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PROSTHETIC AORTIC VALVE EVALUATION: SHOULD THE ASSESSMENT OF HEMODYNAMIC PERFORMANCE DURING EXERCISE COMPLETE THE ANALYSIS?

To the Editor:

In a recent publication, Suri and colleagues¹ evaluated the hemodynamic performance of the latest generation of biologic aortic valve prostheses. The results evidenced small but consistent early postoperative hemodynamic differences among current third-generation bioprostheses (Edwards Magna, Sorin Mitroflow, and St Jude Epic). We read the article with interest and were also impressed by Dr David's comment in the meeting discussion. We congratulate Suri and colleagues¹ on this study; however, we would like to add some comments.

First, Suri and colleagues¹ likely included in their study any type of aortic valve disease, which could be misleading for comparative results. Aortic stenosis, aortic incompetence, and their combination have differences in physiology, histology, and anatomy, leading to different behaviors after the valve replacement.

Second, patients were assessed for hemodynamic performance before hospital discharge. This is contrary to previous studies, which indicate that in vivo values should be taken at 1-year follow-up because gradients may change during the first postoperative year, with significant impact on

either the hemodynamic results or the exercise capacity.²

Third, any realistic assessment of hemodynamic behavior of a prosthesis should include evaluation during exercise. Results obtained under stress are by far more suitable to evaluate the performance of a valve type than hemodynamic data obtained at rest, and they also reflect more closely the situation in daily life. In this regard, Gerosa and colleagues³ used the Sheffield pulse duplicator to demonstrate in vitro that different prostheses perform differently in different hemodynamic circumstances. In vivo evaluations are even more difficult. Stress-induced echocardiographic assessment could be hindered by several confounding factors: heart rate, cardiac output, left ventricle diastolic pattern, hypertension, reduced systemic arterial compliance, and so on.

In a recent study, we evaluated by echocardiography the hemodynamic performance at rest and during exercise of 2 different aortic prostheses of similar size implanted in patients who underwent surgery for pure aortic stenosis.⁴ Although the study compared a mechanical valve with a porcine bioprosthesis, our results validated the technical procedures as model for evaluations under stress.

As we were aware that the sole measurement of gradients does not entirely represent the complex function of a valve during physical exercise, we also analyzed the stress-induced abnormalities of the cardiac cycle 1 year after aortic valve replacement. As is widely known, the total cardiac cycle duration is algebraically dependent on the heart rate (60,000 ms/heart rate), which is the major determinant affecting diastolic and systolic duration. Systolic time has a negative linear correlation with heart rate. Diastolic time is longer at low heart rates and decreases more markedly than systolic time during exercise. Transprosthetic gradient is a function of both diastolic duration

and systolic/diastolic ratio, which depends on a number of cofactors but could also be attributed to the flexibility of the stent and the geometric design of the bioprostheses. These factors interfere with the delicate physiologic mechanism of active annulus motion and aortic root expansion at each phase of the cardiac cycle, especially during exercise. This is more valid for mechanical valves and for 19- to 23-mm bioprostheses. A meaningful evaluation of a bioprosthesis should therefore further consider the stent flexibility during exercise and the effective tolerability of its distortion when upsized.

Vito Mannacio, MD

Vincenzo De Amicis, MD

Carlo Vosa, MD

Department of Cardiac Surgery
University of Naples Federico II
Naples, Italy

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LIMITATIONS IN THE USE OF LEFT CAROTID ARTERY TURNDOWN FOR INTERRUPTED AORTIC ARCH REPAIR

To the Editor:

Todman and associates¹ recently described favorable outcomes after

use of the left carotid artery turndown (LCATD) technique for interrupted aortic arch. Several techniques to repair interrupted arch have been described, including the end-to-side anastomosis from sternotomy approach favored by our center.² The use of the LCATD technique may no longer be justified by the avoidance of cardiopulmonary bypass. We have demonstrated that the neurodevelopmental outcomes of these patients is not affected by the use of cardiopulmonary bypass, provided circulatory arrest is not used.³

The LCATD technique seems to have been limited to some patients, and we would have been interested to hear the thoughts of Todman and associates¹ on the limitations of this technique. In particular, we note that Todman and associates¹ included only 1 patient (2%) with type A interrupted arch and 3 with aberrant right subclavian artery (6%),¹ even though the prevalences of these anomalies are usually reported at around 34% and 20%, respectively.² In addition, we would have loved to know whether Todman and associates¹ excluded patients with single ventricle from the report or whether they found the technique contraindicated in these instances because of the known development of subaortic stenosis in these patients.

Todman and associates¹ concluded that the LCATD technique resulted in similar outcomes to those described in the literature. They kindly mentioned our work; however, they only compared their result with the entire group we reported, whereas we were actually attempting to demonstrate the superiority of the end-to-side repair. Even though our historical series was not designed as a comparative study, we believe that the 18-year survival of 97% (added to an 8% in-hospital mortality)² compares favorably with the 67% 15-year survival achieved after LCATD.¹ In addition, the 18-year freedom from arch reoperation after end-to-side repair was

78%,² a figure higher than the 57% quoted at 15 years after LCATD, especially if, as it appears, the latter technique was reserved for a selection of more favorable patients.¹

Finally, we have previously raised concerns that patients with smaller arches may be more susceptible to the development of hypertension if they do not undergo a more radical technique of repair.⁴ We have demonstrated that the growth of hypoplastic segment of aortic arches is unreliable, and we are concerned that some of their patients may have had hypertension develop.⁵ We found the 18-year freedom from hypertension after interrupted arch repair in our study to be 88%.² The finding of a similarly low incidence of hypertension after the use of the LCATD technique would be very interesting.

In conclusion, we believe that unless further details are given regarding the potential limitations of the LCATD technique, it will be difficult to ascertain its usefulness for the treatment of interrupted aortic arch.

Melissa G. Y. Lee, BMedSc
Christian P. Brizard, MD
Yves d'Udekem, MD, PhD
Department of Cardiac Surgery
The Royal Children's Hospital
Department of Paediatrics
University of Melbourne
Murdoch Children's Research
Institute
Melbourne, Australia

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THREE-DIMENSIONAL CONFIGURATION OF THE MITRAL SUBVALVULAR APPARATUS

To the Editor:

Functional mitral regurgitation is a group of diseases in which surgical treatment is quite difficult and outcomes are not satisfactory when long term outcomes are considered. In light of published data on high recurrence rates with downsizing ring annuloplasty, many surgeons and cardiologists have carried out various studies. It is obvious that such scientific researches will further expand our horizon on the treatment of functional mitral regurgitation. In this context, we appreciate the study by Santana and colleagues¹ suggesting solutions to this problem. We would like, however, to discuss some issues probably missed by these authors.

First, when examined in detail, some inaccuracies can be seen in the article's Figure 1, which illustrates the placement of a polytetrafluoroethylene graft around papillary muscles.¹ The 3-dimensional configuration of interventricular septum, papillary muscles, and leaflets is improperly illustrated. Papillary muscles were represented as if they were aligned perpendicular to the septum, with each muscle having chordal insertions to only one leaflet.¹ Traditionally, however, it is accepted that in the left ventricular anterolateral view papillary muscles are aligned parallel to the interventricular septum, with multiple chordal attachments to both anterior and posterior leaflets.²