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ARTYKUŁ ORYGINALNY / *ORIGINAL ARTICLE*

Transcatheter aortic valve implantation in patients with bicuspid aortic valve: a series of cases

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Abstract

Background: Bicuspid aortic valve (BAV) has been considered a relative contraindication for transcatheter aortic valve implantation (TAVI). Due to more oval shape of the BAV annulus compared to tricuspid aortic valve, the procedure has been discouraged because of an increased risk of stent assembly displacement, uneven expansion, post-procedure paravalvular leakage, stent valve distortion, or other malfunction after implantation. For the same reasons patients with BAV have been excluded from the majority of clinical TAVI trials.

Aim: To evaluate the efficacy and safety of TAVI in patients with BAV stenosis.

Methods: We analysed a group of 104 patients admitted to our institution for TAVI between January 2009 and May 2012. During pre-procedure evaluation, transthoracic and transoesophageal (TEE) echocardiography as well as angio-computed tomography (CT) scan were performed to assess aortic valve anatomy and morphology. Appropriate measurements and detailed analyses of imaging data have been accomplished to select optimal access site, prosthesis size as well as to plan the procedure. BAVs were recorded in seven patients (6.7%; mean age 77.7 years). These patients presented with severe symptomatic aortic valve stenosis with a mean aortic valve area of 0.55 cm^2 (0.46–0.7 cm^2) as measured in TEE. All of the patients had been disqualified from surgical valve replacement due to high surgical risk with a mean logistic Euroscore of 19.9%. All of them successfully underwent TAVI using CoreValve (n = 5) or Sapien (n = 2) valves. Follow-up was completed at 30 days, and six and 12 months after the procedure.

Results: During follow-up one patient developed an elliptic distortion of the aortic prosthesis in CT, although it did not result in significant malfunctioning of the implant. One patient died of infective endocarditis 30 days after the procedure. Survivors at 30-day follow-up had mild to moderate aortic insufficiency, and it did not deteriorate after six months. At one year follow-up six out of seven patients remained alive. They achieved significant functional improvement by New York Heart Association class compared to baseline.

Conclusions: TAVI may constitute an alternative treatment option for high-risk patients with BAV, resulting in a low periprocedural mortality rate, and good 30-day, six-month, and one-year outcomes.

Key words: TAVI, aortic valve stenosis, bicuspid aortic valve, elliptic distortion, safety

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INTRODUCTION

Bicuspid aortic valve (BAV) belongs to the most common cardiac congenital abnormalities diagnosed in approximately 0.8–2% of the population [1, 2]. This anatomic variation is associated with higher risk of rapid leaflet degeneration and calcification leading to stenosis of the aortic orifice [3]. It often co-exists with dilatation of proximal thoracic aorta and precedes such adverse events as aneurysm formation and dissection or rupture of the main vessel [4]. There have been many surgical techniques and different therapeutic options for patients presenting with BAV stenosis with or without regurgitation [5]. With the advent of transcatheter valves specifically for minimally invasive implantation procedures, patients with aortic stenosis have benefited with a new therapeutic approach. Nevertheless, BAV has been considered an exclusion criterion in most randomised controlled trials [6]. Although this anomaly still remains a relative contraindication for transcatheter aortic valve implantation (TAVI) [7], there have been a number of cases presented worldwide in which patients successfully underwent TAVI in a native orifice of BAV [8–16].

Alternated anatomy of bicuspid aortic root causes certain problems with adequate stent-valve assembly positioning, deployment, and functioning. The anatomical features to be carefully evaluated before TAVI procedure are the existence of an elliptic shape of the aortic annulus and the presence of asymmetric heavy calcifications [4]. Multiscan computed tomography (MSCT) together with transthoracic (TTE) and transoesophageal (TEE) echocardiography yield an effective diagnostic approach to the management of BAV and allow the implantation to be properly planned [17]. Figures 1 and 2 show cross sectional views of stenotic BAV with marked calcification forming a calcium bridge along the raphe between the right and left aortic leaflets.

METHODS

In this retrospective report we present the data of seven patients (72–85 years old, mean age 77.7 years, four females) with documented BAVs, admitted to the Institute of Cardiology in Warsaw. This cohort has been selected from the group of 104 patients who underwent TAVI procedure in our institution between January 2009 and May 2012. All of the investigated patients presented with severe symptomatic aortic valve stenosis (functional New York Heart Association [NYHA] class II to IV) with mean aortic valve area of 0.55 cm^2 (0.46–0.7 cm^2) and transaortic mean pressure gradient of 74.57 mm Hg (60–94 mm Hg) as measured in TEE. They were considered high surgical risk with an average calculated logistic Euroscore of 19.9% (5.8–33.09%), and they had been previously disqualified from surgical aortic valve replacement (SAVR) by an institutional Heart Team. Every patient routinely underwent a pre-procedural diagnostic scheme based on TTE and TEE, MSCT scanning of heart and ascending aorta, as well as angio-MSCT of iliac and femoral arteries for proper planning of the valve implantation in terms of selection of access route, valve size, and complication risk assessment. Two patients suffered from occlusive aortic sclerosis and were excluded from transfemoral approach. One patient had had an abdominal aortic aneurysm. One patient (with a relatively low log Euroscore of 5.8%) had a history of oncologic disease and had undergone mastectomy and chest radiotherapy, which was an unfavourable factor for surgery. Finally, four patients were qualified for transfemoral approach, two for subclavian, and one for transapical access. The clinical characteristics of the patients are shown in Table 1.

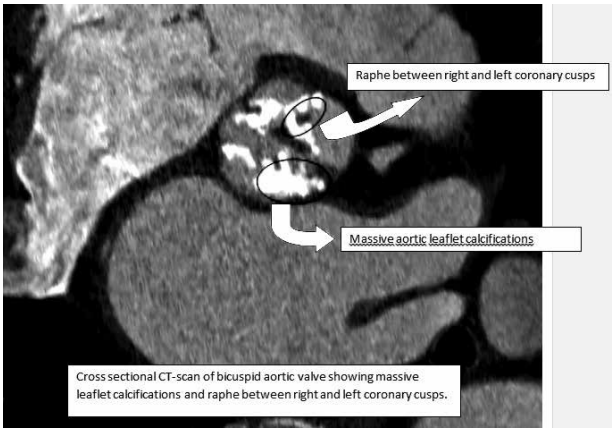

Figure 1. Cross-sectional computed tomography (CT) scan of stenotic bicuspid aortic valve with marked calcification forming a calcium bridge along the raphe between the right and left aortic leaflets

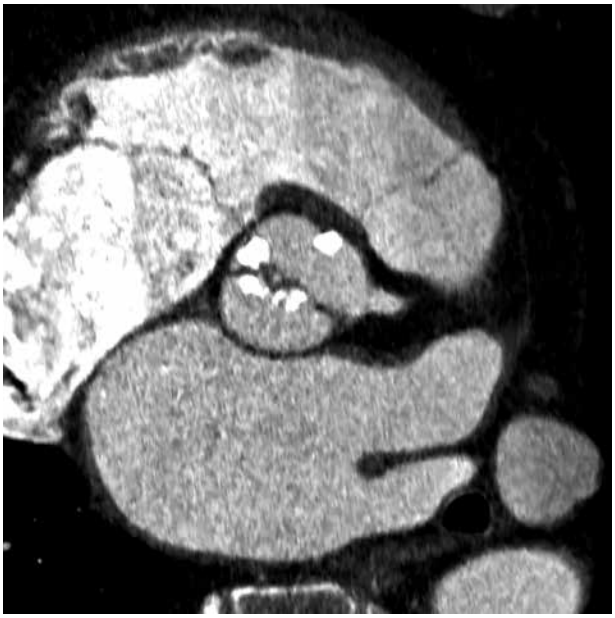

Figure 2. Cross-sectional computed tomography scan of bicuspid aortic valve with no evident calcific raphe

Table 1. Baseline characteristics of the patient group

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7
Patient number in case series	25	34	39	55	89	97	104
Age [years]	85	80	72	73	84	75	75
Gender	Male	Male	Female	Male	Female	Female	Female
Medical history:							
Previous MI	Yes	No	Yes	Yes	No	No	No
PCI	No	No	No	No	No	No	No
CABG	No	Yes	No	Yes	No	No	No
Stroke/TIA	No	Yes	No	No	No	No	No
Diabetes mellitus	Yes	Yes	Yes	Yes	Yes	No	No
Obesity/MS	Yes	No	Yes	No	Yes	No	No
Other	Peptic ulcer disease — gastroduodenal bleeding	Abdominal aortic aneurysm; aortic surgery	Chronic skin ulceration	Gastric resection, AO	Mastectomy, erosive gastritis, severe anaemia; ascending aortic aneurysm 51 mm	Mastectomy, radiotherapy, osteoporosis	Epilepsy
NYHA class	III	IV	II	IV	III	II	II
Angina class — CCS	0	4	1	3	3	1	3
Baseline electrocardiogram	SR, narrow QRS	SR, narrow QRS	SR; 1st AV block; LAH	SR; LAH	RBBB, 1st AV block; LAH	SR, narrow QRS	SR, narrow QRS
Echocardiography:							
LVEF [%]	60	43	65	60	55	70	60
Peak/mean TAVG	116/67	96/60 84/55	127/81	110/76	127/70	136/94	119/74
Mean logistic Euroscore [%]	15.7	33.1	27.5	32.22	12	5.8*	12.5

*Such a low logistic Euroscore does not fully reflect the high surgical risk of this patient, who had undergone mastectomy and chest radiotherapy, and had suffered from osteoporosis.
AO — atherosclerosis obliterans; AV block — atrioventricular block; CABG — coronary artery bypass graft; CCS — Canadian Cardiovascular Society; LAH — left anterior hemiblock; LVEF — left ventricular ejection fraction; MI — myocardial infarction; MS — metabolic syndrome; NYHA — New York Heart Association; PCI — percutaneous coronary intervention; RBBB — right bundle branch block; SR — sinus rhythm; TAVG — transaortic valvular gradient; TIA — transient ischaemic attack

The aortic annulus diameter measured in TEE was 22.9 mm (20–27 mm), but when measured by computed tomography (CT) it was 24.2 mm (22–26 mm — approximate diameter calculated as average of short and long diagonals). Both TEE and MSCT revealed massive calcifications and significant thickening of the bicuspid valve leaflets in all presented cases. Five patients had an elliptic annulus shape, defined as a difference of ≥ 3 mm between the shortest and the longest diameters of the aortic annulus measured by MSCT in the plane of the lowest attachment points of the leaflets to the annulus (hinge points). Imaging features of the aorta and aortic valve are shown in Table 2.

RESULTS

After diagnostic evaluation the patients were ultimately qualified for TAVI by the Heart Team. They were informed of the procedural details and risk. The details of the TAVI procedure have been described elsewhere [18, 19]. Written informed consent was given and signed by every patient and an operator. Five patients received CoreValve aortic prostheses (Medtronic, Inc., Minneapolis, MN, USA): 26 mm in one patient and 29 mm in four patients. In two other patients Sapien 23 mm valves were used (Edwards Life Sciences, Inc., Irvine, CA, USA). Transfemoral access was utilised in five patients, whereas the remaining two received transapical (one patient, Edwards Sapien valve) or trans-subclavian (one patient, CoreValve valve) approach. Another patient had been initially considered for trans-subclavian approach, but in the course of the procedure the surgically prepared left subclavian artery turned out to be too narrow to advance the CoreValve assembly (suspected vasoconstriction). Thus, conversion to femoral access was necessary. None of the patients required post-dilatation of the newly implanted prosthesis. Overall there was no intraprocedural death. All of the procedures were

Table 2. Imaging characteristics of the aorta and aortic valve

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7
AVA [cm^2] (TEE)	0.5	0.7	0.6	0.7	0.46	0.51	0.52
TEE — AoVAn [mm]	23	27	24	22	22	20	20
MSCT — AoVAn (short and long axis) [mm]	20 × 29	22 × 29	24 × 25	22 × 25	24 × 28	21 × 23	20 × 27
Elliptic annulus	Yes	Yes	No	Yes	Yes	No	Yes
MSCT — SoV [mm]	31	34 × 40	27	39	39	28	31 × 26
MSCT — STJ [mm]	24	36 × 33	32	31	35	24	26
AsAo [mm]	34	40 × 39	39	35	50	29	30 × 30
Prosthetic valve type and size [mm]	CV 26	CV 29	CV 29	ES 23 (transapical)	CV 26	SXT 23	CV 29

AoVAn — aortic valve annulus diameter measured across the root of the aorta from the basal attachment of two leaflets (hinge point); AsAo — ascending aorta diameter; AVA — aortic valve area; CV — CoreValve; ES — Edwards Sapien; MSCT — multiscan computed tomography; SoV — sinus of Valsalva diameter; STJ — sinotubular junction diameter; SXT — Sapien XT; TEE — transoesophageal echocardiography

Table 3. Echocardiographic characteristics of the patients after the procedure

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7
Peak/mean TAVG [mm Hg]	41/23	13.5/6.3	26/15 (slightly atypical position of prosthetic valve)	31.4/18.5	21.2/13.9	30/14.7	20/–
Paravalvular regurgitation	Moderate	Moderate	Mild	Mild	Mild	Mild	Trivial
Transvalvular regurgitation	None	None	None	Trivial	Trivial	None	Mild
LVEF [%]	65	45	64	65	65	70	65

LVEF — left ventricular ejection fraction; TAVG — transaortic valvular gradient

successful in terms of direct reduction of aortic transvalvular gradient. Device success and end-point definitions were adapted from the consensus report according to the Valvular Academic Research Consortium [20]. Adverse events were prospectively recorded at hospitalisation for index procedure, at 30-day, six-month, and one-year medical visits at our institutional ambulatory care unit or via telephone contact. Table 3 presents outcome assessed by echocardiography during index procedure hospitalisation or at discharge.

In general TAVI yielded effective transvalvular gradient reduction evaluated by TTE. Maximal and mean gradient dropped from 117.86 mm Hg to 20.87 mm Hg (range: 6.3–36 mm Hg) and from 74.57 mm Hg to 11.36 mm Hg (range: 0–16 mm Hg), respectively. Post-procedure aortic valve insufficiency (paravalvular leak) in the entire cohort was mild to moderate, not significantly varying from the values observed in our experience after TAVI in tricuspid aortic valves [21]. In the remaining 97 consecutive patients (with tricuspid aortic valves), who were treated in our centre within the same timeframe, two patients had unsuccessful procedure and six died in the hospital.

During 30-day follow-up functional NYHA class improved by one in four out of seven patients. The lack of improvement in three patients can be explained by the fact that one of them was highly inefficient due to complications (deep venous thrombosis and infective endocarditis), whereas two others had presented with good NYHA class from the beginning (NYHA II), so clinical improvement was not so evident.

Two patients needed an additional CT scan after the procedure because of suspicion of asymmetric deployment or underexpansion of the stented valve. In one case (patient no. 1) it was confirmed and visualised at three weeks after TAVI as elliptic distortion of the stent-valve assembly (CoreValve 26 mm). Figures 3 and 4 show deformation of the lower part of the stent with an asymmetric size of 24 × 7 mm. The distortion resulted in moderate paravalvular aortic regurgitation but decreased to mild at 90-day follow-up without further sequelae. Due to the good physical condition of the patient and the lack of a need for further evaluation another CT-scan was not performed.

In a second case (patient no. 4), after implantation of an Edwards Sapien 23-mm valve via transapical route, repeated CT scan revealed the correct position of the prosthetic valve

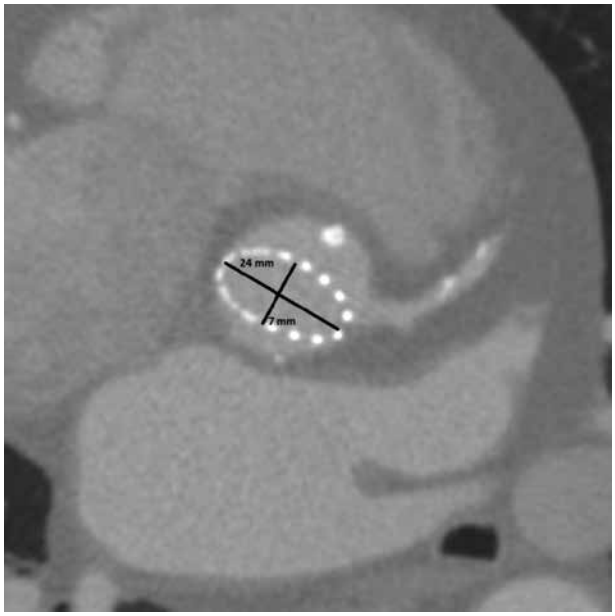

Figure 3. Cross-sectional computed tomography scan visualising elliptic distortion of the CoreValve aortic bioprosthesis (patient no. 1)

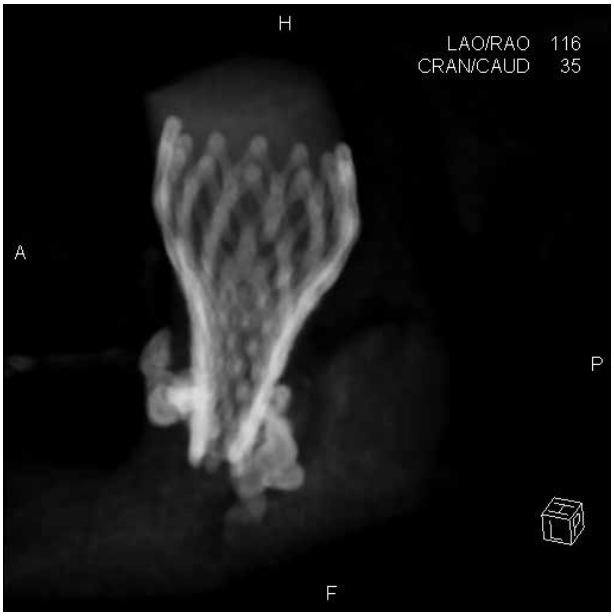

Figure 4. Computed tomography scan — longitudinal section visualising elliptic distortion of the CoreValve aortic bioprosthesis (patient no. 1)

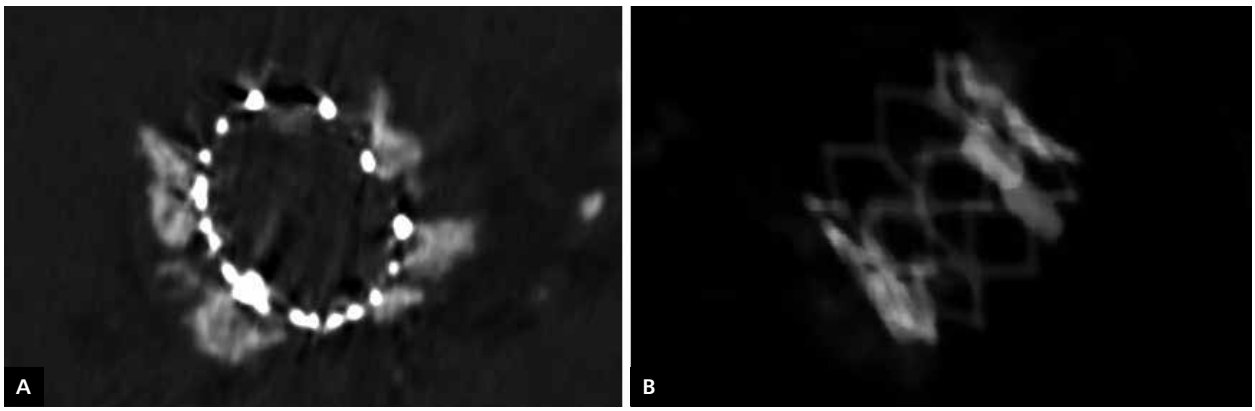

Figure 5. **A**, **B**. Good alignment of an Edwards Sapien 23 mm prosthetic valve in a patient with massive calcification of bicuspid aortic valve. Calcific tissue of native leaflets pushed aside of the bioprosthesis

and slightly elliptic shape of the frame (25 × 21 mm) correlating with annulus deformation (Fig. 5A, B). No significant malfunction of the prosthetic valve was observed. At six-month follow-up in TTE good valve function was sustained with a mean transvalvular gradient of 19 mm Hg and only mild paravalvular and trivial transvalvular regurgitant jets.

Another deformation of a stented valve (CoreValve; patient no. 3) was also suspected upon TTE, but because of good clinical and haemodynamic results the CT scan was not repeated and the patient remained well. What is interesting in this case is the slight elliptic deformation of the prosthetic valve in spite of a regular shaped annulus as assessed on MSCT before the procedure. The distortion, however, may result from massive calcification of the native leaflets. Nevertheless, it did not seem to have an impact on the clinical outcome.

Two patients required pacemaker implantation because of bradycardia (sick sinus syndrome) or advanced atrioventricular block. One of them developed infective endocarditis on pacemaker electrodes, which progressed to a major paravalvular leak, and died 30 days after the index procedure. One patient developed access site bleeding requiring transfusion of two units of packed red blood cells (patient no. 6). Table 4 presents 30-day follow up, including complications since the index procedure.

Six and 12 months after the procedure all six survivors remained alive and did not develop any further complica-

Table 4. Thirty-day follow-up

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7
Peak/mean TAVG	28/14	6.3/–	36/–	27/15	20.8/12.8	13/–	15/–
Aortic regurgitation	Mild/ /moderate	Moderate–severe	Mild	Mild (paravalvular)/trivial (transvalvular)	Mild	Mild	Mild
LVEF [%]	72	40–45	66	65	70	70	65
Change in NYHA class	II (improved from III)	IV (no change)	II (no change)	III (improved from IV)	II (improved from III)	I (improved from II)	II (no change)
Prosthetic valve malapposition/ /deformation	Elliptic distortion	None	Slight deformation suspected	Elliptic shape with good alignment	None	None	None
Complications since implantation	None	DVT; implanted DDDR → IE on pacemaker electrodes and death	Access site complications	None	Implanted DDDR	Access site bleeding; transfusion two units of PRBC	LBBB

DVT — deep venous thrombosis; IE — infective endocarditis; LBBB — left bundle branch block; LVEF — left ventricular ejection fraction; NYHA — New York Heart Association; PRBC — packed red blood cells; TAVG — transaortic valvular gradient

Table 5. Six-month follow-up

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7
Peak/mean TAVG [mm Hg]	*65.5/26.7	This patient died because of IE 30 days after TAVI	32.5/15	37/19	6/–	14/9	21/–
Aortic regurgitation	Mild		Mild	Mild (paravalvular)/trivial (transvalvular)	Mild (paravalvular)	Trivial/mild	Mild (transvalvular)
LVEF [%]	70		70	60	66	65	65
Prosthetic valve malapposition/ /deformation	As previously		–	–	–	–	–
Complications	–		–	–	–	–	–
Change in NYHA class	I/II (improved from II)		I/II (improved from II)	I (improved from III)	I/II (improved from II)	I (no change)	I/II (improved from NYHA II)

*This TTE shows increased TAVG, but after 12 months 38/16 mm Hg; IE — infective endocarditis; LVEF — left ventricular ejection fraction; NYHA — New York Heart Association; TAVG — transaortic valve gradient; TAVI — transcatheter aortic valve implantation; TEE — transoesophageal echocardiography

tions. Table 5 presents clinical and echocardiografic six-month follow-up. The patients were free of major cardiac adverse events and none of them required hospitalisation due to cardiovascular causes. Five patients achieved further improvement in NYHA class and presented hardly any symptoms of heart failure. One patient remained in NYHA class I (no change compared to 30-day follow up). Four patients had just a slight improvement (by ½ class), whereas one patient presented dramatic improvement from NYHA III to NYHA I (patient no. 4). This is the patient who had been treated with transapical approach, and his belated progress in overall efficiency may be explained by gradual wound healing and slow return to normal daily activity. It should be mentioned that patients five and six reported poor mobility due to osteoporosis and multiple articulation pains, respectively; nevertheless, they denied dyspnoea or ankle swelling.

DISCUSSION

Bicuspid aortic valve accounts for a considerable number of patients operated on due to severe aortic stenosis. According to available data the frequency varies between 30% and 50% of all adult SAVRs [3, 22]. Although this common cardiac anomaly remains a relative contraindication to TAVI, selected patients may take advantage of this less invasive method [12].

Table 6. Prosthesis sizing based on aortic annulus perimeter

Patient no.	Annulus diameter in TEE [mm]	Aortic annulus diameters in CT [mm]	Aortic annulus perimeter in CT [cm]	Chosen valve size	Valve size chosen if perimeter sizing utilised
1	23	29 × 20	8.22	CV 26	29!
2	27	29 × 22	8.25	CV 29	29
3	23	25 × 24	8.09	CV 29	29
4	22	25 × 22	7.48	ES 23	26!
5	22	28 × 24	8.41	CV 26	31!
6	20	23 × 21	6.98	ES 23	23
7	23	27 × 20	6.96	CV 29	26!

CT — computed tomography; CV — CoreValve; ES — Edwards Sapien; TEE — transoesophageal echocardiography

Some specific facts must be taken into consideration before qualifying a BAV stenotic patient to TAVI. Due to the more oval shape of the aortic annulus compared to tricuspid aortic valves [23], an operator may expect difficulties with proper expansion and effective sealing of the valve prosthesis. Accurate assessment of native valve morphology is crucial for TAVI planning. BAVs, especially with bulky leaflets, enlarged aortic roots, dilated ascending aorta, and significant aortic incompetence might cause difficulties with positioning and deploying a valve prosthesis [24]. Little is also known about valve sizing criteria in the setting of elliptic annulus shape. Among the cases presented in this article the patient, who developed elliptic distortion of an aortic valve prosthesis, was supplied with seemingly adequate valve size — CoreValve 26 mm — based on TEE measurements (aortic valve annulus 23 mm). However, the longest diameter of elliptic annulus assessed by MSCT was 29 mm. It is not fully understood whether larger valve diameter ensures better sealing, preserves distortion or malfunction, and maintains the same safety of procedure as smaller size. In such a case, spontaneous reduction of paravalvular leakage within several months (from moderate to mild) is undoubtedly noteworthy. One may suspect gradual adaptation of perivalvular tissue that enhances proper sealing. It can also be considered that, especially with self-expandable CoreValve valves, a self-adaptive mechanism of nitinol frame may compensate over time for uneven diameters of oval BAV annuli.

Recently a new method of valve sizing has been proposed. In contrast with the traditionally used valve sizing based on diameter measurements, this new method is based on the perimeter of the aortic annulus measured on CT-scan [25]. The authors describe the dynamic on conformational changes that occur throughout the cardiac cycle of the aortic annulus, reshaping its elliptical shape in diastole to a more rounded shape in systole, to increase the cross-sectional flow area. This change occurs without a significant variation in the perimeter size, especially in patients with calcific aortic stenosis. Perimeter changes are negligible in patients with calcified valves, because tissue properties allow very little expansion. Aortic annulus perimeter appears therefore ideally suited for accurate sizing in TAVI.

In our cases TEE and average CT-based diameter were utilised for prosthesis sizing. Now we have re-evaluated our cases in order to check which prosthesis size would have been selected if sizing had been based on the perimeter of the aortic annulus. The results of the analysis are shown in Table 6.

The first thing to note is the discrepancy between selected prosthetic valve size and estimation based on aortic annulus perimeter. Four out of seven patients would have received different prosthetic valves than actually chosen (three — larger, one — smaller). Interestingly, patient no. 5 had the most explicit discrepancy — by estimation she would receive a CoreValve 31 whereas she actually received a CoreValve 26. This is the patient who presented with significantly dilated aorta (50 mm). In such cases we bear in mind the risk of aortic regurgitation and problems with proper anchorage of the prosthesis. However, none of that happened in this patient (she developed mild aortic regurgitation at most). We may suspect that this is because of a relatively small sinotubular junction diameter (35 mm) compared to ascending aorta diameter.

We are not sure if perimeter-based sizing would result in better patient outcome, if utilised in BAV patients. Similarly, we can only guess if one case of the elliptic distortion of prosthetic valve (patient no. 1) could have been avoided if a larger valve had been selected. Further investigation is needed to evaluate the perimeter based sizing method compared to CT diameter sizing.

Another topic for discussion is the type of prosthesis preferably dedicated for BAVs. Some clinicians claim that the Sapien XT is contraindicated in the setting of BAV in spite of several successful implantations having been done in recent years [9, 14]. Basically, balloon-expanded valves show higher radial strength directly after implantation whereas the self-expanding nitinol stents reveal unique properties reported as shape memory or so-called superelasticity, which lead to an increase in maximal radial force with the passage of

time [26]. The long aortic cuff of the CoreValve system may show particular benefit when anchoring in a widened aortic root, which is commonly associated with BAV. We could clearly observe how well it applied to patient no. 5, who suffered from an aortic aneurysm and gained sustained clinical benefit owing to CoreValve implantation. On the other hand the literature presents a case of unsuccessful implantation of the Sapien system in the setting of ascending aortic aneurysm (the prosthesis did not anchor adequately) [27].

It is hard to reliably compare self-expanding valves (CoreValve) with the balloon-expandable system (Sapien XT). Our small cohort study indicates that two self-expanded bioprostheses underwent distortion and two others caused need for pacemaker implantation, whereas there were no complications of this kind with two Sapien valves. However, six and 12 months after implantation we observed clinical improvement of at least one NYHA class in all treated patients (except the one who died after 30 days) irrespective of valve type used.

The other important issue is long-term follow-up after TAVI in BAVs. Distortion of the valve-stent assembly and non-uniform stent expansion may potentially lead to prosthetic valve malfunction with time. Although we did not observe any of this in our cohort we cannot definitely exclude the escalation of paravalvular leaks.

Further data is needed to compare the systems and achieve long-term follow-up in comparison to TAVI performed in tricuspid aortic valves.

Limitations of the study

This is a retrospective analysis of a small patient cohort treated at a single clinical centre. No systematic approach was utilised. The study included patients with BAV of unconfirmed origin (congenital and degenerative taken together). Two different prosthetic valve types were assessed, which makes the comparison of outcomes unreliable.

CONCLUSIONS

Transcatheter aortic valve implantation, using either Sapien or CoreValve systems, may constitute an alternative treatment option for patients with BAV and high surgical risk. TAVI is feasible and effective in this group of patients, resulting in low periprocedural mortality rate and good 30-day and one-year outcomes. Further studies with larger patient cohorts are needed to confirm long-term efficacy of implanted valves. Nonetheless, thorough pre-procedure planning, involving echocardiography and CT, and more gathered experience is needed to master the differences in technique and postoperative care between bicuspid and tricuspid valve patients treated with TAVI.

Conflict of interest: *none declared*

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Przezcewnikowa implantacja zastawki aortalnej u pacjentów z zastawką dwupłatkową: seria przypadków

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Streszczenie

Wstęp: Obecność dwupłatkowej zastawki aortalnej (BAV) uważa się za względne przeciwwskazanie do zabiegu przezcewnikowej implantacji zastawki aortalnej (TAVI), a leczenie chirurgiczne pozostaje metodą z wyboru w przypadku jej ciasnego zwężenia. Procedura TAVI nie jest zalecana w tej grupie chorych m.in. ze względu na owalny kształt pierścienia zastawki dwupłatkowej w porównaniu z pierścieniem prawidłowej (trójpłatkowej) zastawki, co zwiększa ryzyko dysfunkcji i zniekształcenia protezy. Dwupłatkowa zastawka aortalna stanowiła kryterium wyłączenia w większości badań klinicznych dotyczących TAVI i brakuje dokładnych danych na temat bezpieczeństwa i skuteczności takiego postępowania w tej grupie chorych.

Cel: Celem pracy była ocena bezpieczeństwa i skuteczności TAVI u pacjentów z ciasnym zwężeniem BAV.

Metody: Analizie poddano grupę 104 pacjentów przyjętych do Instytutu Kardiologii w celu wykonania TAVI w okresie od stycznia 2009 r. do maja 2012 r. W ramach kwalifikacji do zabiegu wykonano echokardiograficzne badania przezklatkowe i przezprzełykowe oraz tomografię komputerową serca, aorty i jej rozgałęzień. Odpowiednie pomiary i analiza danych z badań obrazowych umożliwiły wybór optymalnego dostępu przeznaczyniowego, dobranie protezy zastawkowej i właściwe zaplanowanie zabiegu. Dwupłatkową zastawkę aortalną zidentyfikowano u 7 pacjentów (6,7%; średni wiek 77,7 roku), których poddano bardziej szczegółowej analizie. Pacjenci ci mieli zdiagnozowaną ciasną objawową stenozę aortalną ze średnim polem powierzchni przekroju zastawki 0,55 cm^2 (0,46–0,7 cm^2). Wszyscy zostali zdyskwalifikowani z zabiegu chirurgicznej wymiany zastawki aortalnej ze względu na wysokie ryzyko operacyjne (uśredniony wynik logistic Euroscore 19,9%). Wykonano TAVI z wykorzystaniem systemow CoreValve (5 osób) lub Sapien (2 chorych). Następnie przeanalizowano prospektywne wyniki długoterminowej obserwacji klinicznej i echokardiograficznej w punktach czasowych: 30 dni, 6 miesięcy i 12 miesięcy po zabiegu.

Wyniki: U 1 pacjenta w tomografii komputerowej zaobserwowano eliptyczne zniekształcenie implantowanej protezy, jednak bez istotnej klinicznie dysfunkcji zastawki. Jeden pacjent zmarł w ciągu 30 dni po TAVI z powodu infekcyjnego zapalenia wsierdzia. Pozostali, którzy przeżyli, charakteryzowali się małą do umiarkowanej niedomykalnością aortalną w punkcie czasowym wynoszącym 30 dni. W kolejnych punktach czasowych nie zaobserwowano progresji niedomykalności aortalnej. Po roku od zabiegu 6 spośród 7 pacjentów pozostawało przy życiu. Wszyscy oni osiągnęli istotną poprawę funkcjonalną ocenianą wg klasyfikacji *New York Heart Association*.

Wnioski: Zabieg TAVI może stanowić alternatywną opcję terapeutyczną dla pacjentów z ciasną stenozą BAV. Według obserwacji autorów niniejszej pracy metoda ta cechuje się względnie niską śmiertelnością i dobrymi wynikami w obserwacji 30-dniowej, 6- oraz 12-miesięcznej.

Słowa kluczowe: TAVI, przezcewnikowa implantacja zastawki aortalnej, stenoza aortalna, dwupłatkowa zastawka aortalna, zniekształcenie eliptyczne

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