What does the Cardiologist Expect from the Echocardiogram of a Transcatheter Aortic Valve Implant?

O que o Cardiologista Espera do Ecocardiograma no Implante Transcateter da Válvula Aórtica?

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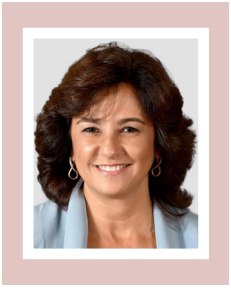

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Aortic stenosis (AS) is the most common valve disease in the elderly, with an increasing prevalence. According to the Global Burden of Disease, in Brazil, the incidence of degenerative aortic valve disease has significantly increased from 53.5 patients (95% confidence interval [CI], 48.1–59.9) in 1990 to 64.4 patients (95% CI, 57.2–72.5) per 100 thousand population in 2017, with prevalence rates of 18.5% and 24.2% among men and women, respectively.[1]

Transcatheter aortic valve implantation (TAVI) has become a universally accepted alternative to surgical aortic valve replacement in high-risk or inoperable patients and, more recently, possibly in intermediate-risk patients. In 2008, the first TAVI was performed in Brazil, with 2,667 cases reported in the Brazilian Transcatheter Aortic Valve Implant Registry (*Registro de Implante de Bioprótese Aórtica por Cateter e Novas Tecnologias*) thus far, with success rates similar to those described in high-performing centers worldwide.[2,3]

Proper selection of TAVI candidates is critical to the success of the procedure. The Heart Time, which consists of clinical cardiologists, cardiovascular surgeons, interventional radiologists, anesthesiologists, and imaging specialists, is responsible for the multidisciplinary approach for selecting the best treatment for patients.[4]

Advanced age, history of heart surgery, heart, renal, and/or respiratory failure, and the severity of the valve pathology dictate the choice of procedures and treatment optimization. Risk stratification is required in asymptomatic patients. The prognosis in symptomatic patients is poor in the presence of heart failure, syncope, and angina, with estimated times between the onset of symptoms and death of 2, 3, and 5 years, respectively.[5-7]

Multimodal imaging plays a key role in the evaluation of patients with AS. Echocardiography (ECO) is the most frequently used method for identifying patients, followed by multi-slice computed tomography (MSCT), cardiovascular magnetic resonance imaging (also known as cardiac MRI), and coronary angiography, which are used in treatment planning. MSCT is essential for evaluating the aortic valve complex and access route and for estimating the imaging projection used to release the bioprosthesis. Furthermore, aortic valve calcium scoring by MSCT and myocardial fibrosis quantification by MRI have prognostic implications. Periprocedural transesophageal echocardiography (TEE) and transthoracic echocardiography (TTE) for short-, medium-, and long-term follow-ups are also fundamental in the systematized approach to the management of patients with AS.[6,7]

High-grade AS is defined as a peak aortic velocity of >4 m/s, mean gradient of >40 mmHg, and valve area (VA) of <1 cm^2. Low-flow and low-gradient AS with a reduced ejection fraction (EF) has a VA of <1 cm^2, mean gradient of <40 mmHg, EF of <50%, and systolic volume index (SVi) of ≤35 mL/m^2. Stress ECO with dobutamine is useful for differentiating severe from pseudo-severe AS (VA of >1.0 cm^2 with flow normalization). In this case, the presence of contractile reserve (increased systolic volume, >20%) is associated with good prognosis. Low-flow and low-gradient AS with a preserved EF (VA, <1 cm^2; mean gradient, <40 mmHg; EF, ≥50%; SVi, ≤35 mL/m^2) is associated with small ventricles, significant left ventricule (LV) hypertrophy, systemic arterial hypertension, and advanced age. Assessing the calcium score in the aortic valve by using MSCT is useful for determining the AS severity and prognosis. Low-gradient AS with a normal flow and preserved EF

Keywords

Aortic Valve Stenosis; Echocardiography; Tomography; Magnetic Resonance.

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(VA, <1 cm²; mean gradient, <40 mmHg; EF, ≥50%; SVi, >35 mL/m²) is considered moderate AS.[6,7]

The examiner's experience is essential for increasing the accuracy of the diagnostic method, with visual assessment of the valve structure and calcification and mobility of the aortic leaflets. A mobile aortic valve will unlikely be associated with severe AS, regardless of the aforementioned measurements.[8] Multiple windows must be used, such as the right parasternal window, to quantify the gradient in severe AS. The measurement of the dimensions of the LV outflow tract must be repeated because the aortic orifice in AS is elliptical, which may cause the underestimation of the VA on TTE. In the near future, three-dimensional ECO can improve the accuracy of this measurement, which is useful for selecting the size of the bioprosthesis. Performing TEE may provide additional information regarding the associated mitral regurgitation when planning the intervention and the detection of paravalvular lichen, with the advantage of having no radiological contrast medium required, which minimizes the occurrence of contrast-induced nephropathy.[7,8]

The intervention is indicated for symptomatic patients with high-gradient severe AS (mean gradient of ≥40 mmHg or peak velocity of ≥4.0 m/s, Class I and Level of Evidence B) or low-flow and low-gradient severe AS (<40 mmHg) with reduced EF and evidence of contractile (flow) reserve, excluding pseudo-severe AS (Class I and Level of Evidence C).[7,8]

Available data from randomized controlled clinical trials and large records from elderly patients with increased surgical risk show that TAVI reduces mortality, in comparison with conservative therapy (balloon valvuloplasty and medication) in extreme-risk patients.[5] It is neither inferior nor superior to surgery in high-[9,10] and intermediate-risk patients.[11,12] Patients with low-flow and low-gradient AS with reduced EF, predominantly due to increased postload, show improved LV function after intervention. In turn, if the dysfunction results from fibrosis, the patient is highly unlikely to recover. Higher rates of vascular complications, pacemaker implantation, paravalvular regurgitation with TAVI, major bleeding, acute kidney injury, and new atrial fibrillation have been observed during surgery.[6,7]

Conclusion

ECO plays a key role in AS diagnosis, TAVI implantation planning, and short- and long-term follow-ups. TTE is useful in the diagnosis of AS and for evaluating the aortic valve complex, aortic valve morphology, mitral regurgitation, and left ventricular function. TEE plays a key role during the procedure, in prosthetic valve function monitoring, and in detecting complications. Stress ECO with dobutamine is useful for evaluating asymptomatic patients and differentiating severe from pseudo-severe low-flow and low-gradient AS with an EF of <50%. Follow-up with TTE can detect mismatches between the prosthesis and the patient, structural deterioration of the bioprosthesis with significant stenosis or regurgitation, and clinical or subclinical thrombosis, among other long-term complications.[7,8]

New semiautomated analysis techniques for the aortic annulus have shown good accuracy as compared with MSCT and may be incorporated in TAVI implantation planning.[7,8,13]

Conflict of interest

The authors have declared that they have no conflict of interest.

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