



Investigating the Role of Ethnicity and Race in Patients Undergoing Treatment for Intracerebral Aneurysms Between 2008 and 2013 from a National Database

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■ **BACKGROUND:** The objective of this study is to classify patients using federally mandated categories of ethnicity and race and to determine whether subgroups are associated with patient outcomes and aneurysmal subarachnoid hemorrhage (SAH).

■ **METHODS:** The American College of Surgeons National Surgical Quality Improvement Program database from 2008 to 2013 was used to identify patients undergoing treatment of an intracerebral aneurysm. Ethnicity and race were combined to create subgroups. A descriptive statistical analysis was performed and a multivariable logistic regression model was tested whether ethnic and racial subgroups were associated with SAH.

■ **RESULTS:** A total of 686 patients met the study criteria. There were no endovascular cases reported. Four subgroups were identified, which included non-Hispanic Whites ($n = 504$, 73.47%, NH Whites), Hispanic Whites ($n = 38$, 5.54%), non-Hispanic Blacks ($n = 109$, 15.89%, NH Blacks), and non-Hispanic Asians ($n = 35$, 5.10%, NH Asians). Significant statistical associations were found between subgroups and the following baseline variables: age, female gender, body mass index, smoking, and treated hypertension (all $P < 0.01$). The NH Whites had the lowest proportion of SAH diagnosis (30.91%), which was statistically significant ($P < 0.001$). Multivariable logistic regression model adjusted for age, smoking, female gender, hypertension, and multiple comparisons found a

statistically significant difference only between NH Asians compared with NH Whites (odds ratio = 1.25, 95% confidence interval 0.25–2.29, $P < 0.01$). Postoperative outcomes were similar across ethnic and racial subgroups.

■ **CONCLUSIONS:** There are differences in baseline characteristics and the proportion of SAH. Future studies must take into account risk factors and outcomes not reported in the database.

INTRODUCTION

Studies evaluating the role of race and ethnicity in aneurysmal subarachnoid hemorrhage (SAH) have demonstrated differences in incidence, time to treatment, rate of treatment, allocation of resources, inpatient mortality, and discharge to institutional care.^{1–6} The definition of race and ethnicity is variable in the published literature and remains a challenge in comparing across existing studies. The Office of Management and Budget considers ethnicity and race as 2 distinct entities with independent definitions.⁷ In 1997, federal agencies, including the Centers for Medicare and Medicaid Services (CMS), were mandated to assign a minimum of 6 racial categories (White, Black or African American, American Indian or Alaska Native, Asian, and Native Hawaiian or Other Pacific Islander, and some other race) and 2 ethnic categories (Hispanic or Latino, non-Hispanic or non-Latino) to all demographic data on self-identification.^{7,8} Researchers in the health disparities

Key words

- Ethnicity
- Health disparities
- Intracerebral aneurysm
- Race

Abbreviations and Acronyms

ACS-NSQIP: American College of Surgeons National Surgical Quality Improvement Program

CI: Confidence interval

CMS: Centers for Medicare and Medicaid Services

CPT: Common procedural terminology

ICD-9: International Classification of Diseases, Version 9

H Whites: Hispanic Whites

NIS: National Inpatient Survey

NH: Non-Hispanic

OR: Odds ratio

SAH: Subarachnoid hemorrhage

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literature often combine these 2 variables to capture relevant subgroups such as non-Hispanic Whites, or Hispanic Whites, non-Hispanic Asian.⁹⁻¹¹

Recent publications from the National Inpatient Survey (NIS) have identified differences across race and ethnicity in patient outcomes for those treated for intracerebral aneurysms.^{1,2,12-14} Unfortunately, the NIS database contains only a single mixed variable combining racial and ethnic subgroups. The NIS subgroups include White, Black, Hispanic, Asian or Pacific Islander, Native American, or Other. This is due to issues with data collection and inconsistent reporting of race and ethnicity as 2 independent entities across states.¹⁵ The American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) is another large quality database that contains race and ethnicity variables according to government-mandated definitions created in 2008. Unlike the NIS database, this database identifies patients according to billable common procedural terminology (CPT) codes and data on >300 variables is extracted. In the present study we investigated the role of ethnicity and race by federal definitions among patients undergoing treatment of intracerebral aneurysms. Two independent variables for ethnicity and race were used to create subgroups and identify associations in patient characteristics, outcomes, and proportion of SAH.

METHODS

Data Source and Population

The ACS-NSQIP database is a nationwide program that collects data on major surgical procedures in the inpatient and outpatient settings. Patients are selected by a billable CPT code. Trained surgical clinical reviewers extract variables from the preoperative period and ≤30 days after the procedure in systematic sampling process described elsewhere.¹⁶ Every case is assigned an International Classification of Diseases, Version 9 (ICD-9) code corresponding to the postoperative diagnosis extracted from a brief operative note, surgical, or pathology report. In 2008, the definitions of ethnicity and race were revised to comply with CMS and other federal agencies.¹⁷ Data from national participant using files from 2008 to 2013 were compiled and all patients undergoing treatment of an intracerebral aneurysm were identified. The ACS-NSQIP data are a publicly available, deidentified database, and as such Institutional Review Board approval or informed consent was waived.

Study Variables

Five CPT codes specific to open aneurysm surgery were included (61697, 61698, 61700, 61702, and 61703). Three additional CPT codes were excluded that did not differentiate between aneurysm and other vascular malformations (61705, 61708, 61710). Primary endovascular treatment CPT codes included 61624 and 61635. The CPT codes for endovascular treatment do not differentiate between vascular or neoplastic pathologies, therefore, postoperative diagnoses by ICD-9 code were used for all 7 CPT codes and cases were excluded if assigned a diagnosis unrelated to intracerebral aneurysm or SAH.

Racial and ethnic subgroups were created using the ethnicity and race variables. Exclusion criteria were subgroups with <15 observations and admission before 2008. Body mass index in

kilograms per meter squared was calculated. Operative and postoperative risk factors were identified, as well as known risk factors associated with subarachnoid hemorrhage (i.e., smoking status, age, gender, alcohol consumption, and history of hypertension). Intracranial pressure monitoring was identified using the secondary or concurrent CPT code 61107. Postoperative outcomes measures included mortality, stroke, 30-day readmission, reoperation in 30 days, and surgical site infections. Functional patient outcomes (i.e., modified Rankin scale scores) and angiographic findings in the postoperative period are not variables collected by ACS-NSQIP.

Statistical Analysis

Stata Intercooled, Version 12 (Stata Corporation, College Station, Texas, USA) was used for statistical analysis. Descriptive statistics comparing across ethnic and racial subgroups was conducted with 1-way analysis of variance for continuous variables and χ^2 tests for categorical variables. The F statistic is reported for continuous variables and the variance across subgroups was assessed using Levene's robust test statistic for equality. When necessary, the Fisher's exact test was used for small cell counts with <10 observations. Two multivariable parametric binary logistic regression models were constructed to test the association of racial and ethnic subgroups with the outcome of postoperative SAH diagnosis. Pairwise comparisons were conducted across the subgroups and adjusted for multiple comparisons using the Bonferroni correction method. The odds ratios (ORs) are presented with 95% confidence intervals (CIs). The likelihood ratio test was implemented to compare the goodness of fit between the logistic regression models and $P < 0.05$ were considered statistically significant.

RESULTS

Demographic and Baseline Characteristics

From 2008 to 2013, 686 patients met the inclusion and exclusion criteria. There were no primary endovascular cases reported, as these codes are not yet considered major surgical procedures according to the ACS-NSQIP database. The 4 ethnic and racial subgroups that were identified included: non-Hispanic Whites ($n = 504$, 73.47%, NH Whites), Hispanic Whites ($n = 38$, 5.54%, H Whites), non-Hispanic Blacks ($n = 109$, 15.89%, NH Blacks), and non-Hispanic Asians ($n = 35$, 5.10%, NH Asians). **Figure 1** shows the number of patients by admission year for each subgroup. There were 659 patients (96.06%) with an ICD-9 postoperative diagnosis of SAH or unruptured intracerebral aneurysm.

Significant associations were found between ethnic and racial subgroups and the following baseline variables: age, gender, body mass index, smoking, and treated hypertension (all $P < 0.01$; **Table 1**). There were 487 (71.09%) female patients. Black patients were the youngest (mean age, 52.15 years, standard error = 1.08) with the highest proportion of female gender (85.32%), obesity (47.17%), current smoking status (52.29%), and treated hypertension (71.56%). When NH Blacks were compared with the NH Whites alone, significant differences were found in age ($P < 0.001$), female gender ($P < 0.01$), treated hypertension ($P < 0.01$), and obesity ($P = 0.01$).

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