

Should we implant a permanent pacemaker in patients with left bundle branch block and PQ prolongation following transcatheter aortic valve implantation?

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Introduction

Transcatheter aortic valve implantation (TAVI) includes the risk for development of heart block. The presence of left bundle branch block (LBBB) after TAVI with PQ interval prolongation is not clearly defined as an indication for pacemaker implantation.

Case report

A 76-year-old woman with a combined aortic valve disease, with a predominance of severe aortic stenosis, who had been previously disqualified from the classical cardiac surgery of aortic valve replacement because of the high risk of the procedure, was qualified for transcatheter aortic valve implantation (TAVI) due to increasing symptoms of heart failure. Moreover, she had a history of long-term arterial hypertension, symptomatic heart failure (NYHA II/III), rheumatoid arthritis (RA) and degeneration of the spine in the thoracic-lumbar part and lumbar scoliosis limiting her mobility. Baseline ECG revealed: regular sinus rhythm 70 bpm, the mean electrical axis in the frontal plane = -20° , PQ interval = 170 ms, QRS = 98 ms, QTc = 410 ms. The baseline echocardiography examination revealed left ventricular (LV) hypertrophy (LV = 42 mm, posterior wall (PW) of LV = 14 mm, interventricular septum (IVS) = 15 mm), significantly stenotic, extremely calcified aortic valve (peak pressure gradient (PPG) = 174 mm Hg, mean PG (MPG) = 101.2 mm Hg, and Vmax = 6.6 m/s) with good ejection fraction (EF) of the LV (EF = 65%). Computed tomography scans disclosed multiple calcifications of the aortic valve (Figure 1 A) and within the coronary sinus area (aortic valve area 417 mm², perimeter 23.4 mm). Operative mortality was estimated using the following scoring sys-

tems: Euro SCORE standard = 7 p., logistic [%] = 6.19%, EUROSCORE II = 2.11%, STS score mortality [%] = 11.12%, mortality & morbidity = 58.526. The TAVI was carried out in general anesthesia from a femoral approach using the Prostar system. Before valve implantation balloon aortic valvuloplasty using Numed Z-Med II-X 18 mm × 50 mm was performed. Following that a CoreValve 29 mm was implanted (the depth of implantation calculated on computed tomography scan was 4 mm), which resulted in a complete elimination of the transvalvular gradient with a trace of paravalvular aortic regurgitation. There were no complications of the procedure.

On the first day after TAVI the patient's general condition was good. ECG revealed: regular sinus rhythm 86 bpm, new onset of left bundle branch block (LBBB) with QRS complex prolongation from 96 to 173 ms (Figure 2 A) and QTc = 465 ms. For the next 5 days the patient remained in a good general condition. Physical rehabilitation started on the second day after the TAVI procedure. Continuous ECG monitoring was applied throughout the patients' stay in the cardiac intensive care unit. On the 6th day an episode of pre-syncope (lightheadedness and dizziness lasting approximately 15 to 20 s) occurred. Its mechanism remained unknown since the patient had unplugged the ECG while going to a rest room. The ECG showed: regular sinus rhythm 64 bpm, with PQ interval prolongation to 194 ms, LBBB with QRS complex prolongation to 173 ms (Figure 2 A) and QTc = 473 ms. The 24 h Holter-ECG monitoring did not reveal any other arrhythmias or conduction abnormalities. On the 7th day 2 more pre-syncope episodes occurred (during normal activities, with no ECG tracing). The patient complained of a short onset of heart palpitation prior to the pre-syncope episode. Lacking ECG documentation of these episodes and

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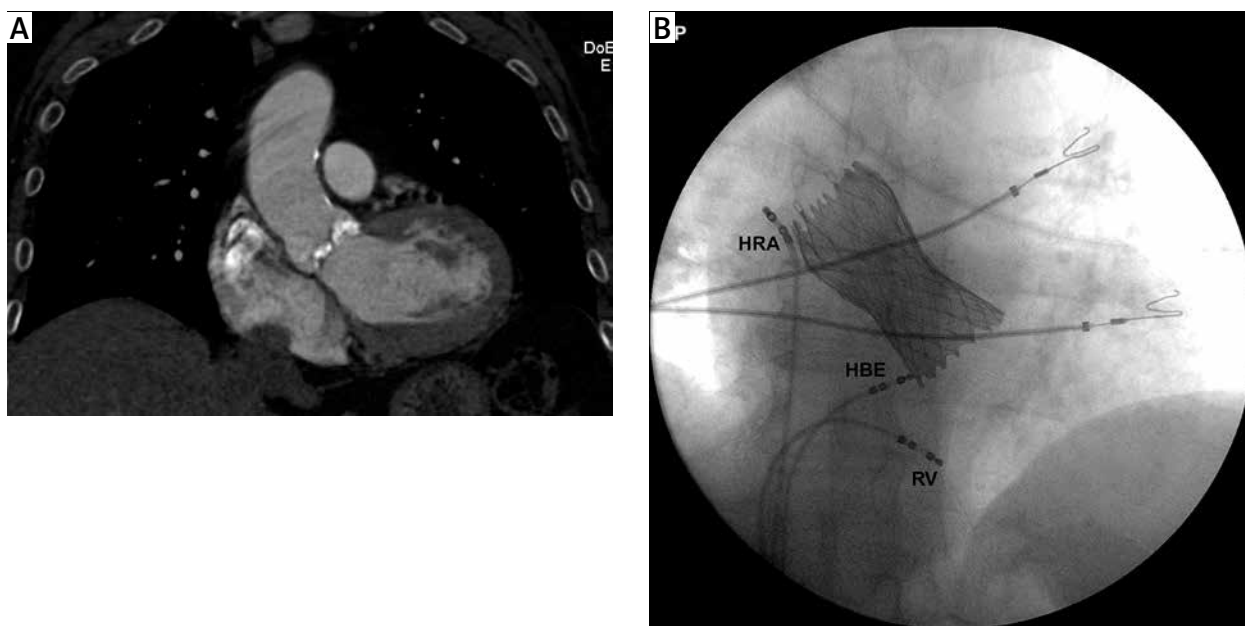


Figure 1. A – Computed tomography scan of ascending aorta with calcified aortic valve. **B** – Chest X-ray examination of the heart in anterior-posterior projection; CoreValve prosthesis of aortic valve and quadripolar, diagnostic catheters during electrophysiological study located on the high right atrium (HRA), in the His area (HBE) and in the apex of the right ventricle (RV) are visualized

considering the patient's safety, the decision of invasive electrophysiology (EP) testing was made. The EP was performed on the 8th day after TAVI, after obtaining the patient's informed consent. Three quadripolar, diagnostic catheters were used with the diameter of 6 Fr located on the right atrium (HRA), in the His area (HBE) and in the apex of the right ventricle (RV) – Figure 1 B. Baseline ECG during EP: sinus rhythm with LBBB. PQ interval varied and ranged from 205 to 220 ms, QRS = 173 ms (LBBB), QTc = 494 ms, RR = 1000 ms, AH interval = 128 ms, HV interval = 62 ms. Right ventricle stimulation (PCL 800+S2 and 700+S2) with no retrograde conduction. Effective refractory period RV = 300 ms. Each stimulation of the right atrium resulted in an immediate progression of AV block to advanced second-degree AV block. During EP examination a variable PQ interval was observed (with maximum prolongation to 318 ms) and HV interval from 60–70 ms to 160 ms. Having positioned the electrodes towards the apex of the right ventricle and His area (HBE) a dynamic increase of infra-Hisian and advanced second-degree AV block occurred with AV conduction 11 : 1; 6 : 1 (advanced second-degree AV block with maximal RR interval up to 10.4s) – Figure 2 B. Apart from LBBB multi-level AV conduction disturbances were found, with domination of advanced AV distal-type block. No arrhythmias were induced during the electrophysiological study.

After the EP study the patient was secured with an electrode for temporary pacing and underwent a DDD pacemaker implantation on the 8th day after TAVI. The patient's rehabilitation and recovery on subsequent days were uneventful. Follow-up at 1 month and 6 months in

the outpatient clinic revealed 99% up to 100% of right ventricular pacing.

Discussion

Here we present the analysis of clinical progression of the ECG changes in a patient after TAVI (CoreValve) who had a pre-syncope episode on the 6th and 7th days after valve replacement. It was necessary to make a decision whether to implant a pacemaker and, if so, when to do it. Although the literature data suggest that LBBB occurrence after TAVI is frequent (14–83%) [1], there are no clear criteria relating to the optimal time of elective pacemaker implantation and advisability of this procedure. The presence of right bundle branch block (RBBB) before TAVI is a factor correlating with an increased risk for pacemaker implantation [2]. RBBB, however, was not present in our case. According to the literature, patients who received CoreValve and Lotus devices have higher risk of AV conduction disturbances requiring pacemaker implantation (19.2% to 42.5%) in comparison to the Sapien valve (1.8% to 8.5%) [3, 4].

The presence of LBBB after TAVI is a common finding, and LBBB coexisting with PQ interval prolongation is not clearly defined as an indication for PM implantation. The EP testing revealed a vast area of heart tissues with damaged electrophysiological properties causing AV conduction abnormalities such as multilevel AV block, possibly developing into a third-degree AV block. Probably, the mechanism of AV conduction disorders is complex. Any direct mechanical trauma or compression to the His



Figure 2. A – Electrocardiogram (paper speed 25 mm/s) before transcatheter aortic valve implantation (TAVI), on days 6 and 8 after TAVI; left bundle branch block progression with PQ interval prolongation to 194 ms on day 6. Also, with a more intense prolongation of PQ interval to 220 ms followed by an episode of syncope (day 8). **B** – ECG (paper speed 13 mm/s) spontaneous advanced second-degree atrioventricular block with 10.4 s gap

bundle related to a self-expandable valve prosthesis in the region of the membranous septum and right trigone beneath the noncoronary/right coronary cusps and the area of the upper 1/3 of the intra-ventricular septum needs to be considered. Significant calcification of aortic valve leaflets may also contribute to conduction disturbances. Therefore, the optimal valve implantation in the LVOT above the His bundle is crucial. The location of the His bundle and its distal part with branches in the intra-ventricular septum near the left ventricle endocardium is another important issue. It can be assumed that severe concentric hypertrophy of the LV (the dimension of IVS) distinctive in aortic stenosis, in patients with good EF, may affect the conductive system at various levels. Eventually, the insertion of diagnostic electrodes for the EP testing may also contribute to exertion of mechanical pressure on tissues. However, dynamic progression of AV block is not observed in routine EP examination.

In this case, the EP testing was a useful tool to take the final decision to implant a pacemaker. However, in our opinion, this strategy may be used in selective cases in the early period after TAVI to reduce the number of unnecessary pacemaker implantations. According to the statement from the 2013 ESC Guidelines on cardiac pacing and cardiac resynchronization therapy [5]:

1. An intrinsic AV block should be differentiated from the other known forms of the block, namely, vagal (extrinsic) and idiopathic AV block. The infra-Hisian block by EPS supports a diagnosis of intrinsic AV block.
2. The presence of bundle branch block (BBB), unexplained syncope and non-diagnostic investigations; pacing may be considered in selected patients with unexplained syncope and BBB (class II b, level B).
3. Asymptomatic BBB; pacing is not indicated for BBB in asymptomatic patients (class III, level B).

Therefore, in such specific clinical situations, a question arises: what is the proper action? An individual approach to each patient seems to be the best answer.

Conclusions

In patients after the TAVI procedure (particularly with CoreValve) in the presence of LBBB and prolonged PQ interval, EP study may be considered to establish the indication for PM implantation.

Conflict of interest

The authors declare no conflict of interest.

References

1. Holmes DR Jr, Mack MJ, Kaul S, et al. 2012 ACCF/AATS/SCAI/STS expert consensus document on transcatheter aortic valve replacement. *J Am Coll Cardiol* 2012; 59: 1200-54.
2. Adams DH, Popma JJ, Reardon MJ, et al. Transcatheter aortic-valve replacement with a self-expanding prosthesis. *N Engl J Med* 2014; 370: 1790-8.
3. Meredith Am IT, Walters DL, Dumonteil N, et al. Transcatheter aortic valve replacement for severe symptomatic aortic stenosis using a repositionable valve system: 30-day primary endpoint results from the REPRISE II study. *J Am Coll Cardiol* 2014; 64: 1339-48.
4. Popma JJ, Adams DH, Reardon MJ, et al. Transcatheter aortic valve replacement using a self-expanding bioprosthesis in patients with severe aortic stenosis at extreme risk for surgery. *J Am Coll Cardiol* 2014; 63: 1972-81.
5. Brignole M, Auricchio A, Baron-Esquivias G, et al. 2013 ESC Guidelines on cardiac pacing and cardiac resynchronization therapy: the Task Force on cardiac pacing and resynchronization therapy of the European Society of Cardiology (ESC). Developed in collaboration with the European Heart Rhythm Association (EHRA). *Eur Heart J* 2013; 34: 2281-329.