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TAVI in Bicuspid Aortic Valve Stenosis: What's Changing? - A Mini Review

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Abstract

Bicuspid aortic valve (BAV) is the commonest congenital heart disease affecting predominantly male sex (male to female ratio 3:1), with an estimated incidence in general population ranging from 0.9 to 2%. Due to its abnormal geometry and mechanical stress, this valve anatomy is a predisposing condition for the development of calcific aortic stenosis.

Keywords: TAVI • Bicuspid aortic valve • Regurgitation • Pacemaker

Introduction

Although number of patients with BAV treated with TAVI is increasing, this kind of procedure is still associated to many concerns in current American and European Guidelines [1-5]. Patients with BAV with aortic stenosis compared to the ones with stenotic tricuspid aortic valve (TAV) are younger, have a lower incidence of coronary disease and a lower EuroScore and STS (Society of Thoracic Surgeons) score [6-8]. Therefore, since TAVI is moving toward lower patients' risk profile, probably more bicuspid valves will be found in the younger population.

Literature Review

BAV has been classically divided in three types according to Sievers' classification [9]. A further recent classification divided bicuspid valves in type 0 (2 cusps and no raphe) and type 1 (2 cusps and 1 or more raphe) [8]. During TAVI procedures in patients with BAV dilated ascending aorta, possible concomitant aortopathy, calcium distribution in leaflets and commissures and eccentricity of the valve opening can impact on procedural outcomes [10,11].

Type 0 valves are more complex for their elliptical shape at annular level and for possible obstruction of the coronary ostia during valve implantation from the two big leaflets (length <10 mm), occurring in up to 4.6% of procedures in BAV [12]. In most cases big Valsalva sinuses, a quite common condition related to type 0 anatomy, counterbalance the risk of coronary ostia occlusion [13]. In case of doubt, balloon inflation through aortic valve with contrast injection in ascending aorta could be helpful to rule out the possibility of ostia obstruction. As suggested by in vitro studies elliptical valve shape, particularly at valve orifice, can be one of the main causes of paravalvular (PVL) and intra-valvular leaks, occurring in 11.5% to 18.1% of patients with BAV undergone TAVI [14]. Calcium distribution is of paramount importance particularly in bicuspid valves, apposed at level of both leaflets and annulus [15].

Annular rupture risk is up to 2% in BAV and even higher with the employment of balloon expandable valves (up to 5.3%) and it has been related to possible concomitant aortopathy, annular and commissural calcium and a relatively higher degree of oversizing for anchoring and preventing PVL [16,17].

Patients undergone TAVI with first generation percutaneous bioprosteses had higher rates of malposition, use of multiple transcatheter heart valves and moderate-to-severe residual aortic regurgitation [18]. On the other hand, second-generation valves, featuring repositionability, sealing properties and a more accurate deployment, found better outcomes even if PVL remains an issue for patients with BAV undergoing TAVI [6].

Discussion

Moderate to severe aortic regurgitation after TAVI has been related to worse short and long-term outcomes [19-21]. Recent studies show reduced incidence of PVL in bicuspid anatomy compared with the former results of the German TAVI registry, where it has been estimated around 25% [18,22-24].

Recent data show a higher rate of post-procedural stroke in BAV patients compared to those with TAV (2.5% vs. 1.6%), leading to prefer employment of cerebral embolic protection devices in BAV patients undergoing TAVI [12]. Post-procedural pacemaker implantation does not seem to significantly differ between BAV and TAV undergoing TAVI even if recent studies reported relatively higher rates of new pacemaker (PM) insertions after TAVI with new generation devices (Sapiens 3 and Lotus) estimated around 16.7% in bicuspid valves [6].

TAVI in BAV: What's new?

Higher implant: Radial force of the valve seems to play an important role determining post-procedural PVL. Valves with higher radial force, such as Lotus and Edward Sapiens 3, can easily modify the elliptical shape of BAV to round shape, decreasing the occurrence of PVL [6,8]. Starting from Laborde, who firstly suggested higher supra-annular implant, in order to allow deployment of the part with higher radial force at the level of the orifice of the valve in order to achieve a round shape, Core Valve implantation in BAV has been modified during years [8,25].

Smaller valves: With the advent of new generation valves, provided with an external sealing cuff aimed to reduce post-procedural PVL, oversizing has been eliminated [6]. Furthermore, valve sizing should be based on area-derived perimeter, particularly among BAV patients with borderline annulus and thickened or calcified valves [26]. In bicuspid valves it is still advisable to perform a balloon sizing [27].

Pre procedural CT evaluation: Pre-procedural CT evaluation can provide a more accurate sizing of the valves, significantly reducing the rates of annular rupture and aortic dissections [8]. In BAV, inter-commissural distance (ICD) measured 4-8 mm above the annular plane, seems to directly relate to the

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maximum diameter achievable by a specific aortic prosthesis. Nevertheless, optimal annulus/device or ICD/device ratio is still unclear [8].

Conclusions

Therefore, differing from the past, bicuspid aortic valve stenosis does not seem to be an absolute concern for TAVI procedure even if specific issues are still to be taken into account.

The presence of:

a) Extreme valvular eccentricity, particularly in type 0,

b) Heavy calcification, particularly if at commissural level,

c) Small aortic sinus, particularly in type 0,

d) Ascending aortic dilatation,

e) Still represent an indication for surgery as first option.

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Conflict of Interest

The authors declare there is no conflict of interest.

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