

Options for aortic valve replacement in children and young adults: “Okay, doctor, but which one do you think I should choose?”

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In the older child and young adult with aortic valve disease requiring surgery, I find myself in the uncomfortable position of trying to explain to the patient, or rather usually the patient’s parents, the options for aortic valve substitutes. Usually a lengthy discussion ensues about the pros and cons of each option, including valve repair, mechanical valves, the Ross operation, and rarely biologic valves. The reason that this discussion is uncomfortable is because it exposes to the parents, to the patients, and to me that there are many unanswered questions. Then the dreaded question naturally arises, “Okay, doctor, but what do you think we should choose?”

If one is to look at a lot of the published literature, the Ross operation would appear to be a solid winner in terms of short-term operative outcomes and freedom from reoperation on the aortic valve.¹⁻⁶ Most patients (or parents), however, are led by their health care providers to “choose” another option, usually a mechanical valve prosthesis. This is demonstrated in a recent query of the Society of Thoracic Surgeons database.^{7,8} Of 2180 patients 18 to 30 years of age listed in the adult Society of Thoracic Surgeons database who received an aortic valve replacement between 2008 and 2011, 9% had valve repair, 2% had the Ross operation, and 85% had a prosthetic valve. In a younger group of patients 12 to 30 years of age from the congenital Society of Thoracic Surgeons database (n = 882), 20% had valve repair, 24% had the Ross operation, and 39% had a prosthetic valve. The big question is why. Why has the Ross operation, the operation of choice according to most of the literature, failed to penetrate the modern surgical practice?

The answer is probably complex; however, several factors play a significant role. Some of these factors are demonstrated by analyzing the discrepancy in the adoption of the Ross operation by the congenital heart disease surgeons versus the adult surgeons, 24% versus 2% of aortic valve surgery, respectively. At least 3 factors play a



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Central Message

Systematic review and meta-analysis in the context of surgical options for aortic valve replacement in children and young adults.

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major role in this discrepancy. First, the perceived value of the Ross operation as a “growing graft” is less important in the older patient who has completed somatic growth. Second, most congenital heart disease surgery is concentrated in centers of excellence with relatively high volumes, whereas most adult cardiac surgery is still done in small or medium programs with less diverse practices. Finally, congenital heart disease surgeons are less averse to the risk of reoperation, especially if the reoperation is mostly on the pulmonary valve.

Another set of factors that has led to the failure of widespread adoption of the Ross operation is the expanding set of relative contraindications of the Ross operation, which were not realized in the early experience. These include but are not limited to connective tissue diseases and bicuspid aortic valve, where progressive dilatation of the neo-aortic (pulmonary autograft) root is a serious and now well-established risk⁸; rheumatic heart disease, where the failure rate of the autograft is high; and comorbid mitral and aortic arch diseases, which significantly increase the operative risk of the Ross operation. More prevalent factors are also considered relative contraindications because of a higher risk of early autograft failure; these include predominant aortic insufficiency as the indication for surgery, male sex, and use of the full root replacement versus the subcoronary technique of the Ross operation.

So far I have managed to introduce to you what can be considered a biased perspective. The literature is full of such reviews and small or relatively large series with very conclusive statements at the end of each article. It is safe to say, however, that such “opinions” are based on personal and institutional biases, expertise, and, importantly, bad experiences. But what do the data show? More specifically, in evidence-based medicine lingo, what is the totality of best available evidence?

In the absence of randomized, controlled trials to compare each pair of aortic valve replacement options, one is left to rely on retrospective cohort studies that either compare 2 or more options or report the outcomes of a single surgical option. One approach would be to “select” studies on the basis of sample size, surgeon or institutional name recognition, or source of publication. It is more prudent, however, again from an evidence-based medicine perspective, to look systematically at the literature and include or exclude studies on the basis of predefined criteria. This process of “systematic review” also includes statistical methods, known as *meta-analysis*. Although classically applied to randomized, controlled trials, the same methods of creating pooled statistics from compatible ones done on the same outcome from different studies is possible, albeit less reliably so, in the case of retrospective cohort studies. A simple way of thinking about this is to imagine yourself calculating a weighted average, where the weight is the number of data points (patients). The pooled statistic will thus be more heavily influenced by the large studies and less influenced by the smaller studies.

In this issue of the *Journal*, Etnel and colleagues⁹ from Erasmus University Medical Center in Rotterdam have done just that. Out of 1218 unduplicated publications, 34 met their predefined inclusion criteria. Etnel and col-

leagues⁹ produced pooled statistics for 9 important outcomes in each of the surgical options, including early and late mortality, thromboembolic complications, and other outcomes. It is very interesting to read the article, and it is especially informative to examine its Tables 2, 3, and 4, in which Etnel and colleagues⁹ present the pooled statistics for the Ross operation, mechanical prosthesis, and homograft, respectively. Unfortunately, and somewhat expectedly, they could not come up with a conclusive winner; however, the information provided is an excellent summary and is the best available evidence.

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