An Epidemiologic Study of Cerebrovascular Disease in Western Japan: With Special Reference to Transient Ischemic Attacks

Katsuya Urakami, Masayuki Igo, and Kazuro Takahashi

The prevalence and incidence ratios of cerebrovascular disease, with special reference to transient ischemic attack (TIA), were studied in the towns of Daisen and Ama in western Japan. There have been no previous reports on this subject in Japan. The prevalence ratios of TIA were estimated to be 4.4 in Daisen and 2.0 in Ama per 1,000 people over 40 years old. The ratio of carotid arterial system TIA to vertebrobasilar arterial system TIA was about 1 to 1. The incidence ratios of stroke were 319.6 in Daisen and 314.5 in Ama per 100,000 people of all ages. The prevalence ratios of stroke were estimated to be 14.8 in Daisen and 13.5 in Ama per 1,000 people of all ages. The prevalence ratio of TIA in Japan is about one-third to one-half of that in Western countries. However, the prevalence of complete stroke is much higher in Japan compared with that in Western countries. Therefore, the ratio of TIA to stroke is much lower in Japan than in Western countries. The obstruction of small intracranial arteries, in addition to heart disease, might play an important role in TIA in Japan, whereas in Western countries TIA might be mostly caused by heart disease or the atherosclerosis of extracranial arteries (Stroke 1987;18:396-401)

Subjects and Methods

The areas we surveyed were Daisen, Tottori Prefecture and Ama, Shimane Prefecture, situated at latitude 35°20'-36°7' north and longitude 133°4'-133°43' east, in western Japan (Figure 1).

The area of Daisen is 85.4 km², and its population was 7,740 on the day of the survey in 1981. We investigated the incidence ratio of stroke from 1976 to 1983. We diagnosed the possible cases of TIA by checking National Health Insurance medical records. Two neurologists definitively diagnosed the possible cases of TIA in Daisen and 54 (2.8% of 1,961 people) in Ama. We investigated stroke in 2,390 people over age 30 in Daisen and 58 (2.4% of 2,390 people over age 30) in Ama. By these methods, we detected 385 (9.8% of 3,896 people possible cases of TIA in Daisen and 229 possible cases of stroke (4.6% of 4,978 people over age 30) in Daisen and 58 (2.4% of 2,390 people over age 30) in Ama. The reason for more possible cases of TIA than of stroke is that there were many cases of false-positive TIA.

Two neurologists definitively diagnosed the possible cases as stroke and TIA by checking the questionnaires and through neurologic interviews and examinations. We diagnosed the possible cases of TIA by the...
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The Oki Islands group

FIGURE 1. Location of Daisen and Ama.

Diagnostic criteria of the Joint Committee for Stroke Facilities in the USA\(^1\) and by confirming that there were no detectable residuals through neurologic examinations. Most of the possible cases of stroke visited hospitals, and we examined their medical records. We found cases misdiagnosed as TIA whose neurologic symptoms continued over 24 hours after stroke attack and whose neurologic deficits, such as speech disturbance, mild hemiparesis, etc., remained when we visited them at home; we diagnosed them as stroke.

After a 1- or 4-year follow-up period, we investigated the appearance of stroke and cardiovascular death by December 31, 1985 in patients who had suffered TIA in both the areas.

Table 1. Age-Specific Prevalence Ratios of TIA

<table>
<thead>
<tr>
<th>Age</th>
<th>No. of people</th>
<th>TIA</th>
<th>Prevalence per 1,000</th>
<th>No. of people</th>
<th>TIA</th>
<th>Prevalence per 1,000</th>
<th>No. of people</th>
<th>TIA</th>
<th>Prevalence per 1,000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>in Daisen</td>
<td></td>
<td></td>
<td>in Ama</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Men</td>
<td></td>
<td></td>
<td>Women</td>
<td></td>
<td></td>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-49</td>
<td>502</td>
<td>3</td>
<td>6.0</td>
<td>538</td>
<td>1</td>
<td>1.9</td>
<td>1,040</td>
<td>4</td>
<td>3.8</td>
</tr>
<tr>
<td>50-59</td>
<td>571</td>
<td>0</td>
<td>0</td>
<td>648</td>
<td>2</td>
<td>3.1</td>
<td>1,219</td>
<td>2</td>
<td>1.6</td>
</tr>
<tr>
<td>60-69</td>
<td>372</td>
<td>4</td>
<td>10.8</td>
<td>498</td>
<td>2</td>
<td>4.0</td>
<td>870</td>
<td>6</td>
<td>6.9</td>
</tr>
<tr>
<td>70+</td>
<td>317</td>
<td>5</td>
<td>15.8</td>
<td>450</td>
<td>0</td>
<td>0</td>
<td>767</td>
<td>5</td>
<td>6.5</td>
</tr>
<tr>
<td>Total</td>
<td>1,762</td>
<td>12</td>
<td>6.8</td>
<td>2,134</td>
<td>5</td>
<td>2.3</td>
<td>3,896</td>
<td>17</td>
<td>4.4</td>
</tr>
<tr>
<td>40-49</td>
<td>96</td>
<td>0</td>
<td>0</td>
<td>184</td>
<td>0</td>
<td>0</td>
<td>280</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>50-59</td>
<td>228</td>
<td>2</td>
<td>8.8</td>
<td>342</td>
<td>0</td>
<td>0</td>
<td>570</td>
<td>2</td>
<td>3.5</td>
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<tr>
<td>60-69</td>
<td>237</td>
<td>0</td>
<td>0</td>
<td>324</td>
<td>0</td>
<td>0</td>
<td>561</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>70+</td>
<td>198</td>
<td>2</td>
<td>10.0</td>
<td>352</td>
<td>0</td>
<td>0</td>
<td>550</td>
<td>2</td>
<td>3.6</td>
</tr>
<tr>
<td>Total</td>
<td>759</td>
<td>4</td>
<td>5.3</td>
<td>1,202</td>
<td>0</td>
<td>0</td>
<td>1,961</td>
<td>4</td>
<td>2.0</td>
</tr>
</tbody>
</table>

TIA, transient ischemic attack.
Table 2. Prevalence Ratios of TIA in Various Countries

<table>
<thead>
<tr>
<th>Population</th>
<th>Years</th>
<th>Reported by</th>
<th>Age</th>
<th>Number</th>
<th>Prevalence ratio per 1,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evans County, Georgia^19</td>
<td>1967–1969</td>
<td>Karp et al</td>
<td>15+</td>
<td>2,455</td>
<td>11.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>65+</td>
<td>551</td>
<td>18.1</td>
</tr>
<tr>
<td>Cook County, Illinois^20</td>
<td>1973</td>
<td>Ostfeld et al</td>
<td>67–74</td>
<td>2,772</td>
<td>63.0</td>
</tr>
<tr>
<td>Six cities, People’s Republic of China^27</td>
<td>1983</td>
<td>Li et al</td>
<td>All</td>
<td>63,195</td>
<td>1.8</td>
</tr>
<tr>
<td>Eight cities in the USA^21</td>
<td>1979</td>
<td>Wilkinson et al</td>
<td>60+</td>
<td>7,404</td>
<td>8.2</td>
</tr>
<tr>
<td>Daisen, Japan (Present study)</td>
<td>1981</td>
<td>Authors</td>
<td>40+</td>
<td>3,896</td>
<td>4.4</td>
</tr>
<tr>
<td>Ama, Japan (Present study)</td>
<td>1984</td>
<td>Authors</td>
<td>40+</td>
<td>1,961</td>
<td>2.0</td>
</tr>
</tbody>
</table>

TIA, transient ischemic attack.

Results

In Daisen, 17 patients with TIA were found. There were 3,896 people over 40 years old, and the prevalence ratio of TIA was 4.4 per 1,000 people over 40 years old. The prevalence ratios of men and women with TIA were 6.8 and 2.3 per 1,000 people over 40 years old (Table 1).

In Ama, 4 patients with TIA were found. There were 1,961 people over 40 years old, and the prevalence ratio of TIA was 2.0 per 1,000 people over 40 years old. The prevalence ratios of men and women with TIA were 5.3 and 0 per 1,000 people over 40 years old (Table 1).

The prevalence ratios in both areas were lower than those in Western countries (Table 2). The number of TIA types in both areas were as follows: 11 cases had carotid arterial system (CAS) TIA, and 10 cases vertebrobasilar arterial system (VBS) TIA. The prevalence ratios of CAS TIA and VBS TIA were 1.9 and 1.7 per 1,000 people over 40 years old (Table 3).

As for the prognosis of TIA patients, one case developed to cerebral infarction and one case to cardiovascular death in our study during 1 or 4 years of follow-up.

In Daisen, 114 patients with stroke were found. We examined 4,978 people over 30 years old, and the prevalence ratio of stroke was 22.9 per 1,000 people over 30 years old and 14.7 per 1,000 people of all ages. The prevalence ratios of men and women with stroke were 27.6 and 19.0 per 1,000 people over 30 years old (Table 4). The incidence ratio of stroke was 314.5 per 100,000 people of all ages (Table 5). The incidence ratio of SAH was 28.3 per 100,000 people, and the ratio of SAH in all strokes was 9.0%.

Discussion

Epidemiologic study always requires an accurate method. Self-administered questionnaires are a useful method of finding TIA patients among large groups of people. Tanaka^12 reported that few cases of TIA were missed by this method, although many false-positive cases of TIA were included. We also found that 90% of the cases showed false-positive responses that are caused by musculoskeletal diseases and vertiginous disorders. Since TIA is often diagnosed primarily by history, a mild stroke is often misdiagnosed as TIA. It is extremely difficult to exclude such mistakes in diagnosis through only screening questionnaires. Nonneurologists have often missed residual findings and diagnosed a stroke as TIA. In this study, respondents were interviewed and examined carefully by two neu-

Table 3. The Ratio of CAS TIA to VBS TIA

<table>
<thead>
<tr>
<th>Examine</th>
<th>Ratio CAS:VBS</th>
<th>Prevalence Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CAS TIA</td>
<td>VBS TIA</td>
</tr>
<tr>
<td>Evans County^19</td>
<td>2:1</td>
<td>8.8</td>
</tr>
<tr>
<td>Cook County^20</td>
<td>1:1.3</td>
<td>27.7</td>
</tr>
<tr>
<td>Daisen and Ama (Present study)</td>
<td>1:1</td>
<td>1.9</td>
</tr>
<tr>
<td>Italy^23</td>
<td>3:1</td>
<td></td>
</tr>
<tr>
<td>Japan^22</td>
<td>4:1</td>
<td></td>
</tr>
<tr>
<td>USA^13</td>
<td>4:1</td>
<td></td>
</tr>
</tbody>
</table>

CAS, carotid arterial system; TIA, transient ischemic attack; VBS, vertebrobasilar arterial system. *Data on inpatients.
The prevalence ratio of stroke in Ama was lower than in Daisen. The prevalence ratio of stroke was 8.0% in Hisayama, 7.5% in Shibata, and 6.0% in the Harvard Cooperative Study Registry. In our study, the ratio of stroke in all strokes was 7.6% in Hisayama, 7.5% in Shibata, and 6.0% in the Harvard Cooperative Study Registry. In our study, the ratio of stroke in all strokes is generally invariable and is an index of reliability in the epidemiologic study of stroke. It has been reported that SAH accounts for < 10% of strokes. The incidence ratio of SAH in all strokes was 7.6% in Hisayama, 7.5% in Shibata, and 6.0% in the Harvard Cooperative Study Registry. In our study, the ratio of SAH in all strokes was 6.1% in Daisen and 9.0% in Ama. These ratios are almost the same as those in above reports, and therefore the data on stroke in this study are thought to be reliable.

The TIA prevalence ratio in Evans County, Georgia was 18.1 per 1,000 people over 65 years old, and that in Cook County, Illinois was 63.0 per 1,000 persons 65–74 years old. These prevalence ratios of TIA are higher than those in this report, but the data is thought to be reliable considering the difference in prevalence ratios of strokes. The prevalence ratio of stroke in Daisen was similar to that in other reports in Japan, and it is thought that living customs, eating a lot of fish, and working to old age on the island reduce the prevalence ratio of stroke in Ama. In our previous survey, the eicosapentaenoic acid level in the blood was higher in Ama than in Daisen. Although these areas are situated close together, the prevalence ratios of stroke and TIA were different, and perhaps this can be attributed to their lifestyle. The prevalence data may be biased by differential case fatality between the two areas, although this is unlikely.

The TIA prevalence ratio in Evans County, Georgia was 18.1 per 1,000 people over 65 years old, and that in Cook County, Illinois was 63.0 per 1,000 persons 65–74 years old. These prevalence ratios of TIA are higher than those in this report, but the data is considered too old or too limited in scope to be reliable.
able. However, in the report of Wilkinson et al., where methodology was similar to ours, the prevalence ratio of TIA was 8.2 per 1,000 people over 60 years old. The prevalence ratios in Daisen were 4.4 per 1,000 people over 40 years old, and in both the areas 3.6 per 1,000 people over 40 years old and 4.7 per 1,000 people over 60 years old. These results are only about one-third of those for Evans County and lower than those in the report of Wilkinson et al.

The ratio of CAS TIA to VBS TIA was about 1 to 1 in our study. In other epidemiologic studies, the ratios of CAS TIA to VBS TIA were about 2 to 1 in Evans County and about 1 to 3 in Cook County, almost the same as our results. Reports on inpatients give ratios of about 4 to 1 in Japan, about 3 to 1 in Italy, and about 4 to 1 in the United States (Table 5). It is supposed that cases with VBS TIA were often overlooked in the study of inpatients because patients with mild VBS TIA signs such as dizziness, vertigo, giddiness, lightheadedness, and cerebellar ataxia do not often visit the hospital.

The incidence ratios of stroke were 319.6 in Daisen and 314.5 in Ama per 100,000 people of all ages. When the age-specific incidence ratios in Daisen, Ama, Hisayama, and Shibata were compared, the incidence ratios of all ages were similar (Table 5).

In Japan, the stroke prevalence ratios were 15.2 in men and 15.6 in women per 1,000 people over 40 years old in a preliminary study in Hisayama in 1961. In our report, the prevalence ratios were 27.6 in men, 19.0 in women per 1,000 people over 30 years old in Daisen and 26.6 in men, 13.1 in women in Ama, but the age-specific prevalence ratios in our study were almost the same as in Hisayama. The stroke prevalence ratio per 1,000 people over 35 years old in Rochester, Minn., was 5.59 from 1955 to 1969, and the stroke prevalence ratio in a Copenhagen City heart study was 5.18 per 1,000 people over 20 years old in 1976 (Table 6). The prevalence ratio of stroke in Japan was 3 or 4 times as high as in Western countries, but the prevalence ratio of TIA in Japan was about one-third or one-half of that in Western countries. The ratio of TIA to stroke in Japan is about 1 to 3, and in China about 1 to 4, a fraction of that in Western countries. The above figures can perhaps be explained by the fact that TIA is often caused by emboli, which are produced by atherosclerosis of the internal carotid artery and heart disease; these conditions are found more frequently in Western countries than in Japan. On the other hand, since hypertension is predominant in Japan, hypertensive sclerotic change of the intracranial small vessels occur very often, which causes a high incidence of cerebral infarction.

References
15. Ueda K, Omae T, Hirota Y, Takeshita M, Katsuki S, Tanaka...

Key Words • stroke • TIA • prevalence ratio
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