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Scientific letter

Predictors of late pacemaker implantation following TAVI

Predictores de implante tardío de marcapasos tras TAVI

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To the Editor,

Transcatheter aortic valve implantation (TAVI) has become a safe and minimally invasive alternative to surgical aortic valve replacement, and its indications have expanded to include younger and lower surgical risk patients.[1] The development of advanced atrioventricular conduction disorders (AVCD) requiring permanent pacemaker implantation has been reported in 2.3% to 36% of patients, and is one of the major concerns associated with this technique, leading to higher mortality rates.[2] Specifically, late-onset AVCD can have fatal consequences. Its highly variable temporal definition hampers the identification of predictive factors. However, the appearance of complete left bundle branch block and baseline atrial fibrillation has been suggested.[3,4]

We conducted a study to assess whether electrocardiographic (ECG) changes can be predictors of late-onset AVCD requiring permanent pacemaker implantation within the first month after discharge following TAVI. This was a retrospective, observational, and cohort study of consecutive patients treated with TAVI from 2011 through 2022 at a tertiary referral center. We studied sociodemographic variables, atrial fibrillation, prior pacemaker implantation, baseline ECG abnormalities and within 24 hours after implantation, the need for pacemaker implantation during admission and after discharge, survival, and the length of stay. The diagnosis of late-onset AVCD and the indication for pacemaker implantation occurred through in-person consultations or visits to the ER. Due to the retrospective design and anonymous data handling, the research ethics committee deemed it unnecessary to require additional informed consent forms other than those obtained prior to the procedure.

The statistical analysis compared the baseline ECG abnormalities and those reported 24 hours after TAVI in the group requiring permanent pacemaker implantation after discharge vs the group with no such requirement. The chi-square test was used for qualitative variables, and the Student t-test for quantitative variables. Binary logistic regression was used, including statistically significant comparisons to identify the variables with the best predictive ability. Statistical tests were applied with a 95% level of confidence, and the IBM SPSS version 26.0 statistical software was used.

The study included a total of 448 patients with a mean age of 81.38 ± 6.1 years, 49.1% of whom were women. The device used was the Edwards-SAPIEN 3 valve (Edwards Lifesciences, United States), which was always implanted by the same operator. We excluded 49 patients (10.94%) who were chronic pacemaker carriers. Fifteen patients (3.8%) developed late-onset AVCD after discharge, requiring readmission for pacemaker implantation. No significant differences were reported in the baseline characteristics between the 2 study groups. The factors significantly associated with a higher rate of pacemaker implantation at discharge were baseline complete right bundle branch block (CRBBB) ($P = .002$), the presence of type I or Wenckebach and type II first- or second-degree atrioventricular block (AVB) at baseline ($P < .001$), the postoperative development of left anterior fascicular block ($P = .005$), CRBBB ($P < .001$), and first-degree transient AVB after implantation ($P = .018$) (table 1). Binary logistic regression was used to identify the best predictors of the need for pacemaker implantation after discharge, which were the combination of first- or second-degree AVB at baseline (odds ratio [OR], 2.008; 95% confidence interval [CI], 1.480-2.725), persistent CRBBB (OR, 10.53; 95%CI, 2.949-37.669), and second-degree transient AVB after implantation (OR, 8.15; 95%CI, 1.35-49.73).

This study reports a combination of ECG findings that can predict an increased risk of late-onset AVCD at discharge, a vulnerable time due to the cessation of ECG monitoring and discharge from hospital. Pacemaker implantation after discharge is associated with longer admissions, mainly due to closer and more prolonged ECG monitoring, which stresses the need for rapid decision-making following these ECG findings. In this study, the mean length of stay for the group that did not require pacemaker implantation was longer than that associated with this procedure at the present time,[5] mainly due to vascular complications in the first few years after the introduction of the procedure.

There is a discrepancy in the medical literature on the temporal definition of late blocks, their risk factors, and predictive ability. Only 1 study has considered late-onset AVCD as those occurring at discharge. The study was conducted by McCaffrey et al.,[6] who analyzed a series of 98 patients, 4 of whom required pacemaker implantation. This series was heterogeneous regarding the type of implanted valve and reported that predictors of late-onset AVCD after discharge were baseline CRBBB, longer QRS duration at baseline and at discharge, more than moderate aortic regurgitation, and atrial fibrillation.

The strength of our study lies in the uniformity of the valves, which were implanted by the same operator. However, it has the inherent limitations of a retrospective study, in addition to possibly underestimating events at discharge, including 5 deaths of unclear cause which could be associated with late-onset AVCD.

In conclusion, the presence of baseline CRBBB, first- or second-degree AVB at baseline, and the development of transient first or second-degree AVB should alert us to the possibility of late-onset AVCD.

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Table 1. Characteristics of the patients

Variables	PM implantation during admission (n = 37)	PM implantation after discharge (n = 15)	No need for PM implantation (n = 347)	*P* for PM implantation during admission	*P* for PM implantation after discharge
Women	12 (32.43)	11 (73.3)	206 (59.36)	.360	.866
Baseline CRBBB	9 (24.32)	7 (46.67)	39 (11.23)	.006	.002
Baseline CLBBB	3 (8.1)	0	38 (10.95)	.912	.130
Baseline LAFB	10 (27.02)	2 (13.33)	51 (14.69)	.003	.612
1st or 2nd-degree AVB at baseline	5 (13.51)	6 (40)	51 (14.69)	.702	< .001
Atrial fibrillation	16 (43.24)	8 (53.33)	164 (47.26)	.549	.683
Valve-in-valve	4 (10.81)	0	21 (6.05)	.079	.263
Persistent posterior LAFB	3 (8.1)	4 (26.67)	19 (5.47)	.356	.005
Transient posterior LAFB	0	0	1 (0.28)	.763	.815
Persistent posterior CLBBB	9 (24.32)	3 (20)	84 (24.2)	.444	.414
Transient posterior CLBBB	6 (16.21)	2 (13.33)	44 (12.68)	.220	.785
Persistent posterior CRBBB	1 (2.7)	7 (46.67)	14 (4.03)	.511	< .001
Transient posterior CRBBB	0	0	6 (1.73)	.458	.564
Persistent posterior 1st-degree AVB	8 (21.62)	4 (46.67)	34 (9.79)	.001	.517
Transient posterior 1st-degree AVB	1 (2.7)	3 (20)	14 (4.03)	.711	.018
Persistent posterior 2nd-degree AVB	1 (2.7)	1 (6.67)	0	< .001	.073
Transient posterior 2nd-degree AVB	6 (16.21)	1 (6.67)	19 (5.47)	.001	.069
Length of stay (days)	9.89 ± 8.89	12.03 ± 17.4	6.78 ± 7.98	< .001	.027

AVB, atrioventricular block; CLBBB, complete left bundle branch block; CRBBB, complete right bundle branch block; LAFB, left anterior fascicular block; PM, pacemaker.
Note: Qualitative variables are expressed as frequency, and quantitative variables as mean ± standard deviation.

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None declared.

ETHICAL CONSIDERATIONS

Due to the retrospective design and anonymous nature of data, informed consent was not deemed necessary by the research ethics committee. The SAGER guidelines were taken into consideration.

STATEMENT ON THE USE OF ARTIFICIAL INTELLIGENCE

No artificial intelligence was used.

AUTHORS' CONTRIBUTIONS

R. Muñoz-Rodríguez was involved in the design, data mining, analysis, and drafting of this manuscript. M. A. Rivero-García, and J.J. Castro-Martín were involved in data mining. G. Yanes-Bowden, and F. Bosa-Ojeda conducted the manuscript critical review process.

CONFLICTS OF INTEREST

None declared.

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