Demographics and Short-Term Outcomes of Spontaneous Subarachnoid Hemorrhage in Young Adults

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OBJECTIVE: **Spontaneous subarachnoid hemorrhage (SAH) is a catastrophic disease with a high mortality. Although it is associated with poor prognosis in older patients, the socioeconomic consequences in younger patients with stroke may be more severe. We aimed to focus on the demographics and short-term outcomes of SAH in a population younger than 50 years.**

METHODS: **We retrospectively enrolled 1689 patients with a primary diagnosis of SAH from 1993 to 2010. We identified intergroup differences in clinical variables between the patients aged 18–49 years (n = 531) and those aged ≥50 years (n = 1158).**

RESULTS: **The patients with SAH included 688 men and 1001 women (an overall male/female ratio of 1:1.45), of whom 31.4% were aged 18–49 years. Men comprised 53.5% of the younger patients and 34.9% of the older patients (P < 0.01). The post-SAH sequela of hemiplegia was more common in the younger patients (P < 0.01), whereas the incidences of in-hospital mortality in the younger and older groups were 25.4% and 32.4%, respectively (P < 0.01).**

CONCLUSIONS: **Adults younger than 50 years account for a significant portion of the population with SAH. There is a male predominance in this age group, probably related to early and substantial risk exposure. Although younger age imparts a higher probability of survival, it is also accompanied by a greater incidence of resultant sequelae. A better understanding of the age-related variability of SAH will assist in guidance for public health and adjustment of clinical management.**

INTRODUCTION

Spontaneous subarachnoid hemorrhage (SAH), a subtype of hemorrhagic stroke, is a catastrophic disease with a high rate of early mortality of 20%–40%.[1,2] Even survivors usually have neurologic deficits in memory, communication, or cognition and cannot regain independence because of their disabilities.[3] An epidemiologic study has shown that SAH occurs more frequently in elderly people, and during recent decades, the mean age of the population with disease has increased from 52.9 to 56.6 years.[4] Although old age is associated with poor outcomes after SAH,[5,6] stroke may result in more substantial impacts on socioeconomic consequences in younger patients. Because young adults are in the early stages of building their careers and have a long life expectancy, premature death from SAH is a tremendous loss financially. The adverse effects of SAH sequelae are also long lasting to diminish the patient's quality of life and increase the burden on their families. Many studies have reported the prognosis of ischemic stroke and intracerebral hemorrhage at a young age,[7-9] but only limited data are available to characterize young-onset SAH despite the more complicated behaviors of SAH.

A better understanding of age-related variability in patients with SAH could help in guiding public health and in adjusting clinical management. The aim of this study, therefore, was to establish the incidence, clinical manifestations, and in-hospital morbidity and mortality of spontaneous SAH in adults aged <50 years.

METHODS

Patient Selection

This study was conducted at a tertiary medical center in Taiwan with a 22-bed neurosurgical intensive care unit. The study design was retrospective and delinked, and informed consent of patients

Key words
- Mortality
- Outcome
- Subarachnoid hemorrhage
- Young

Abbreviations and Acronyms
CSF: Cerebrospinal fluid
ICD-9-CM: *International Classification of Diseases, Ninth Revision, Clinical Modification*
SAH: Spontaneous subarachnoid hemorrhage

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was not required after approval by the institutional review board. We retrieved medical records from the administrative database, which provides the following information: sex; age; marital status; dates of admission and discharge; diagnostic codes based on the *International Classification of Diseases, Ninth Revision, Clinical Modification* (*ICD-9-CM*); procedure codes; discharge type; and related data. A total of 1843 hospital admissions with a primary diagnosis of SAH (*ICD-9-CM* code 430) were initially identified from 1993 to 2010. We excluded patients who were readmitted, aged <18 years, or who had incomplete medical documents. A total of 1689 adult patients with SAH were enrolled for analysis and divided into the following 2 age groups: <50 years and ≥50 years (Figure 1).

Baseline Characteristics

For each patient, we examined baseline information, including demographic features, year and season of disease onset, length of hospital stay, and comorbidities of hypertension (*ICD-9-CM* codes 4010–4059), diabetes mellitus (*ICD-9-CM* codes 2500–2509), hyperlipidemia (*ICD-9-CM* codes 2720–2724), coronary artery disease (*ICD-9-CM* codes 4140–4149), heart failure (*ICD-9-CM* codes 4280–4289), chronic pulmonary disease (*ICD-9-CM* codes 490–505), chronic kidney disease (*ICD-9-CM* codes 585–586), and liver disease (*ICD-9-CM* codes 570–573). Major therapeutic managements were recorded; these included blood product (whole blood, packed cells, platelets, coagulation factors, or serum) transfusion (procedure codes 9903–9907), surgical treatments for cerebral aneurysms (procedure codes 3951–3952), and endovascular interventions for cerebral aneurysms (procedure code 3979).

Outcome Evaluation

The outcomes focused on in this study were in-hospital mortality and morbidities. Medical complications included hypernatremia or hyperosmolarity (*ICD-9-CM* code 2760), hyponatremia or hyposmolarity (*ICD-9-CM* code 2761), hyperpotassemia (*ICD-9-CM* code 2767), hypopotassemia (*ICD-9-CM* code 2768), anemia (*ICD-9-CM* codes 2851 and 2859), gastrointestinal tract hemorrhage (*ICD-9-CM* codes 5780–5789), acute kidney failure (*ICD-9-CM* codes 5845–5849), pneumonia (*ICD-9-CM* codes 481–486), and urinary tract infection (*ICD-9-CM* code 5990). Neurologic complications included central nervous system infection (*ICD-9-CM* codes 3200–3249), hydrocephalus (*ICD-9-CM* codes 3313–3314), cerebral ischemia or infarction (*ICD-9-CM* codes 4330–4371), convulsion (*ICD-9-CM* code 7803), and hemiplegia (*ICD-9-CM* codes 3420–3429).

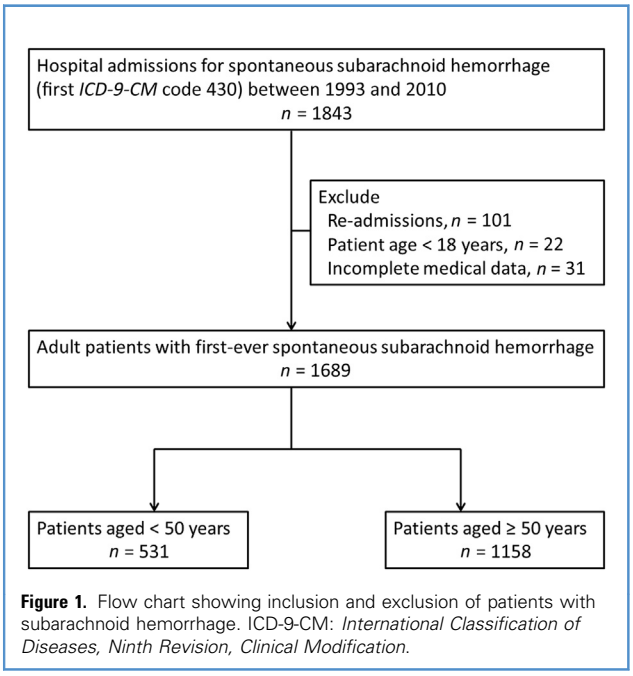

Figure 1. Flow chart showing inclusion and exclusion of patients with subarachnoid hemorrhage. ICD-9-CM: *International Classification of Diseases, Ninth Revision, Clinical Modification.*

Statistical Analysis

We analyzed data with SPSS software (version 20.0 [IBM Corp., Armonk, New York, USA]). Parameters were presented as numbers (percentage) or as a mean ± standard deviation. Intergroup differences were assessed using the χ^2 test or Fisher exact test for categorical variables and the Student t test for continuous variables. A Kaplan-Meier survival curve was constructed and compared using the log rank test. Statistical significance was defined as $P < 0.05$.

RESULTS

The 1689 patients with first-ever spontaneous SAH included 688 men and 1001 women. The mean age at the time of diagnosis was 57.0 ± 14.5 years (range, 18–93 years). The mean length of hospital stay was 15.5 ± 15.1 days (range, 1–178 days), and the patients' underlying diseases were as follows: 540 (32.0%) hypertension, 114 (6.7%) diabetes mellitus, 16 (0.9%) hyperlipidemia, 14 (0.8%) coronary artery disease, 10 (0.6%) heart failure, 19 (1.1%) chronic pulmonary disease, 19 (1.1%) chronic kidney disease, and 38 (2.2%) liver disease. Of these patients, 607 (35.9%) underwent surgical treatments and 172 (10.2%) underwent endovascular interventions for cerebral aneurysms. There were 411 patients (24.3%) who received blood product transfusions.

Among the study cohort, 531 patients (31.4%) were aged 18–49 years. The mean age was 40.2 ± 7.1 years in the younger group and 64.7 ± 9.7 years in the older group. Statistical analysis showed significant intergroup differences in the following clinical parameters: sex ($P < 0.01$); marital status ($P < 0.01$); hypertension ($P < 0.01$); diabetes mellitus ($P < 0.01$); coronary artery disease ($P < 0.01$); heart failure ($P = 0.04$); chronic pulmonary disease ($P = 0.01$); and blood product transfusion ($P < 0.01$) (Table 1). To clarify the relationship between sex and age, we further stratified patients into 4 subgroups based on age (≤39, 40–49, 50–59, and ≥60 years), and the male/female ratio was greatest in the youngest age group (Figure 2). The length of hospital stay did not differ significantly between the younger and older groups ($P = 0.45$).

Type-specific frequencies of post-SAH morbidities during hospitalization were compared between the 2 main age groups (Table 2). There were significantly lower rates of hypopotassemia ($P < 0.01$) and anemia ($P = 0.02$) in the younger group, and this group had fewer general hospital-acquired infections, including pneumonia and urinary tract infections ($P < 0.01$ for both). Hydrocephalus, including obstructive or communicating types, was recorded in 17.9% of the younger group and 29.6% of the older group ($P < 0.01$). In contrast, the sequela of hemiplegia was found