

Successful Transcatheter Aortic Valve Implantation in A Patient With Severe Dilatation of The Ascending Aorta

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ABSTRACT— *Background: Transcatheter aortic valve implantation (TAVI) has become a well established method for treating severe symptomatic aortic stenosis (AS) in surgical high-risk patients. Despite increasing use there are certain contraindications for TAVI, one of them being until recently severe dilatation of the ascending aorta.*

Case presentation: 86-yr old female patient, with known arterial hypertension, diabetes mellitus type 2 and chronic atrial fibrillation, was admitted due to heart failure. Echocardiography showed a severe calcified aortic stenosis (aortic valve area 0,5 cm², mean gradient 47 mmHg). Further investigations showed a severe dilatation of the ascending aorta with a maximum diameter of 52 mm. According to EuroSCORE (19.85%) and STS (12) the patient had a high risk for surgery and was rejected for surgical aortic valve replacement by the Heart Team. Successful TAVI was performed. On 6-month follow up the patient is in good clinical condition and free of symptoms. Control investigations show the bovine aortic valve in proper position with normal function and no progression of dilatation of the ascending aorta.

Conclusion: In surgical high-risk patients with severe AS and dilatation of the ascending aorta of degenerative etiology (without connective tissue diseases) TAVI can be successfully performed using the Edwards XT valve. Dilatation of ascending aorta should not be an absolute contraindication for TAVI. However, decision for TAVI should be driven by all circumstances of the patient including the 1-2 year prediction of the possible progression of the aortic dilatation.

Key words: TAVI, dilated ascending aorta

1. BACKGROUND

Transcatheter aortic valve implantation (TAVI) has become a well established method for treating severe symptomatic aortic stenosis (AS) in surgical high-risk patients with similar long-term results and lower periprocedural risks to surgical aortic valve replacement (AVR) (1). Despite increasing use of TAVI there are certain contraindications for the procedure. Until recently one of them was severe dilatation of the ascending aorta (maximum diameter ≥ 5 mm) (2). However, in the recent ESC guidelines on the management of valvular heart disease, dilatation of the ascending aorta is not mentioned as a contraindication for TAVI (3).

2. CASE PRESENTATION

86-yr old female patient with a history of arterial hypertension, diabetes mellitus type 2 and chronic atrial fibrillation was admitted due to heart failure.

Echocardiography showed a severely calcified aortic valve with severe stenosis (aortic valve area 0.5 cm², mean gradient 47 mmHg) and moderate regurgitation, normal systolic function (ejection fraction 65%), diastolic dysfunction and severe pulmonary hypertension (estimated systolic pulmonary pressure 65 mmHg).

Coronary angiogram showed no significant coronary artery disease. However, on aortogram significant dilatation of the ascending aorta was observed (Fig. 1). Transoesophageal echocardiography (TEE) proved the dilatation of the ascending aorta with the maximum diameter of 52 mm which was matched with the measurement on the computed

tomographic (CT) angiography (Fig 2). According to logistic EuroSCORE (19.85%) and STS (12) the patient had a high risk for surgery and was rejected for AVR by the Heart Team.

Despite the optimal medical treatment full recompensation of heart failure was not achieved. Therefore, the patient underwent further investigations for TAVI. TEE showed the annulus of the aortic valve measuring 19,5 mm in diameter and the aortic root of 36 mm (Fig 3). CT angiography of iliac and femoral arteries proved TAVI as feasible.

According to all measurements Edwards XT 23 mm valve was chosen. Before the actual implantation balloon valvuloplasty was performed with a 23 x 40 mm balloon for final sizing. Valvuloplasty was followed by TAVI as a two-step process due to unfavorable anatomy and heavy calcifications with the intermediate position control (Fig 4). Immediately after TAVI good position of the valve was confirmed by aortography and mild aortic regurgitation was observed. Transthoracic and TEE echocardiography showed good hemodynamic properties of the valve (aortic valve area 1.4 cm², mean gradient 14 mmHg) with mild paravalvular leak and normal left ventricular systolic function (Fig 5). On 6-month follow up the patient is in good and stable clinical condition, free of symptoms and with a good function of the aortic valve recorded on transthoracic echocardiography .

No progression of the dilatation of the ascending aorta was observed on transthoracic echocardiography or CT angiography (Fig 6, Table 1).

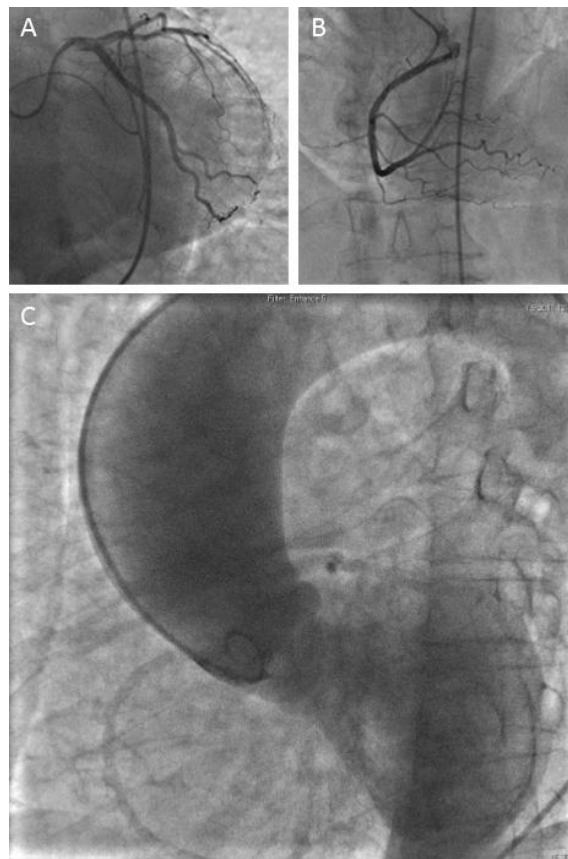


Figure 1: No significant coronary artery disease in left (A) or right (B) coronary artery. Dilatation of the ascending aorta with moderate aortic regurgitation (C).

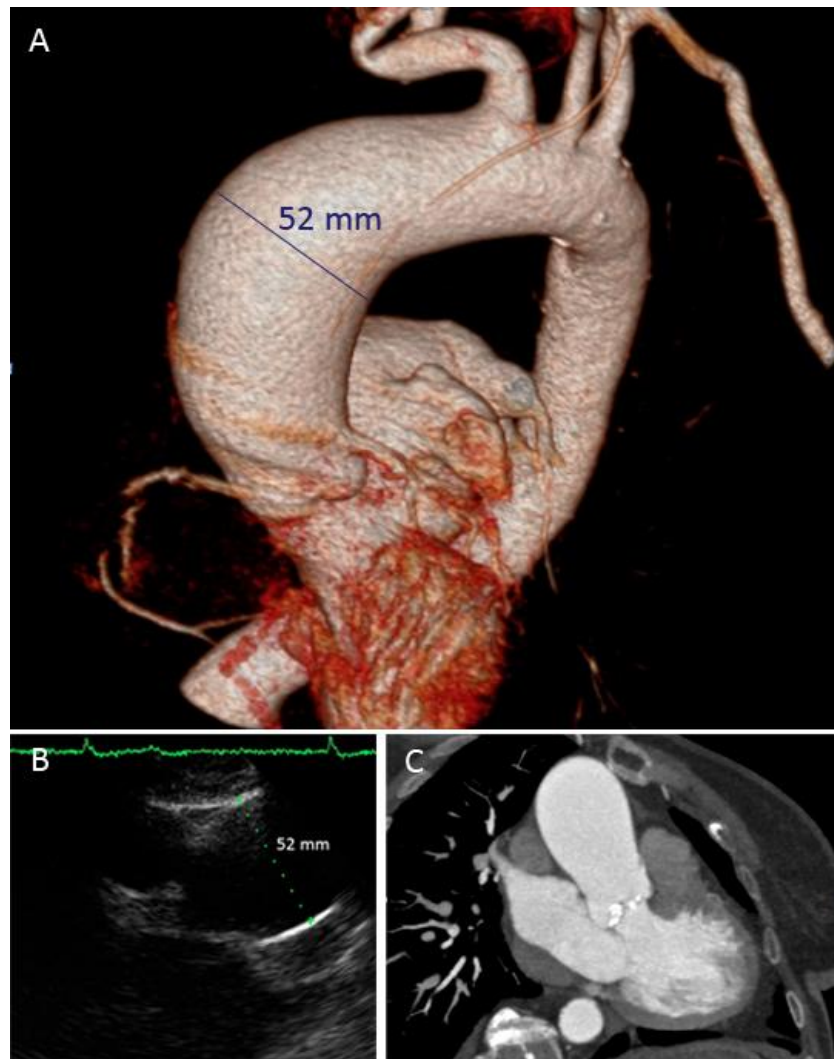


Figure 2: CT reconstruction of the ascending aorta (A), measurement of the maximum diameter of the ascending aorta by TEE (B) and CT angiography of the ascending aorta (C).

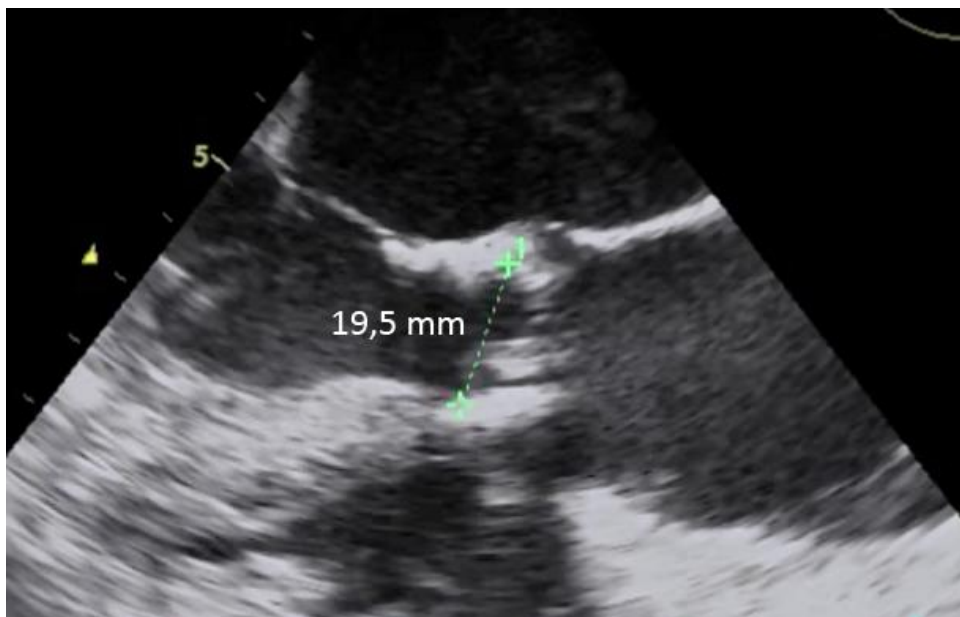


Figure 3: Measurement of the diameter of aortic valve annulus by TEE.

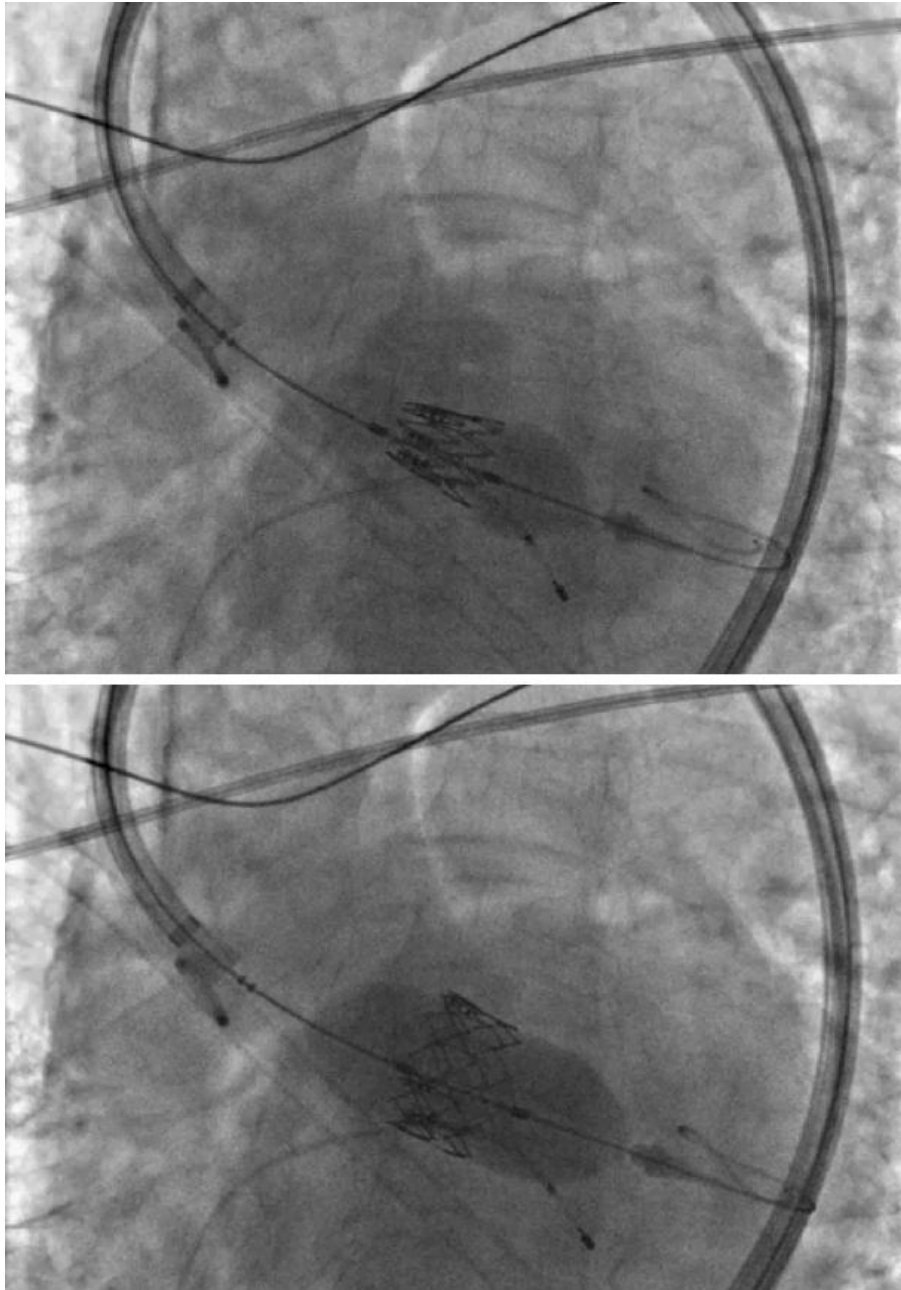


Figure 4: Two-step Edwards XT 23 mm valve implantation due to unfavorable anatomy and heavy calcifications with the intermediate position control.

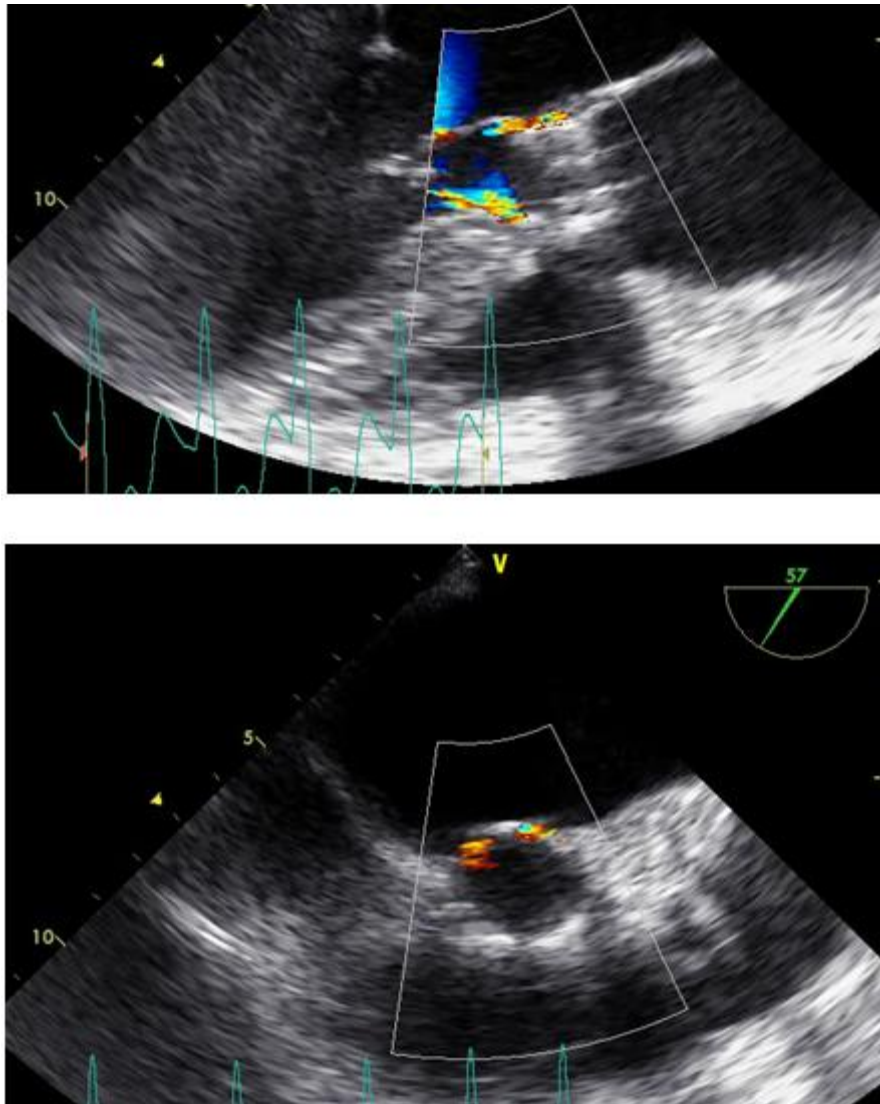


Figure 5: TEE immediately after TAVI shows a good position of the valve (A) with mild paravalvular leak (B).

Table 1: Echocardiographic characteristics of the patient. Legend: AVA=aortic valve area; AR=aortic regurgitation; MR=mitral regurgitation; LVEF=left ventricular ejection fraction; PAP systolic=estimated systolic pulmonary pressure; Ao=aorta.

	Before TAVR	After TAVR	6 mo after TAVR
AVA (cm ²)	0.5	1.4	1.3
mean gradient (mmHg)	47	14	11
AR	moderate (2/4)	mild (1/4)	mild (1/4)
MR	trivial	trivial	trivial
LVEF (%)	65	65	65
PAP systolic (mmHg)	65	60	65
Ao ascending (mm)	52	51	51

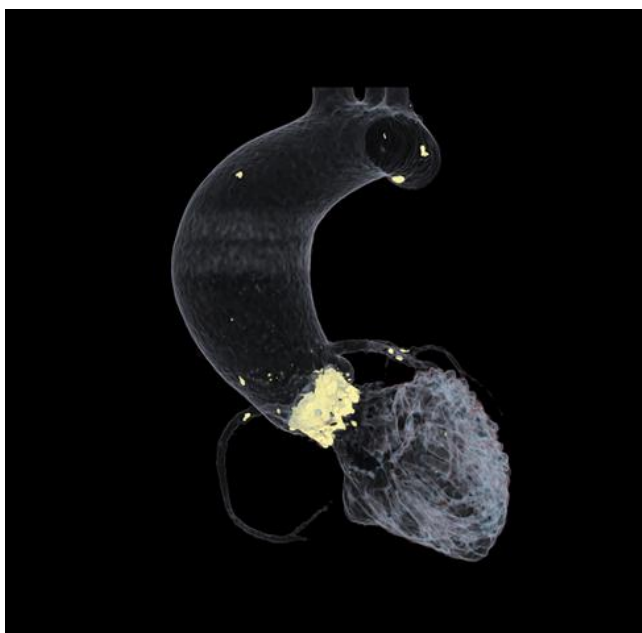


Figure 6: No progression of the dilatation of the ascending aorta was observed on CT angiography 6 mo after TAVR.

3. DISCUSSION

Until a few years ago AVR was the only definite choice of treatment for patients with severe symptomatic AS with a well established improvement in physical quality of life and vitality (4). In the group of patients with the combination of severe AS and severe post-stenotic dilatation of the ascending aorta a combined AVR with the replacement of the ascending aorta is often performed due to the fear of progression of aortic dilatation in the case of AVR alone. Kim TH et al. have shown that AVR combined with the concomitant replacement of the ascending aorta showed an excellent outcome and equivalent to the AVR alone (5).

However, the risk of progression of dilatation of the ascending aorta in the case of AVR alone remains uncertain. Andrus BW et al. have shown that in patients with severe AS and the baseline dilatation of the ascending aorta undergoing AVR alone there was no progression of aortic dilatation beyond 5.5 cm on the long-term follow-up and argued against the routine use of the combined procedure (6). Joo HC et al. performed a 28-year retrospective analysis of Bentall operations in different populations of patients in their center and concluded that the disease of the aorta may progress especially in patients with Marfan syndrome (7). Furthermore, Gaudino M et al. have shown in their recent study that in the absence of connective tissue disorders, AVR alone is sufficient to prevent progression of the dilatation of the ascending aorta and have speculated that the replacement of ascending aorta can be reserved for patients with a long life expectancy (8).

According to the latest guidelines for thoracic aortic disease in patients undergoing AVR or aortic valve repair concomitant surgery on the ascending aorta should be considered when the diameter of the ascending aorta or aortic root exceeds 4.5 cm (level of evidence: C) (9). Indication for surgery for aortic root disease in combination with or without aortic regurgitation is ascending aorta diameter over 55 mm. In case of Marfan disease or bicuspid aortic valve the indications for surgery is at lower diameter of 50 mm or 45 mm, respectively (10).

Elderly patients with many concomitant chronic diseases are often rejected for AVR by the Heart Team due to high periprocedural risk and are being put on medical treatment alone. In this group of patients optimal medical treatment in many cases cannot be achieved due to underlying diseases and the life expectancy is low.

With the advancement of TAVI in the recent years there is a new hope for the group of surgical high-risk patients with severe and symptomatic AS (2). However, with new possibilities of treatment new concerns arise, amongst them being the feasibility of TAVI in patients with severe AS and concomitant severe dilatation of the ascending aorta. In elderly patients aortic dilatation frequently accompanies AS due to long-lasting AS, concomitant arterial hypertension and advanced age. Major concerns when dealing with this group of patients are: damage to the dilated ascending aorta and malpositioning of the bovine valve during TAVI and the progression of the dilatation of the ascending aorta after TAVI.

We have shown in the case of our patient that with proper planning and careful technique TAVI is not only feasible but provides the patient a good quality of life and no progression of the dilatation of the ascending aorta on 6-month follow-up.

Prospective and randomized trials on larger number of patients need to be conducted to prove the good outcomes of TAVI in the group of surgical high-risk patients with severe AS and concomitant severe dilatation of the ascending aorta.

4. CONCLUSIONS

In surgical high-risk patients with severe AS and dilatation of the ascending aorta of degenerative etiology (without connective tissue diseases) TAVI can be successfully performed using the Edwards XT valve. Dilatation of ascending aorta should not be an absolute contraindication for TAVI. The decision for TAVI should be tailored to the patient's characteristics and the individual risk to benefit ratio. It should be driven also by the prediction of the 1-2 year progression of the aortic dilatation. Therefore only a very severe dilatation of the ascending aorta may be considered as a contraindication in the patients who are candidates for TAVI today. However, the final decision should be done by TAVR team.

In the future guidelines should include this new perspective and provide recommendations for TAVI candidates and concomitant aortic dilatation.

5. REFERENCES

1. Smith CR, Leon MB, Mack MJ et al. Transcatheter versus surgical aortic-valve replacement in high-risk patients. *N Engl J Med.* 2011 Jun 9;364(23):2187-98.
2. Leon MB, Smith CR, Mack M et al. Transcatheter Aortic-Valve Implantation for Aortic Stenosis in Patients Who Cannot Undergo Surgery. *N Engl J Med.* 2010 Oct 21;363(17):1597-607.
3. Vahanian A, Alfieri O, Andreotti F et al. Guidelines on the management of valvular heart disease (version 2012). *Eur Heart J.* 2012 Oct;33(19):2451-96.
4. van Geldorp MW, Heuvelman HJ, Kappetein AP et al. The effect of aortic valve replacement on quality of life in symptomatic patients with severe aortic stenosis. *Neth Heart J.* 2013 Jan;21(1):28-35.
5. Kim TH, Park KH, Yoo JS et al. Does additional aortic procedure carry a higher risk in patients undergoing aortic valve replacement? *Korean J Thorac Cardiovasc Surg.* 2012 Oct;45(5):295-300.
6. Andrus BW, O'Rourke DJ, Dacey LJ et al. Stability of ascending aortic dilatation following aortic valve replacement. *Circulation.* 2003 Sep 9;108 Suppl 1:II295-9.
7. Joo HC, Chang BC, Youn YN et al. Clinical experience with the Bentall procedure: 28 years. *Yonsei Med J.* 2012 Sep;53(5):915-23.
8. Gaudino M, Anselmi A, Morelli M et al. Aortic expansion rate in patients with dilated post-stenotic ascending aorta submitted only to aortic valve replacement long-term follow-up. *J Am Coll Cardiol.* 2011 Aug 2;58(6):581-4.
9. Hiratzka LF, Bakris GL, Beckman JA, Bersin RM, Carr VF, Casey DE Jr, Eagle KA, Hermann LK, Isselbacher EM, Kazerooni EA, Kouchoukos NT, Lytle BW, Milewicz DM, Reich DL, Sen S, Shinn JA, Svensson LG, Williams DM; American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines; American Association for Thoracic Surgery; American College of Radiology; American Stroke Association; Society of Cardiovascular Anesthesiologists; Society for Cardiovascular Angiography and Interventions; Society of Interventional Radiology; Society of Thoracic Surgeons; Society for Vascular Medicine. *Circulation.* 2010 Apr 6;121(13):e266-369.
10. Vahanian A, et al. Guidelines on the management of valvular heart disease (version 2012): the Joint Task Force on the Management of Valvular Heart Disease of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS). *Eur J Cardiothorac Surg.* 2012 Oct;42(4):S1-44.