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EDITORIAL COMMENTARY

Individualized treatment strategies for patients with aortic valve disease and porcelain aorta

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See related article on pages 131-4.

The presence of porcelain aorta, defined as severe circumferential calcification of the aorta (Figure 1), substantially increases the complexity and risk associated with the treatment of aortic valve (AV) disease. The unique report by Idrees and colleagues¹ focuses on a series of 19 patients who were referred for treatment after an attempt at open surgical AV replacement (AVR) was abandoned due to the unanticipated discovery of porcelain aorta. Importantly, this is a contemporary series that began in 2001 and includes the period just before the availability of transcatheter aortic valve replacement (TAVR) devices. The report indicates that excellent early results can be achieved when an individualized approach is applied at an experienced center. Notably, no patients died within 30 days and no patients experienced stroke. Although the report focuses on patients referred after aborted AVR, the

results and their implications are relevant to all patients with porcelain aorta and AV disease. Their experience highlights that a successful individualized treatment strategy hinges on several key decision points.

WHETHER TO PERFORM ANY PROCEDURE AT ALL

The first decision point, whether or not to proceed with any AVR intervention, is perhaps the most challenging. In the series by Idrees and colleagues,¹ there were 2 deaths within 6 months after TAVR; both deaths were due to comorbid conditions, and the authors acknowledge that nonoperative management may have been a better choice for these patients. As articulated by Miller,² the line between utility and futility for TAVR has not yet been clearly defined. Improving our ability to identify those patients who are unsuitable for either open AVR or TAVR remains an extremely important focus of investigation. A recent analysis of Placement of Aortic Transcatheter Valve (PARTNER) trial results to identify predictors of poor outcomes is an excellent step in this direction.³

WHETHER TO PERFORM OPEN AVR OR TAVR

Once the decision has been made to proceed with an intervention, the next decision centers on whether to perform open AVR or TAVR. In the series by Idrees and colleagues,¹ this decision was largely driven by whether additional cardiac procedures were needed; patients with aneurysmal ascending aorta, multivalve disease, or

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FIGURE 1. Artistic rendition of porcelain aorta and aortic valve stenosis (longitudinal cross-section). Used with permission of Baylor College of Medicine.

coronary artery disease who were deemed clinically operable underwent open AVR.

The excellent results in the small group of patients who underwent open AVR suggest that carefully selected patients do well and argue against liberally using TAVR in low- or medium-risk patients solely on the basis of porcelain aorta. A recent report by Kaneko and colleagues⁴ regarding a series of 122 patients with porcelain aorta who underwent open AVR with hypothermic circulatory arrest during a similar time period (2004-2012) further illustrates that excellent results are achievable in

lower-risk subsets of patients. In their series, nonoctogenarians had much lower rates of death (4% vs 16%; $P = .035$) and stroke or transient ischemic attack (6% vs 23%; $P = .019$) compared with the octogenarians. Going forward, the challenge will be to consistently identify which patients are likely to do well with open AVR and which patients are not.

Idrees and colleagues¹ used TAVR in patients who did not need additional procedures and were considered too high risk for open repair, provided they had suitable anatomy. Early experience with TAVR suggests that this approach is particularly well suited for such patients. In the inoperable arm (cohort B) and continued access registry of the PARTNER trial, porcelain aorta was the most common reason for considering patients as inoperable from a technical standpoint.⁵ In 2010, Rodés-Cabau and colleagues⁶ reported outcomes of 61 patients with porcelain aorta who were considered either nonoperable or very high risk for open AVR, and thus underwent TAVR under the Canadian compassionate clinical use program; procedural success was achieved in 98%, 30-day deaths occurred in 12%, and stroke occurred in 2%. More recently, Pascual and colleagues⁷ reported a multicenter series of 36 patients with porcelain aorta who underwent TAVR after being deemed unsuitable for open AVR; procedural success was achieved in 94%, 30-day deaths occurred in 6%, and stroke occurred in 3%. In both studies, early outcomes after TAVR in patients with porcelain aorta were similar to those achieved in patients without porcelain aorta.^{6,7} The encouraging results of TAVR in these patients has led to increasing enthusiasm toward considering TAVR as the preferred approach in suitable patients with porcelain aorta.^{8,9}

WHETHER TO CLAMP THE AORTA DURING OPEN AVR

Upon deciding to proceed with open AVR, the next major decision is whether the aorta can be safely clamped. This decision is based on thorough examination of distal ascending aorta on preoperative imaging, ideally multislice computed tomography and 3-dimensional reconstruction. When a safe clamp site was identified, Idrees and colleagues¹ performed AVR under standard cardiopulmonary bypass, whereas when a safe clamp site was not identified,

TABLE 1. Classification of porcelain aorta proposed by Amorim and colleagues¹⁰ and corresponding degrees of calcification proposed by Nishi and colleagues¹¹

Type	Definition	Degree of calcification
IA	Circumferential ascending aortic calcification that precludes clamping	Calcification of $\geq 75\%$ of the circumference of the distal ascending aorta
IB	Circumferential ascending aortic calcification that does not preclude clamping	Calcification of $< 75\%$ of the circumference of the distal ascending aorta
II	Circumferential calcification of only the aortic arch and/or descending thoracic aorta	

ACD

they performed AVR and graft replacement of the ascending aorta under hypothermic circulatory arrest.

Given the importance of the distinction between clampable and nonclampable porcelain aorta, adoption of the classification recently proposed by Amorim and colleagues¹⁰ (Table 1) may be beneficial when deciding among treatment options, assessing perioperative risk, and counseling patients. Further, using the classification as part of standardized reporting in studies regarding treatment of patients with porcelain aorta would facilitate comparisons of study populations and the interpretation of results. To incorporate an objective parameter when distinguishing between Types IA (not clampable) and IB (clampable), Amorim and colleagues¹⁰ suggest using Nishi and colleagues¹¹ approach to quantifying the calcified proportion of the circumference of the ascending aorta just proximal to the innominate artery.

WHICH DELIVERY APPROACH TO USE DURING TAVR

Finally, upon deciding to proceed with TAVR, the team must then select the delivery approach. In the series by Idrees and colleagues,¹ transfemoral access was the preferred approach, but was able to be used in less than half of the 12 TAVR cases; the transapical or transaortic approaches were used as alternatives in the 7 patients with severe peripheral vascular disease, a common feature in patients with porcelain aorta.⁷ The direct transaortic delivery route can be used in patients with porcelain aorta provided that a noncalcified “safe spot” is identified in the anterolateral aspect of distal third of the ascending aorta.¹² Other alternative sites to consider in these patients include the axillary and carotid arteries.^{7,13}

OPTIMIZING THE INDIVIDUALIZED APPROACH

The experience reported by Idrees and colleagues¹ supports using an individualized approach when treating patients with AV disease and porcelain aorta. The decision-making process when devising the optimal strategy in a specific patient relies heavily on detailed assessment of comorbidities, physiologic reserve, anatomic factors, the severity and distribution of aortic calcification, and the quality of various potential sites for vascular access. Future improvements in risk assessment, imaging techniques, and TAVR design will undoubtedly enable

continual progress toward optimizing the individualized treatment strategy for each patient.

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