Prognosis of Patients With Unilateral Extracranial Occlusion of the Internal Carotid Artery

O. Waltimo, M.D., M. Kaste, M.D., and R. Fogelholm, M.D.

SUMMARY One hundred fifty-five patients (121 men and 34 women) had an angiographically verified unilateral internal carotid artery (ICA) occlusion immediately after carotid bifurcation. The median follow-up period was 53 months. Forty-five percent of the patients were fully independent in the activities of daily living (ADL), 22% required assistance in ADL, 11% were disabled, and 22% died within the follow-up period. The mortality rate was exceptionally low compared with previous series. A life-table analysis of the material gave a 94% probability of surviving the first year, 84% the third year, and 78% the fifth year.

Young age was favorable in regard to functional recovery, but it had no influence on mortality. The condition at the acute stage was the most important clinical sign in predicting the prognosis. The prognosis of mortality and functional recovery was poorer for smokers than for nonsmokers, and hypertension had no effect on prognosis. Cerebrovascular disease and coronary heart disease were found to be the cause of death with equal frequency in this study.

Introduction

THE LITERATURE contains many reports dealing with survival after stroke. In hospital studies of stroke patients without diagnostic selection, the case-fatality rate in the acute phase ranged between 35% and 60%.1-4 Studies restricted to brain infarction have fatality rates of 10% to 35%.4-6 Studies concerning functional recovery after stroke have shown that about half of the survivors become independent in self-care and about 10% need institutional care.2,3

On the other hand, there is little information about case-fatality rate and functional recovery of patients with internal carotid artery (ICA) occlusion.10 This seems to us an important clinical question, and we therefore have analyzed the long-term prognosis of patients with verified unilateral internal carotid artery occlusion when located near the carotid bifurcation.

Patients and Methods

During 1966 to 1973, 171 patients with unilateral ICA occlusion were treated by the Department of Neurology, University of Helsinki, Finland. Occlusion was verified by either aortic arch angiography or serial carotid angiography. At the turn of the year, 1973 to 1974, a questionnaire was sent to all these patients concerning their state of health and/or disability. Altogether 163 patients could be traced. The median follow-up time was 53 months (range 2 to 144 months). One hundred fifty-five patients (121 men and 34 women) had had occlusion of the ICA immediately after carotid bifurcation, and these patients constituted the study material. Eight patients with occlusion of the carotid siphon were excluded. The location of the ICA occlusion was right-sided in 78 patients and left-sided in 77 patients.

Results

The age of the patients at onset of symptoms varied from 19 to 79 years (median 53 years). Age and sex distributions are shown in table 1.

The patients were divided into four categories according to prognosis: (1) fully independent in their activities of daily living (ADL), (2) those who required assistance in ADL, (3) totally disabled, and (4) died during follow-up period. The numbers of patients in these four groups were 70, 34, 17 and 34 (45%, 22%, 11% and 22%), respectively (fig. 1). Sex had no significant influence on prognosis, and the same is true for the location of the occlusion (fig. 1).

One hundred thirty-four patients had brain infarction and 21 had transient ischemic attacks (TIA). The percentage of patients fully independent in ADL (Group 1) among those with TIA (71%) was significantly higher (p<0.01, chi-square) than in those with brain infarction (14%). The percentages of Groups 2 and 4 were significantly lower (5% and 14%; p<0.05 and p<0.01) in those with TIA when compared with brain infarction (25% and 42%) (fig. 1).

The level of consciousness was normal in 126 patients and lowered in 29 patients. The former subseries presented a higher percentage of Group 1 patients (49%, p<0.05) than the latter (28%). The difference between Group 4 percentages, 19% in the former and 35% in the latter series, did not reach statistical significance (fig. 1). At the acute stage, 56 patients were bedridden and 99 were ambulatory. As expected, the prognosis was better in the ambulatory group of patients at the acute stage when compared to the bedridden group of patients.

The median age at onset of symptoms was 53 years (identical for men and women), and the location had no influence on the median age. The median age at onset of symptoms also was 53 years in Group 4. Subdivision of the patients into four age groups (<40, 40 to 49, 50 to 59, ≥60 years, fig. 2) revealed a consistent decrease of the Group 1 percentage with increasing age (73%, 56%, 39%, 33%, respectively), with statistically significant differences between the age groups: <40 and 50 to 59 years (p<0.05) and <40 and ≥60 years (p<0.05), and the combined groups: <50 and ≥50 years (p<0.01). The percentage of Group 3 was higher (15%) among the patients 50 years or older than in those younger than 50 years (2%, p<0.05). The percentages of Group 4 did not differ markedly between the age groups.

Hypertension (>160/95 mm Hg) was measured in 72 patients (46%) during their hospital visit. In this series hypertension had no prognostic value (fig. 2).

Data on smoking habits were obtained in 137 patients. Classifying those who had never smoked and the ex-smokers together as nonsmokers, 41% were nonsmokers. The nonsmokers had a higher Group 1 percentage than the smokers (63% versus 43%, p<0.05) and a lower Group 4 percentage (7% versus 13%, p<0.05) (fig. 2).
Thirty patients (20% of the entire study) returned to work and the majority of these belonged to Group 1 (fully independent). During the follow-up period, 34 patients (21%), 27 men and 7 women, had died. The causes of death are shown in Table 2. Nine of these patients died within three months after onset of cerebrovascular symptoms, the case-fatality rate in the acute stage being 5%. The cause of death was obtained from the death certificates of these patients; an autopsy was performed in 20 cases. The case-fatality rate was virtually equal for men and women. A life-table analysis of the material gave a 94% probability of surviving the first year, 84% the third year, and 78% the fifth year.

### Discussion

It must be pointed out that this material was highly selected: first, the patients who could be admitted to the Department of Neurology of the University of Helsinki had to have a chance of relatively good prognosis, and second, angiographical examinations were restricted to the younger age classes. This selection and the relatively young age structure of the series may be partially responsible for the results obtained.

In the present study the numbers of occlusions of the right and left ICA were equal, in disagreement with most previous reports of brain infarction, which disclosed a left preponderance. On the other hand, this agreed with a previous report from our clinic of ICA thrombosis.

The case-fatality rate in the acute stage was only 5%, which is much lower than has been reported earlier in connection with brain infarction. On the other hand, Katz et al. reported a similar acute mortality rate in their study of 138 patients with cerebral infarction. In our series we studied only ICA occlusion, and therefore our study consists of 21 patients with TIA alone and no brain infarction. We found that the patients with TIA had a better prognosis, but this cannot have profoundly affected the case-fatality rate of the entire series.

One-fifth of our patients died within the follow-up time (median 53 months). A life-table analysis gave a 78% probability of surviving the fifth year, which is extremely high considering that only 31% of 843 patients with cerebral thrombosis studied by Robinson et al.14 survived five years. Marshall and Shaw had 23 patients with ICA occlusion of whom 50% died within the follow-up time (four to nine years). In the study by Katz et al.13 which presented an equally good acute prognosis similar to ours, 41% of the patients died within two years after the stroke. It can be concluded that the probability of survival was exceptionally good among our patients with extracranial ICA thrombosis.

Functional recovery of our patients was similar to that of the survivors in previous studies. Thus, the salient difference from earlier investigations was the low mortality. This might be due to the young age of the patients studied and to good collateral circulation in connection with extracranial ICA occlusion. The latter was clearly observed in 22 patients with TIA alone in spite of their ICA occlusion.

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**Table 1**: Age and Sex Distributions

<table>
<thead>
<tr>
<th>Age</th>
<th>Men</th>
<th>Women</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>0 (0)*</td>
<td>1 (3)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>20-29</td>
<td>0 (0)</td>
<td>1 (3)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>30-39</td>
<td>7 (6)</td>
<td>6 (18)</td>
<td>13 (8)</td>
</tr>
<tr>
<td>40-49</td>
<td>31 (25)</td>
<td>5 (14)</td>
<td>36 (23)</td>
</tr>
<tr>
<td>50-59</td>
<td>63 (52)</td>
<td>17 (50)</td>
<td>80 (52)</td>
</tr>
<tr>
<td>60-69</td>
<td>18 (15)</td>
<td>4 (12)</td>
<td>22 (14)</td>
</tr>
<tr>
<td>70+</td>
<td>2 (2)</td>
<td>0 (0)</td>
<td>2 (1)</td>
</tr>
<tr>
<td>Total</td>
<td>121 (100)</td>
<td>34 (100)</td>
<td>155 (100)</td>
</tr>
</tbody>
</table>

*Numbers in parentheses are percent.

**Table 2**: Cause of Death

<table>
<thead>
<tr>
<th>Cause of Death</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cerebrovascular disease</td>
<td>14</td>
</tr>
<tr>
<td>Coronary heart disease</td>
<td>14</td>
</tr>
<tr>
<td>Malignancy</td>
<td>3</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>34</td>
</tr>
</tbody>
</table>

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**Figure 1**: Distribution of 155 patients with ICA occlusion and of various subgroups according to prognosis groups: Group 1: fully independent in ADL (70 patients), Group 2: required assistance in ADL (34 patients), Group 3: totally disabled (17 patients), and Group 4: died within follow-up period (34 patients).

**Figure 2**: Distribution according to prognosis group (see fig. 1) of various subgroups.
SUMMARY  The long-term prognosis of 78 stroke patients with occlusion of the middle cerebral artery (MCA) or its branches is described. The mean age of the patients was 44 years. The mortality rate in the acute phase was 5%. The acute and total mortality rates of men were higher than those of women (p < 0.05). Life-table analysis gave 94% probability for one-year's survival, 84% for three years' survival, and 78% for five years' survival. Subsequent strokes were twice as common as cardiovascular events as the cause of death. Seventytwo percent of the survivors became fully independent in activities of daily living (ADL), 27% required assistance, 1% was totally disabled, and 43% returned to work. Left-sided occlusion was overrepresented in those who died (p < 0.001) and those who returned to work (p < 0.05), and right-sided occlusion was overrepresented in those who required assistance in ADL (p < 0.05).

Introduction

NUMEROUS STUDIES have dealt with long-term prognosis of stroke and various types of stroke, while little attention has been paid to the clinical entity of occlusion of one major cerebral artery. It would be desirable in clinical routine work to know the stroke patient's long-term prognosis evaluated on this basis, since this type of stroke is frequently encountered. Therefore, we have analyzed the long-term prognosis of stroke patients with occlusion of the middle cerebral artery (MCA) or its branches.

Patients and Methods

From the 1966 to 1973 files of the Department of Neurology, University of Helsinki (Finland), 83 patients with ischemic brain infarction and occlusion of the MCA or its branches, verified angiographically or by autopsy, were found. Etiological causes other than ischemic were excluded.
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