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Prevalence of Stroke in Finland

KARI AHO, M.D., ANTTI REUNANEN, M.D., ARPO AROMAA, M.D., PAUL KNEKT, M.SC., AND JOUNI MAATELA, M.D.

SUMMARY The prevalence of stroke was investigated in a Finnish population study. The results were based on cross-sectional data from a follow-up examination of a prospective study conducted in 1973-1976. The study population drawn from four regions of the country comprised 11,103 men and 11,096 women aged 20 years and over. The age-adjusted prevalence of stroke was 10.3/1000 in men and 5.8/1000 in women. The prevalence was significantly higher in non-attendants at the examination than in attendants. In 15 per cent of the prevalence cases the stroke was caused by subarachnoid hemorrhage, in six per cent by cerebral hemorrhage and in the remainder by cerebral infarction or the type could not be specified. Over half (57 per cent) of the survivors of stroke had no or only slight disability; eight per cent were totally disabled. Some form of organic heart disease and hypertension was significantly more common in the prevalence cases than in the others.

IN FINLAND, as in many other developed countries, stroke lies third on the list of leading causes of death after coronary heart disease and cancer. 1, 2 To date, however, the epidemiology of stroke has been based on only a few population studies, in most of which the incidence of stroke has been investigated. 3-8 Although the incidence describes the rate of all new cases in the community adequately, the prevalence provides the best measure of the impact that stroke has on the community and provides the information needed for developing health care services.

Very few studies 8 have been conducted on the prevalence of stroke, and no reports have been published from Finland. We have studied the prevalence of stroke and risk factors in stroke survivors as part of a survey of cardiovascular diseases in Finland. The incidence of stroke in the same population is presented in another article in this issue. 1

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Study Population and Methods

The prevalence of stroke was investigated at the follow-up examination phase of a large Finnish prospective population study, The Social Insurance Institution's Mobile Clinic Health Examination Survey. Details of the baseline examination carried out in the years 1966–72 and the mortality follow-up of the whole study have been published elsewhere. After a mean follow-up of six years, 1973–76, a third of the population invited to the baseline investigation and known to be still alive was invited to a follow-up examination. This group consisted of 23,279 men and women aged 20 years and over drawn from 12 cohorts from southwestern, western, central and eastern Finland. A total of 19,518 (84 per cent) participated in the follow-up examination. A questionnaire posted to all non-participants was returned by 2,681 of them. Thus 1,080 (5 per cent of all invited) were known to be alive but no information on their health status was available and they were excluded from the population of this study. The study population thus consisted of 11,103 men and 11,096 women. The results obtained are point prevalence rates of stroke in persons alive at the time of the re-examination of the cohort.

All participants filled in a questionnaire posted beforehand with information on the history of their disease diagnosed by a doctor and on their health behaviour and possible incapacity. The entries were checked by a nurse at the examination. The questionnaire posted to non-participants also enquired the reasons for non-attendance and items on known chronic diseases. The question: “Have you had a stroke that has been diagnosed by a doctor?” was included in the questionnaires completed by both participants and non-participants. If the answer was affirmative, details on hospital admissions were requested. On the basis of these answers one of the authors (KA), a neurologist, carefully checked all records from hospitals, health centres and homes for the elderly, mentioning treatment for a suspected stroke. Only cases with enough data documented in the medical records were accepted. The diagnostic criteria of stroke and its type were the same as those applied in the WHO stroke register study.

Reasons for affirmative answers to the question on stroke diagnosed by a doctor are given in table 1. In a quarter of the people giving affirmative answers there was no reliable evidence of stroke or any other neurological diseases. In 53 per cent of them there was enough evidence for diagnosis of a completed stroke; in the remainder, transient ischemic attacks or other organic neurological disorders were the basis for the affirmative answers.

The affirmative answers to the question on known stroke were not the only source of information. In 12 cases answers to other questions enquiring causes of incapacity or history of other cardiovascular diseases hinted at stroke. Lastly a further 13 cases were identified from information contained in the death certificates of those who died after the follow-up examination. Mortality follow-up was complete until the end of 1978, a mean of three years after the follow-up examination took place. Non-fatal stroke at the time of re-examination was satisfactorily documented in the 13 cases who according to the questionnaire did not mention the occurrence of a known stroke. Figure 1 describes schematically how stroke cases were identified.

Incacity following stroke was assessed by the answers to the questionnaire. The answers also supplied information on incapacity pensions, other known chronic diseases and smoking habits. Angina pectoris symptoms were interviewed on all participants by the Rose questionnaire. Casual blood pressure was measured in all participants. Serum cholesterol was determined in all and serum triglycerides in a quarter of participants from a fasting venous blood sample. The distribution of obesity was measured with Quetelet's body mass index (BMI, kg/m²).

The age-adjusted prevalence rates were calculated with direct method. The standard population comprised whole population of Finland aged 20 years and over in 1970. The statistical significance of the age-adjusted risk ratios was tested by the Mantel-Haenszel procedure.

Results

Altogether 177 people were ascertained to have had a stroke at the time of the follow-up examination. The prevalence seemed to increase steadily with age (table

<table>
<thead>
<tr>
<th>Stroke</th>
<th>TIA or chronic cerebrovascular disease</th>
<th>Other neurological disease</th>
<th>Syncope, dizziness, other neurological symptom</th>
<th>Symptoms too vague, lack of evidence</th>
<th>Wrongly completed questionnaire</th>
</tr>
</thead>
<tbody>
<tr>
<td>152</td>
<td>38</td>
<td>24</td>
<td>39</td>
<td>29</td>
<td>4</td>
</tr>
<tr>
<td>53</td>
<td>13</td>
<td>8</td>
<td>14</td>
<td>10</td>
<td>2</td>
</tr>
</tbody>
</table>

Total 286

Table 1. Causes of Affirmative Answers to the Question: “Have you had a stroke that has been diagnosed by a doctor?”

Diagram of detection of the prevalence cases.
2). Exceptions to this trend was observed in elderly men and in women aged 55–75 years. The unexpectedly low rates in men aged 75 and over and women aged 65–74 years may have arisen by chance because of relatively low number prevalence cases by age groups or by selective survival. The age-adjusted prevalence rate was 10.3/1000 in men and 5.8/1000 in women. In all age groups, except 75 years and over, the prevalence was greater in males. The age-adjusted risk ratio of stroke prevalence in men and women was 1.8 (p < .001). There were no significant differences in the prevalence rates in 12 study cohorts or four study areas.

One hundred and thirty-three of the prevalence cases had had a stroke between the baseline and follow-up examination. In 39 cases (35.8%), the information was not adequate for reliable classification of the event. In 16 cases (14.7%) had subarachnoid hemorrhage, seven (6.4%) cerebral hemorrhage and 47 (43.1%) thrombotic or embolic brain infarction. In 39 cases (35.8%), the information was not adequate for reliable classification of the event.

The disability grade of the stroke survivors could be assessed in 153 cases from their own description (table 3). More than half (57 per cent) of the stroke survivors had no significant (or only slight) disability. In eight per cent of them disability was so severe that help of other people was regularly needed in some daily activities. Eight per cent were totally bedridden or needed regular help in most daily activities.

In Finland the general retirement age is 65 years.

Seventy-one per cent (34 out of 48) of the men with stroke and 66 per cent (19 out of 29) of the women had retired before that age because of ill health. Thus only 31 per cent of the survivors younger than 65 had retained their working capacity at the time of examination.

The prevalence of some associated chronic diseases in stroke survivors and other people is presented in table 4. Coronary heart disease and angina pectoris were significantly more common in men with stroke than in men without stroke. The age-adjusted prevalence of heart failure and any form of organic heart disease was also significantly more common in men with stroke than in those without it. In women there was no difference in the prevalence of coronary heart disease between stroke survivors and other women. Heart failure and all organic heart disorders were, however, significantly more common in women with stroke than in women without stroke. Known hypertension was significantly more common in stroke survivors than in other people, in both men and women. Diabetes was significantly more common in men with stroke than in those without it.

The prevalence of some risk factors of cardiovascular diseases in stroke survivors and other people is

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>20–44</th>
<th>45–54</th>
<th>55–64</th>
<th>65–74</th>
<th>75+</th>
<th>Total age-adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>6,212</td>
<td>2,134</td>
<td>1,569</td>
<td>933</td>
<td>255</td>
<td>11,103</td>
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<tr>
<td>(10)</td>
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<td></td>
<td></td>
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<tr>
<td>Women</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>5,605</td>
<td>2,039</td>
<td>1,688</td>
<td>1,279</td>
<td>485</td>
<td>11,096</td>
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<tr>
<td>(6)</td>
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<tr>
<td>Both sexes</td>
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<tr>
<td>N</td>
<td>11,817</td>
<td>4,173</td>
<td>3,257</td>
<td>2,212</td>
<td>740</td>
<td>22,199</td>
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<td>(16)</td>
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</tbody>
</table>

Number of prevalence cases in parentheses.

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>20–44</th>
<th>45–54</th>
<th>55–64</th>
<th>65–74</th>
<th>75+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>N</td>
<td></td>
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<tr>
<td>(10)</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Women</td>
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<td></td>
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<tr>
<td>N</td>
<td></td>
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<td>(6)</td>
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<tr>
<td>Both sexes</td>
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<tr>
<td>N</td>
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<tr>
<td>(16)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Baseline cases*</th>
<th>Follow-up cases</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>No significant disability</td>
<td>20 (35%)</td>
<td>16 (17%)</td>
</tr>
<tr>
<td>Slight disability</td>
<td>18 (32%)</td>
<td>32 (33%)</td>
</tr>
<tr>
<td>Moderate disability</td>
<td>13 (23%)</td>
<td>30 (31%)</td>
</tr>
<tr>
<td>Moderately severe disability</td>
<td>4 (7%)</td>
<td>8 (8%)</td>
</tr>
<tr>
<td>Severe disability</td>
<td>2 (3%)</td>
<td>10 (10%)</td>
</tr>
<tr>
<td>Total</td>
<td>57</td>
<td>96</td>
</tr>
</tbody>
</table>

*Baseline case: stroke occurred before baseline examination. Follow-up case: stroke occurred between baseline and follow-up examination.
presented in table 5. There were no significant differences in the prevalence of current smokers in male stroke survivors and other men. None of the women with stroke smoked. Treated hypertension or, if untreated, systolic blood pressure of 170 mm Hg or over and diastolic blood pressure of 100 mm Hg or over were significantly more common in stroke survivors than in others. Prevalences of hyperlipidemias tended to be higher in stroke survivors than in others, but only the prevalence difference of hypertriglyceridemia in men was statistically significant. Obesity was more common in stroke survivors than in other examinees, but the difference was not statistically significant.

### Discussion

The study population cohorts are strictly speaking representative only for the defined areas from which they were drawn. However, as presented earlier, the cohorts were drawn from four geographic areas of the country and the demographic features of the study population were close to those of the population in the whole country. Thus knowing the weaknesses of the generalizability of this study population some general conclusions can be made.

Only the stroke cases treated in hospitals, health centres and homes for the elderly were detected by our method. This causes an insignificant underestimation of the prevalence because in an earlier population study it was found that a mere four per cent of people with stroke in Finland are treated only at home. A greater drawback may be that we did not get any data on five per cent of the original cohort. Ill health probably was one reason that prevented them from participating and from completing the questionnaires. Non-participants in the follow-up examination had a significantly higher prevalence of stroke than the participants. This supports our suspicion that the group of non-participants who did not return the questionnaire may include stroke cases who were not detected in the present study. The number of such cases would not, however, substantially alter the prevalence rates presented, and we can only conclude that the data represent a minimum estimate of the true prevalence.

In many epidemiological studies concerning the prevalence of strokes the rates are expressed as referred to the whole population although the rates are extremely low in the younger age groups. Assuming that the prevalence rates in those aged under 20 years of age is negligible the crude prevalence of stroke in the whole Finnish population using the rates obtained in our study would be 6.4/1000 (men 7.9, women 4.8). The rate is higher than that reported from Denmark (5.18/1000) and from Norway (4.39/1000). Different age grouping, however, impedes comparison. The age-specific prevalence rates obtained in our study are fairly similar to those found in other studies in Western countries (fig. 2). The prevalence of stroke in Japanese men is at a substantially higher level. Prevalence rates from the USA are somewhat higher in most age groups but the data are from the 1960s, and it is well known that the morbidity of stroke has thereafter decreased since then. According to the large and de-
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TABLE 6

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>20-54</th>
<th>55-64</th>
<th>65+</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975 Men</td>
<td>3,400</td>
<td>4,500</td>
<td>6,300</td>
<td>14,200</td>
</tr>
<tr>
<td>Women</td>
<td>1,600</td>
<td>3,800</td>
<td>6,700</td>
<td>12,100</td>
</tr>
<tr>
<td>Both sexes</td>
<td>5,000</td>
<td>8,300</td>
<td>13,000</td>
<td>26,300</td>
</tr>
<tr>
<td>2000 Men</td>
<td>4,500</td>
<td>6,300</td>
<td>10,300</td>
<td>21,100</td>
</tr>
<tr>
<td>Women</td>
<td>1,900</td>
<td>4,300</td>
<td>12,100</td>
<td>18,300</td>
</tr>
<tr>
<td>Both sexes</td>
<td>6,400</td>
<td>10,600</td>
<td>22,400</td>
<td>39,400</td>
</tr>
</tbody>
</table>

These studies, however, included all stroke patients, those who died as well as those who did not, whereas our study concerned only survivors. The lower frequency we obtained may well be due to selection: patients with more associated diseases had a lethal course of stroke and did not survive to be included in our material.

The frequency of cardiovascular risk factors: hypertension, hyperlipidemia, smoking and obesity in stroke survivors compared to those without stroke was consistent with other cross-sectional and incidence studies of stroke. The presentation of risk factors in this article concerning the prevalence of stroke is, however, only descriptive. The importance of various risk factors in predicting stroke in our study population will be presented in subsequent articles. An interesting point, however, is that risk factors identified as important in prospective studies are also evident in cross-sectional studies of stroke survivors, like our study.

The main use of prevalence studies is descriptive investigations forming the basis of assessments of the extent and degree of the problem in planning health care services. Using the prevalence rates obtained in our study and the population census of Finland in 1975 we estimated the number of stroke survivors in the whole country at the time of our investigation (table 6). The figure obtained was some 26,000 stroke survivors in the whole country, about a half of whom are aged 65 years or over. Assuming that the prevalence rates remain the same but only the age distribution changes with time there would be 39,000 stroke survivors in the whole country in the year 2000 (table 6). The increase is particularly striking in the oldest age groups. The number of stroke survivors aged 65 years and over would almost double (from 13,000 to 22,400) by the year 2000 if the only change were the natural aging of the population. Furthermore, since incapacity after stroke is very age-dependent the estimated increase in the numbers of stroke survivors presents a substantial challenge to the health services of this country.

References


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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/17/4/681