A 1–4 Year Follow-Up Study of 306 Cases of Stroke

QINGTANG CHEN, M.D.,* AND RUIZHU LING, M.D.†

SUMMARY To study the long-term prognosis of stroke, we performed annual follow-up examinations on 306 patients who had survived cerebrovascular accidents. All patients had been admitted to the Neurology Service, First Teaching Hospital, Beijing Medical College from January 1, 1976, to December 31, 1978, and were followed up for 1 to 4 years. The series included 217 cases of cerebral thrombosis, 54 of cerebral hemorrhage, and 35 of TIA. The life-table method was used to determine the cumulative survival rate (CSR), cumulative marked improvement rate (CMIR), and cumulative recurrence rate (CRR), for each of these three types of stroke. The main results were the following: 1. The prognosis was not significantly influenced by sex, BP level on admission, or type of cerebrovascular accident. 2. Age was an important prognostic factor. The survival rate decreased significantly in each successive age group. However, age was not a risk factor for recurrence or poor improvement. 3. The cumulative survival rate, cumulative marked improvement rate, and cumulative recurrence rate did not differ significantly among cerebral thrombosis, cerebral hemorrhage, and TIA.

THE SHORT-TERM OUTCOME of cerebrovascular accidents has been widely reported. We studied the long-term prognosis in cerebral thrombosis, cerebral hemorrhage, and TIA, and used the life-table method to determine the cumulative survival rate (CSR), the cumulative marked improvement rate (CMIR), and the cumulative recurrence rate (CRR) in these diseases. 1, 2

From The Department of Neurology, First Teaching Hospital, Beijing Medical College, Beijing, China.

Address correspondence to: Qingtang Chen, M.D., Department of Neurology, First Teaching Hospital, Beijing Medical College, Beijing, China.

Received April 19, 1984; revision #1 accepted September 5, 1984.

Materials and Methods

Selection of Cases

There were about 150 admissions for stroke per year to the Neurology Service, First Teaching Hospital, Beijing Medical College between 1976 and 1979. Each stroke was classified by type as either cerebral thrombosis, cerebral hemorrhage, cerebral embolism, subarachnoid hemorrhage, TIA or other. Most of the patients had lumbar puncture, EEG, and skull radiographs. Cerebral arteriography and isotope brain scan were performed in some of our patients. CT scan was not available during that time. The diagnosis and differential diagnosis were based on clinical history, neurological symptoms and signs, and the examinations
mentioned above. Some decedents in the cohort were autopsied and the brains were examined. Our study group included only the survivors of cerebral thrombosis, cerebral hemorrhage, and TIA, who were Beijing residents (including suburbs). We identified 306 such patients between January 1, 1976, and December 31, 1978. Follow-up examinations were performed on each patient every year for 1-4 years. Follow-up ended on December 31, 1979. On each annual follow-up examination, the subjects were routinely questioned by two qualified nurse investigators (under careful supervision by an associate professor of the Neurology Service) concerning the medications, the recovery, and the illnesses during the preceding year. Then the muscle strength of the paralyzed limbs were evaluated according to the uniform criteria (on a scale of 0-5). If the patient experienced a recurrence or died before the annual examination, the details about the recurrence or the cause of death were queried and the hospital records were reviewed if necessary. The series included 217 cases of cerebral thrombosis, 54 of cerebral hemorrhage, and 35 of TIA. Age and sex distributions are shown in table 1.

Six patients who were under 40 years of age were not included in this study.

Follow-up Examination Data

The following data were collected during the follow-up examinations: the muscle strength of paralyzed limbs (on a scale of 0-5), the date of recurrence and death, the type of stroke of each recurrence, and the cause of death.

Classes of Prognosis

1. Death Patients who died of cerebrovascular accidents or complications such as secondary respiratory infection, upper gastrointestinal tract bleeding, and cardiac insufficiency were considered deaths. Patients who died of other causes, e.g. traffic accidents, cancer, or encephalitis, etc., were considered withdrawals.

2. Marked improvement Patients whose muscle strength in the paralyzed limbs improved at least two grades over the initial levels were considered markedly improved. (Patients with TIA and vertebrobasilar thrombosis without paralysis of limbs were not included.)

3. Recurrence Patients with further attacks of stroke were assigned to this class. Only the first recurrence was considered in determining the recurrence rate.

Statistics

The fitting proportion and pairing methods were used to evaluate the risk factors for death, recurrence, and prolonged disability. Age, sex, blood pressure on admission, and the type of cerebrovascular accidents were considered possible risk factors. When one factor was being analyzed, the other factors were adjusted. Finally, the life-table method was used to determine CSR, CMIR, and CRR.

Results

The results showed that the prognosis was not significantly influenced by sex, blood pressure level on admission, or the type of cerebrovascular accident.

For cerebral thrombosis, CSR did not differ significantly between the 40-49 and 50-59-year age groups, therefore, these two groups were combined. The CSR in the three age groups (40-59, 60-69, 70 and above) are shown in table 2 and figure 1. Logrank test revealed a significant difference among three groups, (X² = 18.6344, p = 0.005). Age seemed to be an important factor in long-term prognosis. Older patients, especially those over 70, tended to have a higher fatality rate after stroke. The survival rate decreased significantly between successive age groups.

The CMIR and CRR in the three age groups after cerebral thrombosis are shown in tables 3 and 4, and figures 2 and 3.

As indicated by the overlapping curves in figure 2.

Table 1  Age and Sex Distribution

<table>
<thead>
<tr>
<th></th>
<th>&lt;40 yrs</th>
<th>40-49 yrs</th>
<th>50-59 yrs</th>
<th>60-69 yrs</th>
<th>≥70 yrs</th>
<th>Total</th>
</tr>
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<tr>
<td></td>
<td>M F</td>
<td>M F</td>
<td>M F</td>
<td>M F</td>
<td>M F</td>
<td>Sum</td>
</tr>
<tr>
<td>CT</td>
<td>1 0</td>
<td>15 9</td>
<td>46 26</td>
<td>50 23</td>
<td>14 33</td>
<td>126 91 217</td>
</tr>
<tr>
<td>CH</td>
<td>1 0</td>
<td>5 4</td>
<td>11 9</td>
<td>10 9</td>
<td>2 3</td>
<td>29 25 54</td>
</tr>
<tr>
<td>TIA</td>
<td>3 1</td>
<td>6 1</td>
<td>9 2</td>
<td>6 2</td>
<td>0 5</td>
<td>24 11 35</td>
</tr>
<tr>
<td>Total</td>
<td>5 1</td>
<td>26 14</td>
<td>66 37</td>
<td>66 34</td>
<td>16 41</td>
<td>179 127 306</td>
</tr>
</tbody>
</table>

CT = cerebral thrombosis; CH = cerebral hemorrhage; M = males; F = females.

Table 2  Cumulative Survival Rate in Cerebral Thrombosis, Cerebral Hemorrhage, and TIA (%)

<table>
<thead>
<tr>
<th></th>
<th>CT</th>
<th></th>
<th>CH</th>
<th>TIA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>40-59 yrs</td>
<td>60-69 yrs</td>
<td>≥70 yrs</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td>SR Sp</td>
<td>SR Sp</td>
<td>SR Sp</td>
<td>SR Sp</td>
</tr>
<tr>
<td>End of 1 yr</td>
<td>96.7 1.89</td>
<td>89.9 3.63</td>
<td>76.6 6.15</td>
<td>90.1 2.35</td>
</tr>
<tr>
<td>End of 2 yrs</td>
<td>91.8 3.27</td>
<td>76.4 5.67</td>
<td>51.8 9.16</td>
<td>81.9 3.28</td>
</tr>
<tr>
<td>End of 3 yrs</td>
<td>88.4 4.63</td>
<td>62.2 8.98</td>
<td>51.8 9.16</td>
<td>75.5 4.71</td>
</tr>
</tbody>
</table>

SR = survival rate; Sp = standard error of the rate.
and figure 3, the CMIR and CRR did not differ significantly among the age groups.

The CSR, CMIR, and CRR in cerebral thrombosis, cerebral hemorrhage, and TIA are presented in tables 2, 3, and 4 and figures 4, 5, and 6. Logrank test showed that these three rates did not differ significantly among these conditions, \( X^2 = 0.154, 0.95 > p > 0.90 \) (CSR); \( X^2 = 0.105, p = 0.75 \) (CMIR); \( X^2 = 3.45, 0.25 > p > 0.10 \) (CRR).

Causes of death were ascertained in 42 cases. In 20, the cause of death was cardiovascular disease, respiratory infection, or gastrointestinal bleeding.

**Discussion**

Stroke is a leading cause of death in China as well as in most developed countries. In 1974–1978, cerebrovascular diseases, heart diseases, and malignant neoplasms were the main causes of death in China and accounted for 58.0–63.8%. Stroke ranked first as a cause of death. The specific mortality was 125.02–
144.52 per 100,000 population. In some areas of China, stroke ranked second or third, next to heart diseases or malignant neoplasms, or both. The purpose of this study is to evaluate the long-term prognosis in cerebral thrombosis, cerebral hemorrhage, and TIA. In addition, we are trying to compare the CSR, CMIR, and CRR among these diseases.

Our results indicate that age is the most important factor influencing the survival rate. Table 2 suggests the CSR of patients above 60 years old decreases rapidly year by year. The CSR, two years after onset was only 51.78% (Sp = 9.16%) in patients aged 70 and above but 91.82% (Sp = 3.27%) in patients aged 40-59. It should be noted that the CSRs after three years were similar in all three conditions: the figures were 75.53% (Sp = 4.71%) in cerebral thrombosis, 80.17% (Sp = 9.13%) in cerebral hemorrhage, and 78.26% (Sp = 8.89%) in TIA. It is very interesting to find that there are some similarities between our figures and the Framingham study findings in 1982. For instance, the 5-year cumulative survival rate for stroke victim survivors was 60% for women and 52% for men. Their study also revealed the survival results of ABI were similar to all strokes combined.

In our study, the CRR of cerebral thrombosis at the end of three years after the initial stroke was 32.6% (Sp = 5.92%). In the Framingham study, 5-year cumulative recurrence rate was 42% for men and 24% for women. Because our study group was not big enough, especially in cerebral hemorrhage and TIA, there was no recurrence case after 24 months, or in the final 12 months of cerebral thrombosis (fig. 6). But according to our clinical experience, the period for recurrence is the first two years post stroke. Contrary to expectation, CRR did not differ significantly among cerebral thrombosis, cerebral hemorrhage, and TIA. However, CRR tended to increase more rapidly in cerebral thrombosis than that in cerebral hemorrhage (fig. 6). Perhaps study of a larger number will reveal a significant difference.

Extent of recovery and outcome of stroke have been extensively studied by various authors. It has been estimated that 39% to 42% of patients surviving stroke have a complete functional recovery, 25% to 32% become ambulatory, and 27% to 35% remain incapacitated. Our study showed that many surviving stroke patients experience marked improvement. As shown in table 3 and figure 5, about 70.8% of patients with cerebral thrombosis and 73.7% of those with cerebral hemorrhage had marked improvement in their paralyzed limbs at the end of the second year. Most had a complete functional recovery and were independent in their daily activities. Three years from onset, 89.2% of the patients with cerebral thrombosis and 84.2% of those with cerebral hemorrhage had marked improvement. Only a small fraction of patients remained incapacitated. Thus, some patients may require a long period for maximum functional recovery. The long-term prognosis for the paralyzed limbs was not as bad as we expected. We found that most of our patients went to accupuncture clinics and did some Chinese traditional exercises after discharge. These treatments may afford great benefit for the recovery of paralyzed limbs.

Our survival analysis was based on deaths from cerebrovascular diseases or immediate complications only (and did not refer to death from other causes, such as traffic accidents, cancer, or encephalitis, etc.) because we do not think the other causes are the real impact of stroke on survival rate.

Among long-term survivors, the cardiovascular disease, respiratory infection, and gastrointestinal bleeding were the most common causes of death. In the Framingham study, the leading cause of death was cardiovascular disease. These findings have important therapeutic and preventive implications.

In conclusion, our long-term study of stroke suggested if the rehabilitation is conducted properly and complications are treated vigorously, a better outcome will be expected and the survival rate will be improved.

### Table 3

<table>
<thead>
<tr>
<th>Age Group</th>
<th>CT</th>
<th>MIR (%)</th>
<th>Sp (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-59 yrs</td>
<td>CH</td>
<td>17.3 4.07</td>
<td>13.9 6.49</td>
</tr>
<tr>
<td>60-69 yrs</td>
<td>20.4 6.48</td>
<td>17.6 3.08</td>
<td>31.6 7.26</td>
</tr>
<tr>
<td>≥70 yrs</td>
<td>59.3 7.45</td>
<td>91.2 7.90</td>
<td>89.2 3.64</td>
</tr>
</tbody>
</table>

**MIR** = marked improvement rate.

### Table 4

<table>
<thead>
<tr>
<th>Age Group</th>
<th>CT</th>
<th>RR (%)</th>
<th>Sp (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-59 yrs</td>
<td>CH</td>
<td>12.7 3.58</td>
<td>9.1 3.55</td>
</tr>
<tr>
<td>60-69 yrs</td>
<td>14.8 5.59</td>
<td>12.9 2.70</td>
<td>5.4 3.72</td>
</tr>
<tr>
<td>≥70 yrs</td>
<td>17.2 5.03</td>
<td>33.0 9.47</td>
<td>19.3 3.54</td>
</tr>
</tbody>
</table>

**RR** = recurrence rate.
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References


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Stroke. 1985;16:323-327
doi: 10.1161/01.STR.16.2.323

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Print ISSN: 0039-2499. Online ISSN: 1524-4628

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