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Commentary: Prosthesis–patient mismatch, the controversy goes on

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Given the definition of prosthesis–patient mismatch (PPM), all aortic valve substitutes, with the possible exception of aortic valve allografts and pulmonary autografts, will present at least mild degrees of mismatch.¹ Based on the association between echocardiographic-derived indexed effective orifice area (EOAi) and mean transvalvular gradient, $0.85 \geq \text{EOAi} > 0.65 \text{ cm}^2/\text{m}^2$ and $\text{EOAi} < 0.65 \text{ cm}^2/\text{m}^2$ have been used as cut-off values to define moderate and severe mismatch, respectively.²

In this issue of the *Journal*, Vriesendorp and colleagues³ have challenged this correlation and claimed that EOAi is not justified in the classification of PPM. Several factors, however, may explain disparities and inconsistencies on the definition and clinical consequences of PPM.⁴

The EOAi, as determined by the continuity equation, has several limitations and sources of miscalculations.⁵ The location and precise measurement of the left ventricular outflow tract (LVOT) diameter is subject to observer variability, not to say that the echo measurements assume that the LVOT is circular when in reality it has an elliptical shape. The ability to find the greatest aortic time–velocity integral requires investigation in multiple incidences and failure to do so may underestimate the degree of valvular stenosis in 20% of the cases. In addition, the precise determination of the LVOT time–velocity integral may also be a source of variability.⁵ Given that a substantial proportion of aortic stented prosthetic valves have calculated EOAi that lie in between 0.6 and 0.9 cm^2/m^2 , it becomes readily apparent that subtle differences in the above measurements

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CENTRAL MESSAGE

Despite controversies and limitations, indexed effective orifice area charts are still helpful to avoid prosthesis–patient mismatch when performing aortic valve replacement.

may place a single individual prosthesis under different categories of PPM.

Other factors such as left ventricular function, left ventricular stroke volume, and diameter of the sinus of Valsalva and of the ascending aorta may also influence to varying degrees the calculated EOAi.⁶ In addition, “surgeon factor” that includes the choice of suture technique, use of pledget versus single interrupted sutures, implantation in supra versus intra-annular position, and correct sizing of the stented valve been shown to significantly influence the final measured EOAi.^{7,8}

Based on the low accuracy of EOAi to predict elevated gradients, Vriesendorp and colleagues³ suggested that the use of EOAi charts has little value and is not supported by current evidence. Some authors proposed that charts based on predicted rather than measured EOAi have shown stronger association with residual gradients; however, this is also controversial.^{9,10}

One may argue on the arbitrariness and appropriateness of setting a mean gradient of 20 mm Hg as indicative of true PPM. Although it may be justified as a threshold for mild prosthetic stenosis in the Valve Academic Research Consortium-2 guidelines, other series may indicate that a lower threshold should be considered. Johnston and colleagues¹¹ have analyzed 12,569 aortic valve replacements with the Carpentier-Edwards PERIMOUNT bioprosthesis and found that, in younger patients, a postoperative mean gradient above 15 mm Hg was associated with an earlier and 2-fold increase of explant due to structural valve

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Disclosures: The author reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

Received for publication Nov 2, 2020; revisions received Nov 2, 2020; accepted for publication Nov 3, 2020; available ahead of print Nov 6, 2020.

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J Thorac Cardiovasc Surg 2022;164:833-4

0022-5223/\$36.00

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<https://doi.org/10.1016/j.jtcvs.2020.11.012>

deterioration at late follow-up. By multivariable analysis, residual gradient, as opposed to valve size had a stronger correlation with late structural valve dysfunction.

Although the data presented by Vriesendorp and colleagues³ are provocative, they do not allow one to determine thresholds ranges of EOAi and gradients that are indicative of true PPM and consequential for the patients. EOAi charts certainly have limitations, but we believe that they still serve as a useful guide to help surgeons in the selection of the most appropriate valve type and size and also to indicate when a root enlargement is advisable when facing patients with small aortic roots.

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