Patterns of Cerebrovascular Disease in Japanese and Other Population Groups in Hawaii: An Angiographical Study

BY RAYMOND W. BRUST, JR., M.D.

Abstract: Patterns of Cerebrovascular Disease in Japanese and Other Population Groups in Hawaii: An Angiographical Study

Angiograms of the carotid system were analyzed for incidence and type of intracranial and extracranial lesions in 296 patients with a final diagnosis of non-hemorrhagic stroke. These patients represent all the major ethnic groups in Hawaii. A significant difference was found between the ratio of frequency of involvement of the extracranial and intracranial vessels in Caucasian and that in the Hawaiian-born Japanese populations, similar to that reported by others in native Japanese. The Filipino, Chinese, Hawaiian and part-Hawaiian populations showed no such significant difference.

Additional Key Words
extracranial cerebrovascular disease ethnic groups carotid angiography non-hemorrhagic stroke

Reports on cerebrovascular disease in the various racial groups in Hawaii have been few and based mainly on mortality and autopsy data. Differences have been shown in the incidence of cerebrovascular disease in native Japanese and migrant Japanese. A long-term clinical study of these Japanese populations is in progress. The incidence of intracranial and extracranial stroke lesions has been demonstrated to be different in native Japanese and Caucasian populations. The present investigation was undertaken to determine if this difference persists in Hawaiian-born Japanese and if similar differences exist in other racial groups in Hawaii.

Methods
The medical records of all patients admitted to the three largest acute care hospitals in Honolulu, Hawaii, over a five-year period (1968 through 1972) with a final neurological diagnosis of cerebrovascular disease (HICDA code numbers 432 through 437) and who had had angiographical studies during their hospitalization were reviewed by professional medical record librarians. The specific cerebrovascular diagnosis, age, sex, race and place of birth of the patient, the angiographical procedure and any intracranial or vascular surgical procedures or autopsies performed were recorded.

Angiography in these patients had been performed by a number of neurosurgeons and vascular surgeons and a few radiologists with a variety of techniques and with very few studies of the vertebrobasilar system. In view of this and the fact that the overwhelming occurrence of extracranial cerebrovascular lesions is at the common carotid bifurcation, only standard common carotid arteriography or arch arteriography with visualization of the internal carotid artery and the intracranial vessels in at least two projections was utilized in this study.

The degree of stenosis of the extracranial internal carotid and the intracranial vessels was measured according to the method given by Alter et al., relating the diameter of the narrowed lumen to the lumen proximal to the stenosis. Only lesions producing greater than 25% narrowing or showing a definite ulceration were considered abnormal. Extracranial stenosis of the internal carotid artery was divided according to type into smooth, irregular and ulcerated.

Results
A total of 464 patients with a diagnosis of non-hemorrhagic stroke who had angiography performed during their hospitalization were studied. Twenty of these proved to have other cerebrovascular disease or tumor upon further review. An additional 148 cases had to be discarded because of missing radiographs or inadequate or unsatisfactory angiographical studies. Thus a final total of 296 patients (190 male, 106 female) was available for analysis. Ninety percent of the patients had angiography performed within seven days of admission; none had the study more than 30 days after admission.

The racial distribution of the cases and the normal and abnormal studies are given in table 1. This racial distribution of patients compares favorably with the 1970 census of Hawaii. The average age and age range of the Caucasian patients and Hawaiian-born Japanese were similar. The older age of the native Japanese probably represents survivors of the immigrant generation. The preponderance of males in the native Filipino population most likely reflects the early labor immigration practices in Hawaii. Except for the native Japanese and Samoan, the normal studies comprised roughly 50%, comparable to other series. The number of patients in the Korean, Puerto Rican, Samoan, native Chinese and migrant Filipino populations was too few for analysis. Those recorded had predominantly intracranial lesions.


**TABLE 1**

**Racial Distribution of Angiography Cases**

<table>
<thead>
<tr>
<th>Racial Group</th>
<th>Total No. of Patients Studied</th>
<th>Sex</th>
<th>Average Age &amp; Age Range</th>
<th>Normal Studies</th>
<th>Abnormal Studies*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caucasian</td>
<td>93</td>
<td>49M 44F</td>
<td>62 (31-77)</td>
<td>49 (52%)</td>
<td>44 (48%)</td>
</tr>
<tr>
<td>Japanese</td>
<td>84</td>
<td>62M 22F</td>
<td>56 (37-74)</td>
<td>50 (58%)</td>
<td>34 (42%)</td>
</tr>
<tr>
<td>Hawaiit Japan</td>
<td>23</td>
<td>14M 9F</td>
<td>73 (56-89)</td>
<td>6 (26%)</td>
<td>17 (74%)</td>
</tr>
<tr>
<td>Filipino</td>
<td>1</td>
<td>1F</td>
<td>44</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Hawaiian</td>
<td>29</td>
<td>26M 3F</td>
<td>65 (56-82)</td>
<td>16 (55%)</td>
<td>13 (45%)</td>
</tr>
<tr>
<td>Hawaiian</td>
<td>14</td>
<td>8M 6F</td>
<td>61 (42-73)</td>
<td>7 (50%)</td>
<td>7 (50%)</td>
</tr>
<tr>
<td>Chinese</td>
<td>2</td>
<td>2M</td>
<td>64 (60-68)</td>
<td>0</td>
<td>2 (100%)</td>
</tr>
<tr>
<td>Korean</td>
<td>5</td>
<td>4M 1F</td>
<td>56 (49-64)</td>
<td>3 (60%)</td>
<td>2 (40%)</td>
</tr>
<tr>
<td>Puerto Rican</td>
<td>1</td>
<td>1F</td>
<td>69</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Hawaiian</td>
<td>16</td>
<td>8M 8F</td>
<td>60 (39-80)</td>
<td>8 (50%)</td>
<td>8 (50%)</td>
</tr>
<tr>
<td>Part-Hawaiian</td>
<td>18</td>
<td>9M 9F</td>
<td>58 (44-74)</td>
<td>11 (61%)</td>
<td>7 (39%)</td>
</tr>
<tr>
<td>Samoan</td>
<td>5</td>
<td>4M 1F</td>
<td>48 (38-57)</td>
<td>1 (20%)</td>
<td>4 (80%)</td>
</tr>
</tbody>
</table>

* >25% stenosis or ulcerated lesion.
† Birthplace.

Intracranial and extracranial lesions 50% or greater were distributed as shown in table 2. As would be expected, extracranial lesions predominated in the Caucasian population. Comparison of the native Japanese and Hawaiian-born Japanese with the Caucasian population utilizing a chi-square analysis revealed a significant difference (P < 0.05) between the ratio of the frequency of involvement of the extracranial and intracranial vessels. On the other hand, no such significant difference was found when the native Filipino, Hawaiian-born Chinese, Hawaiian and part-Hawaiian populations were compared with the Caucasian population. Similar results also were found when extracranial and intracranial occlusions were studied (table 3). To further test the difference between our Caucasian and the native and Hawaiian-

**TABLE 2**

**Stenosis (50% or More)**

<table>
<thead>
<tr>
<th></th>
<th>Caucasian</th>
<th>Japanese Hawaiit</th>
<th>Japanese Japan†</th>
<th>Filipino Philippines†</th>
<th>Chinese Hawaiit</th>
<th>Hawaiian</th>
<th>Part-Hawaiian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extracranial</td>
<td>20</td>
<td>11</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Intracranial</td>
<td>5</td>
<td>8</td>
<td>8</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Extracranial +</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>intracranial</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chi-square</td>
<td>P &lt; 0.05</td>
<td>P &lt; 0.05</td>
<td>NS†</td>
<td>NS†</td>
<td>NS†</td>
<td>NS†</td>
<td>NS†</td>
</tr>
</tbody>
</table>

* Birthplace.
† NS: No significant difference between the ratio of the frequency of involvement of the extracranial and intracranial vessels in Caucasian population.

**TABLE 3**

**Occlusion**

<table>
<thead>
<tr>
<th></th>
<th>Caucasian</th>
<th>Japanese Hawaiit</th>
<th>Japanese Japan†</th>
<th>Filipino Philippines†</th>
<th>Chinese Hawaiit</th>
<th>Hawaiian</th>
<th>Part-Hawaiian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extracranial</td>
<td>8</td>
<td>6</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Intracranial</td>
<td>3</td>
<td>7</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chi-square</td>
<td>P &lt; 0.05</td>
<td>P &lt; 0.05</td>
<td>NS†</td>
<td>NS†</td>
<td>NS†</td>
<td>NS†</td>
<td>NS†</td>
</tr>
</tbody>
</table>

* Birthplace.
† NS: No significant difference between the ratio of the frequency of involvement of the extracranial and intracranial vessels in Caucasian population.
CVD IN ETHNIC GROUPS IN HAWAII

TABLE 4

<table>
<thead>
<tr>
<th>Type of Extracranial Stenosis</th>
<th>Caucasian</th>
<th>Hawai*</th>
<th>Japan*</th>
<th>Filipino*</th>
<th>Chinese</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smooth (&gt;25%)</td>
<td>12</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Irregular (&gt;25%)</td>
<td>6</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Ulcerated</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

*Birthplace.

Born Japanese populations, comparison was made with the Minnesota and Kyushu populations reported by Kieffer et al. regarding the ratio of the frequency of extracranial and intracranial occlusions of 50% and 100%. No significant difference was found (P < 0.05).

Regarding the type of extracranial carotid stenosis, the Hawaiian-born Japanese and Chinese had a higher incidence of ulceration compared with the Caucasians (table 4, fig. 1).

Discussion

Intracranial patterns of cerebral atherosclerosis in native Japanese have been documented with autopsy studies. One Japanese series of 74 cases of cerebral infarction also studied extracranial lesions and found only two cases of extracranial internal carotid thrombosis. Angiographical studies of native Japanese populations also report fewer extracranial compared with intracranial lesions, a reverse of the pattern found in Caucasians. Our angiographical study reveals the ratio of the frequency of extracranial and intracranial lesions in Hawaiian-born Japanese as being similar to native Japanese and statistically different from the Caucasian population. Heyden et al. suggest that there is a difference in the pathogenesis and etiology of the vascular disease in patients with extracranial and intracranial lesions. Dietary factors in stroke are being intensively studied in various Japanese populations.

Little appears to have been reported on stroke in Chinese and Filipino populations, particularly regarding incidence of intracranial and extracranial lesions. Comparison of cerebrovascular disease in Chinese and Japanese populations by Chin showed no difference regarding the incidence of thrombosis. In a Singapore study the predominantly Chinese population had mostly thrombosis and, interestingly, TIA appeared to have greater incidence in the vertebrobasilar rather than the carotid territory of the brain. The mortality study of various populations in Hawaii by Bennett et al. revealed a high incidence of cerebrovascular disease in Chinese and Filipino men thought by the authors to be on the basis of hypertension rather than atherosclerosis. They also found the highest rate of cerebrovascular disease mortality among the Polynesians. In our study, the Hawaiian-born Chinese and the Filipino populations had a ratio of frequency of extracranial and intracranial lesions similar to the Caucasian population. The limited number of Hawaiian and part-Hawaiian patients studied also had a Caucasian pattern.

Since a detailed review of the entire clinical record was not carried out in this project, no effort was made to specifically correlate the angiographical findings with the clinical stroke syndromes.

Conclusion

Patients hospitalized in the three major Honolulu hospitals over a five-year period with a final diagnosis of non-hemorrhagic cerebrovascular disease and who had angiography of the carotid system were studied regarding the pattern of extracranial and intracranial lesions. A significant difference was found between the ratio of frequency of involvement of the extracranial and intracranial vessels in Caucasian and that in the Hawaiian-born Japanese populations, similar to that reported by others in native Japanese populations. On
the other hand, no such significant difference was found with the Filipino, Chinese, Hawaiian and part-Hawaiian populations studied.

Acknowledgment

The author wishes to thank Dr. James Lumeng, Associate Professor, Department of Pathology, University of Hawaii School of Medicine, for his statistical analysis of the angiographical data. Acknowledgment is also given to Dr. Richard Moore, Director, Department of Radiology, St. Francis Hospital; Dr. Grover Liese, Director, Department of Radiology, Queen’s Medical Center; and Dr. Edgar Childs, Director, Department of Radiology, Kuakini Hospital, for their assistance and support in this study.

References

Patterns of Cerebrovascular Disease in Japanese and Other Population Groups in Hawaii: 
An Angiographical Study
RAYMOND W. BRUST, JR.

Stroke. 1975;6:539-542
doi: 10.1161/01.STR.6.5.539

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://stroke.ahajournals.org/content/6/5/539

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in Stroke can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Stroke is online at:
http://stroke.ahajournals.org//subscriptions/