Results of the Seven-Year Prospective Study of Stroke Patients

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Using the registry method, 1,538 stroke patients were detected in one district of Moscow between January 1, 1972, and December 31, 1974. Of the 965 patients who survived the acute stage of stroke (the first 3 weeks after onset), 941 (505 women and 436 men) were followed for the next 7 years. We analyzed incidence and types of recurrent strokes. During this 7-year follow-up, we recorded 32.1% of the patients as having recurrent strokes, most of which developed in the first 3 years and especially during the first year after the index stroke. The majority of recurrent strokes were of the same type as the index stroke and were localized in the same area of the brain. The cumulative mortality rates for the initial 1,538 patients were 37.3% dead by 3 weeks, 63.6% dead by 3 years, 72.1% dead by 5 years, and 76.5% dead by 7 years. In the first 3 months (excluding the first 3 weeks), most patients who died died of pulmonary thromboembolism. The mortality rate from recurrent strokes and pneumonia was higher than that from cardiovascular mortality. Transient ischemic attacks occurred in 49.5% of all patients and myocardial infarction in 16.4%. Functional prognosis was determined mainly by age, motor function, and concomitant diseases. After 1 year, 68.2% of the surviving patients were fully independent, while 81% of those surviving 7 years had reached this level. A significant number of patients were capable of returning to their previous work. (Stroke 1988;19:942-949)

Cerebrovascular disease is a major medical and social problem because of its high prevalence, its marked degree of resultant disability, and its high mortality rate. Relatively little information has been collected to identify the degree of functional recovery of patients following stroke, the different complications resulting from the disease, and its natural history.

Subjects and Methods

To address this problem, the Program of Stroke Registration was organized with the help of the USSR Ministry of Health in one district of Moscow. There were 208,921 residents of that district in the census of 1970 (116,343 females and 92,578 males). Of the total population, 12.3% were aged ≥60 years. In different age groups, females exceeded males in a ratio of 3 to 2. These particular features of this population are characteristic for the city of Moscow and are typical of some western European cities.

The World Health Organization (WHO) has described the Community Control Stroke Program and has suggested using the "stroke registry method." In the Moscow district under study, a similar program was established in 1972 with the participation of the Institute of Neurology of the USSR Academy of Medical Science. Various public health institutions supplied current information concerning patients as well as inhabitants of this district, including those who received treatment in local hospitals or different Moscow medical institutions or in other cities of the USSR. All information was recorded on standard forms using WHO protocols for the initial examination, follow-up examinations, and death records. All forms were completed according to instructions provided to the data collectors.

The neurologists of the Stroke Registry Center examined all patients with stroke or suspected stroke from among the residents of this district; 2,294 patients were examined and registered in 1972–1974. In 67% of the patients, the diagnosis of stroke was confirmed. Brain tumors, transient ischemic attacks, hypertensive cerebral crises, complications of trauma, subdural hematomas, and similar clinical cases were excluded. According to our evaluation, we registered 97% of all strokes, calculated using the total number of deaths due to stroke obtained from death registration bureaus and the mortality rate determined among all patients examined.
Neurologists from the Program of Stroke Registration examined most (66%) of the patients within 24 hours after the onset of stroke. Follow-up examinations were performed after 3, 12, and 18 months and then each year for 7 years. If a patient died before the Registry neurologist examined him, information was obtained from the examinations of other physicians or from autopsy. When a patient worsened clinically or died, a Registry physician was assigned to see him immediately, without waiting for the scheduled visit. Of those patients who died during the acute stage (the first 3 weeks after onset), 80% were autopsied with the requirement that the brain be included. During the acute stage of stroke, 61.5% of the patients were hospitalized in the neurology department of clinical hospitals, usually during the first 2 days after the onset of the stroke.

The evaluation of clinical as well as pathological data followed a standardized methodology. Neurologists and pathologists from the appropriate institutions received special instructions describing the Program of Stroke Registration. The medical institutions serving the residents of this Moscow district used diagnostic criteria defining the type of stroke according to standards originated at the Institute of Neurology using the International Classification of Diseases. A diagnosis was formulated after 3 weeks, following repeated examination, based on both clinical and laboratory information. When completing the Registry form, data derived from out-patient medical forms, records of diseases suffered by the patient, and other available medical documents were taken into account.

**Diagnostic Criteria of Stroke**

In accordance with WHO criteria, a stroke was defined as rapidly developing clinical signs of a localized (or general) disturbance of brain function, persisting for >24 hours or leading to death, in the absence of possible causes other than those of vascular origin. The following classifications were used:

- **Brain infarction (nonembolic).** Abrupt or gradual development of localized signs, partial disturbance of consciousness, normal or elevated blood pressure, and absence of blood in the cerebrospinal fluid.
- **Cerebral embolus.** Sudden development of focal neurologic signs in the presence of a possible source of arterial embolus.
- **Intracerebral hemorrhage.** Rapid development of focal neurologic signs, rapid and progressive disturbance of consciousness, signs of meningeal irritation, blood pressure elevation, headache, and, frequently, blood in the cerebrospinal fluid.
- **Subarachnoid hemorrhage.** Sudden development of intense headache, disturbance of consciousness, presence of meningeal signs, blood in the cerebrospinal fluid, and absence of focal neurologic signs.
- **Unspecified stroke.** This category was used when there was insufficient data for precise classification.

A mixed type of stroke was classified based on predominance of the characteristics of one of the above classifications. It is therefore possible that an intracerebral hemorrhage producing the clinical features of localized brain infarction might be incorrectly classified or that a large cerebral infarction might be incorrectly classified as a hemorrhage.

**Recurrent stroke.** According to WHO recommendations, a stroke that occurs >3 weeks after the first stroke. Occurrence of a new cerebrovascular event <3 weeks after the first stroke is a progression of the first stroke rather than a recurrence.

**Hypertensive cerebral crisis.** Predominance of general cerebral symptoms (headache, vertigo, nausea, and vomiting). These crises differed from acute hypertensive encephalopathy by the absence of signs of a fixed structural lesion manifested by an unchanging localized neurologic loss of function.

Arterial blood pressure was measured in a standardized fashion. Patients were considered to suffer arterial hypertension if blood pressure was ≥160/95 mm Hg at the time of the first neurologic and medical examination during the acute stage of the disease.

**Evaluation of Functional Impairment**

On the basis of WHO recommendations, the neurologic signs were assessed and recorded at the time of maximum deficit during the first 24 hours after the onset of symptoms. These findings were estimated in 88% of the patients and were recorded using the following criteria:

- **Level of consciousness.** 1) Fully conscious; 2) somnolent, the patient responds to verbal stimulation with a delay; 3) semicomatose, severe deprivation of consciousness with the patient responding to painful stimulation but not answering to a verbal call or giving only a one-word answer to a question repeatedly asked; and 4) comatose, no reaction to any stimuli.

**Motor disturbance.** We used criteria of the Central Institute of Expertise of Work and Employment of Invalids (Moscow); these criteria are recommended for neurologists working in special institutions in which invalids are examined to estimate their ability to work:

1) paralysis, complete absence of movement in the paralyzed extremities; 2) severe paresis, significant restriction of movement in the distal parts and absence of movement in the proximal parts of extremities; 3) pronounced paresis, significant restriction of the amount and extent of active movement in the distal parts of extremities, less significant decrease in the proximal parts but diminished muscle strength especially in the distal parts; 4) moderate paresis, full range of movement in the proximal parts and restricted capacity of movement in the distal parts of extremities; 5) mild paresis, all active movement preserved but mild weakness in several muscle groups, detectable difficulty in fine finger movement; and 6) central motor pathway deficit, increased fatigue on physical activ-
Activity, increased activity of myotactic reflexes in the impaired extremities.

**Activities of daily living (ADL).** Self-care, by WHO definition, includes 1) use of bath, 2) use of toilet, 3) control of urination and defecation, 4) ability to clothe oneself, 5) ability to wash oneself, and 6) ability to consume food. We determined the ADL index according to the classification of Katz et al,12 which we modified1314 (see footnote to Table 9).

**Work capacity.** We followed WHO recommendations: 1) returned to previous work; 2) returned to previous work with some restrictions such as shortened working day, extra day free of work, work to be performed with an assistant; 3) returned to previous work as a specialist but with lowered position and salary; and 4) doesn’t work, invalid or pensioner. For housewives, pensioners, and persons who were invalid before the index stroke, we compared the work capacity with that before the onset of the stroke: 1) same as before stroke, 2) restricted, 3) considerably restricted, and 4) unable to work.

**Statistical Analysis**

The mean±95% confidence intervals were computed. Follow-up studies analyzed cumulative mortality rates. The number of patients who died was calculated as percent of the number of patients registered for 3 weeks, 3 months, and 1, 3, 5, and 7 years.

**Results**

**Among Initial Patients**

There were 1,538 patients with a first stroke (884 or 57.5% women; 654 or 42.5% men) entered into the Program of Stroke Registration between January 1, 1972, and December 31, 1974. Of this group, 135 women and 46 men were older than 80 years. The average age of the women was 69 years and of the men 64.8 years. Four percent of the patients died before registration, and 61.5% were hospitalized. Also, 1.5% of the patients had a stroke while hospitalized for another disorder.

The distribution of the type of stroke was 74.0% brain infarction (nonembolic), 2.9% cerebral embolus, 11.9% intracerebral hemorrhage, 2.7% subarachnoid hemorrhage, and 8.5% unspecified stroke. Most patients who could not be classified as to type of stroke died very soon after the onset and included a preponderance of aged individuals. This group of 130 patients also included individuals who died but did not have an autopsy.

Of the initial patients, 47.0% suffered some disturbance of consciousness. Of those 723 patients, 37.2% were somnolent, 23.5% semicomatose, and 39.3% comatose. Of the initial 1,538 patients, 92.1% suffered motor disturbances, 53.4% on the right and 38.7% on the left side. Various kinds of aphasia were identified in 38.5% and dysarthric speech in 14.1% of the initial patients.

Three weeks after the onset of stroke, 24 of the initial patients (1.6%) could not be located. This small percentage probably does not significantly influence our analysis of the results. Follow-up after the acute stage was studied in 941 patients (505 women and 436 men). In 302 of these follow-up patients (32.1%), recurrent strokes were identified during the 7 years. We analyzed data for follow-up patients with a single stroke and for follow-up patients with recurrent strokes separately in relation to the type of stroke and its prognosis. The average age of follow-up patients with a single stroke was 65.5 years, while the average age of follow-up patients with recurrent strokes was 62.1 years at registration. The younger ages of follow-up

**TABLE 1. Cause of Death During Acute Period After Brain Infarction in 1,538 Patients in Program of Stroke Registration, Moscow, USSR**

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>% of 573 deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brain lesion</td>
<td>55.4</td>
</tr>
<tr>
<td>Visceral complications</td>
<td>44.6</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>17.6</td>
</tr>
<tr>
<td>Thromboembolism of pulmonary arteries</td>
<td>13.6</td>
</tr>
<tr>
<td>Acute cardiac insufficiency</td>
<td>8.6</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>2.9</td>
</tr>
<tr>
<td>Other</td>
<td>1.9</td>
</tr>
</tbody>
</table>
TABLE 2. Leading Causes of Death After Acute Stage in 941 Patients Followed Up in Program of Stroke Registration, Moscow, USSR

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>3 wk to 3 mo (n = 105)</th>
<th>3 mo to 1 yr (n = 118)</th>
<th>1-3 yr (n = 177)</th>
<th>3-5 yr (n = 129)</th>
<th>5-7 yr (n = 67)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recurrent stroke</td>
<td>24.8</td>
<td>26.3</td>
<td>24.9</td>
<td>14.7</td>
<td>19.4</td>
</tr>
<tr>
<td>Cardiac pathology</td>
<td>25.7</td>
<td>41.5</td>
<td>41.8</td>
<td>55.0</td>
<td>50.8</td>
</tr>
<tr>
<td>Acute cardiovascular insufficiency</td>
<td>16.2</td>
<td>23.7</td>
<td>19.2</td>
<td>38.7</td>
<td>38.8</td>
</tr>
<tr>
<td>Chronic cardiovascular insufficiency</td>
<td>3.8</td>
<td>11.0</td>
<td>10.7</td>
<td>10.1</td>
<td>6.0</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>5.7</td>
<td>6.8</td>
<td>11.9</td>
<td>6.2</td>
<td>6.0</td>
</tr>
<tr>
<td>Thromboembolism of pulmonary arteries</td>
<td>13.3</td>
<td>3.4</td>
<td>3.4</td>
<td>4.6</td>
<td>1.5</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>20.0</td>
<td>15.2</td>
<td>12.4</td>
<td>7.8</td>
<td>13.4</td>
</tr>
<tr>
<td>Malignant tumors</td>
<td>5.7</td>
<td>6.8</td>
<td>5.6</td>
<td>7.8</td>
<td>10.4</td>
</tr>
<tr>
<td>Brain lesion due to stroke</td>
<td>6.7*</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>3.8</td>
<td>6.8</td>
<td>11.9</td>
<td>10.1</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Values are % of total deaths for each time.
*Brain death during fourth week.

patients with recurrent strokes depended on concomitant disease, which occurred more often in follow-up patients with a single stroke. In addition, recurrent strokes developed earlier in those patients who had a severe index stroke.

Among All Follow-up Patients

The risk of mortality was highest during the first year (Figure 1), even higher during the first 3 months. The risk of mortality diminished after the first 3 months and was almost constant after 12 months. The rate of change of this mortality curve suggests that the greatest disturbance in the patients' state occurs during the first year following stroke, and that thereafter the risks return to those appropriate for others of the same age. The cumulative mortality rate of the initial 1,538 patients was 573 (37.3%) dead by 3 weeks, 678 (44.1%) dead by 3 months, 800 (52%) dead by 1 year, 978 (63.6%) dead by 3 years, 1,109 (72.1%) dead by 5 years, and 1,177 (76.5%) dead by 7 years.

Of the initial 1,538 patients, 79.2% of those with hemorrhagic stroke died during the acute stage. Severe damage, for example ruptured hematoma into the ventricular system, is well recognized to lead to rapid death. In most cerebral infarctions, a different picture is present (Table 1). During the acute stage, the brain lesion appeared to be responsible for death in 55.4% of the fatalities, while the remaining deaths were caused by complications in other visera. Analysis of mortality during the first 3 months, excluding the acute stage, showed that most patients died of pulmonary thromboembolism, which represented 45.1% of all pulmonary embolic deaths during the entire 7 years of follow-up. In Table 2 the leading causes of death are shown for different intervals after the acute stage of stroke.

Transient ischemic attacks, including hypertensive cerebral crises, occurred in 49.5% and myocardial infarction in 16.4% of the initial 1,538 patients. In the majority of patients, these manifestations were observed during the first 3 years.

After 7 years, patients with severe hypertension (blood pressure of ≥200/115 mm Hg) had a higher mortality rate than patients with less severe hypertension (blood pressure in the range 179-160/104-95 mm Hg). The cumulative mortality rate in the severe group was 68.9%, 53.5% in the less severe group (p<0.05).

Among Follow-up Patients With Single Stroke

The occurrence of a single stroke without impairment of consciousness during the acute stage of the disease (Table 3) carried a more favorable 7-year prognosis, a finding also observed by others. In the presence of a motor disturbance in patients

TABLE 3. Cumulative Mortality Rates by Level of Consciousness During Acute Stage in 676 Patients With Single Stroke Followed Up in Program of Stroke Registration, Moscow, USSR

<table>
<thead>
<tr>
<th>Level of consciousness during acute stage</th>
<th>n</th>
<th>3 wk to 3 mo</th>
<th>3 mo to 1 yr</th>
<th>1-3 yr</th>
<th>3-5 yr</th>
<th>5-7 yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fully conscious</td>
<td>509</td>
<td>7.7</td>
<td>16.7</td>
<td>31.0</td>
<td>44.4</td>
<td>51.7</td>
</tr>
<tr>
<td>Somnolent</td>
<td>130</td>
<td>24.6</td>
<td>40.9</td>
<td>51.5</td>
<td>70.8</td>
<td>75.4</td>
</tr>
<tr>
<td>Comatose, semicomatose</td>
<td>37</td>
<td>21.6</td>
<td>35.1</td>
<td>54.1</td>
<td>64.9</td>
<td>73.0</td>
</tr>
</tbody>
</table>

Values are % of patients in each level. Level of consciousness defined in "Subjects and Methods." All values are significant (p≤0.05–0.001).
suffering a single stroke, which was analyzed independently of level of consciousness, there was a worse prognosis and a higher mortality rate (Table 4), again noted by other authors.17,18

Functional prognosis appeared to be determined by many factors. Return of the ability for self-care and work depended principally on recovery of the motor system rather than on other dysfunction such as impairment of mental activity. The clinical features of the index stroke changed over time and, between 5 and 7 years after the stroke, motor function improved significantly (Table 5). Of those patients surviving for 7 years, over half had no paresis.

Both previously existing diseases determined from history and medical records at the time of registration and those diseases that occurred after the onset of stroke were analyzed for patients suffering a single stroke. Among the preexisting conditions were pulmonary diseases such as emphysema, chronic bronchitis, chronic pneumonia, etc. Atherosclerotic heart disease occurred in 63.2%, diabetes mellitus in 7%, obesity (by Quetelet index) in 4.1%, and epilepsy in 2.2%. Chronic cholecystitis occurred in 16.5% of the patients after the acute stage of stroke. During the first 3 months, the highest mortality rate was 56.2% or 1.5 times greater than the mortality rate during the acute stage was 37.7% of the patients whose index stroke was a hemorrhage. In the majority of the patients with recurrent strokes, the recurrent strokes were localized in the same area of the brain as the index stroke.

The mortality rate was different for recurrent strokes than for the index stroke. With the first recurrent stroke (second stroke), mortality during the acute stage was 56.2% or 1.5 times greater than among the follow-up patients with recurrent strokes.

Among Follow-up Patients With Recurrent Strokes

The incidence of recurrent strokes was analyzed. During the 7-year follow-up of 941 patients, 302 (32.1%) had recurrent strokes; 265 (28.2%) had one recurrent stroke, 30 (3.2%) had two recurrent strokes, six (0.6%) had three recurrent strokes, and one had four recurrent strokes. The average yearly incidence of recurrent strokes was 4.0%. Most recurrent strokes occurred in the first 3 years, with the highest proportion during the first year. Recurrent strokes appeared to be related to the size and location of the already-existing cerebral infarction, to atherosclerotic vascular changes, and to the status of the collateral circulation.

Among the 302 patients with recurrent strokes, 42.99% of the patients whose index stroke was a hemorrhage had a recurrent stroke that was also hemorrhagic, while nonembolic cerebral infarction occurred in 37.7% of the patients whose index stroke was a hemorrhage. In the majority of the patients with recurrent strokes, the recurrent strokes were localized in the same area of the brain as the index stroke.

The mortality rate was different for recurrent strokes than for the index stroke. With the first recurrent stroke (second stroke), mortality during the acute stage was 56.2% or 1.5 times greater than among the follow-up patients with recurrent strokes.
TABLE 6. Cumulative Mortality Rates by Associated Diseases During Acute Stage in 676 Patients With Single Stroke Followed Up in Program of Stroke Registration, Moscow, USSR

<table>
<thead>
<tr>
<th>Disease present during acute stage</th>
<th>3 wk to 3 mo</th>
<th>3 mo to 1 yr</th>
<th>1–3 yr</th>
<th>3–5 yr</th>
<th>5–7 yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ischemic heart disease and/or chronic cardiovascular insufficiency</td>
<td>11.2</td>
<td>19.3</td>
<td>39.7</td>
<td>56.7</td>
<td>63.5</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>26.9</td>
<td>38.5</td>
<td>57.7</td>
<td>73.1</td>
<td>80.8</td>
</tr>
<tr>
<td>Epileptic seizures</td>
<td>25.0</td>
<td>25.0</td>
<td>37.5</td>
<td>62.5</td>
<td>62.5</td>
</tr>
<tr>
<td>Obesity</td>
<td>20.0</td>
<td>26.7</td>
<td>33.3</td>
<td>46.7</td>
<td>60.0</td>
</tr>
<tr>
<td>Kidney diseases</td>
<td>19.0</td>
<td>33.3</td>
<td>52.4</td>
<td>57.1</td>
<td>66.7</td>
</tr>
<tr>
<td>Pulmonary diseases</td>
<td>17.2</td>
<td>28.0</td>
<td>59.1</td>
<td>75.3</td>
<td>81.7</td>
</tr>
<tr>
<td>Heart rhythm disorder</td>
<td>16.1</td>
<td>22.6</td>
<td>51.6</td>
<td>77.4</td>
<td>87.1</td>
</tr>
<tr>
<td>Intermittent claudication of various etiology</td>
<td>15.6</td>
<td>21.9</td>
<td>46.9</td>
<td>65.6</td>
<td>75.0</td>
</tr>
<tr>
<td>Chronic cholecystitis</td>
<td>11.5</td>
<td>19.7</td>
<td>32.8</td>
<td>45.9</td>
<td>54.0</td>
</tr>
</tbody>
</table>

Values are % of patients at each time. Diseases were revealed in history.

Functional Recovery by Age

Improvement occurred more frequently during the first year following stroke, but the rate of recovery decreased after 3 years. At the end of the first year, 68.2% of the surviving patients were fully independent, while 81% of those alive after 7 years reached this level. By contrast, 7% of the surviving patients were fully dependent at the end of the first year, 0.5% after 7 years. Older patients had less useful rehabilitation than younger patients. The presence of concomitant diseases and their health burden appeared to influence unfavorably the ability to reach better levels of self-care (Table 9).

Discussion

An important feature of our study is that it was carried out using the registry method. A large cohort was registered, and the follow-up was reasonably long (7 years). Our inclusion of all patients from the district population necessarily provides results different from those in studies that enlist only those patients entering a hospital. In this regard our data show a cumulative mortality rate exceeding that given by Marquardsen, who studied 769 patients admitted to the neurology department of Frederickberg Hospital in one district of Copenhagen between 1940 and 1952. In that study, mortality at 3 years was 46% compared with 63.6% in our initial group. Waltimo and coworkers prospectively studied all cases detected by the registry method in Espoo, an urban area in south Finland during 1972–1973, which has also been described in other works. The mortality rate in that study was 40% at 3 months, 62% after 4 years, and 67% after 6 years. In that study, patients with intracerebral hemorrhage had a mortality rate of 72% at the end of 3 months, while patients with cerebral infarction had a mortality rate of 30% during that time. These data do not bear a close relation to our findings. In general, mortality depends on age, type of stroke, and severity of concomitant diseases. Diseases important in cumulative mortality rates emphasize the importance of cardiac arrhythmias, pulmonary disease, and diabetes mellitus. The importance of these risk factors is emphasized by many other authors as well.

The yearly incidence of recurrent strokes in our study was 4.0%, slightly less than that noted by Baker and coworkers, where 6% of their total...
TABLE 8. Activities of Daily Living for 449 Patients With Single Stroke Who Had Not Worked Before Stroke Followed Up in Program of Stroke Registration, Moscow, USSR

<table>
<thead>
<tr>
<th>Activities of daily living</th>
<th>1 yr (n = 449)</th>
<th>3 yr (n = 324)</th>
<th>7 yr (n = 244)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same as before stroke</td>
<td>27.5</td>
<td>47.4</td>
<td>45.1</td>
</tr>
<tr>
<td>Restricted</td>
<td>24.5</td>
<td>17.2</td>
<td>11.7</td>
</tr>
<tr>
<td>Considerably restricted</td>
<td>10.7</td>
<td>6.1</td>
<td>0.6</td>
</tr>
<tr>
<td>Absent</td>
<td>9.4</td>
<td>4.7</td>
<td>0</td>
</tr>
<tr>
<td>Mortality rate</td>
<td>27.9</td>
<td>24.6</td>
<td>42.6</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Values are % of patients at each time.

patient population with ischemic strokes suffered recurrent strokes.

Our results lead us to agree with Marquardsen17 in suggesting that the totality of cardiovascular complications, including strokes, transient ischemic attacks, and myocardial infarctions, reflects the underlying progressive vascular disease. As a result, preventive measures against the underlying disease, such as control of arterial hypertension and suppression of atherosclerosis, are of great importance.

Our study indicates that the majority of surviving patients have a relatively favorable outlook for recovering a satisfactory functional state. The degree to which rehabilitation is successful correlates with age, severity of the stroke, and the presence of risk factors. Waltimo et al19 reported that 71% of patients surviving 6 years were fully independent in activities of daily living, and 16% returned to work. According to Fugl-Meyer et al,22 who surveyed only hospital patients, during 7 years approximately one third returned to work. Among able-bodied patients, 38.4% were able to continue their previous work; 15.4% of those beyond that age were able to do so. Of our patients who did not work before their stroke, 45.1% could return to their previous activities of daily living after 7 years. Fully dependent individuals comprised only 0.5% of our patients at the time of this survey.

Conclusion

Using the stroke registry method, 1,538 patients with strokes were cataloged in a single district of Moscow. At the end of the first 3 weeks, considered to be the acute stage of the disease, 965 were alive. It was possible to study the late outcome of 941 cases. Mortality rate, main cause of death, average annual incidence of recurrent strokes, incidence of transient ischemic attacks, and incidence of myocardial infarction were determined. The success of rehabilitation and work capacity was determined for the successive periods of follow-up.

Our data can be used to improve the effectiveness of the health care system and the choice and method of application of prophylactic measures.

Acknowledgment

After the tragically premature death of Dr. Bruce Schoenberg, the authors learned that he had been a referee of this manuscript and had contributed extensive and extremely pertinent suggestions. We are grateful for the value he added to our effort and wish to express our sorrow in our loss of him as a friend. Even more, the world of science must mourn the absence of his intellect and spirit.

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KEY WORDS • cerebrovascular disorders • epidemiology •
mortality • USSR
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Stroke. 1988;19:942-949
doi: 10.1161/01.STR.19.8.942

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