Epidemiology of Stroke in the Poznań District of Poland

Mieczysław Wender, MD, Danuta Lenart-Jankowska, MD, Danuta Pruchnik, MD, and Piotr Kowal, MD

The incidence of cerebrovascular disease was established in the Poznań district in Poland for 1985. Mortality from cerebrovascular disease during this year was compared with mortality during 1977. The autopsy material from the years 1925 to 1985 was analyzed to differentiate ischemic from hemorrhagic stroke. The incidence of stroke was 198.3 per 100,000 inhabitants >20 years of age. Mortality from cerebrovascular disease decreased significantly in both males and females from 1977 to 1985. Analysis of the pattern of cerebrovascular disease in the autopsy material from 1925 to 1965 demonstrated an overwhelming percentage of hemorrhagic stroke. In the years that followed, an inversion was noticed in the ratio of ischemic to hemorrhagic stroke. It should be assumed that the growing efficacy of antihypertensive therapy largely explains the decreasing incidence of stroke-induced mortality.

Geographic variations in the incidence of and mortality from stroke are indisputable and may be a key to understanding the risk factors for cerebrovascular disease (CVD). Therefore, worldwide epidemiologic studies of CVD are important. Until now, no detailed data concerning stroke epidemiology, including the temporal trends of stroke, have been available for Poland.

A decrease in mortality from stroke has been observed in several countries. The most probable explanations for this decrease are under discussion. Some possible factors are changes in the incidence of particular types of stroke (cerebral infarction versus cerebral hemorrhage). However, these explanations may not be accurate because before the era of the present imaging techniques, stroke type diagnosed exclusively on the basis of clinical and laboratory data was often erroneous. Moreover, difficulties in studying stroke trends over the course of decades have been augmented by changes in clinical terminology. Therefore, we limited this part of our study to autopsy material only.

Subjects and Methods

Our investigation was conducted in one district in western Poland. The principal city, Poznań (approximately 600,000 inhabitants), is surrounded by an agricultural but increasingly industrialized area. The population of the district was 1,195,000 on June 30, 1977, and 1,277,000 on June 30, 1981 (Figure 1).

Preliminary information on persons with CVD was obtained from patients' records from all possible medical sources, all inpatient and outpatient departments of neurology, neurosurgery, and internal medicine in this district. These included three neurosurgery inpatient clinics, seven neurology inpatient departments, 15 internal medicine inpatient departments, and 24 outpatient neurology and neurosurgery clinics. Records of emergency clinics, general medicine polyclinics, and pathology and forensic medicine departments were analyzed as well. The last two sources are very important because in Poland autopsy of each patient who dies in a hospital is obligatory, with few exceptions. The information obtained regarding diagnoses was then verified by a team of neurologists. Demographic data were obtained from the national and regional censuses (Table 1).

On the basis of verified cases, the annual incidence of CVD per 100,000 inhabitants was calculated for 1985. The categories were as follows: 1) completed stroke, including both ischemic and hemorrhagic stroke because differentiation between these two could be erroneous when based (as it was in the majority of cases) on clinical grounds only; 2) subarachnoid hemorrhage without primary focal symptoms; or 3) transient ischemic attacks (TIAs) with focal symptoms induced by cerebral ischemia, lasting no longer than 24 hours. Mortalities due to the first two categories for 1977 and 1985 were compared. Statistical evaluation was done with the U test. Levels of significance were p <0.05 and 0.01, respectively.
Incidence and mortality rates age-adjusted to the United States population in 1960 were also calculated. Incidences of CVD adjusted using the total population of the district as a standard were also compared between the rural region surrounding it and the district town of Poznań. Statistical evaluation was done with the $U$ test. Level of significance was $p < 0.01$.

In addition, all records accessible in pathology and forensic medicine departments of the district about persons who died of CVD between 1925 and 1985 at the age of $>20$ years were analyzed. Data obtained from these records at 5-year intervals were evaluated statistically using the $\chi^2$ test. Levels of significance were $p < 0.05$ and 0.01, respectively. (Because of the lack of available records for the time of World War II, data from 1939 instead of 1940 were analyzed.) In evaluating the autopsy records, special attention was given to differentiating ischemic from hemorrhagic stroke. The first category included cases with pale, hemorrhagic, or mixed infarcts; the second included cases with primary cerebral or subarachnoid bleeding. Pathogenetically distinct subdural and epidural hematomas, infarcts, and hemorrhages evoked by primary or metastatic neoplastic processes, craniocerebral trauma, acute intoxication, or postshock syndromes were excluded from the analysis.

### Results

For 1985, the incidence of stroke was 198.3 per 100,000 population $>20$ years of age, including completed stroke (188.2) and subarachnoid hemorrhage (10.1); the incidence of TIA was 24.1 per 100,000 population $>20$ years of age.

The incidences of total CVD and completed stroke were highest in the groups aged 70–89 years.

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**Table 1. Demographic Data for Poznań District of Poland in 1977 and 1985**

<table>
<thead>
<tr>
<th>Age class (yr)</th>
<th>1977</th>
<th></th>
<th>1985</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Total</td>
<td>Male</td>
</tr>
<tr>
<td>20–29</td>
<td>124,627</td>
<td>125,211</td>
<td>249,838</td>
<td>106,506</td>
</tr>
<tr>
<td>30–39</td>
<td>72,141</td>
<td>72,629</td>
<td>144,770</td>
<td>112,393</td>
</tr>
<tr>
<td>40–49</td>
<td>68,843</td>
<td>72,307</td>
<td>141,150</td>
<td>61,062</td>
</tr>
<tr>
<td>50–59</td>
<td>52,373</td>
<td>62,651</td>
<td>115,024</td>
<td>62,443</td>
</tr>
<tr>
<td>60–69</td>
<td>42,396</td>
<td>56,713</td>
<td>99,109</td>
<td>38,147</td>
</tr>
<tr>
<td>≥70</td>
<td>28,911</td>
<td>35,439</td>
<td>81,911</td>
<td>35,439</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>389,291</td>
<td>442,511</td>
<td>831,802</td>
<td>415,990</td>
</tr>
</tbody>
</table>
incidences were slightly but significantly higher in males than in females. This trend was more pronounced in the younger groups (those aged 40-69 years). CVD incidence was found to be related to sex and age (Table 2). The incidences of total CVD and completed stroke were significantly higher in the city of Poznań than in the exclusively rural communities (Table 3). Mortality from CVD decreased significantly in both males and females between 1977 and 1985. The decrease was marked in the groups aged ≥40 years (Table 4).

Analysis of the pattern of CVD in autopsies performed from 1925 to 1965 demonstrated (with the exception of 1950) an overwhelming percentage of hemorrhagic strokes. In subsequent years, an inversion in the ischemic-to-hemorrhagic ratio was noticed, changing from a predominance of hemorrhagic to a predominance of ischemic strokes.

**Discussion**

The unique system of health care delivery in Poland permitted identification of practically all residents of the Poznań district who satisfied the diagnostic criteria of our study. The available data comprise records of every medical contact for each
individual in the geographic region studied. The neurologic records were acquired and critically reviewed by the staff of the present project. The epidemiologic data based on this system appear to fulfill the criteria for scientific validity.

The synthesis of stroke incidence data from various geographic regions gathered by Aho et al.,7 despite varying methods of ascertainment and different definitions of the disease, allowed the estimation of minimum and maximum incidences. Our findings obtained in the Poznan district of western Poland are similar to those gathered in the United States and several European countries and are approximately in the middle of the range of worldwide values. The lowest values have been found in Nigeria and in the Faeroe Islands,8 whereas the highest incidences were recorded in Finland, Japan, and northern China. The risk factors for CVD, which could explain the differences in incidences, are under discussion. We noticed diverse dispersions of CVD in the geographic region studied, with markedly lower incidences in rural areas. Therefore, we would add to the aforementioned discussion the argument that one of the risk factors for CVD is the complex ecosystem associated with urbanization.

The profound decrease in stroke-associated mortality that we observed in the Poznan district is similar to the trend in most countries.1,5,9,10 No similar tendencies were noticed in Finland11 or Czechoslovakia.12 The decreasing mortality from CVD in the Poznan district contrasts with the continually increasing mortality from coronary heart disease in that region.13

A very basic question arises as to the cause of the decrease in mortality from stroke. The positive correlation between the decrease in total CVD mortality on one hand and the relative diminution in mortality from hemorrhagic stroke on the other seems to provide an important clue. On the basis of autopsy material from three hospitals in Manchester, England, fewer deaths caused by cerebral hemorrhages since 1955 with more caused by brain infarcts has also been established.14 It is generally known that mortality in patients with cerebral hemorrhages is higher than that from any other type of stroke. Therefore, a decrease in the incidence of hemorrhagic stroke should decrease the mortality from all CVD.

Hypertension plays an important pathogenetic role in both ischemic and hemorrhagic stroke. However, the role of hypertension is significantly greater in the pathomechanism of cerebral bleeding. Therefore, it should be assumed that the growing efficacy of antihypertensive therapy largely explains the decreasing rate of intracerebral hemorrhage.1,5,15 This assumption seems applicable to both Poland and other countries in which similar trends over time have been noted in the epidemiology of stroke. Nevertheless, it cannot be excluded that partial elimination of other risk factors by changing lifestyle, including dietary habits, also plays an important role in the positive trends that we observed in the epidemiology of stroke.

References


Key Words • cerebrovascular disorders • mortality • Poland
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Stroke. 1990;21:390-393
doi: 10.1161/01.STR.21.3.390

The online version of this article, along with updated information and services, is located on the World Wide Web at:
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