A.R. is a consultant for Sorin Group, Milan, Italy. The other author has nothing to disclose with regard to commercial support.

The incidence of explants is considerably high, and this single-center experience yields the limitation of an initial experience and the related learning curve, because improper implantation may influence further evaluation and results. A word of caution is therefore necessary to avoid misleading conclusions regarding durability.

In the majority of the 14 cases of explantation,² a clear relationship between incorrect implantation and need for reoperation could be identified. Oversizing was one of the most frequent flaws. With oversizing, leaflets are wrinkled at level of the suture line for excess of tissue, determining reduced mobility, higher gradients, and irregular coaptation with residual regurgitation; thrombosis and early degeneration may occur as well. Similarly, implanting a smaller valve than indicated may lead to structural failure. Leaflets are restricted in their movements and do not coapt properly, with an excess of tension on the suture line, aortic wall and commissures, leading to suture dehiscence, early failure, and commissural tears. Three-quarters of the leaflet rupture cases were size 27 (and not 23-25, as stated in the data section).² Again, avoidance of incorrect indications, such as a dilated annulus, seems of paramount importance to improve valve durability. Finally, the use of the Freedom SOLO valve in patients with bicuspid valve has not been recommended (because of incorrect alignment and asymmetry); however, this was the case for 1 patient of this series.

According to guidelines,³ all cases of inappropriate size, improper positioning, and technical errors should be considered nonstructural dysfunction. Such was the case for 9 of 14 reoperations.

Moreover, structural valve deterioration (SVD) was reported in 26 patients (16 of whom did not undergo reoperation); however, the definition of SVD for stenosis as adopted by Stanger and colleagues¹ is arbitrary and not according to recent echocardiographic criteria,⁴ in which pathologic obstruction is characterized by an elevated acceleration time (>100 ms). Moreover, the definition of SVD stenosis of Stanger and colleagues¹ is similar to recent reports about the long-term normal hemodynamic performance of conventional stented bioprosthesis.⁵ The reported freedoms from explantation and SVD at 9 years of 0.82 and 0.70, respectively, are thus widely influenced by implant pitfalls and improper classification of SVD, rather than the real valve deterioration.

The only true structural valve deteriorations seem to have occurred only in 4 of 149 patients (2.7%) at an average of 7.5 years after implantation. All patients were young (56-66 years) and had a small annulus.

In conclusion, we believe that the results of Stanger and colleagues¹ should be carefully interpreted, because avoiding common pitfalls in implantation might have changed their results by contributing to limiting premature failure and positively influencing the freedom from SVD.

A statement such as, "The Solo durability is considerably lower than that of conventional stented prostheses,"¹ without any comparative study and based on arbitrary SVD criteria, is therefore not supported by scientific evidence. Additional multicenter studies and longer follow-up are thus needed to assess real valve durability.

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ON EXPLAINING THE CAUSE WITH THE EFFECT

Reply to the Editor:

Thank you for the interest¹ in our article reporting our single-institution experience with a consecutive series of 149 patients receiving the Freedom SOLO (FS) (Sorin, Milan, Italy) stentless valve.² In our article, we provide an overview of relevant technical and operative details, short- and long-term results, and complications for which the freedom from explantation rate was only 1 of several late major adverse events presented as numeric Kaplan–Meier estimates. Despite excellent early

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and mid-term hemodynamic performance, structural valve deterioration (SVD) and explantation accelerated markedly after only 5 to 6 years. Kaplan–Meier estimates for freedom from explantation at 9 years averaged 0.82 (0.69–0.90), and all 14 cases were exceptionally well documented. This rare opportunity to share detailed insight into the potential pitfalls and failures justified a separate report,³ including precise case histories, operative findings, histologies, post hoc transesophageal echocardiography analyses, surgical details, difficulties, and outcomes of reoperations. As such, both reports clearly complement each other without overlap and should be read and understood in concert.

There is general agreement that both oversizing and undersizing potentially cause stentless prosthesis failure; however, correct sizing, at times, can be difficult. In contrast to the authors' view,¹ a hypothesized relationship between incorrect implantation and need for reoperation is not generally supported by post hoc analyses of the available transesophageal echocardiography records on positioning at the time of initial surgery. All cases of leaflet rupture occurred with prosthesis sizes 25 (n = 1) and 27 (n = 3), as clearly shown in the "Results" section (cases 6–9) in Table 2, with further elaboration in the "Discussion." Not only were the large sizes affected but also all tears were located close to the same commissure. Valve sizes 23 to 25 refer to the new prostheses implanted as replacements for explanted FS valves and are shown correctly, but seem to be misunderstood by the authors.¹ Another source of confusion arises from the assumption that "true SVD" (calcification) occurred only in young patients with small annuli. The text and table alike demonstrate that annuli were normal (allowing sizes 21 and 23), but degeneration was associated in each case with gross root calcification and shrinkage resulting in demanding reoperations and replacement with prostheses at least 1 size smaller than the FS valve.

Prosthesis failure represents a morphologic end point, mostly after many years of intense workload. Given the retrospective nature of these findings, it is not always possible to identify simple and (avoidable) causes for failure and degeneration, although tempting and understandable from a consultant's perspective. The mechanism of prosthesis degeneration in most cases is more likely to include a complex interplay of technical and patient- and tissue-related aspects, for example, root and flow dynamics, immunologic and metabolic responses, stress and strain absorption, valve design, and anticalcification treatments. We were particularly careful in avoiding simplified

conclusions on causal effects and clearly separated speculation from documentable findings.

Although the authors¹ suggest that the SVD cases (Kaplan–Meier estimate for freedom from SVD at 9 years averaged 0.70 [0.57–0.79]) were mostly due to improper classification, the reference provided refers to stented valves and the sole criterion of elevated acceleration time is clearly insufficient. Although the authors assume inappropriate size, positioning, and technical errors and claim that most reoperations should be classified as nonstructural dysfunction, the same reference defines SVD as dysfunction or deterioration involving the operated valve (exclusive of infection or thrombosis), as determined by reoperation, autopsy, or clinical investigation.⁴ This is in full accordance with previous guidelines defining SVD as "change in function or deterioration of an operated valve resulting from an intrinsic abnormality of the valve that causes stenosis or regurgitation, exclusive of infection or thrombosis" (eg, wear, fracture, poppet escape, calcification, leaflet tear, stent creep, and suture line disruption of components of an operated valve),^{5,6} which correspond to most of our cases that were therefore considered appropriately and based on documentation. In the absence of established reference values, particularly for stentless valve prostheses, our definition of SVD using a combined set of morphologic and hemodynamic criteria is rather conservative considering the generally larger effective orifice area and lower gradients of stentless versus stented valves.

We continue to emphasize that particular attention must be given to proper patient selection and recognition of constraints, which include observing root anatomy, correct sizing, and symmetric implantation, when using FS stentless valves. On the basis of current experience and knowledge that may not have been readily available at the time of the introduction of the FS valve, criteria for ideal patient selection and limitations for use were recently characterized to help optimize long-term results.⁷ Our report was aimed to contribute to awareness of potential pitfalls and failures, and thus to promote better outcomes. A final conclusion on the long-term durability of the FS valve cannot be based on case reports or a single-institution experience alone, but requires further data from other centers and additional longer follow-up.

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TOTAL ARTERIAL REVASCULARIZATION OF

TRIPLE VESSEL CORONARY DISEASE BASED ON COMBINED INTERNAL THORACIC AND RADIAL ARTERY GRAFTS

To the Editor:

We read with great interest the article by Buxton and colleagues.¹ The study rightly focuses the spotlight on the topic of total arterial revascularization (TAR). Indeed, given the continuously improving and expanding application of newer drug-eluting percutaneous coronary stents, TAR likely represents the future of coronary artery bypass graft surgery. We wish to make a few comments on this important study.

The authors' finding that radial and internal thoracic artery (ITA)-based TAR is associated with a substantial 15-year survival benefit compared with traditional left ITA plus additional vein grafts operation confirm the findings previously reported in a 2009 study.² That study, not discussed by Buxton and colleagues,¹ also found that the benefits of TAR manifest particularly in triple-vessel disease and are less prominent in cases of double-vessel disease.² However, the fact that the series by Buxton and colleagues¹ includes patients who were substantially older (mean age 70 years vs 61 years) complements previous data and supports a potential claim that the TAR benefit is present across age groups.

Another observation implied in the study by Zacharias and colleagues² is that the benefits of TAR depend on the extent of

completeness of revascularization—more complete revascularization leads to greater TAR benefit. This issue was not directly addressed in the analysis.¹ Indeed, both studies had a comparable (10%-12%) portion of their arterial-only grafting triple-vessel patients receiving fewer than 3 grafts (ie, were incompletely revascularized). Accordingly, because of this complete revascularization effect, we suggest that the TAR benefit reported by Buxton and colleagues (hazard ratio, 0.79) may underestimate the true late survival effect.¹ The corresponding TAR effect reported by Zacharias and colleagues² had a hazard ratio of 0.58. It is perhaps ideal to reserve the term TAR for cases of complete revascularization only.

The triple-vessel coronary artery disease surgical series analyzed by Buxton and colleagues¹ is truly remarkable, with arterial-only grafting used in an exemplary 79% compared with a low 21% left ITA/additional vein graft use, with the latter seemingly reserved mostly for older patients.¹ This multicenter experience is in sharp contrast to the prevailing coronary artery bypass graft practice in the United States (~90% left ITA/saphenous vein graft) and reflects the enviable progress of coronary artery bypass graft surgery in Australia. As good as this all-arterial use rate is, current data suggest it can potentially be even higher based on evidence that left ITA with radial artery-based multiarterial coronary artery bypass graft in elderly persons (ie, older than age 70 years) is associated with equivalent or better survival benefit to that achieved in younger patients.³

We hope this excellent study will provide impetus for the cardiac surgery community to embrace multiarterial—indeed TAR—coronary artery bypass graft surgery.

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