Rate of Use and Determinants of Withdrawal of Care Among Patients with Subarachnoid Hemorrhage in the United States

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■ BACKGROUND: **The use of "withdrawal of care" and impact upon outcomes among patients with subarachnoid hemorrhage (SAH) is not well studied.**

■ OBJECTIVE: **To identify the rate and determinants of "withdrawal of care" among SAH patients.**

■ METHODS: **We determined the frequency of "withdrawal of care" and compared the demographic, clinical characteristics, and in-hospital outcomes among patients with SAH stratified by use of "withdrawal of care."**

■ RESULTS: **"Withdrawal of care" during hospitalization was instituted in 8912 (3.4%) of the 266,067 patients with SAH. In the stepwise logistic regression, age >65 (odds ratio [OR] 4.5, 95% confidence interval [95% CI] 3.3—6.1), women (OR 1.2, 95% CI 1.0—1.3), African American (OR 0.7, 95% CI 0.5—0.8), Hispanic ethnicity (OR 0.4, 95% CI 0.3—0.6), renal failure (OR 1.6, 95% CI 1.2—1.9), intracerebral hemorrhage (OR 2.0, 95% CI 1.7—2.4, All Patient Refined Diagnosis-Related Groups severity score of extreme loss of function (OR 40.1, 95% CI 6.0—270.7), All Patient Refined Diagnosis-Related Groups severity score of severe loss of function (OR 15.0, 95% CI 2.1—103.8), insurance status of private health maintenance organization (OR 0.7, 95% CI 0.5—0.9), and hospital region south United States (OR 0.7, 95% CI 0.5—0.8), were significant predictors of "withdrawal of care" among patients with SAH. In-hospital mortality was significantly greater, but mean hospitalization charges and length of stay were significantly lower among those with "withdrawal of care."**

■ CONCLUSIONS: **Although "withdrawal of care" was effective in limiting hospital charges and resource use, caution is needed to avoid disproportionately high mortality. The prominent relationship between race/ethnicity, insurance status, and hospital location with "withdrawal of care" raises concerns that factors other than severity of disease influence decision making.**

Several studies have looked at do not resuscitate and withdrawal of care practices among patients with ischemic stroke and those with intracerebral hemorrhage (ICH) (1, 17, 20, 21, 23, 25, 30); however, data are limited regarding withdrawal of care in patients with subarachnoid hemorrhage (SAH) (10). The hospital charges for SAH admissions are 2-fold greater than admissions for ICH and 4-fold greater than admissions for ischemic stroke (16). Patients with SAH have greater than 2-fold greater odds of withdrawal of mechanical ventilation compared with other patients admitted in a neurocritical care unit (6). Discrepancies in hospital charges and Medicare reimbursement associated with endovascular and surgical treatment have increased over the decade (9). Therefore, national data regarding withdrawal of care practices among patients with SAH is of considerable importance because of its relationship to hospital charges and resource use. We performed this study to identify the rate and determinants of "withdrawal of care" among patients with SAH at a national level.

MATERIALS AND METHODS

The analysis was based on data files from Nationwide Inpatient Sample (NIS), 2002—2010. NIS is the largest all payer database in the United States and contains information on patient demographic and clinical characteristics, in-hospital procedures, hospital

Key words
- Mortality
- Palliative care
- Subarachnoid hemorrhage
- Withdrawal of care

Abbreviations and Acronyms
APRDRG: All Patient Refined Diagnosis-Related Groups
CI: Confidence interval
DNR: Do not resuscitate
ICD-9-CM: *International Classification of Diseases*, 9th Revision, Clinical Modification
ICH: Intracerebral hemorrhage
NIS: Nationwide Inpatient Sample
OR: Odds ratio
SAH: Subarachnoid hemorrhage

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characteristics, and discharge outcomes. A comprehensive synopsis on NIS data is available at http://www.hcup-us.ahrq.gov.

We used the *International Classification of Diseases*, 9th Revision, Clinical Modification (ICD-9-CM) primary diagnosis codes 430 (recommended by Joint Commission) (13) to identify patients admitted with SAH. We also used ICD-9-CM procedure code V66.7 (palliative care, end-of-life care, hospice care, or terminal care) to identify the patient who received "withdrawal of care." We had determined the accuracy of the code in a previous analysis. We compared the documentation in the medical records and the use of code V 66.7 in 100 consecutive patients (March 2010–June 2012) with stroke at 2 University affiliated teaching hospitals. The sensitivity and specificity values were 81% and 97%, respectively (20).

Study variables included were patient's age, sex, race/ethnicity, and comorbidities obtained from the Agency for Healthcare Research and Quality comorbidity data files, including diabetes mellitus, hypertension, congestive heart failure, renal failure, chronic lung disease, alcohol abuse, and coagulopathy. Patients also were categorized based on insurance status into Medicare/Medicaid, private/health maintenance organization, or no insurance. ICD-9-CM secondary diagnosis codes were used to identify patients with atrial fibrillation (427.3), nicotine dependence (305.1), dyslipidemia (272.0), aphasia (784.3), hemiplegia/hemiparesis (342), and clinical trial participation (V70.5 and V70.7). ICD-9-CM secondary diagnosis codes were used to identify those with SAH associated complications such as hydrocephalus (331.3 and 331.4), hyponatremia (276.1), hypernatremia (276.0), pulmonary edema (518.4), myocardial ischemia (410.0-410.9), pneumonia (486, 481, 482.8, and 482.3), urinary tract infection (599.0, 590.9), sepsis (995.91, 996.64, 995.92, and 999.3), deep venous thrombosis (451.1, 451.2, 451.81, 451.9, 453.1, 453.2, 453.8, and 453.9), ICH (431-432), and pulmonary embolism (415.1).

We also used procedure codes to estimate the percentage of patients with SAH who underwent in-hospital procedures such as cerebral angiography (88.41), intubation (96.04), mechanical ventilation (96.72), endovascular treatment (39.71-39.79), surgical treatment (39.51 and 39.52), angioplasty for vasospasm (00.62 and 39.50), cerebrospinal fluid/ ventriculoperitoneal shunt (54.95, 02.41, and 02.42), tracheostomy (31.20-31.29), transfusion (99.04), and gastrostomy (431.1-431.9). The All Patient Refined Diagnosis-Related Groups (APRDRG) severity of illness quantifies the extent of physiologic decompensation or organ system loss of function (26) based on principal and secondary ICD-9-CM diagnoses codes, procedures codes, age, sex, and discharge disposition. These data elements are combined together on a patient-specific basis to determine patient's severity of illness.

Hospitals were categorized by geographic region in United States as Northeast, Midwest, West, and South. The admitting hospitals were classified as teaching or nonteaching; teaching hospitals were those which have a residency program approved by the American Medical Association or have membership in the Council of Teaching Hospitals (19). The hospitals were further characterized into small, medium, and large sized on the basis of available hospital beds; the thresholds for stratification are based on hospital's location and teaching status. For example, the definition of large size may vary from exceeding 325 to exceeding 450 acute hospital beds depending upon the location and characteristics of the hospital.

We determined the length of stay and hospital charges (amount billed for services, but not the specific amounts received in payment). The charges therefore include hospital overhead costs, charity care, and bad debt, among other costs but not physicians' professional fees. Discharge status was categorized into routine, home health care, short-term hospital, other facility including intermediate care and skilled nursing home, or death in NIS. We categorized routine discharge as none to minimal disability, any other discharge status as moderate to severe disability as previously described (18).

Statistical Analysis

The SAS 9.1 software (SAS Institute, Cary, North Carolina, USA) was used to convert NIS database data into weighted counts to generate national estimates, following Healthcare Cost and Utilization Project recommendations (8). We performed univariate analysis, χ^2 for categorical, and t test for continuous variables to identify differences in study variables and end points between patients with or without "withdrawal of care." We adjusted for multiple comparisons by using Bonferroni correction. A logistic regression analysis was used to identify the association between patient and hospital characteristics and odds of "withdrawal of care." All variables that were significant in the univariate analysis were added as "predictor variables" to stepwise wise logistic regression model. These variables were retained in the final model if *P* value was <0.1. We also performed a trend analysis to determine any change in annual rates of "withdrawal of care" from 2002 through 2010 using Cochran-Armitage trend test.

RESULTS

Withdrawal of care during hospitalization was instituted in 8912 (3.4%) of the 266,067 patients with SAH. There was no difference in the rate in use of "withdrawal of care" according to size of hospital and teaching status (**Table 1**). The rate of "withdrawal of care" use was greater in hospitals located in West region of the United States ($P = 0.04$). The mean age ± standard deviation of the patients who underwent "withdrawal of care" was significantly greater (70 ± 16 years vs 57 ± 17, $P < 0.001$). Women and white patients were more likely to have "withdrawal of care" during hospitalization. Patients with Medicare/Medicaid insurance were more likely to have "withdrawal of care." The proportion of patients with atrial fibrillation or those with renal failure was significantly greater among patients who underwent "withdrawal of care" compared with those who did not. There were no differences in the rates of pneumonia, sepsis, or pulmonary embolisms between the 2 groups. The rate of intubation and mechanical ventilation were significantly greater among patients who underwent "withdrawal of care." The rate of use of both endovascular (12% vs 19%, $P < 0.001$) and surgical (9% vs 21%, $P < 0.001$) for intracranial aneurysm were significantly lower among patients with "withdrawal of care." In-hospital mortality (80% vs 21%, $P \leq 0.0001$) was significantly greater but mean hospitalization charges ($82,170 ± 125,787 vs $124,456 ± 148,956, $P < 0.001$) and length of stay (6 ± 8.8 vs 12 ± 13.8 days, $P < 0.0001$) were significantly lower among those with "withdrawal of care."

In the stepwise logistic regression (**Table 2**), age >65 (odds ratio [OR] 4.5, 95% confidence interval [CI] 3.3–6.1), women

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