Commentary: The Ross procedure in a polyethylene terephthalate graft: Is everything OK in there?

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During the past decade, overwhelming evidence from various groups has supported the notion that the Ross procedure is the only aortic valve replacement operation that restores long-term survival.1 Low rates of valve-related complications and near-normal hemodynamic parameters are additional advantages of the living pulmonary autograft, 2 critical end points in young patients with an anticipated long life expectancy. Aside from its technical complexity, the main concern with the Ross procedure is freedom from autograft reintervention, which could be due to primary valve failure or secondary regurgitation due to autograft root dilatation. This has led many groups to abandon the Ross procedure since the early 2000s. Instead, several centers of excellence sought technical improvements and management optimization strategies to address concerns over durability. Instead of throwing out the baby with the bathwater, others sought technical answers to this durability issue.

Dr Starnes and his colleagues at the University of Southern California followed that path and should be congratulated for demonstrating significant improvements in their outcomes using a technique of pulmonary autograft wrapping inside a straight polyethylene terephthalate graft to prevent pulmonary autograft dilatation, an adjunct technique introduced in 2001 in adults.2 Comparing the first 71 unwrapped cases (1992-2001) to the subsequent 58 wrapped cases (2001-2019), the authors demonstrate a remarkable reduction in the rate of autograft reintervention at 10 years. Of course, part of the difference may be explained by some of the study’s limitations: these are non-contemporaneous cohorts, with the unwrapped cohort corresponding to the early learning curve; median follow-up was very uneven (15 years in the unwrapped group vs 4 years in the wrapped group); and there were significantly less ascending aortic replacements in the unwrapped versus wrapped group, an important means of sinotubular junction stabilization in the unwrapped technique (14% vs 34%). Nevertheless, this study represents a potential technical adjunct to mitigate the risk of autograft dilatation and reintervention after the Ross procedure, especially in patients with preoperative aortic regurgitation (AR) and a dilated aortic annulus, the main predictors of reintervention after the Ross procedure. It is noteworthy that nearly 36% of the entire cohort underwent surgery for pure AR.

It is important to remember that the main benefit of the Ross procedure is the ability to replace the aortic root with a living autologous pulmonary root, which behaves as a structural and functional unit. Preserved root physiology plays a key role in leaflet excursion and annular dynamics. It ensures atraumatic opening and closing of aortic valve cusps; it ensures optimal coronary flow reserve, especially in systole, and it minimizes left ventricular impedance during the cardiac cycle.3

root may prevent late dilatation, it influences the geometry of the root and eliminates the function of the sinuses of Val- salva. The mode of failure with the wrapping technique is anticipated to be primary valve failure, and may occur early or late. In the present study, 3 patients (5%) in the wrapped group required autograft reintervention within 2 years of surgery. Although the mode of failure is not well understood, the influence of the polyethylene terephthalate wrap should not be overlooked. In the long-term, animal studies demonstrate that loss of mechanotransduction with wrapping leads to smooth muscle apoptosis, extracellular matrix disarray, and wall thinning.4 In wrapped Ross recipients, this may have detrimental effects on long-term valve durability and ventricular function. In the short-term, intraoperative attention is required to avoid coronary button kinking through the polyethylene terephthalate graft, hematoma, and infection between the autograft wall and polyethylene terephthalate wrap, as well as valve distortion at the time of implantation. In the hands of an experienced surgeon like Dr Starnes, these potential complications are minimized, but should not be ignored.

Ultimately, the main goal is to provide patients with a safe and durable operation that will optimize long-term survival and quality of life. In adults, this is best achieved with the Ross procedure. The present study provides an avenue toward further improving these outcomes. Other stabilization techniques, especially in patients with AR have shown good results, whereas preserving autograft root geometry and dynamism.5,6 The key will be continued systematic long-term clinical and echocardiographic follow-up of patients to tailor the optimal technique to each individual patient.

References