

Effect of Race on the Incidence of Aortic Stenosis and Outcomes of Aortic Valve Replacement in the United States

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Abstract

Objective: To assess the effect of race on the incidence of aortic stenosis (AS) and utilization and outcomes of aortic valve replacement (AVR).

Patients and Methods: Patients older than 60 years hospitalized with a primary diagnosis of AS and those who underwent AVR between 2003 and 2014 were included. Adjusted and unadjusted incidence of AS-related hospitalizations, utilization rates of AVR, in-hospital morbidity and mortality, and resource utilization was compared between whites and African Americans (AAs).

Results: Between January 1, 2003, and December 31, 2014, the incidence of AS-related admissions increased from 13 (95% CI, 12.8-13.2) to 26 (95% CI, 25.7-26.4) cases per 100,000 patient-years in whites and from 3 (95% CI, 3.5-3.8) to 9.5 (95% CI, 9.4-9.8) cases per 100,000 patient-years in AAs ($P < .001$). The incidence density ratio decreased from 4.3 (95% CI, 2.27-6.6) in 2003 to 2.7 (95% CI, 1.1-3.8) in 2014. The ratio of AVR to AS-related admissions was 11.3% in whites and 6.7% in AAs ($P < .001$). Crude in-hospital mortality after AVR was higher in AAs (6.4% vs 4.7%; $P < .001$). However, after propensity score matching, in-hospital mortality after isolated AVR was not significantly different between AAs and whites (4.7% vs 3.7%; $P = .12$). African Americans also had longer hospitalizations (12 ± 12 days vs 10 ± 9 days; $P < .001$), higher rates of nonhome discharge (32.1% vs 27.2%; $P = .004$), and higher cost of hospitalization ($\$55,631 \pm \$37,773$ vs $\$52,521 \pm \$38,040$; $P < .001$).

Conclusions: African Americans undergo AVR less than whites. The underlying etiology of this disparity is multifactorial, but may be related to a lower incidence of AS in AAs. Aortic valve replacement is associated with similar risk-adjusted in-hospital mortality but higher cost and longer hospitalizations in AAs than in whites.

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African American (AA) race has been identified as an independent risk factor for postoperative morbidity and mortality after coronary artery bypass grafting (CABG) and heart transplantation.¹⁻⁴ These findings have been partially attributed to differences in risk profile, socioeconomic factors, and hospital characteristics.⁴ However, the differential effect of race on the outcomes of isolated surgical aortic valve replacement (AVR) operations has been debated.⁵ With the increasing burden of aortic stenosis (AS) and the dramatic change in its management in the past decade, there is a need to understand contemporary racial differences in the

utilization and outcomes of AVR. We aim to use the Nationwide Inpatient Sample (NIS) to describe the differences in clinical risk profile of white and AA patients undergoing AVR and to investigate disparities in AVR utilization rates, in-hospital outcomes, resource utilization, and cost of care between white and AA patients.

PATIENTS AND METHODS

Study Data

The NIS was used to derive patient relevant information between January 1, 2003, and December 31, 2014. The NIS is the largest



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publicly available all-payer administrative claims–based database and contains information about patient discharges from approximately 1000 nonfederal hospitals in 45 states. It contains clinical and resource utilization information on 5 to 8 million discharges annually, with safeguards to protect the privacy of individual patients, physicians, and hospitals. These data are stratified to represent approximately 20% of US inpatient hospitalizations across different hospital and geographic regions (random sample). The national estimates of the entire US hospitalized population were calculated using the Agency for Healthcare Research and Quality sampling and weighting method.

Study Population

Patients older than 60 years with a discharge diagnosis of aortic valve stenosis (*International Classification of Diseases, Ninth Revision, Clinical Modification* codes 424.1, 395.0, 395.2, 396.2, 746.3) who underwent AVR (*International Classification of Diseases, Ninth Revision, Clinical Modification* procedure codes 35.20 and 35.21) during the study period were identified from the NIS database.

Racial Disparity in AS-Related Hospitalization and AVR Utilization

To investigate the possible effect of race on the utilization rates of AVR, we calculated the following:

1. The incidence of *AS-related admissions*, defined as hospital admissions with a principal diagnosis of aortic valve disease in patients older than 60 years. The total number of whites and AAs were derived from the US Census data.
2. The *incidence density ratio*, defined as relative difference in AS-related admissions between white patients and their AA counterparts.
3. The *ratio of AVR to AS-related admissions* in both races. The trends in AVR utilization over the study period were assessed using the Mann-Kendall test.

Comparative Outcomes Analysis

We aimed to perform a comparative outcomes analysis between white and AA patients undergoing AVR. To account for potential

confounding factors and reduce the effect of selection bias, a vigorous propensity score–matching model was developed using logistic regression to derive 2 matched groups for comparative outcomes analysis. After excluding patients who underwent concomitant cardiac operation, patients who underwent “isolated” AVR were entered into a nearest-neighbor 1:1 variable ratio, parallel, balanced propensity score–matching model using a caliper of 0.01 without replacement to ensure perfect matching. Variables included in the propensity score–matching model are listed in [Supplemental Table 1](#) (available online at <http://www.mayoclinicproceedings.org>). Patients with missing race data were excluded. To estimate the cost of hospitalization, the NIS data were merged with cost-to-charge ratios available from the Healthcare Cost and Utilization Project. We estimated the cost of each inpatient stay by multiplying the total hospital charge with cost-to-charge ratios. The primary end point was in-hospital death. Secondary end points included *procedural mortality* (defined as death occurring on the same hospital day as AVR), vascular complications, pacemaker implantation, transient ischemic attack, cerebral vascular accidents, blood transfusion, acute kidney injury requiring dialysis, cardiac tamponade, hospital length of stay, cost of hospitalization, and discharge disposition.

Statistical Analyses

Descriptive statistics were presented as frequencies with percentages for categorical variables and as means with SDs for continuous variables. Baseline characteristics were compared using the Pearson chi-square test and Fisher exact test for categorical variables and the independent-samples *t* test for continuous variables. Univariate and multivariate logistic regression was performed to estimate odds ratios with 95% CIs to determine predictors of in-hospital death. Matched categorical variables were presented as frequencies with percentages and compared using the McNemar test. Matched continuous variables were presented as means with SDs and compared using a paired samples *t* test. A type I error rate of less than .5 was considered statistically significant. All statistical analyses were performed using SPSS version 24 (IBM

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