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OAKLAND UNIVERSITY WILLIAM BEAUMONT

Changes in Electrocardiographic and Cardiac Implantable Electronic Device Parameters Following Transcatheter Aortic Valve Replacement

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Introduction

Transcatheter aortic valve replacement (TAVR) has become a common procedure to treat severe aortic stenosis, especially in patients who are poor surgical candidates[1].

Due to the close proximity of the aortic valve to the atrioventricular (AV) conduction system (Figure 1), a common complication of TAVR is damage to the cardiac conduction system, leading to the development of conduction abnormalities and the need for permanent pacemaker implantation[2-7].

Reported percentages of patients who undergo TAVR with a previously implanted cardiac implantable electronic device (CIED), including pacemakers and implantable cardiac defibrillators, range from 9-22%[2–8].

The effect of TAVR-related conduction abnormalities on EKG and CIED parameters in patients with preexisting CIEDs is not known.

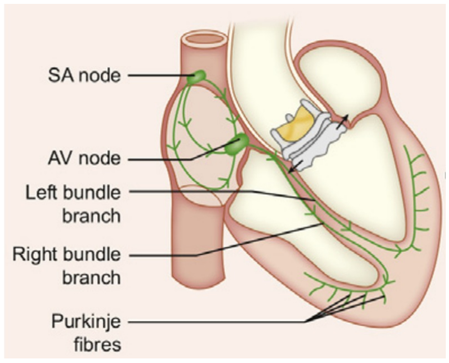

Figure 1: Prosthetic aortic valve and its proximity to the AV conduction system.

Aims and Objectives

In this study, we sought to investigate and describe changes in EKG and CIED parameters following TAVR in patients with preexisting CIEDs.

Methods

We retrospectively reviewed patients with preexisting CIEDs who underwent TAVR at a tertiary care center from 2012 to 2020. EKG and device parameters pre- and post-TAVR were collected. Continuous variables were reported as mean (± SD) or percentage where appropriate. Paired t-test was used to compare various EKG and device parameters pre- and post-TAVR.

Results

A total of 113 patients were included. Median time of device interrogation pre- and post-TAVR was 50 and 1 day(s) respectively. There was an increase in QRS duration (mean 8.9ms ± 32.2) and QTc interval (mean 14.9ms ± 42.5). Additionally, there was an increase in right ventricular (RV) pacing (mean 5.9% ± 17.7) and RV threshold (mean 0.14V ± 0.4) and a decrease in RV impedance (mean -35.5Ω ± 72.5) post-TAVR. Results of paired t-test are shown in Table 1. Seven patients (6.2%) experienced an increase in RV sensing burden from <40% pre-TAVR to >40% post-TAVR (mean 51.4% ± 26.9). Additionally, seven patients (6.2%) required a repeat device procedure within one year after TAVR (Table 2).

Table 1: Changes in EKG and CIED Parameters after TAVR.

EKG/CIED Parameter	Mean Pre-TAVR	Mean Post-TAVR	Mean Delta (Post-Pre)	P-value
QRS (ms)	149.5	158.4	8.9	0.007
QTc (ms)	491.4	506.3	14.9	0.0005
Right Ventricular Impedance (Ω)	520.0	484.5	-35.5	<0.0001
Right Ventricular Sensing (mV)	11.09	11.05	-0.04	0.93
Right Ventricular Threshold (V)	0.86	1.0	0.14	0.0048
Right Ventricular Pacing (%)	59.0	64.9	5.9	0.0036

Table 2: Timing and reasons for repeat CIED procedures within one year after TAVR.

Time after TAVR (days)	Procedure Type	Reason for Procedure
40	Dual chamber pacemaker generator change	Battery at EOL
71	Single chamber ICD to BIV-ICD	EF decrease from 55% to 35%; development of LBBB after TAVR
84	Dual chamber pacemaker generator change	Battery at EOL
104	Right ventricular lead revision	Lead insulation breach
131	Single chamber pacemaker to BIV-ICD	EF decrease from 55% to 35%
215	Dual chamber pacemaker to BIV-ICD	Baseline low EF; development of prolonged QRS with LBBB
288	Dual chamber pacemaker to dual chamber ICD	Baseline low EF that did not improve after TAVR

ICD: implantable cardiac defibrillator; BIV: biventricular; EOL: end of life; EF: ejection fraction; LBBB: left bundle branch block

Conclusions

There are significant electrocardiographic and device parameters changes in patients with preexisting CIEDs who undergo TAVR.

Incorporating routine post-TAVR device interrogation would lead to early detection of clinically meaningful changes.

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Acknowledgements

Thank you to my research mentors, Dr. Mehta and Dr. Madanat, to Jacob Keeley for the biostatistical consultation, and to Dr. Baxa for his support through this process.

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