

Stroke among Chinese American in New York City

Sun-Hoo Foo, M.D., FRCP(C), FACP, FAAN

Introduction

Stroke is a devastating disease, a leading cause of death and disability worldwide. Risk factors profiles and stroke types effect the treatment strategy for this preventable disease. The epidemiology of stroke has been widely studied among white and black patients. However, little is known about the characteristics of stroke among Chinese Americans although they are one of the fastest growing ethnic groups in New York City. This presentation is a summary of several clinical studies of stroke patients admitted to New York Downtown Hospital since 1985. Hopefully through these efforts, there will be increase awareness and effective prevention/ treatment strategies for this serious illness in the Chinese American communities can be implemented.

NYU Downtown Hospital is a community hospital at lower Manhattan. In the year 2000, there were 12,291 patients' discharge, of which 48.2% come from Manhattan, 24.9% from Brooklyn, 17.0% from Queens. Of the patients from Manhattan, 83% came from five zip codes: the top three of this were 51.8% from Chinatown (zip 10002), 16% from Downtown (zip 10038), 16% from Tribeca/Chinatown (zip 10013). Stroke is the 5th most frequent diagnosis at NYUDT Hospital. In the same year, there were 263 stroke admissions: 60.1% of the stroke patients were Chinese, 16% White, 10% African-American.

Under the leadership of Dr. George Liu, Chinese Physician Partnership was formed in 1995 and this subsequently led to the formation of the *Chinese American IPA (CAIPA)* in 1997. As of today, there are 222 CAIPA Chinese American physician service the NYC Chinese community, of which Oxford/CAIPA covers 27,919 residents (7,803 Medicare). 57% of the CAIPA members are primary care physicians, many of them use NYU Downtown Hospital for hospital admission. It therefore provides a large part of the hospital care for Chinese Americans covered by CAIPA in the three major NYC Chinese communities, especially Manhattan (In year 2000, 25.8% of zip code 10002's total 11917 admission were to NYU Downtown Hospital). Chinese stroke patients in NYU Downtown Hospital represent a cross section of the three local Chinese communities, Manhattan Chinatown in particular.

According to health care association of NY State, June 19, 1998, *stroke risk index* of the young people (less than 65 years old) in and around Chinatown is *1.45 times higher* than other communities. From 1998 to 2003, lower Manhattan population is expected to grow by 5%, but Asian population is expected to grow by 11%, elderly Asian population (>65) is expected to increase by 17%. It is not hard to imagine the impact of future strokes to this community and society at large if the trend is not reversed.

Chinese stroke in NYU Downtown Hospital Vs Northern Manhattan Stroke Study

We first did a retrospective analysis of Chinese stroke patients between year 1994-5 (N=108) and compared their social demographics and vascular risk factors which White patients in Northern Manhattan Stroke Study. *Chinese stroke patient is younger* (73 vs. 80, P<. 001) They were *more untreated hypertension* (23% vs. 6%, P<. 001), more left ventricular hypertrophy (33% vs. 9% P<. 01),

higher initial diastolic pressure (32% vs. 17% $P < .05$). Although fewer Chinese patients smoke (11% vs. 17%), those who do smoke, smoke more packs per day (1.3 packs vs. 0.17 pack $P < .001$)¹

We then reviewed additional stroke patients in NYUDH from January 1995 to July 1998. Findings of the Chinese patients between these two periods of studies were analyzed. The average ages of the Chinese patients for these two studies were 71.5 years (1994-5) and 73 years (1995-8) respectively. The frequencies of stroke risk factors were similar in these two periods of studies: untreated hypertension (23% and 23%), left ventricular hypertrophy (37% and 33%), diabetes mellitus (33% and 38%), current smoker (12% and 11%), alcohol (8% and 7%), except hypertension (76% and 68%*), and cardiac disease (28% and 19%*)* $P < 0.05$.

Stroke Patients in NYU Downtown Hospital

Of the 843 stroke patients admitted during 1995-98, there were 499 Chinese, 153 Whites, 88 blacks, 99 Hispanics and 4 other Asian. Compared to other race/ethnic groups, Chinese and white stroke patients were older, 71.5 (Chinese), 69.7 (whites) vs. 62.6 (blacks), and 64.9 (Hispanics) ($p < 0.01$). Chinese patients had lower body mass index (22.8 vs. 26.1, 26.2 and 25.2 respectively) ($p < 0.01$), less likely to smoke (11.8% vs. 22.2%, 22.7 and 32.3%, $p < 0.01$), less likely to drink alcohol regularly (7.8% vs. 28.1%, 34.1% and 29.3%, $p < 0.01$). Chinese and blacks were more likely to have history of hypertension (75.6%, 62.7%, 77.3%, 65.7%, $p < 0.01$); Whites had the lowest incidence of left ventricular hypertrophy (37.5%, 24.8%, 37.5%, 38.4%, $p < 0.01$). Chinese patients were more likely to have higher blood cholesterol (204,192,192,197, $p < 0.05$) and Diabetes (33%, 21%, 24%, 28%, $p < 0.05$), higher admission blood glucose like blacks (161 mg/dl, 145,161,153 $p < 0.01$), Compared with other race/ethnic groups, Chinese had the *highest risk of hemorrhagic stroke* (19.2% vs 12.4%, 12.5% and 11.1% $p < 0.05$). It is higher than any previous published US cerebral hemorrhage incidence which is usually between 8 - 12.9%.

Overall hospital mortality was 12% with no significant difference between groups. Hemorrhagic stroke was more likely to be fatal than ischemic stroke (35.3% vs. 7.0%, $p < 0.001$).²
³(table1).

Cerebral Hemorrhage vs. Cerebral Infarction among Chinese

Among the Chinese patients, those with *hemorrhagic stroke tends to be younger* (68.4 vs. 72.4), have higher systolic and diastolic pressure on admission and higher incidence of left ventricular hypertrophy (47.3 vs. 35.8%). Higher WBC (11.6 K vs. 9.2 K), higher complications (62.7 vs. 28.2%) and in hospital death rate (34.5 vs. 6.1%). The odd ratio of *hospital deaths* among hemorrhagic stroke patients is 5.43 vs. 1 of ischemic stroke. The ischemic stroke patients on the other hand tends to have higher triglyceride level, higher incidence of diabetes (36.9 vs. 20.9%), higher platelet count (226 vs. 204K). All the above is statistically significant.

Controlling for age and gender, the variables significantly predictive of hospital deaths for Chinese stroke patients (odds ratios and 95% confidence interval) are hemorrhagic stroke (5.53, 1.96-15.61), history of diabetes mellitus (2.64,1.35-5.20), history of heart diseases (2.01,1.02-4.19), elevated blood sugar (1.67,1.50-1.84), elevated systolic hypertension (1.58,1.36-1.78), WBC (1.26,1.06-1.50).⁴⁵(tables 2,3).

TABLE 1. DIFFERENCES IN CLINICAL CHARACTERISTICS BETWEEN CHINESE AND WHITE STROKE PATIENTS

| | Chinese | Whites | p-value |
|--------------------------------|------------|-------------|-----------------|
| Patient number | 454 | 115 | |
| Age (years) | 71.4 | 71.7 | 0.97 |
| Male (%) | 51 | 54 | 0.24 |
| BMI (Kg/M²) | 22.8 | 25.8 | 0.02 |
| SBP (mmHg) | 155 | 155 | 0.98 |
| DBP (mmHg) | 87 | 86 | 0.86 |
| Hypertension (%) | 77 | 64 | 0.03 |
| LVH on EKG (%) | 37 | 25 | 0.02 |
| History of IHD (%) | 28 | 46 | <0.01 |
| Atrial fibrillation on EKG (%) | 17 | 20 | 0.59 |
| Cholesterol (mg/dl) | 204 | 192 | 0.01 |
| Triglyceride | 131 | 126 | 0.05 |
| Glucose (mg/dl) | 161 | 145 | <0.01 |
| History of Diabetes (%) | 33 | 21 | 0.01 |
| Drink alcohol (%) | 8 | 25 | <0.01 |
| Current smoker(%) | 13 | 20 | <0.01 |
| Hemorrhagic stroke (%) | 24 | 17 | 0.02 |
| Age adjusted death rate (%) | 13.8 | 14.8 | 0.1 |

TABLE 2. DIFFERENCES OF CLINICAL CHARACTERISTICS OF HEMORRHAGIC AND ISCHEMIC STROKE AMONG CHINESE PATIENTS

| | Hemorrhagic | Ischemic | P-value |
|---------------------------------------|--------------|-------------|------------------|
| Patient number | 110 | 334 | |
| Age (years) | 68.4 | 72.4 | 0.006 |
| Male (%) | 56 | 49 | 0.28 |
| BMI (Kg/M ²) | 22.8 | 22.8 | 0.953 |
| SBP (mmHg) | 163 | 153 | 0.01 |
| DBP (mmHg) | 91 | 86 | 0.032 |
| LVH on EKG (%) | 47.3 | 35.8 | 0.033 |
| Hypertension (%) | 78.2 | 76.2 | 0.69 |
| Atrial fibrillation on EKG (%) | 13.6 | 17.7 | 0.379 |
| Cholesterol (mg/dl) | 207 | 204 | 0.659 |
| Triglyceride | 106 | 137 | <0.001 |
| Glucose (mg/dl) | 155 | 182 | 0.023 |
| History of Diabetes (%) | 20.9 | 36.9 | 0.001 |
| Platelet | 204 | 226 | 0.009 |
| White Blood Cell | 11666 | 9296 | <0.001 |
| Current smoker(%) | 13 | 13 | 0.97 |
| Drink alcohol (%) | 10.0 | 7.6 | 0.53 |
| Complications after stroke (%) | 62.7 | 28.2 | <0.001 |
| Death at discharge (%) | 34.5 | 6.1 | <0.001 |

Table 3. Odds Ratio (95% confidence interval) of hospital death among stroke patients

| Variable | Over all OR (95% CI) | Ischemic OR (95% CI) | Hemorrhagic OR (95% CI) |
|--------------------------------|-------------------------|-------------------------|----------------------------|
| Race (Chinese=1) | 1.01 (0.70-1.40) | 1.06 (0.50-3.10) | 1.34 (0.81-2.12) |
| Gender (male=1) | 1.60 (0.83-3.08) | 1.36 (0.51-3.67) | 2.17 (0.62-7.53) |
| Systolic BP (=30 mmHg) | 1.58 (1.36-1.78) | 1.50 (1.11-3.05) | 1.91 (1.42-3.46) |
| Heart disease(yes=1) | 2.01 (1.02-4.19) | 2.17 (0.92-4.89) | 0.98 (0.37-5.03) |
| Blood Sugar (=10mg/dL) | 1.27 (1.02-1.54) | 1.54 (1.12-2.06) | 1.19 (0.76-1.82) |
| Diabetes (yes=1) | 2.64 (1.35-5.20) | 3.02 (1.14-7.89) | 2.23 (0.46-19.98) |
| Cholesterol (=20mg/dL) | 1.26 (0.97-1.59) | 1.20 (0.88-1.61) | 1.02 (0.69-1.95) |
| WBC(=1000 counts) | 1.26 (1.06-1.50) | 1.20 (1.03-1.40) | 1.32 (1.05-1.61) |
| Type of stroke (Ischemic=1) | 5.43 (4.54-6.97) | | |

Stroke Patients: Taipei vs. New York

Chinese stroke patients at National Taiwan University Hospital, Taipei and NYU Downtown Hospital were different. The age of *stroke onset was even younger in Taiwan* (cerebral infarction 65.5 y vs. 71.8; cerebral hemorrhage 58.2 y vs. 67.3). Incidence of cerebral hemorrhage was also higher in Taipei (30.2 vs. 23.4%). Patients at NYU Downtown Hospital had higher incident of hypertension, diabetes mellitus, atrial fibrillation, and higher cholesterol. The patients in National Taiwan University had higher incidence of smoking, drinking, higher triglycerides. Of importance is the *low incidence of carotid stenosis* at both cities. There were few patients with more than 50% carotid stenosis (11.9 vs. 10.9%), this may support the observation that Chinese stroke is more likely due to microvascular disease. The higher social acceptable alcohol and binge drinking habits in Taiwan may explain the higher incidence of cerebral hemorrhage and at a younger age.

The stroke patients' mortality rate was similar in both places (10.77 vs. 11.01%). Deaths from cerebral infarction was 5% in both places, however, case fatality from cerebral hemorrhage and subarachnoid hemorrhage was very high (21.74, 30.49%; 35.77, 33.85%).⁶(table 4).

Table 4.

Differences of stroke risk factors between NTUH and NYUDTH stroke registries

| | NTUH (n=2,285) | NYUDTH (n=427) | <i>p</i> value |
|-------------------------------------|-------------------|-------------------|----------------|
| Hypertension | 63.9% | 73.5% | 0.0001 |
| Diabetes mellitus | 25.3% | 30.0% | 0.04 |
| Atrial fibrillation | 12.3% | 17.6% | 0.003 |
| Ischemic heart disease | 23.1% | 22.7% | 0.9 |
| Smoking | 32.6% | 21.5% | 0.0001 |
| Drinking | 22.1% | 8.0% | 0.0001 |
| Left ventricular hypertrophy | 35.1% | 37.0% | 0.4 |
| Serum cholesterol \geq 240 mg/dl | 12.2% | 20.0% | 0.004 |
| Serum triglyceride \geq 200 mg/dl | 27.1% | 12.2% | 0.0001 |
| Serum uric acid \geq 7.0 mg/dl | 27.7% | 32.6% | 0.2 |
| Carotid stenosis \geq 50% | 11.9% | 10.9% | 0.7 |

p value by Mantel-Haenszel χ^2 test.

Blood Pressure control Manhattan Chinese Community vs. NHANES III

Compared with subjects in NHANES III, a surveyed to collect information about the health and diet of people in the United States between 1988 and 1994 including 40,000 people., We screened 911 residents in Chinatown, of the 752 valid study objects, many did not know they have hypertension(36,16,12,10% $p < 0.01$). Not only less aware of their hypertension, those who know, their high blood pressure control is less than ideal compared to whites, blacks and Hispanics in the NHANES III (65,16,12,10% $p < 0.01$).

The fact that the Chinese American patients *are less aware of their hypertension and blood pressure is less well controlled* suggest that stroke is but only a small tip of the health risk iceberg of the communities.⁷

The Diet and Stress Factors

Since September 2000, Dr. Jing Fang and I are conducting a case controlled study supported by American Heart Association, to determine the risk factors for stroke among foreign-born Chinese in New York City. The preliminary analysis of the patients admitted through January 31, 2002 is going to be presented at the coming American Epidemiology Society meeting. Questionnaire with detailed information including language, job, medical history and care, dietary pattern, smoking, exercise, as well as changes of these factors after immigration to US were interviewed among 84 hospital stroke cases (20 hemorrhagic stroke) and 74 age-matched hospital controls: Mean age were 73.8 and 74.0 years ($p = 0.732$), with 45% and 48% men ($p = 0.23$), and mean years after immigration to US are 24 and

27 (p=0.01) respectively. Stroke patients have higher blood pressure (135/72 vs. 163/84 mm Hg, p<0.001), more likely to have history of hypertension (52% vs. 67%, p=0.02), to be current smokers (8% vs. 25%, p=0.0125) with increased numbers of cigarettes consumed after immigrating to US. Although exercise during the past 12 months was similar between cases and controls, controls were more likely to participate exercise 20 years ago (43% vs. 27%, p=0.006), increased the amount of exercise after immigration to US (19% vs. 12%, p=0.032). In addition, controls were more likely to change their way of cooking, using less sugar and salt after immigration. Logistic regression analysis, controlling for other characteristics, showed that adjusting score was significantly related to stroke with odds ratio of 0.87 (0.74-0.99, p=0.05) favoring the case control. These results suggest that *increased stress* among Chinese immigrants in US is associated with the subsequent development of stroke. After immigrating to USA, controls also consume more Fish, soybean products and fruit juice than stroke patients.

Patients' response to onset of symptoms

We also look at patients' response to stroke symptoms. The charts of thirty-seven consecutive Chinese patients admitted to NYUDT Hospital between Dec 2000 to Aug 2001 were reviewed. Ten (27%) came to the ER within 3 hours of symptom onset, 8 (21.6%) between 3-6hr; 9 between 7-12 hr; 10 between 2-7 days. Ten (27%) had brain CT taken within 1 hr after registration, 12 (32%) between 1-2 hr, 6 (16%) 2-3 hr, and 9 (24%) >3hr. Overall, 28 (76%) brain CT were completed within 3 hr and the median time was 92 min (range 2 min to 16 hr. Presuming other variables such as hypertension control, anticoagulation use, lab result, etc. are favorable, and half of those coming to the ER within 3hr can have a Brain CT in 1 hr, only **7%** of current Chinese stroke patients is eligible to be evaluated (not treated) for t-PA treatment. If improvements in patient education could make those presenting to ER within 4-6 hr of symptoms onset to the 3hr time frame, and if increased efficiency will shorten the time to get a CT scan from 3 to 1 hr. , we will increase patient eligibility to **37%**. This will increase t-PA usage, which has a new window of three hours, hopefully will result in lesser patient long term disability and improve community health.⁷

Conclusions:

1. Chinese American IPA (CAIPA) and NYU Downtown hospital serve a unique, relatively rapid growing and graying Chinese American community at New York City.
2. There is a higher prevalence of stroke risk factors including untreated/uncontrolled hypertension, uncontrolled diabetes, heavy smoking, hyperlipidemia and physical inactivity.
3. Among Chinese stroke patients, there is an unacceptable higher risk for cerebral hemorrhage with increase mortality and disability.
4. Stroke is but only a small tip of the health risk iceberg of the communities. Medical education and prevention can minimize various risks factor for stroke and disease progression, e.g. Chinese patients are less aware of their blood pressure and their blood pressure is also less controlled.
5. Organized physician network such as CAIPA/CAMS can and should continue to champion the study of the unique health status of the Chinese community, which is largely neglected by the main stream research.
6. CAIPA/CAMS members is the key to promote/improve the health of the Chinese Community.

The above studies were partially supported by NYUDH Chinese Community Partnership for Health, Chinese American Medical Society (CAMS), the United Chinese Health Foundation, a grant from the National Science Council in Taiwan. Special thanks to Susan Lau, Cora Fung and Betty Chin for their invaluable assistance

Reference:

1. SH Foo, L Tao: Differences in Social Demographics and Vascular Risk Factors Among Chinese patients in New York Chinatown. Abstract. VIII International Health Conference related to the Chinese, Vancouver, BC. August 22-25, 1996.
2. SH Foo, J Jeng, J Fang, RK Yip, S Lau. Sociodemographic and Vascular Risk Factors Among Stroke Patients of Chinese Origin at NYU Downtown Hospital. Tenth Conference on Health Problems Related to the Chinese in North America. San Francisco, June 30, 2000.
3. SH Foo, J Fang, M Alderman, JS Jeng, PK Yip. Clinical Characteristics of Stroke among Chinese Patients. Abstract. Journal of Hypertension, Chicago, August 20-24, 2000.
4. SH Foo, J Fang, M Alderman. Clinical Characteristics of Hospitalized Stroke Patients Among Chinese and Whites in New York City. Abstract. 27th International Stroke Conference, San Antonio, TX, Feb 7-9, 2002.
5. JS Jeng, PK Yip, SH Foo. Differences of stroke types and risk factors among Chinese Stroke Patients in Taipei and New York. Acta Neurol Taiwan 2000; 9: p.161-162.
6. J Fang, SH Foo, M Alderman. Hypertension and its treatment in Chinese Residents of New York City and comparison with the General US Population. Abstract. American Society of Hypertension, May 18, 2002. NYC
7. SH Foo, J Fang, C Fung. Potential Benefits of Tissue Plasminogen Activator in Treating Acute Brain Attack of Chinese Patients at NYU Downtown Hospital. Abstract. Chinese American Medical Society 2001 Annual Meeting, New York. Nov 17, 2001.

Sun-Hoo Foo, M.D .is Associate Professor of Neurology, New York University Medical School, and Director of Neurology, NYU Downtown Hospital.