QRS and QT ventricular conduction times and permanent pacemaker therapy after transcatheter aortic valve implantation

Abstract: Transcatheter aortic valve implantation is a therapy for patients with reduced left ventricular ejection fraction and symptomatic aortic stenosis. The aim of the study was to compare the pre- and post- transcatheter aortic valve implantation procedures to determine the QRS and QT ventricular conduction times as a potential predictor of permanent pacemaker therapy requirement after transcatheter aortic valve implantation. QRS and QT ventricular conduction times were prolonged after transcatheter aortic valve implantation in heart failure patients with permanent dual chamber pacemaker therapy after transcatheter aortic valve implantation. QRS and QT ventricular conduction times may be useful parameters to evaluate the risk of post-procedural ventricular conduction block and permanent pacemaker therapy in transcatheter aortic valve implantation.

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1 Introduction

Transcatheter aortic valve implantation is a successful therapy for patients with reduced left ventricular ejection fraction and symptomatic aortic stenosis [1, 2]. The aim of the study was to compare the pre- and post- transcatheter aortic valve implantation procedures to determine the QRS and QT ventricular conduction times as a potential predictor of permanent pacemaker therapy requirement after transcatheter aortic valve implantation.

2 Methods

Transcatheter aortic valve implantation patients were divided into groups without pacemaker and with dual or single chamber pacemaker with different QRS complex and QT ventricular conduction times disturbance before and after transcatheter aortic valve implantation. Electrical QRS duration and QT duration were evaluated with surface ECG before transcatheter aortic valve implantation in patients with dual or single chamber pacemaker after transcatheter aortic valve implantation.

QRS duration was measured between onset and offset of the QRS complex in the surface ECG. QT interval was measured between onset of the QRS complex and offset of the T wave in the surface ECG in 536 high-risk patients before and after transcatheter aortic valve implantation. The mean age of the heart failure patients (314 females and 222 males) was 82.95 ± 5.82 years with 2.9 ± 0.53 New York Association functional class.

Statistical analysis were performed by Origin 9.1 software (OriginLab Cooperation, Northampton, MA, USA) using paired and unpaired t-test, as appropriated, with a statistical significance of p < 0.005 and with Pearson correlation coefficients.

3 Results

3.1 Left ventricular ejection fraction

Left ventricular ejection fraction increased from 41 ± 13.29 % before implantation to 42.3 ± 7.22 % after transcatheter aortic valve implantation (p = 0.02) (Fig. 1).

3.2 Cardiac pacemaker after transcatheter aortic valve implantation

Electrical ventricular conduction QRS time correlated with atroventricular conduction PQ time and heart period duration before (Fig. 2) and after transcatheter aortic valve implantation (p = 0.02) (Fig. 3). Electrical ventricular conduction QT time correlated with atroventricular conduction PQ time (p = 0.04) and with heart period duration before transcatheter aortic...
Figure 1: Box diagram of left ventricular ejection fraction before and after transcatheter aortic valve implantation. LVEF - Left ventricular ejection fraction.

Figure 2: QRS duration, heart period duration and atrioventricular conduction time before transcatheter aortic valve implantation (TAVI) and single chamber ventricular pacemaker. QRS-Prä - ventricular conduction time before TAVI, HPD-Prä – heart period duration after TAVI, PQ-Prä – atrioventricular conduction time after TAVI, r, P – Pearson correlation coefficients.

Figure 3: QRS duration, heart period duration and atrioventricular conduction time after transcatheter aortic valve implantation (TAVI) and single chamber ventricular pacemaker. QRS-Prä - ventricular conduction time before TAVI, HPD-Prä – heart period duration after TAVI, PQ-Prä – atrioventricular conduction time after TAVI, r, P – Pearson correlation coefficients.

Figure 4: QT duration, heart period duration and atrioventricular conduction time before transcatheter aortic valve implantation (TAVI) and single chamber ventricular pacemaker. QRS-Prä - ventricular conduction time before TAVI, HPD-Prä – heart period duration after TAVI, PQ-Prä – atrioventricular conduction time after TAVI, r, P – Pearson correlation coefficients.

Figure 5: QT duration, heart period duration and atrioventricular conduction time after transcatheter aortic valve implantation (TAVI) and single chamber ventricular pacemaker. QRS-Prä - ventricular conduction time before TAVI, HPD-Prä – heart period duration after TAVI, PQ-Prä – atrioventricular conduction time after TAVI, r, P – Pearson correlation coefficients.

valve implantation (Fig. 4) and after transcatheter aortic valve implantation (p < 0.01) (Fig. 5).

4 Conclusion

Electrical ventricular conduction times were prolonged after transcatheter aortic valve implantation in heart failure patients with permanent cardiac pacemaker therapy after transcatheter aortic valve implantation. QRS and QT ventricular conduction times may be useful non-invasive parameters to evaluate the risk of post-procedural prolongation of ventricular conduction times and permanent cardiac pacemaker therapy in transcatheter aortic valve implantation.
Author's Statement
Conflict of interest: Authors state no conflict of interest.
Material and Methods: Informed consent: Informed consent has been obtained from all individuals included in this study. Ethical approval: The research related to human use has been complied with all the relevant national regulations, institutional policies and in accordance the tenets of the Helsinki Declaration, and has been approved by the authors’ institutional review board or equivalent committee.

References