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Late Cardiac Death in Patients Undergoing Transcatheter Aortic Valve Replacement

Incidence and Predictors of Advanced Heart Failure and Sudden Cardiac Death

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ABSTRACT

BACKGROUND Little evidence exists of the burden and predictors of cardiac death after transcatheter aortic valve replacement (TAVR).

OBJECTIVES The purpose of this study was to assess the incidence and predictors of cardiac death from advanced heart failure (HF) and sudden cardiac death (SCD) in a large patient cohort undergoing TAVR.

METHODS The study included a total of 3,726 patients who underwent TAVR using balloon (57%) or self-expandable (43%) valves. Causes of death were defined according to the Valve Academic Research Consortium-2.

RESULTS At a mean follow-up of 22 ± 18 months, 155 patients had died due to advanced HF (15.2% of total deaths, 46.1% of deaths from cardiac causes) and 57 had died due to SCD (5.6% of deaths, 16.9% of cardiac deaths). Baseline comorbidities (chronic obstructive pulmonary disease, atrial fibrillation, left ventricular ejection fraction ≤40%, lower mean transaortic gradient, pulmonary artery systolic pressure >60 mm Hg; $p < 0.05$ for all) and 2 procedural factors (transapical approach, hazard ratio [HR]: 2.38, 95% confidence interval [CI]: 1.60 to 3.54; $p < 0.001$; presence of moderate or severe aortic regurgitation after TAVR, HR: 2.79, 95% CI: 1.82 to 4.27; $p < 0.001$) independently predicted death from advanced HF. Left ventricular ejection fraction ≤40% (HR: 1.93, 95% CI: 1.05 to 3.55; $p = 0.033$) and new-onset persistent left bundle-branch block following TAVR (HR: 2.26, 95% CI: 1.23 to 4.14; $p = 0.009$) were independently associated with an increased risk of SCD. Patients with new-onset persistent left bundle-branch block and a QRS duration >160 ms had a greater SCD risk (HR: 4.78, 95% CI: 1.56 to 14.63; $p = 0.006$).

CONCLUSIONS Advanced HF and SCD accounted for two-thirds of cardiac deaths in patients after TAVR. Potentially modifiable or treatable factors leading to increased risk of mortality for HF and SCD were identified. Future studies should determine whether targeting these factors decreases the risk of cardiac death. (J Am Coll Cardiol 2015;65:437–48) © 2015 by the American College of Cardiology Foundation.

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ABBREVIATIONS AND ACRONYMS

AR = aortic regurgitation

AVB = atrioventricular block

HF = heart failure

LBBB = left bundle-branch block

LVEF = left ventricular ejection fraction

NOP = new-onset persistent

PASP = pulmonary artery systolic pressure

PPM = permanent pacemaker

SCD = sudden cardiac death

TAVR = transcatheter aortic valve replacement

Transcatheter aortic valve replacement (TAVR) improves survival in patients with symptomatic aortic stenosis who are deemed to be at high or prohibitive surgical risk (1). However, in initial studies, approximately 1 of 4 patients died during the first year following TAVR despite relief of the valvular obstruction, highlighting the need to improve patient selection (2). Such efforts have reduced overall mortality after TAVR (3), mainly due to decreased incidence of noncardiac death, without significant changes in the cardiac death rate.

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The persistent risk of death from advanced heart failure (HF) and sudden cardiac death (SCD) in patients undergoing surgical aortic valve replacement (SAVR), the most common modes of death following SAVR, has long been of concern (4–7). Some studies suggested that the risks of cardiac death and SCD are increased by potentially treatable factors, such as new conduction disturbances (4,6,8,9). Although there is little evidence of the burden of death from advanced HF and SCD in patients undergoing TAVR, both accounted for approximately three-fourths of cardiac deaths in some previous studies (10–12). However, their predictors remain largely unknown. More importantly, whether potentially treatable or modifiable factors might increase the risk of death from HF and SCD after TAVR has not yet been elucidated. The objective of this study was, therefore, to assess the incidence and predictors of death from advanced HF and SCD in patients undergoing TAVR.

METHODS

STUDY POPULATION. The study included 3,726 total patients who underwent TAVR in 18 centers in North America, South America, and Europe. The indications for TAVR and approach were assessed by each center's heart team, and TAVR procedures were performed as described (1), with data prospectively collected in a dedicated database in each center. Clinical outcomes were defined according to VARC (Valve Academic Research Consortium)-2 criteria (2).

ELECTROCARDIOGRAPHY AND ECHOCARDIOGRAPHY DATA. Twelve-lead electrocardiography (ECG) tracings were recorded at least at baseline, immediately after the procedure, and at hospital discharge. ECGs at baseline and at hospital discharge were obtained in 95% of patients. American Heart Association/American College of Cardiology Foundation/Heart Rhythm Society recommendations for standardization and interpretation of the electrocardiogram (13) were the basis for diagnosis of intraventricular conduction abnormalities. New-onset persistent (NOP) left bundle-branch block (LBBB) was defined as a new LBBB in a patient without a prior permanent pacemaker (PPM), which persisted at hospital discharge or until death. Primary analyses excluded patients who developed new-onset LBBB and required PPM implantation during the hospitalization period. In a supplementary analysis, patients were classified into 3 groups: NOP-LBBB (no pacemaker); new-onset persistent LBBB and pacemaker during hospitalization (NOP-LBBB-PPM); and no NOP-LBBB. A PPM was implanted if third-degree or advanced second-degree atrioventricular block (AVB) occurred at any anatomical level and was not expected to resolve, or in the presence of sinus node dysfunction and documented symptomatic bradycardia, in agreement with current recommendations (14). In the presence of new-onset LBBB with PR interval prolongation

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