DIFFERENT STROKES FOR DIFFERENT FOLKS: Epidemiology of Cerebrovascular Diseases amongst Chinese-Canadians residing in Toronto

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19th FCMS Conference, Toronto
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Disclosure

• Dr. Chu has received unrestricted research and educational grants from Pfizer Canada, Novartis Canada, Biogen Idec Inc. and Merck Canada.

• Received grants for summer student research scholarship from the Heart & Stroke Foundation of Ontario in 1999-2000.

• Current Research Chair of the Chinese Canadian Council, in support of Heart and Stroke Foundation of Canada.

• No conflict of interests relating to this presentation.
Learning Objectives

• To review the scientific data collected over the past 30 years on the stroke epidemiology of Chinese living in Canada (Toronto).

• Current areas of research relating to Cerebrovascular disorders of Chinese Canadians with Type II diabetes in Toronto.

• What lies in the future for collaborative stroke research on Chinese living in North America?
中風
64 yo man:
HBP + **ACUTE** L. BASAL GANGLIA ICH
10 years ago R. BASAL GANGLIA ICH
IMPACT OF STROKE IN CANADA

• STROKE is the third leading cause of death and #1 cause of disabilities in adults.
• Annual stroke mortality is 14,000 and annual incidence is 50,000, 1 stroke every 10 minutes.
• Annual prevalence is 426,000.
• Annual stroke cost = $3.6 Billion.
• For every 100 patients with stroke:
  15 dies  10 severely disabled
  40 mod. disabled  25 mildly disabled
  ONY 10 will fully recover
Hypothesis

• Chinese living in North America have different stroke patterns and epidemiology than those living in Asia.

• There is an intimate interaction between genetics and environmental factors which dictate the specific stroke patterns and epidemiology for the Chinese.

• Successive generations of Chinese living in North America who follows the lifestyle of their adopted country will develop the stroke patterns similar to those who are born locally.
Multi-Cultural CANADA
Background

- Chinese is the largest visible minority group in Canada
- 2001 Stats Canada data

<table>
<thead>
<tr>
<th></th>
<th>Total Chinese</th>
<th>Visible Minority (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>1,094,700</td>
<td>27.5%</td>
</tr>
<tr>
<td>Toronto</td>
<td>409,530</td>
<td>23.9%</td>
</tr>
<tr>
<td>Vancouver</td>
<td>342,665</td>
<td>42.7%</td>
</tr>
</tbody>
</table>
### Ethnicity groups in the Toronto CMA (2011)

<table>
<thead>
<tr>
<th>Ethnicity group</th>
<th>Population</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>White / Aboriginal</td>
<td>2,924,815</td>
<td>53.0</td>
</tr>
<tr>
<td>South Asian</td>
<td>833,085</td>
<td>15.1</td>
</tr>
<tr>
<td>Chinese</td>
<td>531,635</td>
<td>9.6</td>
</tr>
<tr>
<td>Black</td>
<td>397,175</td>
<td>7.2</td>
</tr>
<tr>
<td>Filipino</td>
<td>230,075</td>
<td>4.2</td>
</tr>
<tr>
<td>Latin American</td>
<td>117,005</td>
<td>2.1</td>
</tr>
<tr>
<td>West Asian</td>
<td>96,650</td>
<td>1.8</td>
</tr>
<tr>
<td>Southeast Asian</td>
<td>90,990</td>
<td>1.6</td>
</tr>
<tr>
<td>Arab</td>
<td>74,990</td>
<td>1.4</td>
</tr>
<tr>
<td>Korean</td>
<td>61,300</td>
<td>1.1</td>
</tr>
<tr>
<td>Japanese</td>
<td>20,015</td>
<td>0.4</td>
</tr>
<tr>
<td>Multiple minorities</td>
<td>74,840</td>
<td>1.4</td>
</tr>
<tr>
<td>Other</td>
<td>68,660</td>
<td>1.2</td>
</tr>
<tr>
<td><strong>Total population</strong></td>
<td><strong>5,521,235</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Concentrations of ethnic groups per Toronto CMA municipality are as follows, with the largest percentages in bold (only percentages higher than 3% are included):
A majority of Torontonians now identify themselves as visible minorities

New census data paints a portrait of a changing country, tells the story of who we are and what we cherish, and offers an opportunity to ask ourselves: how are we all going to get along?

51.5%
Original Research on Office-based Patients
Epidemiology of Cerebrovascular Disease Among Chinese-Canadians-a 10 Years Retrospective Study

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Assistant Professor of Medicine (Neurology),
University of Toronto

Arthur Chung and Jason K. Chu
(HSFO-CCC Summer Scholarship, 1999)

Neurology Asia 2006; 11: 13--18
• STROKE RISK FACTORS

Chu et al: Neurology Asia 2006

HBP = Hypertension
DM = Diabetes Mellitus
CAD = Coronary Artery Disease
HLP = Hyperlipidemia
PVD = Peripheral Vascular Disease

P < 0.025
P < 0.05
P < 0.05 *

Chinese-Canadians
Caucasians

Statistical significance
Chi Square
CONCLUSIONS (4)

• Future long-term prospective study of the stroke risk factors of Chinese-Canadians in the format of national stroke data banks would be an important endeavor to prevent stroke occurrence in this population.

• Studies of stroke pattern of successive generations of Chinese-Canadians, similar to the Honolulu Heart Study would be essential in the understanding of how genetic and the environment influence stroke development. Currently, the ALLIANCE study will be examining a cohort of Chinese-Canadians (@600) prospectively on their CVS health status in Ontario.
EPIDEMIOLOGY OF CEREBROVASCULAR DISEASES AMONG CHINESE-CANADIANS:
A NINE-YEARS STUDY OF HOSPITALIZED PATIENTS

JY Chu, JV Tu, JK Chu, AG Chung
Trillium Health Centre and ICES
University of Toronto
38th CCNS Meeting, June 20th, 2003
MEDICAL HISTORY

HBP
* P=0.04

SMOKE
+ P=0.0002

VALVE
 HD # p=0.06

PVD
# p=0.04

Legend:
- CHINESE
- NON-CHINESE
EPIDEMIOLOGY OF CEREBROVASCULAR DISEASE AMONG THE DIABETIC CHINESE-CANADIANS: A RETROSPECTIVE 10-YEAR CASE MIX STUDY

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Joseph Y. Chu, MD,FRCPC,FACP,FAHA² (JYC)

¹Faculty of Science, University of Waterloo, Ontario, Canada
²Faculty of Medicine, University of Toronto, Ontario, Canada

BIT 4TH ANNUAL INTERNATIONAL CONGRESS OF CARDIOLOGY
GUANGZHOU, CHINA
DECEMBER 4TH, 2012

BACKGROUND AND PURPOSE:

• An article published in Neurology Asia, 2006 by JYC provided impetus to confirm whether specific genetic or environmental differences exist within the Chinese community with diabetes mellitus (DM).

• Exposing distinctive epidemiologic and cerebrovascular patterns may bring forth effectively focused treatment and prevention.
BACKGROUND AND PURPOSE:

Our three retrospective study hypotheses were:

– (1) Chinese-Canadians (CC) with stroke-history within the last 15 years are more frequently diabetic than Non-Chinese-Canadians (NCC)

– (2) CC have higher frequency of intracranial small vessel disease (SVD) than NCC.

– (3) Hypertensive CC with DM have poorer prognosis in stroke than NCC.
METHODS:

- Patients were seen by JYC between 2001-2011 at his Toronto neurology clinic and at Brampton Civic Hospital of William Osler Health System.
- All CC and NCC diabetic stroke patients who are or were under his care were selected by last name and birth country, then age and sex-matched.
- Guideline values and prognosis stratification with hypertension severity grade were obtained from the World Health Organization (WHO).
METHODS:

• The following data was collected:

  – (1) diabetic prevalence excluding patients with TIAs, subarachnoid and subdural haemorrhages.

  – (2) etiology and stroke type in DM patients.

  – (3) risk factor differences between DM CC and NCC.

  – (4) poor prognosis risk, HSG, and blood pressure values.
METHODS:

• Odds ratios and unpaired two-sample t-testing were used to confirm significance (P<0.05).

• Through screening, a total of 184 patients met the criteria (111 NCC, 73 CC)
RESULTS:

- **Significance confirmed (P<0.05):**
  - 1) **CC** had higher DM and stroke incidence than **NCC**. Diabetic **CC** more frequently had SVD, specifically lacunar stroke.
  - 2) **SVD** frequency was much greater than large vessel disease (LVD) in **CC**.
RESULTS:

• **Significance conformed (P<0.05):**

• 3) The low-risk CC cohort was less likely than NCC to have poor prognosis:

  – However, *high-risk CC* seemed more likely had *poor prognosis* than NCC with near significance

• NCC males had a significantly higher systolic blood pressure than CC males.
Sample Proportions of Chinese and Non-Chinese Patients with Stroke and DM

Legend: ⭐ represents p<0.05

Data is expressed in proportion (number with stroke and DM/total patients of the particular ethnicity).

N of Chinese-Canadian stroke patients = 101, N of Non-Chinese-Canadian patients = 926.
Comparing Stroke Types: Chinese and Non-Chinese Population

Legend: * represents p<0.05

Data is expressed in proportion (number with stroke type/total patients of the particular ethnicity).
Comparing Differences of Stroke Etiology between Chinese and Non-Chinese DM Patients

* $P < 0.05$

Data is expressed in proportion (number with stroke etiology/total patients of the 4 categories).

$N$(Chinese) = 73, $N$(Non-Chinese) = 111.
Data is expressed in proportion (number classified with risk/total patients for all 3 categories). N(Chinese)=35, N(Non-Chinese)=127.
Systolic Blood Pressure Averages in Stroke Patients with DM

Legend: ⭐ represents p<0.05

Data is expressed in numerical value of millimoles of mercury. N(Chinese)=34, N(Non-Chinese)=115.
Diastolic Blood Pressure Averages in Stroke Patients with DM

Data is expressed in numerical value of millimoles of mercury. N(Chinese)=34, N(Non-Chinese)=115.
Hypertension Severity Grade Differences in Stroke Patients with Diabetes

Data is expressed in proportion (number classified with particular HSG/total patients for all 4 categories). N(Chinese)=34, N(Non-Chinese)=117.
RESULTS:

<table>
<thead>
<tr>
<th>Hypertension Severity Grade (0=no HTN, 3=very severe HTN)</th>
<th>Caucasian Proportion</th>
<th>Chinese Proportion</th>
<th>Odds Ratio, Non-Chinese/Chinese</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.3590</td>
<td>0.4857</td>
<td>0.5929</td>
</tr>
<tr>
<td>1</td>
<td>0.2906</td>
<td>0.3429</td>
<td>0.7851</td>
</tr>
<tr>
<td>2</td>
<td>0.2564</td>
<td>0.1143</td>
<td>2.6724</td>
</tr>
<tr>
<td>3</td>
<td>0.0940</td>
<td>0.0571</td>
<td>1.7123</td>
</tr>
</tbody>
</table>

Table 1: Distribution of Hypertension Severity and Odds Ratio
The values in **bold** indicate odds ratio values that are significant when comparing Non-Chinese over Chinese likelihood.
## RESULTS:

<table>
<thead>
<tr>
<th></th>
<th>Overweight, SVD</th>
<th>Overweight, LVD</th>
<th>Hyperlipidemia, SVD</th>
<th>Hyperlipidemia, LVD</th>
<th>Hypertension, SVD</th>
<th>Hypertension, LVD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chinese</strong></td>
<td>26.9%</td>
<td>7.7%</td>
<td>36.5%</td>
<td>15.0%</td>
<td>53.8%</td>
<td>25.0%</td>
</tr>
<tr>
<td><strong>OR, SVD/LVD</strong></td>
<td>4.42</td>
<td></td>
<td>3.26</td>
<td></td>
<td></td>
<td>3.50</td>
</tr>
<tr>
<td><strong>Non-Chinese</strong></td>
<td>16.5%</td>
<td>7.9%</td>
<td>23.6%</td>
<td>15.0%</td>
<td>33.1%</td>
<td>26.0%</td>
</tr>
<tr>
<td><strong>OR, SVD/LVD</strong></td>
<td>2.32</td>
<td></td>
<td>1.76</td>
<td></td>
<td></td>
<td>1.41</td>
</tr>
</tbody>
</table>

**Table 2: – Stroke type and Risk Factor**

The values in **bold** indicate significant proportions and odds ratio values which are different between the two categories: having SVD v.s. having LVD.
CONCLUSIONS (1):

• Our study show-cased data suggesting that Chinese-Canadians with stroke more frequently have diabetes than Non-Chinese-Canadians

• Diabetic Chinese-Canadians seem to be especially susceptible to small vessel disease and are uniquely responsive to stroke risk factors compared to the Non-Chinese-Canadians
CONCLUSIONS (2):

- Chinese-Canadian diabetic stroke patients also seem to have poorer prognosis despite Non-Chinese-Canadians more likely scoring high hypertension severity grades
CONCLUSIONS (3):

• These results signify that risk factor prevalence and stroke types differ considerably between Chinese-Canadians and Non-Chinese-Canadians within Toronto.
WHY STROKE EPIDEMIOLOGY DIFFERS BETWEEN CHINESE-CANADIANS AND CAUSASANS?
Patterns of Cerebrovascular Disease of Chinese in Toronto, New York City and China

<table>
<thead>
<tr>
<th>City</th>
<th>Toronto</th>
<th>New York</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td>Author</td>
<td>Chu</td>
<td>Foo</td>
<td>Zhang</td>
</tr>
<tr>
<td>%ICH</td>
<td>29.6</td>
<td>19.2</td>
<td>27.5</td>
</tr>
<tr>
<td>%HBP</td>
<td>63.5</td>
<td>75.6</td>
<td>TAIWAN: LACUNAE= 85.0</td>
</tr>
</tbody>
</table>
### Stroke Risk Factors of Chinese in Toronto, New York City and Taiwan

<table>
<thead>
<tr>
<th>City Author</th>
<th>Toronto Chu</th>
<th>NYC Foo</th>
<th>Taipei Jeng</th>
</tr>
</thead>
<tbody>
<tr>
<td>% D.M.</td>
<td>22.9</td>
<td>33.0</td>
<td>32.5</td>
</tr>
<tr>
<td></td>
<td>(35% in 2018)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Smoker</td>
<td>21.6</td>
<td>11.8</td>
<td>35.0</td>
</tr>
<tr>
<td>% Carotid Stenosis*</td>
<td>6.4</td>
<td>11.9</td>
<td>10.9</td>
</tr>
<tr>
<td>Age of onset</td>
<td>71.6</td>
<td>71.5</td>
<td>ICH: 58.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CI: 65.5</td>
</tr>
</tbody>
</table>
1. Genetics—Moya Moya Disease, CADASIL

2. Dietary factors—
   (i) High salt intake $\rightarrow$ HBP $\rightarrow$ Inc. atherosclerosis
   (ii) Lower meat intake $\rightarrow$ ? Lower Cholesterol $\rightarrow$ Less Carotid Disease
   (iii) Higher frequency of HBP + DM + Smoking $\rightarrow$ Intracranial Disease = Occlusive +/- small vessel disease
FUTURE COLLABORATIVE RESEARCH BETWEEN CANADA AND CHINA IS URGENTLY REQUIRED?

• In order to answer this important question, we need to have prospective, population-based stroke data banks in Canada and China in order to coordinate collaborative research on the interactions between genetics and environmental factors influencing the development of specific stroke patterns of successive generations of Chinese living in Canada!

• Twin studies?
ACKNOWLEDGEMENTS

• CHINESE CANADIAN STROKE AND HEART DISEASES RESEARCH TEAM:
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• PROFESSOR GORDON W. MOE
• PROFESSOR CHI-MING CHOW
• Dr. Jason K. Chu, Dr. Derek K. Chu, Dr. Arthur G. Chung (2000-2001).
• Ms. Susy Lam, summer research student, 2011.
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• DIVISION OF NEUROLOGY, DEPARTMENT OF MEDICINE, UNIVERSITY OF TORONTO, CANADA
REFERENCES


THANK YOU!