JACC: CARDIOVASCULAR INTERVENTIONS
VOL. 9, NO. 12, 2016

ISSN 1936-8798/$36.00
PUBLISHED BY ELSEVIER
http://dx.doi.org/10.1016/j.jcin.2016.05.004

EDITORIAL COMMENT

Electrocardiographic Monitoring Following Transcatheter Aortic Valve Replacement

Do We Need to and for How Long?*

Marina Urena, MD,[a] Josep Rodés-Cabau, MD[b]

The introduction of transcatheter aortic valve replacement (TAVR) has been a major landmark in the treatment of aortic stenosis. Although current clinical practice guidelines recommend TAVR in patients at high or prohibitive surgical risk, its use is already expanding toward the treatment of lower-risk patients (1). However, concerns have been raised about the cost effectiveness of TAVR in intermediate-risk patients, mainly due to the high costs of transcatheter valve systems (2). Efforts to reduce the overall costs of TAVR have focused on decreasing the length of hospital stay and using minimally invasive procedures. Preliminary studies on early discharge (≤3 days) post-TAVR have suggested the safety of such strategy (3,4), as well as its possible association with an overall reduction of periprocedural costs (5).

The occurrence of conduction disturbances, which remain the most frequent complication of TAVR (6), may jeopardize the implementation of a minimalist TAVR approach including early discharge postprocedure. Some of these abnormalities occur late (within days) after TAVR and, in fact, up to 72 h of continuous electrocardiography (ECG) monitoring post-procedure is currently recommended in order to detect late arrhythmic events (7). Nonetheless, no strong evidence supports this cutoff value and the minimum duration of continuous ECG monitoring required after TAVR remains largely unknown.

In this issue of *JACC: Cardiovascular Interventions*, Toggweiler et al. (8) propose a new algorithm to determinate the duration ECG monitoring after TAVR.

SEE PAGE 1269

The authors evaluated the incidence and predictors of delayed (post-procedural) high-degree atrioventricular block (AVB) following TAVR in a cohort of 1,064 patients without prior permanent pacemaker. Both balloon and self-expandable devices were used. Delayed high-degree AVB occurred in 71 patients (6.7%) up to 8 days after the procedure, and was more frequently observed in men (adjusted odds ratio: 2.41; 95% confidence interval: 1.3 to 4.5) and in patients with conduction disorders (left or right bundle branch blocks [BBB]) on the ECG immediately post-TAVR (odds ratio: 10.8; 95% confidence interval: 4.6 to 25.5). A total of 250 patients (24% of the study population) were in sinus rhythm with no BBB, first-degree AVB, or bradycardia on the ECG performed immediately post-TAVR, and none of them developed delayed high-degree AVB. One of these patients (0.4%) required permanent pacemaker implantation before hospital discharge for other reason than AVB. In addition, delayed high-degree AVB occurred only in 1 of the 103 patients (1.0%) with atrial fibrillation (AF) and no BBB and no bradycardia post-procedure. Overall, the presence of conduction disorders (BBB, first-degree AVB, or bradycardia in patients with AF) on the ECG post-TAVI had very high sensitivity (99%) and negative predictive value (99.7%) for the occurrence of delayed high-degree AVB. Furthermore, no delayed high-degree AVB occurred in patients with a stable ECG for 2 days.

Based on such results, the authors concluded that: 1) temporary pacemaker wires or continuous ECG monitoring would not be necessary in patients with

*Editorials published in *JACC: Cardiovascular Interventions* reflect the views of the authors and do not necessarily represent the views of *JACC: Cardiovascular Interventions* or the American College of Cardiology.

From the [a]Bichat-Claude Bernard Hospital, Paris, France; and the [b]Quebec Heart & Lung Institute, Laval University, Quebec City, Quebec, Canada. Dr. Urena has reported that she has no relationships relevant to the contents of this paper to disclose. Dr. Rodés-Cabau has received research grants from Edwards Lifesciences and Medtronic.

JACC: CARDIOVASCULAR INTERVENTIONS VOL. 9, NO. 12, 2016
JUNE 27, 2016:1277–9

a strictly normal ECG immediately post-TAVR; and 2) in those patients with conduction disorders post-TAVR continuous ECG monitoring may be discontinued after 48 h of ECG stability without conduction abnormality progression. Such a strategy would potentially translate into a decrease in the morbidity associated with prolonged temporary pacemaker wires, a reduction in length of hospital stay after TAVR, and, last, a potential reduction of the costs associated with TAVR.

These findings are in accordance with previous observations on the pathological mechanisms of conduction disorders post-TAVR. Two causes have been identified for the occurrence of new conduction disorders after TAVR: first, and most important, the direct insult to the conduction system or surrounding structures by prostheses, wires, or catheters during the procedure (9,10), and, second, the presence of previously undiagnosed pre-existing conduction disorder (11). Therefore, the presence of a normal ECG immediately after TAVR may reflect both, the lack of significant trauma to the conduction system during the procedure and the absence of pre-existing conduction disorders. Furthermore, these results are in accordance with prior studies in TAVR with balloon-expandable valves that showed the absence of high-degree AVB beyond 48 h after the procedure (12).

However, several considerations need to be taken into account when interpreting these results. First, previous studies have reported that the occurrence of incomplete blocks or the increase in QRS duration with no criteria for BBB after TAVR may further progress toward a delayed high-degree AVB (13). Unfortunately, there was no specification on whether such patients were included in the group of patients with "normal" ECG post-TAVR. Second, most of the patients included in the study received the CoreValve (Medtronic, Minneapolis, Minnesota) or Edwards Sapien XT (Edwards Lifesciences, Irvine, California) devices. Although both devices have been the most commonly used to date, they have recently been replaced by the latest generation of transcatheter valve devices. Importantly, the use of some novel-generation devices has been associated with an increased risk of AVB and the need for permanent pacemaker implantation (6). Differences in the intrinsic characteristics of transcatheter valve prostheses may result in different patterns regarding the evolution of conduction disorders over time. Thus, whether delayed conduction disorders may occur in patients with no conduction abnormalities immediately after TAVR when using such devices remains unknown. Third, the percentage of patients with sinus rhythm, no BBB, and no AVB immediately after the procedure was small (one-fourth of the study population). These results would therefore apply only to a minority of TAVR patients. Also, the results obtained in such a limited study population would need confirmation in a much larger number of patients. Fourth, while the risk of delayed AVB in patients with AF and no bradycardia or conduction abnormalities post-TAVR was very low in this study, changes in medical treatment in such patients may have an impact on the occurrence of late conduction disorders. Finally, the recommendation of continuous ECG monitoring post-TAVR is not only for detecting bradyarrythmias but also for diagnosing tachyarrythmias, particularly AF, which are very frequent post-TAVR and may increase the risk of potentially preventable cardioembolic events (14).

The predictors of AVB and pacemaker implantation after TAVR have been extensively reported in previous studies (15). Nonetheless, most such studies have assessed baseline clinical and ECG factors associated with an increased risk of AVB post-TAVR. The study of Toggweiler et al. (8) has the originality of assessing the predictors of delayed AVB (rather than overall procedural and post-procedural AVB), and importantly, have determined the extremely low risk of delayed high-degree AVB in the absence of such predictive variables. This provides the rationale for a new and simplified perspective on the management of rhythm monitoring after TAVR. However, important questions remain unsolved and further research is needed in this field before making definite conclusions. While minimizing the post-procedural care burden and reducing the length of hospital stay are important objectives in TAVR, this should never be at the expense of decreasing safety.

REPRINT REQUESTS AND CORRESPONDENCE: Dr. Josep Rodés-Cabau, Quebec Heart & Lung Institute, Laval University, 2725 chemin Sainte-Foy, G1V 4G5 Quebec City, Quebec, Canada. E-mail: josep.rodes@criucpq.ulaval.ca.

REFERENCES

1. Leon MB, Smith CR, Mack MJ, et al. Transcatheter or surgical aortic-valve replacement in intermediate-risk patients. N Engl J Med 2016; 374:1609–20.

2. Osnabrugge RLJ, Head SJ, Genders TSS, et al. Costs of transcatheter versus surgical aortic valve replacement in intermediate-risk patients. Ann Thorac Surg 2012;94:1954–60.

3. Barbanti M, Capranzano P, Ohno Y, et al. Early discharge after transfemoral transcatheter aortic valve implantation. Heart 2015;101: 1485–90.

4. Durand E, Eltchaninoff H, Canville A, et al. Feasibility and safety of early discharge after transfemoral transcatheter aortic valve implantation with the Edwards SAPIEN-XT prosthesis. Am J Cardiol 2015;115:1116–22.

5. Noad RL, Johnston N, McKinley A, et al. A pathway to earlier discharge following TAVI: Assessment of safety and resource utilization. Catheter Cardiovasc Interv 2016;87:134–42.

6. Urena M, Rodés-Cabau J. Managing heart block after transcatheter aortic valve implantation: from monitoring to device selection and pacemaker indications. EuroIntervention 2015;11:W101–5.

7. Kappetein AP, Head SJ, Genereux P, et al. Updated standardized endpoint definitions for transcatheter aortic valve implantation: the Valve Academic Research Consortium-2 consensus document. J Am Coll Cardiol 2012;60:1438–54.

8. Toggweiler S, Stortecky S, Holy E, et al. The electrocardiogram after transcatheter aortic valve replacement determines the risk for postprocedural high-degree AV block and the need for telemetry monitoring. J Am Coll Cardiol Intv 2016;9:1269–76.

9. Moreno R, Dobarro D, Lopez de Sa E, et al. Cause of complete atrioventricular block after percutaneous aortic valve implantation: insights from a necropsy study. Circulation 2009;120:e29–30.

10. Weymann A, Patil NP, Karck M. Resolution of heart block after surgical correction of failed transcatheter aortic valve implantation. Ann Thorac Surg 2015;99:1437–9.

11. Urena M, Hayek S, Cheema AN, et al. Arrhythmia burden in elderly patients with severe aortic stenosis as determined by continuous electrocardiographic recording: toward a better understanding of arrhythmic events after transcatheter aortic valve replacement. Circulation 2015;131:469–77.

12. Bagur R, Rodés-Cabau J, Gurvitch R, et al. Need for permanent pacemaker as a complication of transcatheter aortic valve implantation and surgical aortic valve replacement in elderly patients with severe aortic stenosis and similar baseline electrocardiographic findings. J Am Coll Cardiol Intv 2012;5:540–51.

13. Mouillet G, Lellouche N, Lim P, et al. Patients without prolonged QRS after TAVI with CoreValve device do not experience high-degree atrioventricular block. Catheter Cardiovasc Interv 2013;81:882–7.

14. Amat-Santos IJ, Rodés-Cabau J, Urena M, et al. Incidence, predictive factors, and prognostic value of new-onset atrial fibrillation following transcatheter aortic valve implantation. J Am Coll Cardiol 2012;59:178–88.

15. Siontis GC, Juni P, Pilgrim T, et al. Predictors of permanent pacemaker implantation in patients with severe aortic stenosis undergoing TAVR: a meta-analysis. J Am Coll Cardiol 2014;64:129–40.

KEY WORDS aortic stenosis, conduction disturbances, pacemaker, transcatheter aortic valve replacement