

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

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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)

SEVERAL clinical reports¹⁻⁷ have said that a high percent of stroke patients have had prior episodes of transient ischemic attack (TIA). TIA is regarded as a significant forewarning of cerebral infarction. However, there have been no reports about its prevalence ratio in Japan, and the etiologic factors of TIA in Japan may be different from those in Western countries. The origins of TIA are often caused by emboli from extracranial arteries in Western countries, whereas in Japan the main cause of TIA is atherosclerosis of intracerebral small arteries.⁸ Some reports^{9,10} say that the frequency of subsequent stroke after TIA is greater in Japan than in Western countries, and it is suggested that TIA in Japan might be indicative of impending stroke. Therefore, we made an epidemiologic survey at two areas in the Sanin District in western Japan to clarify the prevalence of TIA and stroke.

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. The yearly mean temperature is 55.8° F (min, 50.0° F; max, 91.9° F), and the annual average duration of sunshine is 2,324.5 hours. According to the census of 1981, 44.1% of the people were engaged in agriculture, 20.4% in industry, and 35.5% in commerce. Investigation of the prevalence ratio was performed in 1981,

and we examined the final results on December 31, 1981. We investigated the incidence ratio of stroke from 1971 to 1981.

Ama is one of the islands of the Oki Islands group. The area is 33.45 km², and the population was 3,452 in 1984. The yearly mean temperature, annual average rainfall, and annual average duration of sunshine were almost the same as in Daisen. According to the census of 1984, 37.5% of the people were engaged in fishing and agriculture, 12.5% in industry, and 50% in commerce. Investigation of the prevalence ratio was performed in 1984, and we examined the final results on December 31, 1984. We investigated the incidence ratio of stroke from 1976 to 1983.

Questionnaires, in accordance with the standards of the Joint Committee for Stroke Facilities in the USA,¹¹ were sent to 3,896 people in Daisen and 1,961 people in Ama over age 40; 2,576 people (66.1%) in Daisen and 1,276 people (65.1%) in Ama answered the questionnaire. As for the people who did not answer the questionnaire, we identified possible stroke patients through population stroke screening conducted by our clinic, by visiting people over age 40 at home, or by checking National Health Insurance medical records. By these methods, we detected 385 (9.8% of 3,896 people) possible cases of TIA in Daisen and 54 (2.8% of 1,961 people) in Ama. We investigated stroke in people over age 30 by the same methods. There were 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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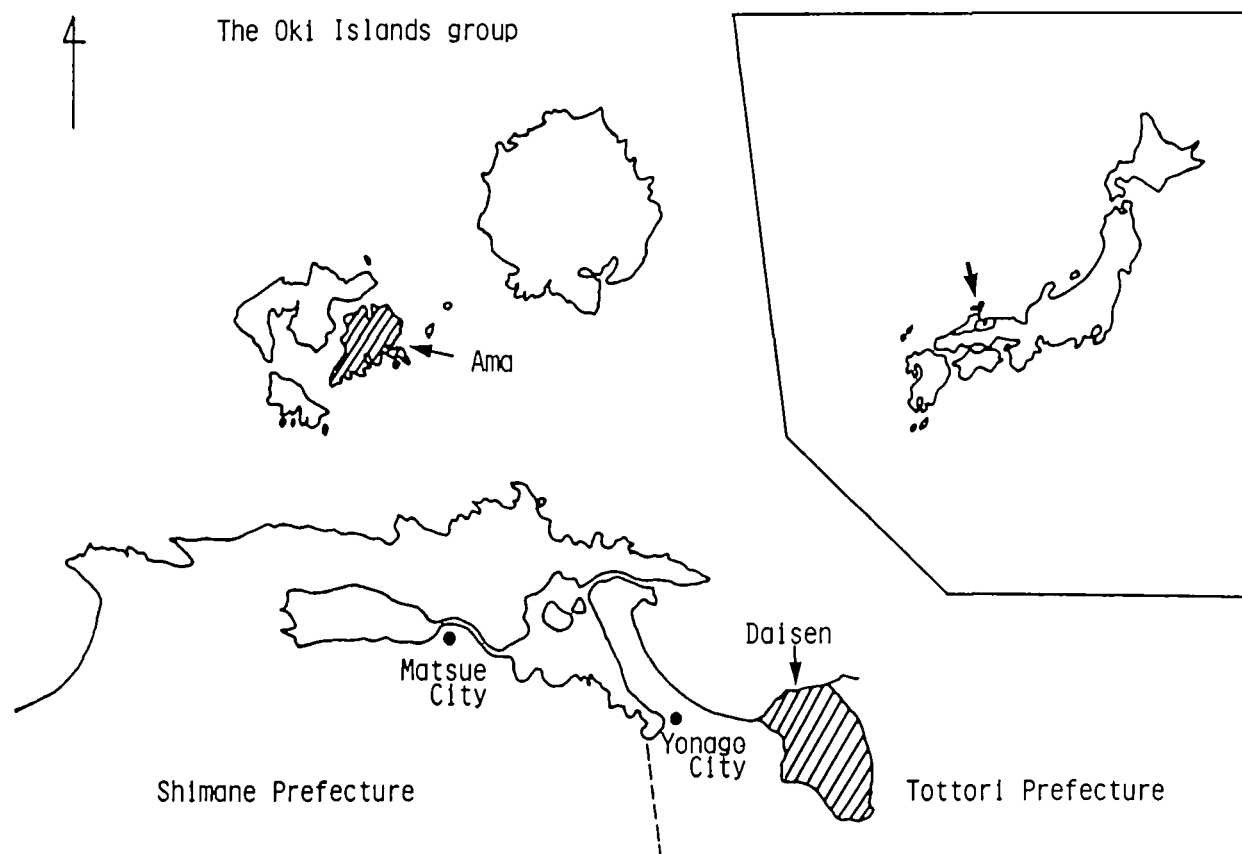


FIGURE 1. Location of Daisen and Ama.

diagnostic criteria of the Joint Committee for Stroke Facilities in the USA¹¹ 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

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

TIA, transient ischemic attack.

Table 2. Prevalence Ratios of TIA in Various Countries

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

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 verte-brobasilar 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 319.6 per 100,000 people of all ages (Table 5). The incidence ratio of subarachnoid hemorrhage (SAH) was 19.4 per 100,000 people, and the ratio of SAH in all strokes was 6.1%.

In Ama, 46 patients with stroke were found. There were 2,390 people over 30 years old, and the prevalence ratio was 19.2 per 1,000 people over 30 years old and 13.3 per 1,000 people of all ages. The prevalence ratios of men and women with stroke were 26.6 and 13.1 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. Tanaka¹² 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.¹³ In this study, respondents were interviewed and examined carefully by two neu-

Table 3. The Ratio of CAS TIA to VBS TIA

	Ratio CAS:VBS	Prevalence Ratio	
		CAS TIA	VBS TIA
Evans County ¹⁹ (Karp et al)	2:1	8.8	4.2
Cook County ²⁰ (Ostfeld et al)	1:1.3	27.7	35.7
Daisen and Ama (Present study)	1:1	1.9	1.7
Italy* ²³ (Fleisch et al)	3:1		
Japan* ²² (Tsuda et al)	4:1		
USA* ¹³ (Dyken et al)	4:1		

CAS, carotid arterial system; TIA, transient ischemic attack; VBS, verte-brobasilar arterial system.

*Data on inpatients.

Table 4. Age-Specific Prevalence Ratios of Stroke

Age	Men			Women			Total		
	No. of people	Stroke	Prevalence per 1,000	No. of people	Stroke	Prevalence per 1,000	No. of people	Stroke	Prevalence per 1,000
<i>in Daisen</i>									
30-39	556	1	1.8	555	0	0	1,111	1	0.9
40-49	480	0	0	517	0	0	997	0	0
50-59	491	8	16.3	648	10	15.4	1,139	18	15.8
60-69	407	20	49.2	514	8	15.6	921	28	30.4
70-79	240	24	100.0	329	20	60.8	569	44	77.3
80 +	73	9	123.0	168	14	90.3	241	23	95.4
TOTAL	2,247	62	27.6	2,731	52	19.0	4,978	114	22.9
<i>in Ama</i>									
30-39	237	0	0	192	0	0	429	0	0
40-49	182	2	11.0	213	0	0	395	2	5.1
50-59	258	1	3.9	293	1	3.4	551	2	3.6
60-69	215	10	46.5	286	8	28.0	501	18	35.9
70-79	139	10	71.9	206	6	29.1	345	16	46.4
80 +	59	6	101.7	110	2	18.2	169	8	47.3
TOTAL	1,090	29	26.6	1,300	17	13.1	2,390	46	19.2

rologists, and TIA was diagnosed in accordance with diagnostic criteria designed by the Joint Committee for Stroke Facilities in the USA.¹¹ Consequently, our study on TIA is considered to be reliable.

It has been reported that SAH accounts for < 10% of all strokes. The ratio of SAH in all strokes is generally invariable and is an index of reliability in the epidemiologic study of stroke.¹⁴ The incidence ratios of SAH in all strokes were 7.6% in Hisayama,¹⁵ 7.5% in Shibata¹⁶ in Japan, and 6.0% in the Harvard Cooperative Study Registry.¹⁷ 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 prevalence ratios of TIA were 4.4 and 2.0 per 1,000 people over 40 years old in Daisen and Ama, respectively, lower in Ama than in Daisen. The prevalence ratio of stroke in Ama was also lower than in Daisen; therefore, the difference in prevalence ratios

of TIA between the two areas is reasonable 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.¹⁸ 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, Georgia¹⁹ was 18.1 per 1,000 people over 65 years old, and that in Cook County, Illinois²⁰ 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 reli-

Table 5. Comparison of Incidence Ratios of Stroke in Japan

Age	Men				Women			
	Daisen	Ama	Hisayama ¹⁵	Shibata ¹⁶	Daisen	Ama	Hisayama ¹⁵	Shibata ¹⁶
30-39	0.74	0.62	—	0.26	0.18	0.0	—	0.13
40-49	0.88	0.27	2.2	1.25	0.14	0.0	0.0	0.22
50-59	2.86	0.70	4.1	3.30	1.58	0.23	2.4	1.05
60-69	8.40	3.75	16.8	10.42	5.73	2.25	6.7	3.78
70-79	17.25	3.95	19.8	15.72	12.40	5.14	13.7	8.01
80-89	35.16	12.32	54.7	27.93	27.30	8.70	23.9	20.89
90 +	27.86	0.72			33.33	3.62		
TOTAL NUMBERS	138	49	105	275	135	40	72	157

Table 6. Comparison of Prevalence Ratio of Stroke

Population	Years	Reported by	Age	No. of people	Prevalence ratio per 1,000
Hisayama, Japan ²⁴	1961	Takeya	40+	25	13.8
Rochester, Minn. ²⁵	1955–1959	Matsumoto et al	35+	184	5.5
Copenhagen City ²⁶	1976	Sørensen et al	20+	115	5.18
Six cities, People's Republic of China ²⁷	1983	Li et al	All	392	6.2
Daisen, Japan (present study)	1981	Authors	30+	114	22.9
Ama, Japan (present study)	1984	Authors	30+	46	19.2

able. However, in the report of Wilkinson et al,²¹ 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 County¹⁹ and about 1 to 1.3 in Cook County,²⁰ almost the same as our results. Reports on inpatients give ratios of about 4 to 1 in Japan,²² about 3 to 1 in Italy,²³ and about 4 to 1 in the United States¹³ (Table 3). 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,¹⁵ and Shibata¹⁶ 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 1961.²⁴ 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.¹⁵ The stroke prevalence ratio per 1,000 people over 35 years old in Rochester, Minn.,²⁵ was 5.59 from 1955 to 1969, and the stroke prevalence ratio in a Copenhagen City heart study²⁶ 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 4,²⁷ a fraction of that in Western countries. The above figures can perhaps be explained by the fact

that TIA is often caused by emboli,^{28,29} 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.³⁰ On the other hand, since hypertension is predominant in Japan, hypertensive sclerotic change of the intracranial small vessels occur very often,⁸ which causes a high incidence of cerebral infarction.

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KEY WORDS • stroke • TIA • prevalence ratio