Early Rehabilitative Care in Community Hospitals: Effect on Quality of Survivorship Following a Stroke

BY B. LIONEL TRUSCOTT, M.D., PH.D., CLAIRE M. KRETSCHMANN, B.A., JAMES F. TOOLE, M.D., AND THOMAS F. PAJAK, PH.D.*

Abstract: The effect of early institution of rehabilitative care on quality of survivorship was investigated in 483 patients with their first cerebral infarction. Impaired consciousness at onset adversely affects survivorship and recovery of motor strength. Early institution of rehabilitation was associated with reduced mortality and improved quality of survivorship regardless of severity of the illness, age, or presence of associated diseases.

Additional Key Words mortality
impaired consciousness motor strength
hypertension age cerebral infarction

In spite of numerous studies on the clinical course of cerebrovascular disease, there is little agreement concerning the anticipated mortality and quality of survivorship following a stroke. Ford and Katz1 have clearly indicated that studies cannot be readily compared because of the lack of uniformity in methods and in reporting sample characteristics: method of selecting patients, the number and kinds of patients lost to follow-up, the method of follow-up, type and duration of treatment, and definition of functional performance before and after the stroke. The severity of illness at onset, the time lag between onset and initiation of rehabilitative therapy, and the presence of associated diseases (hypertension, diabetes mellitus, cardiac disease) are other factors neglected in many studies which analyze the temporal profile of a stroke.

The difficulty in predicting the outcome of a stroke is underscored by the widely divergent reports on mortality rate, and the pitfalls encountered when attempts are made to define and measure the quality of survivorship. Eisenberg et al.2 report that 50% of their patients died within two weeks of onset, while Whisnant et al.3 found a death rate of only 27% within the first month. Similarly, death rates reported during the initial hospitalization period vary from 14% to 58%.5 Several factors account for these discrepancies, but perhaps the most critical are age differences and the failure to consider patients who died before they could be included in the study. The severity of onset is also a major determinant of mortality rate. Thus 72% to 81% of individuals who are comatose at onset die6,6 in contrast to a 26% to 30% death rate when consciousness is not impaired.7 Ford and Katz1 conclude from their study that cerebral thrombosis is associated with a mortality rate of 15% to 35% during the first year, and of 40% to 65% by the fifth year after onset of the stroke.

The difficulty of defining and measuring the quality of survivorship prevents any meaningful comparisons between studies. There is little uniformity in diagnostic criteria, age of patient samples, severity of the incapacity at onset, or terminology. The earlier studies have been reviewed by Ford and Katz,1 who conclude that there is maximal improvement in the first month in 34%. Of those who survive from two to five years after onset, 40% to 60% become independent and 10% to 20% are completely dependent. McDowell and Louis8 noted a marked improvement in 11.7%. During the same time period Stern et al.9 reported independence in activities of daily living in 8% and complete dependence in 22%. Whisnant et al.5 indicate that 4% of patients are bedridden at six months, and 21% showed little or no improvement during a ten-year follow-up. The studies of Dyken10 and Matsumoto et al.11 further suggest that almost 40% return to work or are capable of working. Ford and Katz1, however, conclude that the probability of return to prestroke activities of daily living is 1 in 44 survivors during the first six months, 1 in 37 during the first year, and 1 in

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50 two years after the stroke. Elaborate and formal rehabilitative programs have not been significantly more effective than functionally oriented programs directed at ambulation and self-care activities.9, 12

Methods
This report presents the results of uniform methods of acute care and rehabilitative treatment on mortality and return of motor function during the first three months following a stroke.

The patients reported in this study were hospitalized between September, 1969, and July, 1973, in the 25 hospitals participating in the North Carolina Comprehensive Stroke Program. These hospitals vary in size from 46 beds to more than 400 beds. Details of the organization of these community stroke programs have been published elsewhere13, 14 and have been suggested as a prototype on a national basis.15

All generalists and internists, nurses, and allied health personnel of the participating community hospitals, nursing homes and public health departments have received uniform instruction in diagnosis, evaluation, and treatment of the stroke patient. Special emphasis is placed on institution of positioning and range of motion exercises on admission, and of mobilization procedures as soon as the patient has sitting balance. In particular, the program calls for a regular schedule of change in position at least once every two hours, the separation of limbs from one another and from the body by means of a pillow, and the use of a trochanter and a hand roll. Personnel have been instructed in the frequent and careful movement of joints through the full range of motion. Stress is placed on the recognition of sitting and standing balance, and the procedures to be followed in instructing the patient to change from a lying to a sitting position, and from the latter to standing and walking.

Uniform guidelines are applied in the evaluation of weakness (normal, mild, moderate, and severe), of four categories of functional capacity (totally disabled and dependent, partially dependent but able to perform activities of daily living, independent but unable to resume prestroke activities, and able to resume prestroke activities), and of four levels of consciousness (alert, lethargic, arousable, and

Mortality and status of motor strength in survivors at hospital discharge (fig. 1) and at follow-up three months following onset of stroke (fig. 1a). The effect of age in 483 patients who had survived the first 48 hours of their first cerebral thrombosis. "Rehab": institution of specified rehabilitative procedures within 48 hours of admission. "No Rehab": no such therapy initiated.
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comatose). Hospitalization forms for each patient include vital signs, patient and family history of stroke and associated diseases, date of onset, symptoms, neurological examination, laboratory results, and admitting and discharge diagnoses. The severity of weakness, state of consciousness, and functional capacity at admission and discharge are recorded. Similar data are obtained at follow-up 3, 6, 12, 18, 24, 36, 48 and 60 months following the stroke.

When data on a newly registered stroke patient are completed, the forms are sent to the central office at the Bowman Gray School of Medicine (Winston-Salem, North Carolina), where diagnosis and completeness are verified and the material is coded for filing and keypunching. At the end of each month, the coded information is entered into the master computer file.

By the end of July, 1973, hospital data had been acquired on 1,956 stroke patients, with a maximum follow-up period of 36 months. This patient population has the following characteristics:

Age:
- 609 ≤ 64
- 617 65-74
- 729 ≥ 75

Sex:
- 1,006 male
- 950 female

Race:
- 1,344 white
- 598 black

Diagnosis:
- 29 Subarachnoid hemorrhage
- 204 Cerebral hemorrhage
- 29 Occlusion of precerebral arteries
- 1,503 Cerebral thrombosis
- 17 Cerebral embolism
- 28 Transient cerebral ischemia
- 146 Other and ill-defined CVD

Rehabilitation therapy:
- 802 within 48 hours of admission
- 344 later
- 810 none given

Latest follow-up:
- 604 died in hospital
- 147 discharged alive, no follow-up
- 292 3 months
- 247 6 months
- 666 12 months or longer

The present report is limited to patients with a verified diagnosis of cerebral thrombosis (ICDA 433). The study population has been further selected for the following characteristics: first strokes; unilateral, moderate to severe weakness as evaluated by the attending physician according to the uniform guidelines of the program; admission to

The effect of impaired consciousness on mortality and survivorship in patients below (fig. 2) and above age 75 (fig. 3). Early institution of therapy is associated with reduced mortality in both age groups, regardless of state of consciousness.
hospital within 48 hours of onset; survival beyond the first 48 hours of hospitalization; passive exercises, range of motion and positioning, either initiated within 48 hours of admission ("Rehab") or not given at all ("No Rehab"). The population thus selected consists of 483 patients. For the purposes of this report, the effects of early rehabilitative therapy are measured at discharge and at the three-month follow-up, in terms of mortality and improvement in motor strength.

The characteristics of this population are indicated in Table 1. The term "impaired consciousness" includes the two classifications, "arousable" and "comatose," on the scale of four referred to earlier. The classification "hypertensive" includes patients with admitting blood pressures of greater than 159 systolic or 95 diastolic and/or with x-ray evidence of cardiac enlargement. The term "other diseases" covers electrocardiographical abnormalities and/or laboratory evidence of diabetes mellitus (fasting blood sugar over 130 mg % and/or two-hour postprandial over 160 mg %). This paper correlates age, impaired consciousness at admission, the presence or absence of coexisting disease, and the early institution of rehabilitative therapy, with outcome. Table 2 presents the study population by age and coexisting disease.

It should be noted that patients with uncomplicated stroke were the least likely to be given early rehabilitative care.

**Results**

**AGE**

In-hospital mortality of patients over the age of 75 is almost double that of younger patients, and improvement in motor strength at discharge is far less prominent. In both age groups, however, early rehabilitation is associated with reduced mortality and improved quality of survivorship at discharge (fig. 1). This effect is enhanced at three months following the onset of the stroke (fig. 1a).

**STATE OF CONSCIOUSNESS AT ADMISSION TO HOSPITAL**

The most predictable factor adversely affecting outcome is impairment of consciousness. Bearing in mind that all patients succumbing within the first 48 hours of hospitalization were excluded and that nearly all of these had been admitted with impaired con-
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TABLE 1
Characteristics of Study Population (483 Patients)

<table>
<thead>
<tr>
<th>Below age 75</th>
<th>Age 75 and older</th>
<th>Retained consciousness</th>
<th>Impaired consciousness</th>
<th>Normotensive</th>
<th>Hypertensive</th>
<th>No other disease</th>
<th>Any other disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>282</td>
<td>201</td>
<td>336</td>
<td>147</td>
<td>152</td>
<td>331</td>
<td>207</td>
</tr>
<tr>
<td>Percent of total</td>
<td>58</td>
<td>42</td>
<td>70</td>
<td>30</td>
<td>31</td>
<td>69</td>
<td>43</td>
</tr>
<tr>
<td>Percent with early rehab</td>
<td>65</td>
<td>66</td>
<td>69</td>
<td>56</td>
<td>63</td>
<td>66</td>
<td>62</td>
</tr>
</tbody>
</table>

TABLE 2
Coexisting Disease (Hypertension, Cardiac Disease, Diabetes Mellitus) in the Study Population

<table>
<thead>
<tr>
<th>Normotensive</th>
<th>Hypertensive</th>
</tr>
</thead>
<tbody>
<tr>
<td>No other disease</td>
<td>Other disease</td>
</tr>
<tr>
<td>Age &lt; 74</td>
<td>Early rehab (%)</td>
</tr>
<tr>
<td>Age &gt; 75</td>
<td>Early rehab (%)</td>
</tr>
<tr>
<td>Total</td>
<td>Early rehab (%)</td>
</tr>
</tbody>
</table>

Sciosiousness, it is noted that hospital mortality in survivors of the first 48 hours is still very much higher if consciousness was impaired than if it was retained (figs. 2 and 3). The effect of impaired consciousness at onset is seen even more strikingly three months later (figs. 2a and 3a). In patients under the age of 75, the mortality is four times as great and improvement in motor strength considerably less than in those whose consciousness had been retained.

By three months after the stroke, regardless of

DISCHARGE_STATUS

**FIGURE 4**

The presence or absence of coexisting diseases (hypertension, cardiac disease, diabetes mellitus) appears to have little influence on hospital mortality or motor strength in survivors. The results of early rehabilitation can be seen in all categories.
severity of onset, the "Rehab" group exhibits half the mortality and twice the improvement in motor strength as seen in the "No Rehab" group (fig. 2a). In the older patients (fig. 3a), even though impairment of consciousness at onset has had a devastating effect by three months, there is nevertheless a slight benefit to be reaped by early rehabilitative therapy.

**COEXISTING DISEASES**

Elevated blood pressure at admission and/or x-ray evidence of cardiomegaly do not appear to have a significant influence on in-hospital mortality in patients under the age of 75 (fig. 4), and very little influence in older patients (fig. 5). In view of the high mortality rate in cerebral hemorrhage, always associated with hypertension, this finding is puzzling. One explanation is that many patients with severe hypertension may have died within 48 hours, and that blood pressure in survivors was not sufficiently elevated to produce fatal structural damage, but was adequate to maintain cerebral circulation because of a high perfusion pressure.

Early rehabilitation appears to reduce significantly in-hospital mortality, irrespective of age or blood pressure. At three months following onset (figs. 4a and 5a), age and rehabilitative procedures seem to be of greater importance in determining outcome than is the presence or absence of hypertension.

Mortality does not appear to be influenced by the presence or absence of cardiac disease and/or diabetes mellitus, but patients with no laboratory evidence of either of these diseases have a slightly greater improvement in motor function. In all categories, the early institution of rehabilitative therapy was associated with a reduced mortality at three months after onset of the stroke.

**Discussion**

Studies of mortality and quality of survivorship following a stroke are not readily compared or inter-

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**FIGURE 4a**

Outcome at three months following onset of stroke. Age and institution of rehabilitation are of greater importance than is the presence or absence of coexisting disease.
interpretation because of the heterogeneity of the sample populations (differing from one another in diagnosis, age, methods of treatment, time lag between onset and treatment, severity of the illness at onset, length of follow-up, and presence of associated diseases). Attempts to group patients according to these variables result in study groups so small as to make analysis difficult and generalizations meaningless.

The present study investigates the effect of early institution of care on mortality and quality of survivorship in patients suffering moderate to severe cerebral thrombosis, grouped according to age, state of consciousness at onset of the stroke, and presence of associated diseases. Cohorts were divided into: (1) those receiving no rehabilitation, and (2) those receiving a program of passive range of motion and positioning within 48 hours of the onset of a stroke.

The most potent and predictable factor determining the mortality and quality of survivorship was the state of consciousness at admission to hospital. The effect of coma on stroke mortality has been emphasized by others. In our study, impaired consciousness resulted in a mortality rate four times greater than in individuals whose consciousness was retained at onset. Improvement in motor strength also was less in these more acutely ill individuals, and the adverse effect of altered consciousness was even more apparent three months after the stroke.

Coexistence of hypertension does not appreciably affect in-hospital mortality. This may be due to the fact that the blood pressure is sufficiently high to maintain cerebral blood flow in collateral vessels, without producing fatal structural changes in the brain. Early rehabilitation results in reduction of the in-hospital death rate of these hypertensive patients.

It should be noted that all of the patients in this study were treated in community hospitals without specialized rehabilitative personnel or equipment (present in only 3 of 25 hospitals). The common denominator was the early institution of rehabilitation according to uniform guidelines. The beneficial effect of such treatment on mortality and quality of survivorship is apparent.

References
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