Incidence and Early Prognosis of Stroke in Espoo-Kauniainen Area, Finland, in 1972

BY KARI AHO, M.D., AND RAINER FOGELHOLM, M.D.

Abstract: A stroke register has been operating in the Espoo-Kauniainen area, Finland, since January 1, 1972. The study population was 108,000 persons on January 1, 1972. In order to find totally new cases of stroke the following sources were utilized: hospitals and practicing physicians serving the study area were contacted regularly, death certificates were perused every two weeks, and copies of medical certificates of stroke patients applying for sick leave were received from The National Pensions Institute.

During 1972 a total of 153 new stroke cases were registered, giving an incidence of 142/100,000/year. The young age structure of the study population (5.2% were 65 years or older) explains this relatively low incidence. When applied to the total population of Finland and adjusted for age and sex the incidence is 231/100,000/year. The total cases were distributed equally between men and women. Men in age groups 50 to 59 and 60 to 69 years had an incidence twice that of women. The opposite was true in the age group 70 to 79 years. The incidence increased steeply with age.

Case fatality during the acute phase, the first three weeks, was 38% for all stroke cases. In the different clinical entities the case fatality was highest among intracerebral hemorrhages (66%) and lowest among ischemic cerebral infarction (27%).

The results of the first year of registry give an incidence of stroke for Finland which is relatively high compared with many earlier studies from other countries.

Additional Key Words
stroke register
ischemic cerebral infarction
cerebral hemorrhage
epidemiology

Although stroke is the third leading cause of death in developed countries there are fairly few data on its incidence. In Finland no studies have been made of the total incidence of stroke. Pakarinen has analyzed the incidence of primary subarachnoid hemorrhage in Helsinki and found it to be very high (16.8/100,000/year) compared with studies from other countries. Data on stroke incidence in the other Scandinavian countries are also sparse. Sjöström reported from Sweden an incidence of 227/100,000/year in a retrospective study of hospitalized stroke patients. Harmsen and Tibblin estimated the total incidence of stroke to be about 150/100,000/year in Göteborg. This estimate was based on the first half-year's experience with a stroke register on persons under 65 years of age. Dalsgaard-Nielsen's survey of 1,000 hospitalized stroke patients in Copenhagen gives the very low incidence of 66/100,000/year. Marquardsen and Stensgaard Hansen, on the other hand, who have registered all stroke patients in the corresponding area in Copenhagen since the beginning of 1971, assume the incidence to be about 300/100,000/year or still higher.

This high incidence might partly be explained by the exceptionally high age structure of the study population, 21% being 65 years of age or older. Incidence figures of some studies performed in different parts of the world are listed in table I.

WHO has recognized that the epidemiological data on cerebrovascular disease are far from complete. As a first step to abolish this shortcoming, WHO has urged the establishment of stroke registers in as many countries as possible. The first stroke registers were established in Göteborg and Copenhagen. Now 15 stroke registers are operating in ten countries, two of them in Finland. The stroke register in the Espoo-Kauniainen area in South Finland was started on January 1, 1972. In this report we present the incidence and case fatality of stroke based on the first year's material of this register.

Methods
The aim of the stroke register is to collect as completely as possible all new cases of stroke among a defined population. The patients were examined as soon as they were found and three weeks, three months and one year after the stroke.

From the Department of Neurology, University of Helsinki, Haartmaninkatu 4, 00290 Helsinki 29, Finland.
INCIDENCE AND EARLY PROGNOSIS OF STROKE IN FINLAND

### TABLE I

<table>
<thead>
<tr>
<th>Study</th>
<th>County</th>
<th>Study period</th>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eisenberg et al.</td>
<td>USA</td>
<td>1957-1958</td>
<td>170*</td>
</tr>
<tr>
<td>Katsuki et al.</td>
<td>Japan</td>
<td>1961-1963</td>
<td>230</td>
</tr>
<tr>
<td>Parrish et al.</td>
<td>USA</td>
<td>1963-1964</td>
<td>258†</td>
</tr>
<tr>
<td>Wallace</td>
<td>Australia</td>
<td>1962-1964</td>
<td>330</td>
</tr>
<tr>
<td>Eckstrom et al.</td>
<td>USA</td>
<td>1964-1965</td>
<td>220‡</td>
</tr>
<tr>
<td>Dyken</td>
<td>USA</td>
<td>1963-1965</td>
<td>176</td>
</tr>
<tr>
<td>Acheson et al.</td>
<td>Great Britain</td>
<td>1963</td>
<td>185</td>
</tr>
<tr>
<td>Whisnant et al.</td>
<td>USA</td>
<td>1945-1954</td>
<td>188§</td>
</tr>
<tr>
<td>Matsumoto et al.</td>
<td>USA</td>
<td>1955-1969</td>
<td>158‡</td>
</tr>
</tbody>
</table>

*Age-adjusted to total population of continental USA, 1950.
†Age-adjusted to population of Missouri, 1964.
‡Age-adjusted to white population of USA, 1950.

Various data on the social and medical histories as well as certain clinical signs were recorded on special WHO forms. One of us, a specialist in neurology (K.A.), performed the interviews and examinations. Relatives were interviewed in cases where information from the patient was incomplete or lacking for some reason. Coded data were sent to the WHO headquarters for future central data processing.

### CASE FINDING

All practicing physicians of the study area were informed about the project by a letter and by an informative article published in December, 1971, in *The Journal of the Finnish Medical Association*. The physicians were asked to inform the register of all new stroke patients, especially those who were being treated outside a hospital during their illness. The physicians also were contacted regularly by phone. Hospital wards treating stroke patients and the old age homes were asked to notify the register of new stroke cases. However, the most important source for finding stroke patients was the lists of patients admitted to hospitals. These lists were perused every two to three days. In addition, all medical and neurological hospital wards serving the Espoo-Kauniainen area were contacted by phone every two weeks. Photocopies of the medical certificates of stroke patients sent to The National Pensions Institute were received also, but no new, earlier unrecorded cases were found by this means. All death certificates of the study population were studied every two weeks. Of the cases 77% were found in hospital wards, 20% from death certificates, and the remaining few cases were treated in their own homes or old age homes.

### STUDY AREA AND POPULATION

The study area, consisting of the two adjacent towns Espoo and Kauniainen, is 315 square kilometers and is situated in the southernmost part of Finland on the western boundary of Helsinki (fig. 1). It includes both rural areas and some 10 to 12 densely populated urban centers. The study population consists of 107,673 persons as of January 1, 1972. One special characteristic of this population is its young age structure: only 5.2% are 65 years or older, while the figure for the whole of Finland is 9.3%. The age and sex distributions of the study population are presented in table 2. Another important aspect of the study population is the vast migration which is taking place from the northern and eastern parts of Finland to southwest Finland including Espoo-Kauniainen.

### STROKE DEFINITION

Stroke is defined as rapidly developed clinical signs of focal (or global) disturbance of cerebral functions lasting more than 24 hours or leading to death, with no apparent cause other than a vascular origin. Included are subarachnoid hemorrhage, intracerebral hemorrhage and ischemic brain

### TABLE 2

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Men</th>
<th>Women</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-19</td>
<td>18,616</td>
<td>17,978</td>
<td>36,594</td>
</tr>
<tr>
<td>20-29</td>
<td>10,033</td>
<td>11,415</td>
<td>21,448</td>
</tr>
<tr>
<td>30-39</td>
<td>8,643</td>
<td>9,019</td>
<td>17,662</td>
</tr>
<tr>
<td>40-49</td>
<td>6,618</td>
<td>6,986</td>
<td>13,604</td>
</tr>
<tr>
<td>50-59</td>
<td>4,055</td>
<td>4,885</td>
<td>8,940</td>
</tr>
<tr>
<td>60-69</td>
<td>2,775</td>
<td>3,738</td>
<td>6,513</td>
</tr>
<tr>
<td>70-79</td>
<td>840</td>
<td>1,543</td>
<td>2,383</td>
</tr>
<tr>
<td>80</td>
<td>158</td>
<td>386</td>
<td>544</td>
</tr>
<tr>
<td>Total</td>
<td>51,738</td>
<td>55,935</td>
<td>107,673</td>
</tr>
</tbody>
</table>

Stroke, Vol. 5, September-October 1974
TABLE 3
Age and Sex Distribution of the Stroke Cases

<table>
<thead>
<tr>
<th></th>
<th>20-29</th>
<th>30-39</th>
<th>40-49</th>
<th>50-59</th>
<th>60-69</th>
<th>70-79</th>
<th>80</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>5</td>
<td>2</td>
<td>8</td>
<td>20</td>
<td>20</td>
<td>9</td>
<td>8</td>
<td>72</td>
</tr>
<tr>
<td>Women</td>
<td>1</td>
<td>2</td>
<td>9</td>
<td>12</td>
<td>12</td>
<td>29</td>
<td>16</td>
<td>81</td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>4</td>
<td>17</td>
<td>32</td>
<td>32</td>
<td>38</td>
<td>24</td>
<td>153</td>
</tr>
</tbody>
</table>

Infarction, both embolic and nonembolic. Transient ischemic attacks are excluded according to this definition. The classification of strokes into subgroups has been performed according to the guidelines given by WHO.18

Recurrence
A new stroke which takes place more than three weeks after the initial stroke.

Results
During 1972, a total of 153 persons of the study population had a stroke. Twenty-five of these patients had a stroke before the study period also, but they now had a new, clear-cut stroke. Only five of the 153 patients have had a recurrence by now. The median age for men was 62 years and for women 70.5 years. The age and sex distributions are presented in table 3. The case fatality of the total patients during the first three weeks after stroke was 38%. Of the patients 79 (53%) have died (January, 1972 to October, 1973) and 42 (53%) of these have been autopsied. In only one case was the pathologist unable to substantiate the clinical diagnosis of stroke and the patient was excluded from the material. The clinical diagnosis of the type of stroke, hemorrhagic or ischemic, was changed at autopsy in a few cases only. The proportions of different types of stroke and their case fatalities are presented in figure 2.

The incidence of stroke in the study population was 142/100,000/year. The age and sex specific incidences are presented in table 4. When the latter incidences are applied to the total population of Finland (census 1970), the incidence of stroke will be 231/100,000/year.

Discussion
The incidence of stroke increases steeply with age. Because only 5.2% of the study population was 65 years of age or older the total incidence in the study population remained fairly low (142/100,000/year). The age-adjusted and sex-adjusted incidence for the whole country (231/100,000/year), on the other hand, is fairly high compared with earlier studies from other countries (table 1). As a rule, patients with suspected cerebrovascular disease are treated in hospitals in Finland. We believe that we have found all stroke patients treated in hospitals, but some mild, home-treated cases may have escaped registration.

The results indicate that men in the age groups 50 to 69 years have twice as high an incidence of stroke as women of the same age groups. The sex difference in the stroke incidence has generally been denied,19 but recently a few reports with findings similar to ours have been published.3, 16

The reliability of a clinical diagnosis of stroke type is far from infallible.90 The autopsied cases, however, indicate that the clinical diagnoses in the present material, made according to WHO criteria, are relatively reliable. The proportions of the stroke types do not differ markedly from those of earlier studies.19 In our material the hemorrhages are proportionately more frequent than in many other studies. This might be explained by the young age structure of our study population and the fact that hemorrhages,
INCIDENCE AND EARLY PROGNOSIS OF STROKE IN FINLAND

Table 4
Annual Incidence of Stroke by Age and Sex per 100,000 Population in Espoo-Kauniainen in 1972

<table>
<thead>
<tr>
<th>Years</th>
<th>20-29</th>
<th>30-39</th>
<th>40-49</th>
<th>50-59</th>
<th>60-69</th>
<th>70-79</th>
<th>80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>50</td>
<td>23</td>
<td>121</td>
<td>493</td>
<td>721</td>
<td>1,071</td>
<td>5,063</td>
</tr>
<tr>
<td>Women</td>
<td>9</td>
<td>22</td>
<td>129</td>
<td>246</td>
<td>321</td>
<td>1,879</td>
<td>4,145</td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
<td>23</td>
<td>125</td>
<td>358</td>
<td>491</td>
<td>1,590</td>
<td>4,412</td>
</tr>
</tbody>
</table>

especially subarachnoid hemorrhage, tend to occur at a younger age than ischemic brain infarction.

The early case fatality of 38% during the first three weeks after the stroke seems to be somewhat less than those observed in earlier studies with case fatalities of 47% to 62% during the acute phase of the disease.21-22 This also may be due to the young age structure of our patients and to the fact that younger patients do better.21 It also may depend on the detection of mild cases with a better prognosis.21 On the other hand, the register includes all fatal cases and, therefore, it seems that the prognosis obtained in the present study probably is not "too good." A further possible explanation is that the average prognosis of stroke has improved during the last decades, as has been postulated,15 for reasons that are still obscure, though it might depend on the better treatment of hypertension resulting in a decrease of fatal cerebral hemorrhage.22 Finland unfortunately totally lacks comparable epidemiological studies from earlier years. The only large stroke material, dating from 1941 and consisting of only hospital patients, gave a case fatality of 62% during the acute phase.22

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Stroke, Vol. 5, September-October 1974 661

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