Conduction disturbance after isolated surgical aortic valve replacement in degenerative aortic stenosis

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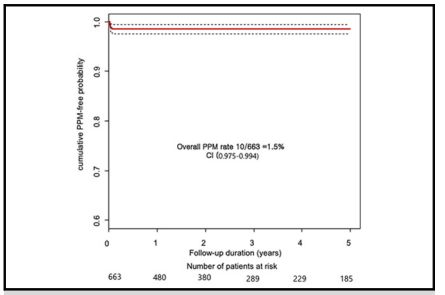
ABSTRACT

Objective: Conduction disturbances are common in patients with aortic stenosis. We investigated the incidence, reversibility, and prognosis of conduction disorders requiring permanent pacemaker implantation in patients with degenerative aortic stenosis after isolated aortic valve replacement.

Methods: This was a retrospective study conducted at a tertiary care center. We evaluated the incidence of conduction disturbances in patients who underwent isolated surgical aortic valve replacement for aortic stenosis between January 2005 and May 2015. Relevant clinical information was obtained from the patients' medical records.

Results: We reviewed results of 663 patients with pathologically proven degenerative aortic stenosis (bicuspid aortic valve, n = 285 [43.0%]) who underwent isolated aortic valve replacement (mechanical valve, n = 310 [46.8%]). Patients' mean age was 67.1 ± 8.1 years, and 362 were male (54.6%). Immediate postoperative intraventricular conduction disorders occurred in 56 patients (8.4%), and atrioventricular block occurred in 68 patients (10.3%). Ten patients with symptomatic second-degree or third-degree atrioventricular block underwent permanent pacemaker implantation within 30 days of aortic valve replacement. During the mean follow-up period of 1288 ± 1122 days, 64 patients (9.7%) developed irreversible conduction disorders (bundle branch block n = 24 and first-degree atrioventricular block n = 42). Of the 10 patients requiring permanent pacemakers, 4 remained depend on the permanent pacemaker during follow-up. Beyond 30 days after aortic valve replacement, 1 patient underwent permanent pacemaker implantation for de novo conduction disturbance 44 months postoperatively.

Conclusions: After isolated aortic valve replacement, permanent pacemaker implantation for conduction disturbance is rare (n = 10/663, 1.5%). Isolated aortic valve replacement for degenerative aortic stenosis has a low risk of conduction disturbances during long-term follow-up. (J Thorac Cardiovasc Surg 2017;154:1556-65)



Kaplan–Meier curve of PPM-free survival.

Central Message

The incidence of conduction disorders requiring PPM implantation after isolated AVR in patients with AS is low.

Perspective

Eleven patients (1.5%) underwent PPM implantation for treating conduction disorders after isolated AVR. During an average 3.5-year follow-up, most conduction disorders were reversible. This suggests that close observation and delayed PPM implantation are clinically reasonable in such patients.

See Editorial Commentary page 1566.

Transient conduction disorders are frequently encountered after open surgery. However, the reported incidence of conduction disorders after cardiac surgery varies. The incidence is known to be higher in patients who have undergone multiple surgeries or multivalve surgery, and in cases of coronary artery bypass combined with valve surgery than in those who have undergone isolated valve surgery. In isolated aortic valve replacement (AVR), the

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Abbreviations and Acronyms

AF = atrial fibrillation
AS = aortic stenosis
AVB = atrioventricular block
AVR = aortic valve replacement
BMI = body mass index
ECG = electrocardiogram
IVCD = intraventricular conduction delay
LBBB = left bundle branch block
PPM = permanent pacemaker
RBBB = right bundle branch block
TAVI = transcatheter aortic valve implantation

incidence of permanent pacemaker (PPM) implantation varies from 1.1% to 7.2%, but these values were obtained from studies that included cases of AVR with multiple causes.[1-3]

Potential risk factors for PPM implantation after isolated AVR include preexisting conduction disorders, bicuspid aortic valve, female sex, prolonged cardiopulmonary bypass time, redo operation, and a history of aortic regurgitation and myocardial infarction.[4,5]

Previous studies have yielded conflicting results regarding the reversibility of post-AVR conduction disorders. Therefore, the decision for early PPM implantation in post-AVR conduction disorders is controversial.[6-8] This study aimed to evaluate the incidence and prognosis of conduction disturbances requiring PPM implantation after isolated AVR in patients with pathologically proven degenerative aortic stenosis (AS).

MATERIALS AND METHODS

Patients

This is a retrospective study that evaluated the development of conduction disturbances in patients who underwent isolated surgical AVR for degenerative AS. Patients were recruited between January 2005 and May 2015 from a single tertiary care center in Seoul, Korea. Their clinical information was obtained from the hospital's electronic medical record system. We included 663 patients with pathologically proven degenerative AS in the final analysis.

Clinical Parameters

Clinical and surgical information were acquired by a thorough chart review. The demographic and clinical characteristics evaluated were age, sex, medical comorbidities, and medication data. All operations were performed through median/upper sternotomy. No stentless valves were included, and no annular enlargement procedures were performed. Surgical data included bypass time, crossclamp time, morphology of native valve (bicuspid, tricuspid), prosthesis type (tissue, mechanical), and prosthesis size. Follow-up days were calculated on the basis of patients' outpatient clinic charts or last hospital discharge date. Major cardiovascular events or deaths were reviewed and described.

Evaluation of Conduction Disturbances

Electrocardiogram (ECG) data were reviewed and analyzed at baseline (preoperative), within 30 days after surgery, and more than 30 days after surgery. At each time point, we reviewed ECGs with respect to (1) rhythm (sinus rhythm, atrial fibrillation [AF], atrial flutter, and junctional or pacemaker rhythm); (2) presence and type of conduction disturbances; and (3) measurable intervals (PR, QRS, and corrected QT intervals). Prespecified conduction disorders included (1) intraventricular conduction disorders including bundle branch block and nonspecific intraventricular conduction delay (IVCD); and (2) atrioventricular conduction disorders such as first-degree atrioventricular block (AVB), second-degree AVB (Mobitz type 1), and symptomatic second- or third-degree AVB. We reviewed all ECG data (including Holter data) from the preoperative period to the most recent follow-up date. In patients with implantable devices, device-related data such as the device type and mode, and pacemaker dependency were obtained. Pacemaker dependency was defined as the presence of an intrinsic escape rhythm of less than 40 beats/min and a percentage of pacing more than 80%. Our study protocol was approved by the Institutional Review Board of Asan Medical Center (Seoul, South Korea; Institutional Review Board No. S2015-2282-0001).

Statistical Analysis

Statistical analysis was performed using R 3.1.2 statistical software (R Development Core Team, 2014). All variables were assessed for normality using the Shapiro–Wilk method. Continuous variables were examined with the t test when appropriate and were expressed as mean $\pm$ standard deviation. Continuous variable that are not normally distributed were described as median $\pm$ interquartile range using Mann–Whitney U test. Categoric variables were described using frequencies. Predictors of PPM were identified by univariate analysis ($P < .2$) and were included as independent variables in a stepwise logistic regression analysis. For predictors of conduction disturbances, we performed the complementary log-log model with random-effects for correlated interval-censored event time data that accounted for patient clustering effects.[9]

RESULTS

Patient Characteristics

A total of 663 patients with pathologically proven degenerative AS who underwent isolated AVR and had ECG data were included. The mean age of the study population was 67.1 $\pm$ 8.1 years, and 362 patients were male (54.6%). The mean follow-up duration was 1288 $\pm$ 1122 days. During this time, 10 patients (1.5%) received an implantable PPM for post-AVR conduction disorders (Figure 1), with 39 patients (5.9%) lost to follow-up. There were no significant differences in baseline and operative variables between patients with PPM and patients without PPM (Table 1). The prevalence of medical conditions, including hypertension, diabetes, cerebrovascular disease, chronic lung disease, coronary artery disease, chronic kidney disease, and arrhythmias diagnosed before AVR, was comparable between patients with PPM and patients without PPM. Overall, 43% of patients had bicuspid aortic valves and 46.8% of patients had implanted mechanical aortic valves. On average, implanted valves were 21.7 $\pm$ 2.1 mm in diameter. There were no statistically significant differences between the PPM and non-PPM groups for cardiopulmonary bypass time and aortic crossclamping time ($P = .15$ and $P = .81$, respectively). Baseline rhythm also was compared between the 2 groups