Revista Portuguesa de Cardiologia 43 (2024) 364–366

Revista Portuguesa de
Cardiologia
Portuguese Journal of Cardiology
www.revportcardiol.org

EDITORIAL COMMENT

The challenge of choosing the right prosthesis for the right patient – The devil is in the details

O desafio de escolher a prótese adequada ao paciente certo –«O diabo está nos pormenores»

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We read the article by Velho et al.[1] with particular interest since it shares the contemporary results of aortic valve surgery in the Portuguese population, particularly in octogenarian patients.

In the last decade, we have witnessed significant technological breakthroughs in the field of the treatment of heart valve disease, which has allowed us to intervene in high-risk patients in whom conventional surgery would otherwise be denied. Simultaneously, demographic changes and increasing life expectancy have contributed to the growth in the patient population with degenerative aortic valve disease, mainly stenosis.[2]

Transcatheter aortic valve implantation (TAVI) has been as a disruptive technology since its inception, breaking down the obstacles that appeared on the way, from the perspective of vascular access to the perivalvular leakage management and pacemaker implantation, conquering the field of aortic valve treatment, all this in a short time frame.[3]

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The swift adoption of this technology can be easily understood. From the patient and relative standpoint, it is seen as a less invasive procedure than the classical surgical aortic valve implantation (SAVR), which is associated with a faster recovery and return to daily life and shorter hospitalization. From the clinician's perspective, its indication has been validated by several randomized clinical trials and grounded in the guidelines.[4] Moreover, early indication in high-risk patients, or those unsuitable for SAVR, seems almost ''prehistorical'', and contemporary discussion has set the bar to lower risk patients. Even from the industry's viewpoint, this procedure has exceeded all expectations, becoming a highly profitable investment; only in 2023 the TAVI market was valued at $8.09 billions.

However, aortic valve surgery has also evolved considerably in recent times, not only in the technical aspects, but also in the perioperative management of patients. In regard to the surgical procedure itself, the development of new prosthesis, such as the sutureless valves, also called rapid deployment valves, has enabled surgeons to reduce operating times, leading to shorter extracorporeal circulation (ECC) and aortic clamping times. Such improvements mean fewer complications associated with longer ECC times, such

https://doi.org/10.1016/j.repc.2024.05.004

as arrythmias, renal failure, cerebrovascular complications. It also allowed to tackling challenging cases, such as heavily calcified aortic roots otherwise impossible to operate by conventional techniques. In these latter circumstances, surgeons are able to avoid calcifications by performing a transverse and higher aortotomy.[5] Moreover, these prostheses have facilitated minimally invasive approaches, from partial sternotomy's (J incision) to right anterior minithoracotomy, permitting faster recovery from surgery and returning to work as needed. It should be stressed, that are units, such as ours in Coimbra, Portugal, that are performing minimally invasive aortic replacement in more than 75% of patients with isolated aortic valve disease.

Notably, various factors have contributed to better surgical outcomes, including: preoperative optimization of patients, refining of patient clinical status before surgery and avoiding or postponing the operation when decompensated, establishing fast-track protocols for extubating and reducing intensive care stays and also promoting cardiac rehabilitation programs in the postoperative period.

Isolated SAVR is currently a straightforward procedure, with a ''nearly zero percent'' of operative mortality, as was shown in the article (only one patient died) and corroborated by our personal experience and that of others. It is also associated with few relevant complications.[6] The majority of patients have minor complications (inotropic support, bleeding without requiring reintervention, transitory rhythm disturbances) that do not impact survival nor the length of hospital stay. These should be distinguished from hard outcomes, such as death, stroke, renal replacement therapy, pacemaker implantation or moderate-severe peri-prosthetic leakage. In the work of Velho et al.,[1] the rate of these latter and impactful complications was only 11.3%; mortality was just 0.5%. Furthermore, the median length of stay in their study was only six days (IQR 5–8), which is very important given the nature of the elderly population involved and likewise reflects the previously mentioned surgical improvements.

Although long-term survival is not a crucial issue in this setting, the results presented by the authors are remarkable: survival rates were 95.3% at two years, 94.1% at three years, 93.4% at four years and 75.4% at five years. Of note, patients with low surgical risk had higher survival (81.7% vs. 57.3%), as well as a lower rate of perioperative complications in comparison with the intermediate-high risk group ($p<0.05$), probably demonstrating the importance of patient selection.

Current guidelines are very forthright regarding the process of choosing the best treatment modality for an individual patient; the choice should take into account clinical, anatomical and procedural factors.[4] Notwithstanding, TAVI is the procedure of choice in patients >75 years, particularly when a transfemoral route is possible. There are several instances in which SAVR should be preferred in older patients: when there is active or suspected endocarditis or the presence of a thrombus in the aorta or in the left ventricle (LV); if it is an active patient, with few comorbidities and no frailty associated, and the transfemoral approach is not feasible or challenging; if there is massive annular and valvular calcification with extension to the left ventricular outflow tract (LVOT) and/or bicuspid anatomy involved; in the presence of a small annulus that is unsuitable for available TAVI devices. In this case, surgical aortic root enlargement (ARE) can accommodate up to 2–4 sizes larger depending on the technique of enlargement used. We demonstrated in a consecutive series of 218 patients who underwent ARE, with a median age of 74 years, that it can be done in a safe (hospital mortality was 0.9%) and reproducible manner.[7] Another unfavorable anatomical feature for TAVI is when there is a high risk of coronary obstruction due to low coronary ostia or heavy leaflet/LVOT calcification and small aortic sinuses. Finally, when there are cardiac conditions requiring concomitant intervention, such as coronary artery bypass grafting, other valve procedures, such as mitral and tricuspid valve disease, and/or aorta surgery due to significant dilatation/aneurysm of the aortic root and/or ascending aorta. Lastly, in patients with markedly hypertrophied hearts, in whom sometimes there is associated asymmetric basal LV hypertrophy, some degree of subvalvular stenosis can supervene and just replacing of the aortic valve would not solve the problem. In some extreme situations, there may be systolic anterior movement of the anterior leaflet or chordae, creating dynamic subvalvular gradient and leading to several degrees of mitral regurgitation. In this situation, only an extended myectomy can correct this problem accurately.

Other factors should enter in the equation on whether TAVI or SAVR should be used; this relates to the expected outcomes or complications of each procedure. TAVI is associated with a higher level of pacemaker implantation, that could go up to 20% of patients, and the presence of pacemaker leads can potentially cause pacemaker-related desynchrony, increase the risk of pacemaker lead endocarditis and tricuspid regurgitation. Similarly, it is undisputable that TAVI prosthesis shows greater degrees of perivalvular leakage in comparison with SAVR and that also impacts survival negatively.[8] On the other hand, SAVR is more invasive and implies a greater risk of arrythmias and renal lesion in addition to longer hospital stays and recovery of daily life activities.

One should highlight the importance of the decision-making process to be undertaken at a heart valve center, where the heart team (clinical cardiologist, interventional cardiologist, cardiac surgeon, imaging specialist with expertise in interventional imaging, cardiovascular anaesthesiologist) plays a critical role in integrating clinical, anatomical, and procedural characteristics, in order to deliver optimal quality of care with a patient-centered approach. Interestingly, high-volume TAVI programs are associated with lower 30-day mortality, particularly at hospitals with a high SAVR volume.[9,10]

In conclusion, we are facing a new demographic reality, since many octogenarians are active citizens who become significantly disabled when symptoms emerge. Age is frequently reported as a very important surgical risk factor, however it does not come alone and age-related comorbidities play an important part in the eligibility for surgery. Long-term survival may be less important here, since in many cases they even have exceeded their life expectancy. The expected quality of life is also of vital importance, and we should be able to assess and balance it in an individual manner: judging the frailty index, need for caregiving, ability for independent living, motivation to live and the individual benefits of surgery. Hence, SAVR and TAVI should

be seen as complementary treatment options for aortic stenosis, even in octogenarian, and despite the preference for the latter, the final decision should rest on the details.

Conflicts of interest

The author has no conflicts of interest to declare.

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