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Immediate Post-Procedural 12-Lead Electrocardiography as Predictor of Late Conduction Defects After Transcatheter Aortic Valve Replacement

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ABSTRACT

OBJECTIVES The aim of this study was to use a 12-lead electrocardiogram obtained immediately post-transcatheter aortic valve replacement (TAVR) to identify predictors of late high-degree conduction defect (HD-CD) within 30 days after TAVR.

BACKGROUND There are limited data on risk factors for the development of late HD-CD and the need to retain the temporary pacemaker after TAVR.

METHODS A single-center study was conducted including 467 consecutive patients, without pre-procedural pacemakers, undergoing TAVR.

RESULTS Self-expandable, mechanical, or balloon-expandable heart valves were implanted in 328 (70%), 61 (13%), and 78 (17%) patients, respectively. For patients in sinus rhythm without right bundle branch block, late HD-CD developed in 0 of 70 patients (0%; 95% confidence interval [CI]: 0% to 5.1%) with PR interval <200 ms and QRS interval <120 ms and in 5 of 109 patients (4.6%; 95% CI: 1.5% to 10.4%; all with sufficient escape rhythm) with PR interval <240 ms and QRS interval <150 ms. Late HD-CD developed in 14 of 101 patients (13.9%; 95% CI: 7.8% to 22.2%; 6 with insufficient escape rhythm [5.9%; 95% CI: 2.2% to 12.5%]) with PR interval ≥240 ms or QRS interval ≥150 ms. Furthermore, late HD-CD developed in 3 of 49 patients (6.1%; 95% CI: 1.3% to 16.9%; all with sufficient escape rhythm) and in 3 of 30 patients (10.0%; 95% CI: 2.1% to 26.5%; 2 with insufficient escape rhythm [6.7%; 95% CI: 0.8% to 22.1%]) with atrial fibrillation and no right bundle branch block with QRS interval <140 and ≥140 ms, respectively.

CONCLUSIONS On the basis of immediate post-TAVR 12-lead electrocardiography, removing the temporary pacemaker immediately following TAVR is potentially safe in patients without right bundle branch block who are: 1) in sinus rhythm with PR interval <240 ms and QRS interval <150 ms; or 2) in atrial fibrillation with a QRS interval <140 ms. (J Am Coll Cardiol Intv 2018;11:1509–18) © 2018 by the American College of Cardiology Foundation.

During the past decade, transcatheter aortic valve replacement (TAVR) has advanced from being indicated in symptomatic patients with severe aortic valve stenosis and extreme or high surgical risk to recently also being indicated in patients with intermediate surgical risk (1,2). Through optimized treatment of complications and simplified care after TAVR, the length of hospitalization has been reduced significantly, decreasing the cost of TAVR without compromising patient safety

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ABBREVIATIONS AND ACRONYMS

AF = atrial fibrillation

AUC = area under the receiver-operating characteristic curve

AVB = atrioventricular block

CI = confidence interval

ECG = electrocardiography

HD-CD = high-degree conduction defects

IQR = interquartile range

LBBB = left bundle branch block

OR = odds ratio

PM = pacemaker

RBBB = right bundle branch block

TAVR = transcatheter aortic valve replacement

(3-5). However, the risk for conduction defects following TAVR requiring implantation of a permanent pacemaker (PM) has remained relatively stable or even increased despite newer generation device (6,7). The risk for late conduction defects after TAVR mandates post-procedural telemetry and/or temporary pacing, but consensus on this practice does not exist (1,2,8). On the basis of the first electrocardiogram obtained in the intensive care unit after TAVR, Toggweiler et al. (9) suggested that the presence of sinus rhythm with PR interval <200 ms and QRS interval <120 ms, or atrial fibrillation (AF) with ventricular rate ≥60 beats/min and QRS interval <120 ms after TAVR were predictors of freedom from late conduction defects after TAVR, indicating no need for post-procedural telemetry or temporary pacing. Furthermore, it was recommended to keep the temporary PM in patients with very high risk for late conduction defects, that is, those with right bundle branch block (RBBB) or undefined very long PR interval.

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On the basis of criteria from immediate post-TAVR 12-lead electrocardiography (ECG), the aim of the present prospective study was to predict the risk for late high-degree conduction defects (HD-CDs) with sufficient and insufficient escape rhythm after TAVR and the subsequent need to keep a temporary PM in place during the first post-procedural days.

METHODS

The study was a prospective single-center registry, including all consecutive patients treated with TAVR at Rigshospitalet, Copenhagen University Hospital, Denmark, between August 2015 and September 2017. Patients with permanent PMs before TAVR or periprocedural complications leading to death were excluded. Baseline and follow-up data up to 30 days post-TAVR were collected from electronic patient records. A 12-lead electrocardiogram was recorded in all patients both pre-TAVR and immediately post-TAVR before leaving the catheterization laboratory.

PROCEDURE. All TAVR patients at Rigshospitalet have a transfemoral pacing electrode placed in the right ventricle and connected to a temporary PM at the start of the procedure. Since August 2015, the majority of TAVR patients have their temporary PMs removed before leaving the catheterization laboratory and are subsequently monitored with telemetry. In case of periprocedural HD-CD or if the risk for late HD-CD is assessed to be high on the basis of immediate post-TAVR ECG, the transfemoral temporary PM is kept in place or replaced with a transjugular temporary PM during further observation.

CONDUCTION DEFECTS. On the basis of a class I/II indication for pacing in case of intermittent bradycardia (8), HD-CD was defined as second-degree atrioventricular block (AVB) type 2 or third-degree AVB or AF with bradycardia. Periprocedural HD-CD was defined as HD-CD that developed during or immediately after TAVR in the catheterization laboratory, and late HD-CD was defined as HD-CD that developed after the patient left the catheterization laboratory and up to 30 days post-procedure.

Every pre-TAVR and immediate post-TAVR electrocardiogram was analyzed. A PR interval ≥200 ms was defined as first-degree AVB and a QRS interval ≥120 ms as bundle branch block and further classified as left bundle branch block (LBBB) and RBBB (9,10). The ΔPR and ΔQRS intervals refer to the difference of the PR and QRS intervals between immediate post-TAVR and pre-TAVR ECG, respectively. Late HD-CD was further categorized into HD-CD with sufficient escape rhythm or HD-CD with insufficient escape rhythm if the episode of late HD-CD resulted in syncope, need for cardiopulmonary resuscitation, unknown symptomatology, or recorded use of the temporary PM, which was typically set to a backup pace rate of 40 beats/min.

For patients without RBBB on immediate post-TAVR ECG, the risk for late HD-CD was analyzed in intervals of 20 ms, starting from the cut point of normal PR and QRS intervals of 200 and 120 ms, respectively (10).

STATISTICAL ANALYSIS. Data are presented as counts and percentages for categorical variables and mean ± SD or median (interquartile range [IQR]) for continuous variables. Risk for late HD-CD in subgroups was calculated with exact binomial confidence limits. Pre-TAVR and immediate post-TAVR electrocardiographic characteristics were investigated as predictors of late and also periprocedural HD-CD in simple logistic regression analysis. For multiple logistic regression analysis, the subset of patients in sinus rhythm and without RBBB was selected. The set of predictor variables included for late HD-CD was pre-TAVR and immediate post-TAVR electrocardiographic characteristics, Society of Thoracic Surgeons score, and valve type. Odds ratios and area under the