



Clinical Study

The incidence, hospital expenditure, and, 30 day and 1 year mortality rates of spontaneous intracerebral hemorrhage in Taiwan

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ABSTRACT

The risks of morbidity and mortality are high in patients with spontaneous intracerebral hemorrhage (sICH). The medical care resources associated with sICH are also substantial. This study aimed to evaluate the medical expenditure for sICH patients in Taiwan. We analyzed the National Health Insurance Research Database from 2005 to 2010. The inclusion criterion was first-event sICH; traumatic ICH patients were excluded. Student's *t*-test, multiple linear regression and the chi-squared test were employed as the statistical methods. Our results showed that the incidence of sICH was 40.77 patients per 100,000 of population per year in Taiwan. The incidence increased with age and was greater in men than women. The mean hospital length of stay (LOS) of first-event sICH patients was 31.8 days; the mean LOS in the intensive care unit was 7.9 days; and the mean survival time was 60.4 months. The mortality rate within 30 days and within 1 year was 19.8 and 29.6%, respectively. The mean hospital expenditure of first-event sICH patients was USD\$7572, and was highly correlated with LOS. In conclusion, the incidence of sICH in Taiwan is higher than that in white and black populations of northern America and some European countries and lower than that in the Asian populations of Japan and China. The features of male and female sICH patients differ. Our findings suggest that the hospital expenditure and mortality rate of sICH patients in Taiwan are comparable with those of other countries.

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1. Introduction

Although modern medical treatment has progressed significantly, patients with spontaneous intracerebral hemorrhage (sICH) not only suffer from high mortality and morbidity rates, but also incur a high medical expenditure.¹ The incidence of intracerebral hemorrhage ranges from 10 to 60 patients per 100,000 of population per year and varies by sex, age and ethnic group.^{2–7} sICH accounts for 10–35% of stroke patients.^{2,3,8–10} The annual mortality rate of sICH is around 50%; this varies from country to country.^{1,5,11,12} Because sICH is an age-related disease, and the size of the aging population has been increasing in recent years, the economic impact of sICH is significant.¹³ This study used Taiwan National Health Insurance (NHI) data to evaluate the incidence and medical expenditure of sICH in Taiwan and to make a comparison with sICH-related medical costs globally.

2. Methods

This research was based on the Longitudinal Health Insurance Database (LHID2005) retrieved from the National Health Insurance Research Database (NHIRD), from 2005 to 2010. One million insured people were randomly selected from all NHI registered people in 2005. The dataset used in this study covers outpatient and inpatient claims data, with detailed information for each visit/stay. The registry file for the one million beneficiaries was processed to identify the demographic data.¹⁴

The inclusion criterion of patients in this research was first-event sICH, identified by a principal diagnosis in the International Classification of Diseases Ninth Revision (ICD-9) of 431. There were 2507 sICH patients registered from 2005 to 2010 in total. Patients who were admitted due to traumatic intracranial hemorrhage (ICD-9 codes 800.00 to 804.99, 850.00 to 854.19, 959.01, and 959.09) were excluded. Sixty-one patients were excluded based on the above exclusion criterion, leaving a final study sample of 2446 patients who were first-event sICH patients registered between 2005 and 2010. The flow chart of data management is shown in Fig. 1.

Information on patients' sex, age, date of admission and discharge, date of mortality (if any), Intensive Care Unit (ICU) utilization, brain

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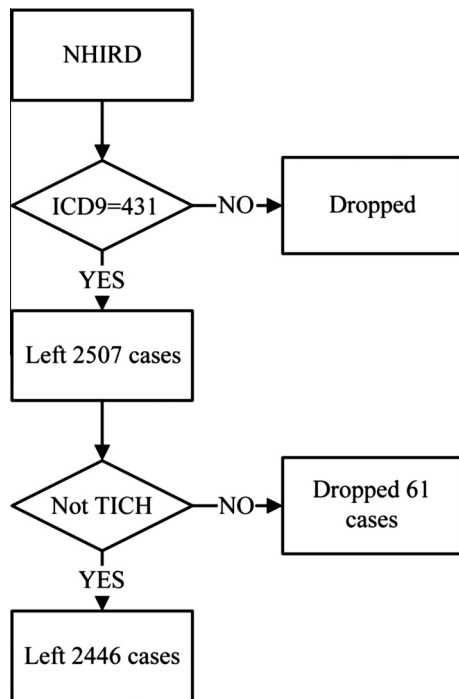


Fig. 1. Flow chart showing the management of data from the National Health Insurance Research Database (NHIRD) database for the purposes of this study. ICD9 = International Classification of Diseases Ninth Revision, TICH = traumatic intracerebral hemorrhage.

surgical interventions and total hospital admission fee was collected. Brain surgical interventions were defined as single-level Clinical Classification Software (Healthcare Cost and Utilization Project, Rockville, MD, USA) procedure category labels 1 and 2.

Student's *t*-test was used for continuous data. The chi-squared test was used for categorical data. Multiple regression models were used to assess the correlation between length of hospital stay (LOS) and total hospital admission fee. The statistical analysis was conducted using the Statistical Package for the Social Sciences version 12.0 (SPSS Inc., Chicago, IL, USA). Statistical significance was defined as $p < 0.05$. Data are presented as mean \pm standard deviation unless otherwise stated.

3. Results

In total, 2446 patients were identified in the NHIRD dataset from 2005 to 2010, including 1534 men and 912 women. The

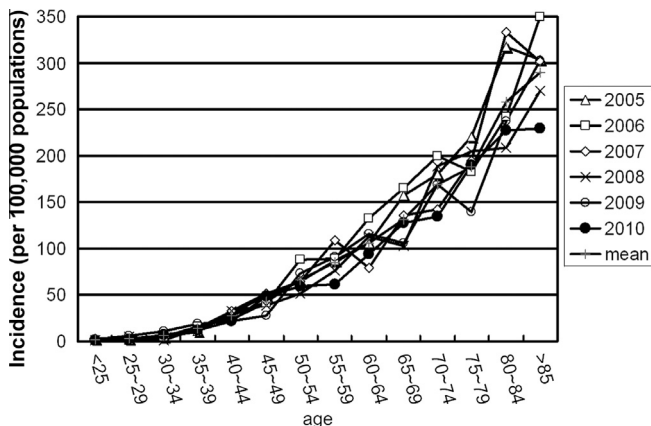


Fig. 2. Graph showing the incidence of spontaneous intracerebral hemorrhage by age between 2005 and 2010.

Table 1

Sex-specific characteristics of spontaneous intracerebral hemorrhage patients in Taiwan

	Male	Female	All
Number of patients	1534	912	2446
Age ^{***}	60.6 (14.7)	66.8 (15.2)	62.9 (15.1)
Hospital stay (days)	32.6 (65.9)	30.3 (66.3)	31.8 (66.0)
ICU stay (days)	7.8 (13.7)	8.1 (14.9)	7.9 (14.2)
Surgical intervention rate [*]	36.0%	31.3%	34.2%
Survival time (months)	61.5 (1.1)	58.5 (1.5)	60.4 (0.9)
Mortality rate (<30 days)	19.2%	20.7%	19.8%
Mortality rate (<1 year)	28.6%	31.5%	29.6%

Data are presented as mean (standard deviation) or percentage.

ICU = intensive care unit.

^{*} $p < 0.05$.

^{***} $p < 0.001$.

incidence of sICH was 40.77 patients per 100,000 of population per year in this study. The mean age of the first-event sICH patients was 62.9 years (± 15.1). It was also found that the female patients were 6.2 years older than the male patients on average ($p < 0.001$). The incidence of sICH increased continuously with age. There were no significant differences among different years of diagnosis. The incidence equation by age was:

$$\text{Incidence} = (0.0001) \times (\text{Age})^{3.2402} - R^2 = 0.9541 \text{ (Fig. 2)}.$$

The mean admission LOS of the first-event sICH patients was 31.8 (± 66.0) days. The mean ICU LOS of the first-event sICH patients was 7.9 (± 14.2) days. There were no significant differences in the admission LOS and ICU LOS between the sexes. The rate of brain surgical intervention during admission for first-event sICH patients was 26.6%, and there was no significant difference in the surgical rate between the sexes. The total mean survival time was 61.5 months. The mortality rate within 30 days and within 1 year was 19.8% and 29.6%, respectively. There was no significant difference between the sexes (Table 1).

The mean total admission fee was USD\$7572 ($\pm 12,891$). The admission fee was highly correlated with LOS. The equation of the multiple regression model for ICU LOS and ordinary ward LOS was:

$$\text{Admission fee} = 6752 + 15,765 \times (\text{ICU days}) + 4014 \times (\text{ordinary ward days}) \text{ and } R^2 = 0.915.$$

This study divided total admission fee into four groups: room fees (USD\$ 2458, 32.5%); drugs fees (USD\$908, 12.0%); surgical fees (USD\$473, 6.3%) and other fees (USD\$3732, 49.3%).

The patients who died within 1 year (66.5 \pm 15.2 years) were older than the patients who lived for more than 1 year (61.4 \pm 14.7 years; $p < 0.001$). The mean admission LOS of the patients who died within 1 year (22.8 \pm 39.9 days) was shorter than that of the patients who lived for more than 1 year (35.5 \pm 74.0 days; $p < 0.001$). In contrast, the mean ICU LOS of the patients who died within 1 year (10.4 \pm 18.0 days) was longer than that of the patients who lived for more than 1 year (6.9 \pm 12.0 days; $p < 0.001$). The brain surgical intervention rate of the patients who died within 1 year (38.3%) was higher than that of the patients who lived for more than 1 year (32.5%; $p < 0.01$). There was no significant difference in the total admission fee between the patients who died within 1 year (USD\$7688 \pm 11,136) and the patients who lived for more than 1 year (USD\$7523 \pm 13,565; Table 2).

The patients who died within 1 month (64.4 \pm 16.0 years) were older than the patients who lived for more than 1 month (62.6 \pm 14.9 years; $p < 0.05$). The mean admission LOS of the patients who died within 1 month (6.8 \pm 6.7 days) was significantly shorter than that of the patients who lived for more than 1 month (37.9 \pm 72.3 days; $p < 0.001$). In addition, the mean ICU LOS of the

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