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doi:10.1016/j.jtcvs.2003.11.067

Prosthesis size and prosthesis-patient size are unrelated to prosthesis-patient mismatch

To the Editor:

We read with interest the report of Blackstone and colleagues¹ published in the September 2003 issue of the Journal, as well as the editorial of Gillinov and coworkers² in the August 2003 issue. The implicit conclusion of these two articles was that prosthesis-patient mismatch (PPM) is a rare occurrence after aortic valve replacement and that it has a negligible impact with regard to postoperative outcomes. To define PPM and analyze its consequences, both sets of authors chose, however, to use an indexed area based on the internal geometric dimension of the prosthesis divided by the patient's body surface area, rather than the indexed effective orifice area, which is the physiologic parameter most often used to define PPM. They justified their choice of parameter on the basis that geometric measures "are determined before implantation, have much less variability, and are independent of hemodynamic state."¹

The physiologic and clinical relevance of the indexed internal geometric area as used by these authors must, however, be challenged. Indeed, it has never been shown that this parameter can be related, in any significant manner, to transvalvular pressure gradients; in particular, it has been demonstrated that the indexed internal geometric orifice area cannot be used to predict which patients will have high postoperative gradients.³ Inherent to the pathophysiology

of valve PPM is the concept that too small a prosthesis in too large a patient will produce abnormally high gradients and thus have potentially detrimental consequences such as might occur with a native aortic stenosis. Thus if the indexed internal geometric area cannot be related to postoperative gradients, we do not see how it can logically be used to identify PPM or to characterize its severity.

In contrast, and despite its inherent limitations, the indexed effective orifice area is the only parameter that has consistently been shown to correlate with postoperative gradients, as well as being highly predictive of adverse outcomes.³⁻⁵ Indeed, when the definition of PPM is based on this parameter, the phenomenon has been shown to be highly prevalent (19%-70%, depending on series^{4,5}) and to be associated with less symptomatic improvement, worse hemodynamics at rest and during exercise, less regression of left ventricular hypertrophy, and more cardiac events after operation.^{4,5} A recent report from our own laboratory has clearly shown that PPM has a major impact on early mortality, particularly in patients with poor left ventricular function and that, in contrast to other risk factors, it can easily be prevented by use of a simple strategy at the time of operation.⁵ Such a strategy was recently used by Castro and associates⁶; as a result, the incidence of moderate-severe PPM in their population was only 2.5%, instead of the 17% that would have occurred had this prospective strategy not been used, whereas operative mortality remained low (1%). Extrapolating these findings to the total number of aortic valve replacements being performed each year in North America, it is estimated that approximately 1000 operative deaths could potentially be avoided through use of such a strategy.

In this context, the conclusion of these two articles with regard to the prevalence of PPM and its consequences cannot be accepted at face value, because the parameter used to define PPM is not valid to characterize postoperative hemodynamics.³ To the contrary, we still believe in the "value of concentrating on better hemodynamic performance"¹ and that research aimed at properly identifying PPM, as well as preventing it, can significantly contribute to improved outcomes after aortic valve surgery.

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Reply to the Editor:

We have long respected the excellent and prolific work of Dumesnil and Pibarot, so it is not surprising that we referred to their publications in our articles. However, they are unhappy in part with the way we have interpreted (or misinterpreted) their work,^{1,2} and in part with the surgical recommendations we based on survival data from our multicenter meta-analysis,¹ which differ from their own, which were based largely on functional prosthesis performance data.

What We Studied Survival

We studied the relation of geometric prosthesis size to time-related survival with nine sources of data and nearly 70,000 patient-years of follow-up among 13,258 patients who underwent aortic valve replacement with mechanical prostheses, stent-