Factors Influencing Outcome and Length of Stay in a Stroke Rehabilitation Unit

Part 1. Analysis of 248 Unscreened Patients — Medical and Functional Prognostic Indicators

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SUMMARY A retrospective analysis of 248 patients with stroke (average age 67, range 17–98) admitted to a stroke rehabilitation unit over a sixteen month period showed that 80% of these patients were able to return home after an average length of stay (LOS) of 43 days. At discharge 85% of the group were ambulatory and 56% required no help in daily living activities. Severity of weakness on admission, long onset-admission intervals, the presence of severe perceptual or cognitive dysfunction or a homonymous hemianopsia in addition to a motor deficit were related to unfavorable outcome and increased LOS. The age of the patient, dysphasia or a hemisensory deficit in addition to weakness, or diabetes, hypertension, or ASHD were unrelated to the patients' functional status on discharge, discharge disposition, or LOS. Many patients with “unfavorable prognostic signs” made significant improvement after admission and were subsequently discharged. Thus, while the above findings may predict which patients can make maximal gains in a short term treatment facility, they also show that most patients, even those with “poor prognostic signs,” can make enough functional improvement to be managed at home after a relatively short hospitalization.

SEVERAL STUDIES have presented data which demonstrate the value of comprehensive stroke rehabilitation programs. Lehmann et al. have presented a cost-benefit analysis which shows that a "substantial savings resulted from rehabilitating the (stroke) patients."

Are there any predictors of outcome which will define groups who benefit maximally or minimally from a rehabilitation program? Recent studies have shown that perceptual or cognitive loss, poor motivation, severe weakness, age, presence of hemisensory loss or a visual field cut, dysphasia, persistent deficits more than 30 days after the onset of stroke, poor initial scores on a functional evaluation assessment (Barthel Index), and the presence of hypertension, diabetes, or heart disease all may adversely affect functional outcome.

Many of these studies have reported conflicting statistics because the populations studied were often different, as were the methods of assessment and reassessment. Two reports have comprehensively evaluated and then correlated specific neurologic disabilities with functional status and eventual discharge disposition. Only these two studies have related length of stay to these variables even though these data are becoming invaluable for utilization review committees and for third party insurance carriers.

This investigation was designed to define medical and functional prognostic indicators in stroke rehabilitation and to gather information relating length of stay to each of these prognostic indicators.

Methods

Admission Criteria

In a 16 month period 248 patients were admitted to a newly established stroke rehabilitation unit at the Burke Rehabilitation Center in White Plains, N.Y. The only criteria for admission were that the patient have had a stroke and that adequate information about the patient's past medical problems be received on a special data transfer form. These patients were not otherwise screened prior to admission.

Description of the Group

The average age of the patients was 67 (range 17–98) and the average onset-admission interval (O-A-I) from the onset of the stroke to the day of admission to the unit was 38 days (range 9–137). Most of the patients were lower or middle class Caucasians, few had college educations. There were an equal number of males and females with approximately equal numbers with left and right hemiparesis. Most of the patients had thrombotic infarctions (47.6%), embolic infarctions (26.2%) or infarctions secondary to occlusive disease of the precerebral arteries (15.4%). Only 3.6% had subarachnoid hemorrhages, 2.8% intracranial hemorrhages, and 4.4%
infarctions from other causes. This population was somewhat older than groups studied in other series. Diagnostic categories were similar to some groups previously reported but somewhat different from other study populations.

Most of the infarctions involved cerebral structures supplied by the middle cerebral artery, although some of the patients had lesions in the brain stem or in the territory of the anterior cerebral artery. A small number had multiple infarctions. The age distribution for males and females and the age distribution of patients with right and left hemiparesis were essentially similar. (Outcome was not significantly different between groups with right and left hemiparesis; therefore data for these two groups were combined in the following analysis.)

Treatment Program

The rehabilitation program consisted of 3 to 4 periods per day of formal physical therapy, occupational therapy, or speech therapy. Activities of daily living (ADL) training was performed in the stroke unit in “real life settings” by the nursing staff and nursing aides. A team approach was utilized involving all members in patient treatment programs and discharge planning. Numerous interdisciplinary staff conferences facilitated communications and vigorous staff training fostered a “questioning approach.” Family and patient training was emphasized and was facilitated by weekly conferences on the medical/rehabilitative/speech/and nursing problems of stroke rehabilitation. In addition, individual counselling was provided as the families accompanied their affected member through the program prior to the first day pass and discharge. Finally, follow up care was offered in our stroke clinic, our Day Hospital, or through appropriate referrals to community agencies.

Assessment Protocols

All descriptive data were abstracted from a computerized stroke discharge summary previously described by Stern et al. as modified by the present authors. Outcome was defined in terms of discharge disposition (home or elsewhere), and functional status on discharge as measured by ability to perform ADL, ability to walk, and length of stay. In analyzing ADL, patients were allocated to one of four designations as 1) independent, 2) needs supervision but no assistance, 3) needs aids with dressing/feeding/hygiene, and 4) needs aids with bowel/bladder care. These ADL ratings were used since each category represents a significant increment in the amount of support needed after discharge (e.g. a patient needing supervision but no assistance can be assisted by unskilled helpers on a part time basis while patients needing help with bowel/bladder care usually require full time skilled helpers). Ambulation status was divided into three categories: 1) those walking with no aids, 2) those walking with aids and/or assistive devices, and 3) those unable to walk.

Results

Overall Outcome Statistics

After an average length of stay (LOS) of 43 days (range 1-120) 80% of the patients in this study returned home, 13% were discharged to nursing homes or extended care facilities, 7% were sent back to general hospitals for further evaluation.
tion and care, and 1 patient died. At the time of discharge 85% were ambulatory (28% requiring no aids, 57% needing some kind of supportive device such as a brace or a cane); only 15% were confined either to a wheelchair or to bed. Of the total group, 52% were completely independent in ADL, 4% required supervision but no aid, 42% required some aid with dressing/personal hygiene/meal preparation or feeding, and 24% required aid for bowel or bladder care (the last two categories are not mutually exclusive).

Relationship of Severity of Weakness to Outcome and LOS

Severity of weakness on admission was one of the strongest predictors of all three measures of outcome, as can be seen in table 1. Only 74% of the patients entering with severe weakness went home compared to approximately 86% of those with mild or moderate weakness. Similarly, only 73% of those with severe weakness were able to walk on discharge (and most of these needed aids) but 96–98% of those with mild or moderate hemiparesis were ambulatory on discharge, many without aids. Forty-three percent of the severely hemiparetic patients needed aids with bowel or bladder care on discharge compared with only 3–6% of those with mild to moderate weakness. While 63% of the more severely paralyzed needed aids in other spheres of ADL, only 10% of those with mild and 28% of those with moderate weakness required assistance in dressing, hygiene, or feeding.

Length of stay was directly related to severity of weakness; the severely affected group required an average of 47 days hospitalization, the moderately impaired group 41 days, and the mildly paretic group only 32 days.

Relationship of Associated Neurologic Deficits to Outcome and LOS

An analysis of associated neurologic deficits is shown in table 2. The presence of dysphasia or a hemisensory loss in addition to hemiparesis did not affect discharge placement, although it did increase the likelihood of needing aids in other spheres of ADL.
ultimate functional status, or length of stay. The presence of a severe organic mental syndrome (OMS), severe perceptual dysfunction (denial, neglect, apraxia, disorders of body image/scheme, visual-spatial or L-R disorientation, etc.), or poor motivation in addition to a hemiparesis adversely affected all 3 measures of "outcome." The presence of a homonymous hemianopsia (HHA) in addition to a hemiparesis also seemed to reduce chances of being discharged home, although the reasons for its effects on functional status were unclear since some patients with visual neglect were included in this category. LOS was not increased in these groups since slow functional recovery often mandated early discharge.

The coincidence of a hemiparesis with any two of the variables mentioned above was also associated with poor prognosis. Length of stay was not increased in hemiparetic patients with several other neurologic deficits for similar reasons.

**Relationship of Age to Outcome and LOS**

Table 3 shows that age (between 40 and 80) is unrelated to disposition and functional status on discharge. Approximately 80% of patients between 40 and 80 were discharged home, approximately 85% were ambulatory on discharge, and about 50-69% needed no help with ADL. The prolonged LOS in some patients between 40 and 60 was related to the fact that these patients tended to have more severe neurologic deficits at the time of admission. Older patients (over 81) were often unable to go home (even though they tended to have less severe weakness) because many were non-ambulatory (36%) and many needed help with bowel and bladder function (45%). The small number of patients in the first 3 decades obviates statistical comparison of these groups.

**Relationship of Onset-Admission Interval to Outcome and LOS**

Table 4 shows that the onset-admission interval (O-A-I) was unrelated to the severity of weakness on admission, and unrelated to length of stay, but was related to discharge disposition and functional status on discharge. Thus, 85% of those entering with an O-A-I of less than 30 days went home compared to about 76% of those with longer O-A-I's. Ninety-one percent of those with the shortest O-A-I's were ambulatory, but only 80% of those with longer O-A-I's were ambulatory at the time of discharge. While 20% of those with an O-A-I of less than 30 days needed help with bowel and bladder care, 27% of those in each of the other two categories needed this type of assistance.

**Relationship of Stroke "Risk Factors" to Outcome and LOS**

The data on ASHD, hypertension, diabetes, and hyperlipidemia showed that these factors were unrelated to discharge disposition, functional status on discharge, length of stay, or severity of deficit on admission.

**Discussion**

Several reports on patients with stroke confirm our findings that severe weakness on admission or severe perceptual or cognitive dysfunction either alone or in combination with any other neurologic deficits are poor prognostic indicators. Inability to walk at the time of discharge and the persistence of urinary and/or fecal incontinence were also found to be poor prognostic indicators in this study. Data

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>Number of patients</th>
<th>DISCHARGED</th>
<th>DEGREE OF PLEGIA</th>
<th>AMBULATION</th>
<th>DRESSING/FEEDING/HYGIENE</th>
<th>BOWEL/BLADDER</th>
<th>Average length of stay</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Home</td>
<td>Mild</td>
<td>Moderate</td>
<td>Severe</td>
<td>Walks</td>
<td>With aids</td>
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<tr>
<td>0 - 20</td>
<td>1 (1%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 - 40</td>
<td>2</td>
<td>1 (1%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41 - 50</td>
<td>15</td>
<td>6 (6%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>51 - 60</td>
<td>33</td>
<td>13 (33%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>61 - 70</td>
<td>83</td>
<td>33 (33%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>71 - 80</td>
<td>100</td>
<td>40 (40%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>81 - 90</td>
<td>11</td>
<td>4 (4%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥91</td>
<td>1</td>
<td>1 (1%)</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
TABLE 4

ONSET-TO-ADMISSION INTERVAL

<table>
<thead>
<tr>
<th>Interval</th>
<th>Number of Patients</th>
<th>Percent of Population</th>
<th>Average Length of Stay</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-30 DAYS</td>
<td>113 (46%)</td>
<td></td>
<td>44 days</td>
</tr>
<tr>
<td>31-60 DAYS</td>
<td>105 (42%)</td>
<td></td>
<td>39 days</td>
</tr>
<tr>
<td>&gt;60 DAYS</td>
<td>30 (12%)</td>
<td></td>
<td>46 days</td>
</tr>
</tbody>
</table>

TABLE 5

FUNCTIONAL STATUS ON DISCHARGE

<table>
<thead>
<tr>
<th>Status</th>
<th>Number of Patients</th>
<th>Percent of Population</th>
<th>Discharge Disposition</th>
<th>Average Length of Stay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can walk</td>
<td>70</td>
<td>28%</td>
<td>Home</td>
<td>34 days</td>
</tr>
<tr>
<td>Walks with aids</td>
<td>141</td>
<td>57%</td>
<td>Elsewhere</td>
<td>49 days</td>
</tr>
<tr>
<td>Can not walk</td>
<td>36</td>
<td>15%</td>
<td></td>
<td>32 days</td>
</tr>
<tr>
<td>Independent in daily living activities</td>
<td>130</td>
<td>52%</td>
<td></td>
<td>40 days</td>
</tr>
<tr>
<td>Requires supervision</td>
<td>11</td>
<td>4%</td>
<td></td>
<td>57 days</td>
</tr>
<tr>
<td>Needs aid dressing/feeding/hygiene</td>
<td>105</td>
<td>42%</td>
<td></td>
<td>44 days</td>
</tr>
<tr>
<td>Requires bowel and bladder routine</td>
<td>59</td>
<td>24%</td>
<td></td>
<td>39 days</td>
</tr>
</tbody>
</table>
suggest that none of these medical problems is a reliable indicator in predicting discharge disposition or functional outcome.

This study shows that patients entering with severe weakness, inability to walk and inability to perform any of their ADL all need longer hospitalization to achieve the levels of function required for "independent living." One previous report has shown that length of stay is increased with increasing disability.

The presence of severe perceptual or cognitive dysfunction, a homonymous hemianopia or poor motivation did not increase length of hospitalization since these patients often made so little progress that prolonged stay seemed unjustifiable. Age, the presence of dysphasia or hemisensory losses, or the presence of concurrent ASHD, hypertension, diabetes, and hyperlipidemia were all unrelated to LOS.

Previous attempts to analyze statistically the complex interactions of various prognostic indicators have not yielded reproducible results of obvious clinical significance. A multiple regression analysis of the data presented in this paper has not only confirmed the statistical validity of the results of this study but also has underscored the finding that adequate perceptual function, cognitive function, and motivation are the only strong predictors of whether or not patients were able to return home.

It should be emphasized that even though severe weakness on admission, the presence of severe perceptual or cognitive dysfunction, and the presence of a homonymous hemianopia are poor prognostic signs, many of the patients with these problems can still achieve some independence, and, therefore, should not be excluded from rehabilitation programs. Our findings are thus in agreement with Lehmann et al.

A random sampling of physicians who referred the patients in our study group showed that all would have sent their patients to nursing homes had the patient not been admitted to the stroke unit at the Burke Rehabilitation Center. Thus, each patient who returned home probably represented a patient who would have otherwise required long term care in a skilled nursing facility. Our high "success rate" (80% discharged home) strongly supports the concept that stroke rehabilitation is indeed cost-effective.

Stroke rehabilitation can be made most cost-effective by 1) limiting care to well-motivated patients under 80 years of age who are not severely confused or too perceptually unaware and who have no homonymous hemianopia, since these patients have a much higher probability of going home, and by 2) excluding patients who still have severe weakness more than 30 days after their stroke because these patients require longer hospitalizations, may be unable to walk at the time of discharge, and have a lower probability of being discharged home.

A number of studies have suggested that from 58 to 90% of patients admitted for stroke rehabilitation can be discharged home after appropriate restorative treatment. The data are divergent because of differences in populations studied, length of hospitalizations, and type of rehabilitation program. Similarly, the reported percentage of patients achieving independence in ADL has varied from 8% to approximately 90%. Our own experience has shown, contrary to current opinion, that it is often possible to overcome the problems of rehabilitating patients who have dysphasia and sensory losses in addition to a hemiparesis, who have severe weakness on admission, or who have multiple medical problems and may be of advanced age. This can be achieved with a vigorous program aimed at care of the whole patient and giving heavy emphasis to teaching both the patient and his family how to live as independently as possible within the confines of the remaining disabilities. Using this approach, it has proved possible to discharge 80% of our 248 patients back to their homes and families; with 85% of them ambulatory at the time of discharge and 56% requiring no help for activities of daily living.

References

J S Feigenson, F H McDowell, P Meese, M L McCarthy and S D Greenberg