, and several different clinical indicators for using one operation over another. These characteristics significantly limit the import of the study’s inferences.

Perhaps more troubling is the high rate of clinically detectable postoperative neurologic abnormalities and associated magnetic resonance imaging findings in both

treatment groups. The prevalence of this complication, although perhaps attributable to a commendable level of vigilance on the part of the investigators, is problematic as regards one of the central tenets of hybrid strategy: that neurodevelopmental outcome will be improved by delaying larger reconstructive operations from the neonatal period into infancy. High-risk cohorts such as this one undoubtedly have an increased prevalence of postoperative neurologic complications, and there are data to suggest that such risk factors are, in essence, immutable.⁵ Nevertheless, any strategy associated with such a high rate of detectable brain injury is difficult to endorse.

Finally, a clinical approach that inserts yet another intervention into what is already a complex series of operations, each with its own hazard function, must clearly demonstrate a salutary impact on the risk/benefit calculus before it can be adopted. Exposure to general anesthesia for the operation and associated diagnostic testing, additional exposure to perioperative narcotics and sedatives, hospital-acquired infection risk, nutritional taxation, and many other well-known intervention-related morbidities strongly attest to the advisability of minimizing the number of procedures required to definitively treat a patient.

Standard Norwood palliation is now achieved with mortality rates of 10% or less at many centers, with a still lower mortality risk at subsequent stages. Hybrid palliation was initially thought to be a therapy that would eventually supplant standard Norwood palliation because of its technical simplicity, its avoidance of general anesthesia and prolonged perioperative recovery periods in the neonatal period, and an intuitive notion that it would be associated with improved neurodevelopmental outcomes.⁶ While we await an answer to this last hypothesis, we can make some observations about the other historical assumptions.

Today, 70% of institutions in the Society of Thoracic Surgeons Congenital Heart Surgery Database use hybrid strategies in less than 20% of their patients with HLHS, and 50% do not use them at all. Only 4 centers use hybrid therapy preferentially over the Norwood.⁷ Clearly, hybrid strategies have failed to convince as an attractive alternative to standard Norwood. The notion of technical simplicity has faded as the timing and nature of atrial septal communication, retrograde coarctation, reverse MBTS, pulmonary arterial reinterventions, and other challenges have occupied

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the attention of investigators. The present report reminds us that hybrid strategies do not relieve a measurable number of patients of the burden of difficult perioperative convalescences and the specter of neurodevelopmental sequelae.

However, it is well established that certain risk factors significantly affect outcomes after standard Norwood palliation. This reality has led to the emergence of a practice pattern wherein hybrid strategies are used for a higher-risk subset of patients, as is the approach used by Nassar and colleagues.¹ The impact and advisability of this particular approach, although intuitively resonant, are still an open question, mainly because of the analytic challenges of risk-adjusted comparison of therapeutic strategies. Those challenges notwithstanding, there is almost certainly a subset of anatomies in which hybrid strategies are the optimal treatment platform.

The nature and the role of hybrid strategies in the palliation of HLHS and its variants continue to evolve. The arterial shunt at stage II is yet another twist in the evolving story of hybrid therapy for HLHS.

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