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

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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, ($X^2 = 18.6344, p = 0.005$). 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>Age Group</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>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>F</td>
<td>M</td>
<td>F</td>
<td>M</td>
<td>F</td>
</tr>
<tr>
<td>CT</td>
<td>1</td>
<td>0</td>
<td>15</td>
<td>9</td>
<td>46</td>
<td>26</td>
</tr>
<tr>
<td>CH</td>
<td>1</td>
<td>0</td>
<td>5</td>
<td>4</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>TIA</td>
<td>3</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
<td>1</td>
<td>26</td>
<td>14</td>
<td>66</td>
<td>37</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>Age Group</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>
</thead>
<tbody>
<tr>
<td>CT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>End of 1 yr</td>
<td>96.7</td>
<td>1.89</td>
<td>89.9</td>
<td>3.63</td>
<td>76.6</td>
<td>6.15</td>
</tr>
<tr>
<td>End of 2 yrs</td>
<td>91.8</td>
<td>3.27</td>
<td>76.4</td>
<td>5.67</td>
<td>51.8</td>
<td>9.16</td>
</tr>
<tr>
<td>End of 3 yrs</td>
<td>88.4</td>
<td>4.63</td>
<td>62.2</td>
<td>8.98</td>
<td>51.8</td>
<td>9.16</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–
our clinical experience, the risk period for recur-

tion is the first two years post stroke. Contrary to

expectation, CRR did not differ significantly among

cerebral thrombosis, cerebral hemorrhage, and TIA.

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 rap-

idly 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 fig-

ures 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.10 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 risk period for recur-

rence 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.1-8 It has been

estimated that 39% to 42% of patients surviving stroke

have a complete functional recovery, 25% to 32% be-
come ambulatory, and 27% to 35% remain incapacita-
ed. Our study showed that many surviving stroke pa-


tients 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 para-
lzyed 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 improve-

ment. Only a small fraction of patients remained inca-

pacitated. Thus, some patients may require a long peri-

od 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 cer-
ebrovascular diseases or immediate complications

only (and did not refer to death from other causes, such

as traffic accidents, cancer, or encephalitis, etc.) be-

cause we do not think the other causes are the real

impact of stroke on survival rate.

Among long-term survivors, the cardiovascular dis-

ease, respiratory infection, and gastrointestinal bleed-
ing 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 sug-

gested if the rehabilitation is conducted properly and

complications are treated vigorously, a better outcome

will be expected and the survival rate will be im-

proved.

Table 3
Cumulative Marked Improvement Rate after Cerebral Thrombosis, Cerebral Hemorrhage, and TIA (%)

<table>
<thead>
<tr>
<th></th>
<th>CT</th>
<th></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>
<td>CH</td>
</tr>
<tr>
<td></td>
<td>MIR Sp</td>
<td>MIR Sp</td>
<td>MIR Sp</td>
<td>MIR Sp</td>
<td></td>
</tr>
<tr>
<td>End of 1 yr</td>
<td>17.3 4.07</td>
<td>13.9 4.29</td>
<td>20.4 6.48</td>
<td>17.6 3.08</td>
<td>31.6 7.26</td>
</tr>
<tr>
<td>End of 2 yrs</td>
<td>66.3 5.60</td>
<td>59.3 7.45</td>
<td>73.5 9.64</td>
<td>70.8 4.35</td>
<td>73.7 7.67</td>
</tr>
<tr>
<td>End of 3 yrs</td>
<td>86.2 4.68</td>
<td>81.9 7.52</td>
<td>91.2 7.90</td>
<td>89.2 3.64</td>
<td>84.2 9.35</td>
</tr>
</tbody>
</table>

MIR = marked improvement rate.
References
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Q T Chen and R Ling

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