Clinical Characteristics of Stroke among Chinese in New York City

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Background: Limited information exists on clinical characteristics of stroke among Chinese persons living in the United States. We compared the clinical characteristics of Chinese and White stroke patients living in New York City.

Methods: We reviewed the medical records of stroke patients hospitalized at NYU Downtown Hospital from January 1995 to July 1998.

Results: During 3.5 years, there were 728 admissions for stroke (454 Chinese, 115 Whites, 75 Blacks, 80 Hispanics, and 4 other Asia). Chinese and White patients had similar age and gender distributions. Compared with Whites, Chinese patients had a lower body mass index (22.8 vs 25.8, respectively, $P=0.02$), were less likely to smoke (13% vs 20%, respectively, $P<0.01$), or regularly consume alcohol (8% vs 25%, respectively, $P<0.01$). Although recorded blood pressure was similar, Chinese patients were more likely than Whites to have a history of hypertension (77% vs 64%, respectively, $P=0.03$), left ventricular hypertrophy (37% vs 25%, respectively, $P=0.02$), history of diabetes (33% vs 21%, respectively, $P=0.01$), and higher levels of blood lipids and glucose. Chinese patients were more likely than Whites to have hemorrhagic stroke (24% vs 17%, respectively, $P=0.02$). Overall age-adjusted in-hospital mortality rate was 14.2%, and no significant difference was observed between Chinese and Whites (13.8% vs 14.8%, respectively, $P=0.1$). For both races, hemorrhagic stroke was far more likely to be fatal than ischemic stroke (34.5% vs 6.1%, respectively, $P<0.001$). Factors associated with in-hospital death included systolic blood pressure, blood glucose level, history of coronary heart disease, and diabetes.

Conclusions: Chinese patients who suffered a stroke showed higher risk profiles, and were more likely to experience a more lethal hemorrhagic stroke, compared to White patients. The short-term in-hospital survival rates were similar between Chinese and White patients with stroke. (*Ethn Dis*. 2004;14:378–383.)

Key Words: Chinese, In-hospital Death, Stroke

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Introduction

Stroke is the third leading cause of death in the United States, after heart disease and cancer.[1] The epidemiology of stroke has been widely studied among White and Black populations.[2–7] Although Chinese are among the fastest growing race/ethnicity groups in the United States, with a stroke mortality rate similar to those of New York City Whites,[8] little is known about the risk factors and clinical characteristics of stroke among Chinese Americans. The epidemiologic studies of stroke within the Chinese population have been primarily conducted in mainland China, Taiwan, and Hong Kong.[9–13] Risk factor profiles observed among Whites or Blacks, or among Chinese in Asia, do not necessarily represent risk factors observed among Chinese Americans. Moreover, stroke types differ by race/ethnicity, with Blacks and Chinese more likely to experience hemorrhagic (intracranial and sub-arachnoid) and lacunar strokes, while Whites are more likely to experience embolic and extra-cranial obstructive vascular disease.[5,14–16]

To determine the clinical characteristics of Chinese patients with different stroke sub-types, and the factors associated with in-hospital mortality among Chinese in New York City, we reviewed the medical records of Chinese patients admitted to NYU Downtown Hospital with stroke, and have now compared the characteristics of stroke among Chinese and White patients in the same hospital.

Methods

Site and Patients

NYU Downtown Hospital is a community hospital serving the lower Manhattan population. It is a major in-hospital health service resource for the New York City Chinese community. Because of the hospital's proximity to NYC Chinatown, and its emphasis on serving the community, approximately 65% of NYU Downtown Hospital patients are Chinese.

The diagnosis of stroke were based on the following criteria: rapid onset of persistent neurologic deficit attributable to an obstruction or rupture of the arterial system, which is not known to be secondary to brain trauma, tumor, infection, or other non-ischemic cause; symptoms lasting more than 24 hours; and absence of other disease process causing neurologic deficit such as neoplasm, subdural hematoma, cerebral angiography, or metabolic disorder. A diagnosis of stroke was confirmed in all cases with brain computed tomography (CT). The stroke type was categorized as either intra-cerebral hemorrhagic (ICD-9 431–432), or ischemic stroke (ICD-9 433–434 and 437.0–437.2).

Measurements

A detailed medical record, including medical history, acute stroke presentation, physical and neurological findings, clinical course, outcome, and laboratory results, was retrospectively abstracted from the NYU Downtown Hospital medical chart for each patient.

A standardized data sheet was created to record the demographic characteristics, including age, gender, race, and medical history, including history of hypertension, diabetes mellitus, coronary

. . . little is known about the risk factors and clinical characteristics of stroke among Chinese Americans.

heart disease, previous stroke or transient ischemic attack, and atrial fibrillation. Data regarding current disease, including weight, height, blood pressure, levels of cholesterol, triglycerides, and blood sugar level, white blood cell count, platelet count, and left ventricular hypertrophy on EKG were abstracted from medical records. Smoking status was defined as current smoker (smoking within the past 12 months), ex-smoker (former smoker who has not smoked for 12 months), and non-smoker (smoked fewer than 100 cigarettes in lifetime). Alcohol users were defined by the consumption of more than one drink per week. Complications of stroke were recorded if the patient developed the following conditions during hospitalization: infection (chest, and urinary tract); deep-vein thrombosis and pulmonary embolus; gastrointestinal bleeding; falls and fractures; skin ulcer; depression; cognitive impairment; painful shoulders; epileptic seizure. Hospital discharge vital status was defined as alive or dead.

Statistical Analysis

Clinical characteristics were compared using chi-square for categorical variables and *t* tests for continuous variables between Chinese and White patients. Chinese patients were further stratified into hemorrhagic and ischemic stroke, and the clinical characteristics were compared between the 2 groups. Age-adjusted in-hospital death rates were then compared among Chinese and White patients, as well as by different type of stroke (hemorrhagic and ischemic), using the 1990 New York City population as the standard.

Table 1. Clinical characteristics of stroke patients by race/ethnicity

	Chinese	Whites	*P* Value
Patient number	454	115	
Age (years)	71.4±11.9	71.7±13.8	.97
Male (%)	51	54	.24
BMI (kg/m^2)	22.8±3.8	25.8±5.0	.02
SBP (mm Hg)	155±30.5	155±30.4	.98
DBP (mm Hg)	87±16.2	86±16.0	.86
Cholesterol (mg/dl)	204±29.6	192±24.2	.01
Triglyceride (mg/dL)	131±14.5	126±14.7	.05
Glucose (mg/dl)	161±18.2	145±17.1	<.01
Current smoker (%)	13	20	<.01
Drink alcohol (%)	8	25	<.01
History of IHD (%)	28	46	<.01
History of diabetes (%)	33	21	.01
Hypertension (%)	77	64	.03
Complications of stroke (%)	53%	36%	.01
White blood cell (/mm^3)	9850±2816	9401±1629	.07
LVH on EKG (%)	37	25	.02
Atrial fribration on EKG (%)	17	20	.59
Hemorrhagic stroke (%)	24	17	.02

Logistic regression models were constructed to predict the factors associated with in-hospital death among stroke. In these models, in-hospital death was entered as a dependent variable, with predictive variables including other clinical characteristics, as well as the available demographic characteristics. Race was in the models with Chinese as the reference. Further, the same models were constructed separately for hemorrhagic and ischemic stroke.

RESULTS

During 3.5 years, 728 stroke patients were hospitalized. The mean age was 70 years (standard deviation = 13), and 52% were males. Of these, there were 454 Chinese (62%), 115 Whites (16%), 75 Blacks (10.3%), 80 Hispanics (11%), and 4 other Asians (0.5%). Chinese patients were approximately the same age as White patients (71.4 vs 71.7 years, respectively) and both were significantly older than Black (62.9 years) and Hispanic (64.0 years) patients. Due to relatively small numbers of Black and Hispanic patients, the current analysis was limited to Chinese and White patients.

Clinical Characteristics

Age, gender, and blood pressure distributions were similar between Chinese and White patients (Table 1). Although Chinese patients were less likely to be obese, smokers, or regular alcohol drinkers, and were less likely to have ischemic heart disease, they were more likely to exhibit higher levels of cholesterol, triglycerides, and blood glucose, and were more likely to have a history of diabetes, hypertension, complications of stroke, and left ventricular hypertrophy on EKG, compared to White patients. There were 110 (24%) and 20 (17%) hemorrhagic strokes among Chinese and White patients, respectively.

The characteristics of hemorrhagic and ischemic stroke among Chinese were compared (Table 2). Patients with hemorrhagic stroke were younger, had higher systolic and diastolic blood pressures and white blood cell counts, and had lower blood glucose levels, compared to patients with ischemic stroke. Although cholesterol levels were similar between patients with hemorrhagic and ischemic stroke, triglyceride levels were significantly lower among patients with a hemorrhagic stroke, compared to those with ischemic stroke. In addition,

Table 2. Characteristics of hemorrhagic and ischemic stroke among Chinese patients

	Hemorrhagic	Ischemic	*P* Value
Patient number	110	334	
Age (years)	68.4±12.2	72.4±13.2	.006
Male (%)	56	49	.28
BMI (kg/m²)	22.8±3.9	22.8±3.8	.953
SBP (mm Hg)	163±33.2	153±31.0	.01
DBP (mm Hg)	91±17.7	86±16.7	.032
Cholesterol (mg/dl)	207±29.7	204±29.6	.659
Glucose (mg/dl)	155±17.9	182±18.2	.023
Triglyceride (mg/dl)	106±14.8	137±15.3	<.001
White blood cell	11666±3284	9296±2530	<.001
Current smoker (%)	13	13	.97
Drink alcohol (%)	10.0	7.6	.53
History of diabetes (%)	20.9	36.9	.001
Hypertension (%)	78.2	76.2	.69
LVH on EKG (%)	47.3	35.8	.033
Complications after stroke (%)	62.7	28.2	<.001
Atrial fribration on EKG (%)	13.6	17.7	.379
Death at discharge (%)	34.5	6.1	<.001

patients with hemorrhagic stroke were more likely to have left ventricular hypertrophy, and less likely to have a history of diabetes. Of particular note is that hemorrhagic stroke patients were substantially more likely to have post-stroke complications, with a significantly higher risk of in-hospital death, compared to patients with an ischemic stroke (Table 2).

In-Hospital Death

Overall, 75 patients died during hospitalization (13.2%). Using the New York City 1990 population as the standard, age-adjusted stroke in-hospital death was 14.2 per 100 patients, overall. Stratifying by type of stroke, in-hospital death was significantly higher among hemorrhagic than ischemic stroke patients (34.5 vs 6.1, respectively, *P*<.001). While Chinese had a lower in-hospital death rate for both hemorrhagic (33.6 vs 40.0, respectively, *P*=.06) and ischemic stroke (4.3 vs 6.4, respectively, *P*=.05), the overall in-hospital death rate was not significantly different between Chinese and Whites (13.8 vs 14.8, respectively, *P*=.1), due to the higher rates of the more lethal hemorrhagic stroke among Chinese.

The clinical characteristics of stroke patients who died in hospital were compared with those who survived (Table 3). Overall, patients who died at discharge had higher systolic blood pressure, glucose levels, and white blood cell count. They were also more likely to exhibit atrial fibrillation and complications after stroke. Other characteristics were similar between patients who died at discharge and those who survived. Stratifying by race did not affect these trends, although the power to detect the differences among Whites was low.

Logistic regression analysis was conducted, with hospital mortality as the dependent variable, while age, race, gender, systolic blood pressure, levels of cholesterol, blood glucose, white blood cell count, history of heart disease, hypertension or diabetes, smoking status, alcohol drinking, and type of stroke, were entered into the models as independent variables (Table 4). Factors associated with in-hospital death among patients with stroke were age, systolic blood pressure, blood glucose, white blood cell count, history of heart disease or diabetes. Of note is the high predictive value of type of stroke—patients with hemorrhagic stroke were at least 5 times more likely to die at discharge than were patients with ischemic stroke. On the other hand, race was not a predictor for in-hospital death.

We then stratified the patients by type of stroke, and determined the risk of in-hospital death for each of the predictive variables by logistic regression analysis. Characteristics associated with increased risk of in-hospital death for both hemorrhagic and ischemic stroke

Table 3. Clinical characteristics among stroke patients who died during hospitalization and those who survived

	Survived	Died	*P* Value
Patient number	494	75	
Age (years)	71.5±12.1	70.4±13.6	0.395
Male (%)	50.2	60.0	0.072
BMI (kg/m²)	23.5±4.5	22.7±4.5	0.221
SBP (mmHg)	153.7±28.7	162.9±39.4	0.015
DBP (mmHg)	86.5±15.3	89.3±16.8	0.167
Cholesterol (mg/dl)	201.4±26.5	209.6±28.7	0.377
Glucose (mg/dl)	149.3±18.3	217.1±19.0	<0.001
Triglyceride (mg/dL)	130.7±17.1	124.3±15.4	0.746
White blood cell	9316±3156	12850±3516	<0.001
Current smoker (%)	14.2	14.7	0.991
Drink alcohol (%)	11.7	10.7	0.763
History of diabetes (%)	30.6	30.7	0.986
Hypertension (%)	74.1	73.3	0.494
LVH on EKG (%)	36.2	36.0	0.969
Complications after stroke (%)	38.5	55.4	<0.001
Atrial fribration on EKG (%)	15.2	33.3	<0.001

Table 4. Odds ratio (95% confidence interval) of in-hospital death among patients with stroke

Variables	Total OR (95% CI)	Ischemic OR (95% CI)	Hemorrhagic OR (95% CI)
Age (=10 years)	1.24 (1.01–1.50)*	1.43 (1.09–1.80)*	1.06 (0.86–1.28)
Gender (male=0)	1.60 (0.83–3.08)	1.36 (0l.51–3.67)	2.17 (0.62–7.53)
Systolic BP (=30 mm Hg)	1.56 (1.33–1.77)*	1.50 (1.11–3.05)*	1.91 (1.42–3.46)*
Blood sugar (=10 mg/dL)	1.27 (1.02–1.54)*	1.54 (1.12–2.06)*	1.19 (0.76–1.82)
Blood cholesterol (=20 mg/dL)	1.26 (0.97–1.59)	1.20 (0.88–1.61)	1.02 (0.69–1.95)
Race (Chinese=0)	1.01 (0.70–1.40)	1.06 (0.50–3.10)	1.34 (0.81–2.12)
White blood cell (=1000 counts)	1.26 (1.06–1.50)*	1.20 (1.03–1.40)*	1.32 (1.05–1.61)*
Coronary heart disease (no=0)	2.01 (1.02–4.19)*	2.17 (0.92–4.89)	0.98 (0.37–5.03)
Diabetes (no=0)	2.64 (1.35–5.20)*	3.02 (1.14–7.89)*	2.23 (0.46–19.98)
Type of stroke (ischemic=0)	5.43 (4.54–6.97)*	—	—

* $P<.05$.

. . . Chinese patients were more likely to have high levels of cholesterol and blood glucose, and to be more likely to have a history of diabetes, hypertension, and left ventricular hypertrophy [than White patients].

were systolic blood pressure and white blood cell counts. Blood sugar and history of diabetes were only associated with in-hospital death for ischemic stroke patients. Of note, again, race was not associated with in-hospital death in either type of stroke.

DISCUSSION

The principal finding of this study is that while Chinese stroke patients had similar age and gender characteristics as White patients, Chinese patients were more likely to have high levels of cholesterol and blood glucose, and to be more likely to have a history of diabetes, hypertension, and left ventricular hypertrophy. In addition, compared with Whites, Chinese patients were obviously more likely to have hemorrhagic stroke. Among Chinese patients, those with hemorrhagic stroke had lower levels of serum triglycerides and blood sugar, higher blood pressure, and more leucocytes, compared to patients with ischemic stroke. Despite these differences in clinical characteristics, in-hospital mortality was similar between Chinese and Whites, after adjusting for clinical characteristics. For both Chinese and White patients, in-hospital mortality rate was significantly higher among those with hemorrhagic stroke, compared to ischemic stroke.

The epidemiology of stroke has been widely investigated in Western countries. Both incidence and mortality rates of stroke have been strongly and positively related to age, hypertension, diabetes, dietary behavior, and cigarette smoking.[2–4] In the United States, most of these studies were conducted among Whites and Blacks. The stroke mortality rates among Asian Americans appear to be comparable to those of White Americans.[17] In a study linking New York City mortality records from 1988 through 1992 to the 1990 United States Census data,[8] we compared cardiovascular mortality rates of Whites and Chinese from New York City, and Chinese in mainland China. We found that New York City Chinese had lower all-cause and total cardiovascular disease mortality than did either New York City Whites or Chinese in China. Coronary heart disease death rates among New York City Chinese were intermediate between Chinese in China (lowest) and New York City Whites (highest). However, stroke mortality rates in New York City Chinese were similar to those of New York City Whites, and both were lower than Chinese in China. In previous studies, Chinese subjects have been observed to have lower blood pressure, cholesterol levels, and lower dietary fat intake, compared to Whites and other Asians.[18,19] Previous reports of clinical characteristics of stroke among Chinese patients have been conducted primarily in Asian countries.[11–13,20–22] To our knowledge, no comparison has previously been made between Chinese and White patients in the United States.

The present analysis, has revealed slight differences in risk profiles between Chinese and Whites with stroke. Chinese patients showed higher risk profiles, characterized by higher levels of cholesterol, triglycerides, and glucose. They were also more likely to have a history of diabetes, hypertension, and left ventricular hypertrophy. The most significant finding is the persisting propensity of Chinese to develop cerebral hemorrhage. Nevertheless, post-stroke in-hospital mortality rates did not differ between Chinese and Whites.

It is possible that genetic differences may contribute to the increased risk of hemorrhagic stroke among Chinese. For example, New York City Chinese, although having an overall stroke mortality rate similar to that of New York City Whites, had substantially higher hemorrhagic, and lower ischemic, stroke death rates, compared to New York City Whites.[8] This stroke pattern is consistent with that seen in mainland China. Therefore, immigration to the United States did not alter the higher relative risk of hemorrhagic stroke for Chinese, but changing the environment reduced overall stroke mortality.

Although obesity, smoking, diabetes,

hyperlipidemia, and hypertension, are the major coronary heart disease risk factors,[23] except for hypertension, their independent associations with stroke risk are not clearly defined.[24] The observed higher cholesterol and glucose levels, as well as higher percentage of patients with diabetes, among Chinese stroke patients, suggest that Chinese patients may have more advanced morbidity status compared to Whites, and they may be less aggressively treated for coronary heart disease risk status than are White patients. In fact, in a health screening among 911 Chinese residents in New York City in 2001, we found that, compared with Whites and Blacks from NHANES III, fewer Chinese knew that they had hypertension, or had been told of having hypertension and among those who knew they had the condition, fewer Chinese were on antihypertensive treatment, or were controlling their blood pressure.[25] Higher blood pressure level, and poor blood pressure control, have been reported to be the primary risk factors for hemorrhagic stroke.[26] However, these data provide no evidence about the detail of treatment and control of hypertension among Chinese Americans.

Earlier studies have revealed that predictors of early mortality of stroke include high blood pressure,[27] older age,[21] elevated blood glucose,[28] and hematocrit.[29] We have found in-hospital mortality to be associated with advanced age, higher levels of blood pressure and blood sugar, increased white blood cell count, and history of diabetes and coronary heart disease. In addition, even though clinical characteristics and stroke outcomes differed between Chinese and White patients, race was not associated with in-hospital death, overall, or in either type of stroke.

It has been reported that a relatively higher white blood cell count predicts increased incidence of stroke.[30,31] We also found that, during the acute stage, patients with a hemorrhagic stroke exhibited higher white blood cell counts than did patients with an ischemic stroke. Moreover, increased white blood cell count was associated with increased in-hospital mortality for patients with both hemorrhagic and ischemic stroke. The exact role played by a higher leukocyte count in acute stroke, and its association with increased risk of mortality, is not entirely clear. However, the increased white blood cell count among patients who died suggested a more severe illness, as well as concurrent infectious diseases.

This study is based on retrospective chart review of hospitalized patients, which produce unavoidable limitations. First of all, we were unable to determine the risk factors associated with stroke, as well as different types of stroke among Chinese and Whites. The risk profile found in the hospitalized patients may also be different from the risk factors found among the general population. For example, the general elderly Chinese population living in North America had lower cholesterol and blood pressure levels, compared to elderly Whites.[19] Secondly, since the data here were based on hospital chart review, we were unable to determine the long-term outcome of these patients. Finally, due to selection bias, patients in this study might not represent general stroke patients in New York City. For example, our White patients were substantially younger than those from the Northern Manhattan stroke study[32] (71 vs 80 year). Nevertheless, considering lack of information available regarding the stroke clinical characteristics among Chinese living in the United States, this primary analysis provided important information for future study.

In summary, there were some differences in risk factors between Chinese and White patients hospitalized for stroke. The well-known propensity for hemorrhagic stroke among Chinese in China appears to persist after immigration to the United States. Moreover, Chinese appear to have less effective risk factor management than Whites, although this did not appear to adversely affect short-term survival.

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