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Commentary: Decision-making for right ventricle to pulmonary artery conduit selection: Statistical models and clinical practice

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CENTRAL MESSAGE

RVPA conduit selection may influence durability in certain patient groups, but choices are often limited by patient anatomy and conduit availability.

The ideal right ventricle to pulmonary artery (RVPA) conduit in children is readily available, appropriately sized for patient anatomy, accommodating of somatic growth, accommodating of future transcatheter interventions, and resistant to structural deterioration and endocarditis. In contemporary practice, the surgeon can essentially make 2 choices: which type of conduit to place and what size. Although this seems to impart some degree of autonomous decision-making by the surgeon, in real-world practice there is often much less flexibility due to limitations of patient anatomy and conduit availability.

In the current issue of the *Journal*, Willetts and colleagues,[1] from Birmingham, United Kingdom, provide an exemplary and exhaustive review of RVPA conduit performance over a 30-year period at their center in patients ranging from newborns to young adults. The 4 "traditional" conduit types that were compared included the aortic homograft, pulmonary homograft, composite porcine valve (Hancock, Medtronic, Minneapolis, Minn), and bovine jugular vein (Contegra, Medtronic). Patients were stratified into 3 groups effectively representing neonates (0-5 kg), infants and children (5-20 kg), and adolescents/young adults (>20 kg).

Overall, results were similar to prior reports and provide helpful guidance for conduit selection. Key conclusions were that lower patient weight was a significant risk factor for conduit failure, homograft options were superior to xenograft options in patients weighing 5-20 kg, aortic and pulmonary homografts performed similarly, Contegra grafts had a 4-fold higher rate of endocarditis, and statistical modeling suggested the best durability occurred in all patient groups when conduits were oversized to a Z-score of +3 or greater.

How should these findings be incorporated into clinical practice? In neonates, the availability of an appropriately sized conduit is often the largest obstacle. Homografts may not be available in small sizes, necessitating the use of xenograft alternatives. Although oversizing to a Z-score of +3 may be possible, other studies have found that oversizing conduits in the setting of truncus arteriosus is associated with increased mortality and adverse events, possibly as a result of a larger ventriculotomy, space limitations within the chest, or conduit compression/distortion.[2] The present study only assessed conduit durability and excluded patients who did not survive 90 days, and therefore the more important relationship between conduit size and survival in neonates was not examined. Thus, conclusions regarding conduit size in neonates should be viewed with caution because there may be a competing or inverse relationship between conduit durability and survival in this fragile age group.

In small children (5-20 kg), the key recommendation appears to be to select a homograft option with a Z-score of +3 or greater. However, it is important to note that in the authors' practices, only 4.5% of patients (20/449) in this age group received RVPA conduits of this size. Further, a closer look at the data shows that the hazard ratios for conduits between a Z-score of +1 and +3 are similar. Thus, although oversizing to a Z-score of +3 appears important in the statistical models, real-world physician behavior

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demonstrated that in most patients a Z-score of +3 was not achieved, likely because of the perceived space constraints within the chest or a prohibitive mismatch between an oversized conduit and the size of the pulmonary artery confluence or right ventricular opening, leading the surgeon to select a smaller conduit option. It is also possible that the largest conduits were placed in patients with generously sized branch pulmonary arteries, which further led to the superiority of the results.

In the adolescent/young adult patient group (>20 kg) in whom future somatic growth is perhaps less important, conclusions regarding conduit size become even more nebulous. No patients received conduits with a Z-score of more than +2, and therefore conclusions regarding the performance of conduits with a Z-score of +3 or greater seem even more theoretical and detached from clinical practice.

In summary, the article by Willetts and colleagues[1] provides an exceptional glimpse into the past of practice patterns and durability of RVPA conduits in children and young adults over a 30-year period. However, in real-world practice there are often few options available to the surgeon for a given patient. Future advances in RVPA conduit technology will hopefully improve conduit performance and lead to additional alternatives.[3,4]

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Commentary: The conduit's gambit

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Historically, the preference of conduit type to establish right ventricle-to-pulmonary artery continuity has been largely a discussion of religion. Homograft artery with valve, porcine, or bovine jugular vein composite tubes, polytetrafluoroethylene with or without leaflets, and stem cell–seeded scaffolds all have been proposed as superior vehicles, where success is measured in years of durability and valve competence. Although the platonic flame burns brightly for a "living" connection that might enlarge to accommodate somatic growth while maintaining valve function, the reality is that currently most often the strongest influence for conduit selection is local availability.

What is the Fischer clock of conduits?

CENTRAL MESSAGE

While "judicious oversizing" of conduits hopes to maximize durability, should we focus on strategies of care that incorporate the chance of accelerated deterioration or future transcatheter solutions?

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