



## Aortic homografts, Einstein, and complexity

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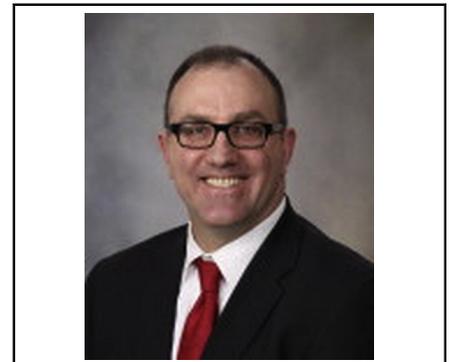
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Readers of the *Journal* will find interest in the article in this issue from Arabkhani and colleagues<sup>1</sup> of the Erasmus University Medical Center in The Netherlands on the long-term outcome of allografts in the aortic position. The article provides almost 3 decades' worth of experience with allografts in the aortic position, with important insights into (1) allograft durability as it relates to implantation technique and (2) echocardiographically derived predictors of reoperation and mortality.

Arabkhani and colleagues<sup>1</sup> are to be congratulated on the completeness of their prospectively collected data on 353 patients operated on from April 1987 through March 2013. Clinical follow-up was accomplished for 345 patients (98%) and included postoperative echocardiography at 6 months, at 1 year, and biennially thereafter. This was a relatively distinctive cohort of patients, however, in that they were relatively young (median age, 45 years), were mostly male (71%), had a high prevalence of bicuspid aortic valve anatomy (36%), and not uncommonly underwent operation for infective endocarditis (33%).

The reported in-hospital mortality for the operation was 5.9%, which seems reasonable in light of the relatively high prevalence of infective endocarditis. With such impressive results, it would seem realistic to expect a broadening of operative indications to other groups of patients and a growing yearly operative rate. But such was not the case. The table in Appendix 1 of the article by Arabkhani and colleagues<sup>1</sup> shows that 95% of the operations were performed before 2005, with just a handful of cases (eg, less than 4 or 5) being done since 2010. Why was there an unexpected decline in the number of operative procedures?

In their article, Arabkhani and colleagues<sup>1</sup> point out the historical enthusiasm for use of allografts as a durable biologic option for aortic valve replacement. The benefits include low operative mortality and of thromboembolic and hemorrhagic events, as noted in the series of Arabkhani and colleagues.<sup>1</sup> The problem is that when allografts fail, they do so with calcification of the root, and that is the sticking point. A major finding in the series of Arabkhani and colleagues<sup>1</sup> is that 20 years after the operation, roughly one-third of patients had died without undergoing a



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### Central Message

Three decades' worth of experience with aortic allografts demonstrates concerning long-term outcomes, with almost two-thirds of patients undergoing reoperation or even dying.

See Article page 1572.

reoperation (37% of these patients died of a valve-related cause), one-third had undergone a reoperation, and one-third survived without undergoing a reoperation. This means that two-thirds of these patients had an untoward outcome. The unsettling issue is that surgeons can't predict the favorable and unfavorable outcome groups.

The allograft aortic valve replacement included the subcoronary technique in 95 patients (26%). Arabkhani and colleagues<sup>1</sup> reported that the technique was abandoned in 1998 because of early valve failure, mainly as a result of technical errors during implantation. It is unfortunate, but other than reporting that the subcoronary technique was correlated with the progression of allograft regurgitation, no specific data are reported to allow further assessment of the issue. Later in their discussion section, however, Arabkhani and colleagues<sup>1</sup> do state that in the second decade of follow-up the patients with subcoronary implants had a slightly better structural valve deterioration pattern than that seen among those who underwent root replacement. The statement raises the possibility that a good subcoronary implantation could justify the historical enthusiasm. Because the number of patients was limited, however, no firm conclusion could be made. For now, I would suggest that we proceed cautiously with the subcoronary technique.

A subset of 308 patients underwent follow-up with a standardized echocardiographic regimen, as previously stated. With such close follow-up, Arabkhani and colleagues<sup>1</sup> were able to identify important echocardiographically

derived variables predictive of mortality (allograft regurgitation and left ventricular enlargement). The presence of such findings should encourage early, elective reoperative aortic valve operation. And although Arabkhani and colleagues<sup>1</sup> did report a reoperative mortality of 3.9%, other experienced centers have noted an operative risk of greater than 10%.<sup>2</sup> These outcome data should be compared with those associated with the less invasive technique of transcatheter aortic valve-in-homograft valve insertion, which has been reported preliminarily to carry low associated operative morbidity and no mortality.<sup>3</sup> Could transcatheter aortic valve-in-homograft valve insertion be a justification for the historical enthusiasm?

Much of the analysis presented here is based on the complicated (at least for me) use of joint modeling of longitudinally measured parameters that influence structural valve deterioration and the clinical end points of reoperation and survival. For the most part, I suspect that the

majority of cardiac surgeons will probably have to take the reported statistical analysis at its face value. What is the worth of such an overlying complex experimental model? Can surgeon investigators understand, appreciate, and repeat the methods? Statistics should help surgeons, not overwhelm them. Further surgical studies could benefit by invoking an observation of Einstein as it is frequently paraphrased: "Everything should be made as simple as possible, but not simpler."

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