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

Part 2. Comparison of 318 Screened and 248 Unscreened Patients

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SUMMARY A comparison of outcome and length of stay (LOS) between a control group of 248 unscreened patients (reported in Part 1) and a second group of 318 patients, medically and socially screened prior to admission, all discharged from the same 30-bed stroke unit over a 33-month period, showed that preadmission medical, neurological, and social service screening did not improve overall outcome or reduce length of stay (LOS). A program aimed at identifying and treating perceptual and cognitive dysfunction did improve functional status and discharge disposition in patients having perceptual but not cognitive deficits. A detailed analysis of the factors influencing outcome and LOS confirmed and extended earlier findings that: 1) severe weakness on admission and long onset-admission intervals were adversely related to outcome as were the presence of perceptual or cognitive dysfunction, poor motivation, a homonymous hemianopsia, multiple neurologic deficits, and poor functional status on discharge; and 2) dysphasia, the presence of a hemisensory loss, age (under 80) and/or the presence of ASHD/hypertension/diabetes were unrelated to outcome. It was again demonstrated that most patients—those with unfavorable prognostic signs—significantly improved after appropriate treatment programs.

FOLLOWING THE FINDINGS of several reports on factors influencing outcome and length of stay (LOS) in stroke rehabilitation in an initial group of 248 unscreened patients, data were analyzed on the next 318 patients discharged from the Stroke Unit at the Burke Rehabilitation Center over a 17-month period. Several variables were changed in an effort to improve outcome in this group. Preadmission screening was instituted and emphasis was placed on more effective identification and treatment of perceptual and cognitive dysfunction.

Methods

Admission Criteria

Admission applications for the group of 318 patients were all screened in an attempt to admit only those candidates who could maximally benefit from a short period of intensive stroke rehabilitation. Since previous studies have shown that severe perceptual and cognitive dysfunction and long onset-admission intervals were poor prognostic indicators, patients in these categories were usually not accepted unless outpatient evaluation demonstrated some capacity for significant functional improvement. Patients who had no close family member or friend to participate in discharge planning usually were not admitted. Patients with severe weakness, visual field defects, or multiple neurological deficits were not excluded from this study group.

Description of the Group

The average age of the patients (67-years-old with a range of 17-90) was similar to the first group studied but the average onset-admission interval (O-A-I) had increased to 69 days (range 0-853). Most of the patients were lower or middle class Caucasians. Few had college educations. There were 145 males and 173 females and approximately equal numbers with right and left hemiparesis. Diagnostic categories were similar to the control group. Most of these patients had cerebral infarctions; 45% were thrombotic, 20.5% were embolic, and 25% were secondary to occlusive disease of the precerebral arteries. Only 4.4% had subarachnoid hemorrhages, 1.6% intracranial hemorrhages, and 3.5% infarctions from other causes. Most of the strokes were confined to areas 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 significant number of patients in this group had multiple infarctions or multiple lacunar infarctions.

The age distribution for males and females and the age distribution of patients with right and left hemiparesis were essentially similar for the patients in this group. A small number of patients (7%) had no weakness on admission although they did have other associated neurological deficits requiring rehabilitative therapy.

Treatment Programs

The rehabilitation program was essentially similar to the program described in earlier reports but all patients (even dysphasic patients) were closely scrutinized for perceptual and cognitive abnormalities by all members of the stroke team. This often included observation of dressing and mealtime activities in addition to formal perceptual testing. Psychometrics were sometimes performed and the "perceptual" part of the Porch Index of Communicative Ability (PICA) was administered to the dysphasic patients. Although specific programs of perceptual and cognitive retraining were devised, it soon became impossible to distinguish the direct effects of formal therapy from the indirect effects of improved patient care rendered by a hospital staff trained (through numerous interdisciplinary staff conferences) to recognize and treat perceptual and cognitive problems. Therefore, no attempt was made in this investigation to relate improvement in outcome with specific therapeutic programs.

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Assessment Protocols

Outcome was again defined in terms of discharge disposition, ability to perform activities of daily living (ADL), ability to walk, and length of stay (LOS).

Results

Overall Outcome Statistics

After an average length of stay (LOS) of 46 days, 78% of the patients returned home. Nine percent were discharged to nursing homes or extended care facilities, 11% were sent back to general hospitals for further evaluation and care, and 2% died. The statistics following are usually (but not always) based on the entire group of 318 patients. Since 2% of the patients died while hospitalized, the statistics presented — particularly referring to discharge disposition and functional status on discharge — add up to only 98% which represents outcome in the 312 surviving patients. At the time of discharge, 85% were ambulatory (28% requiring no aids, 57% needing some type of supportive device); only 13% were confined to a wheelchair or to bed. In ADL, 50% were completely independent, 3% requiring supervision but no aid, and 45% requiring some aid with dressing/hygiene/meal preparation/feeding. Seventeen percent of the total group required aid for bowel and bladder care. These statistics paralleled our earlier findings.

Relationship of Severity of Weakness to Outcome and LOS

Table 1 shows that, as in our earlier study, the severity of the hemiparesis on admission was found to be related to discharge disposition, functional status on discharge, and length of stay. Of the patients with severe weakness, 77% returned home compared to 86% of those with moderate weakness. Although it was expected that most patients with mild weakness would return home, many of these patients were elderly and had other neurologic and/or functional limitations; these biases thus explain the relatively low "success rate" in this group. While only 78% of those with severe weakness were ambulatory on discharge, about 93% of those with mild or moderate weakness were able to walk out of the hospital, many without aids. This data also parallels our earlier findings although in the second group there was a small increase (5%) in the proportion of severely weak patients able to walk at the time of discharge.

In ADL, only 36% of the severely hemiparetic group were completely independent at the time of discharge, while 64% to 68% of those with mild or moderate weakness achieved independence in all activities. Similarly, of the patients with severe weakness, 58% required aid with dressing/feeding/hygiene while only 33% of those with moderate and 28% of those with mild weakness needed this type of assistance. In addition, 20% of the severely hemiparetic patients needed aids with bowel/bladder care as compared to 14% of those with mild to moderate weakness.

When these ADL outcome statistics are compared to the control group, it is apparent that, of those with mild or moderate weakness,

1) fewer patients in the second group became completely independent in ADL, and
2) more patients in the second group needed help with bowel/bladder care.

These findings are largely related to the higher incidence of perceptual and cognitive dysfunction in patients with mild or moderate weakness in the second group. Concomitantly, in patients with severe weakness, the relatively lower incidence of perceptual and cognitive dysfunction in the second group

<table>
<thead>
<tr>
<th>Degree of Weakness on Admission</th>
<th>DISCHARGED</th>
<th>AMBULATION</th>
<th>DRESSING/FEEDING/ HYGIENE</th>
<th>BOWEL/BLADDER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>Home</td>
<td>Walks</td>
<td>Independent</td>
<td>Independent</td>
</tr>
<tr>
<td>MILD</td>
<td>47 (16%)</td>
<td>Can't walk</td>
<td>Needs aids</td>
<td>Needs aids</td>
</tr>
<tr>
<td>MODERATE</td>
<td>78 (26%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEVERE</td>
<td>171 (58%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average length of stay</td>
<td>51 days</td>
<td>38 days</td>
<td>53 days</td>
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</tr>
</tbody>
</table>
probably explains why only 20% of the severely hemiparetic patients needed assistance with bowel/bladder care while 43% of the control group needed that type of assistance.

In the group admitted with severe weakness, LOS was 53 days, while those with moderate weakness stayed only 38 days and those with mild weakness an average of 51 days. Since we were able to achieve successful ambulation with 79% of the severely weak patients, and since ability to walk at the time of discharge was a major factor in whether patients could be managed at home, we felt that this increase in LOS for the severely weak patients was warranted. The relatively long LOS in the group with mild weakness was probably related to the advanced age of these patients and/or to concurrent neurologic and functional deficits.

Relationship of Associated Neurologic Deficits to Outcome and LOS

An analysis of the associated neurologic deficits is shown in table 2. The presence of dysphasia or a hemisensory loss in addition to a hemiparesis was again shown to be unrelated to discharge disposition and ultimate functional status although there was a slight prolongation of hospital stay in these groups. A significant organic mental syndrome (OMS) was present in 27% of the 318 patients. Only 68% of the patients having an OMS were discharged home, only 73% were ambulatory on discharge (24% with no aids, 49% with aids) and only 33% were independent in ADL. Thus, the presence of an OMS was again shown to be adversely related to outcome. LOS was not prolonged in this group. The prevalence of OMS in this sample was higher than in the control group. Ambulation status and ADL status on discharge were not improved in the second group even with specific programs aimed at "cognitive" retraining. More patients with OMS returned home in the second group (68%) than in the first group (48%) but this was probably most related to better family education and to changes in our admission policies which favored admission of patients.

### Table 2 Neurological Deficit

<table>
<thead>
<tr>
<th>Neurological Deficit</th>
<th>Number of Patients</th>
<th>Discharged Home</th>
<th>Ambulation</th>
<th>Dressing/Feeding/Hygiene</th>
<th>Bowel/Bladder</th>
<th>Average Length of Stay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceptual problems</td>
<td>124 (39%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>52 days</td>
</tr>
<tr>
<td>Organic mental syndrome</td>
<td>85 (27%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>43 days</td>
</tr>
<tr>
<td>Hemisensory loss</td>
<td>206 (65%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>47 days</td>
</tr>
<tr>
<td>Dysphasia</td>
<td>106 (33%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>48 days</td>
</tr>
<tr>
<td>Homonymous hemianopsia</td>
<td>97 (31%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>52 days</td>
</tr>
<tr>
<td>Poor motivation</td>
<td>26 (8%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>46 days</td>
</tr>
<tr>
<td>Hemisensory + HHA</td>
<td>82 (26%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>55 days</td>
</tr>
<tr>
<td>Hemisensory + PP</td>
<td>103 (32%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>53 days</td>
</tr>
<tr>
<td>Hemisensory + OMS</td>
<td>58 (18%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>44 days</td>
</tr>
<tr>
<td>Perceptual problems + OMS</td>
<td>55 (17%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>45 days</td>
</tr>
<tr>
<td>Dysphasia + OMS</td>
<td>9 (3%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>32 days</td>
</tr>
<tr>
<td>Poor motivation + OMS</td>
<td>15 (5%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>49 days</td>
</tr>
<tr>
<td>Hemisensory + HHA + PP</td>
<td>62 (19%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>59 days</td>
</tr>
<tr>
<td>Hemisensory + PP + OMS</td>
<td>48 (15%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>46 days</td>
</tr>
<tr>
<td>None of the above</td>
<td>45 (14%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>43 days</td>
</tr>
</tbody>
</table>
whose families were committed to maintain their member in a home setting after discharge.

Thirty-nine percent of the patients had significant perceptual dysfunction (denial, neglect, apraxia, disorders of body image/scheme, visual-spatial/L-R disorientation, etc.). We have estimated that at least 10% had severe dysfunction while 29% had mild to moderate dysfunction. Seventy-four percent of the perceptually impaired patients were discharged home (a 16% improvement over the control group) and 90% were ambulatory on discharge (an improvement of 22% over the control group). On the other hand, only 29% of the perceptually impaired ever achieved independence in ADL (well below the overall group average of 50%) and 23% required aids with bowel/bladder care (8% more than the overall group average). This represents a 7% improvement in independent ADL function and a 46% improvement in bowel/bladder control in the second group. These results suggest that:

1) patients with perceptual dysfunction but not with cognitive dysfunction can make significant gains in ADL and ambulation with adequate training,
2) the treatment program was largely responsible for improved outcome in the perceptually impaired patients,
3) even though most patients with perceptual dysfunction could walk at the time of discharge and even though many could learn to control their bowel and bladder functions, most still continued to need some assistance or supervision with ADL activities, and
4) the preadmission screening program was unsuccessful in identifying patients with perceptual or cognitive dysfunction since post admission evaluation showed 39% of the patients in the second group had significant perceptual abnormalities and 27% had significant cognitive dysfunction.

Average LOS increased for patients with perceptual impairments because they required more time to achieve adequate improvement, whereas LOS was not increased in patients with OMS because they often failed to make enough progress to warrant prolonged hospitalizations.

Thirty-one percent of the patients had a homonymous hemianopsia (HHA). Only 74% of this group could be discharged home; at that time, 27% were independent in ADL, 66% required aids with dressing/feeding/hygiene, and 31% required aids with bowel/bladder care. It is interesting to note that, although 75% were ambulatory on discharge, only 10% were walking without aids or assistive devices whereas 28% of the total group of 318 patients could walk without a brace or a cane on discharge. LOS was also prolonged in patients with HHA. The presence of HHA is thus again identified as a poor prognostic factor. The “outcome pattern” for this group closely parallels the “outcome pattern” of patients with “primary” perceptual dysfunction and emphasizes the clinical impression that many patients in this category (HHA) probably also had visual neglect or denial. Although earlier identification and treatment of these visual field problems in the second group did not increase the percentage of patients becoming ambulatory or achieving independence in ADL, it did improve the proportion of patients achieving independence in bowel and bladder care by 15%, a finding that was probably responsible for the 10% increase in the number of patients with HHA who were discharged home.

Only 8% of the second group had severe motivational problems. Outcome for these patients was, as expected, generally poor (62% discharged home, 38% nonambulatory, and 92% dependent in ADL). LOS was not increased in this group.

Patients with multiple neurologic deficits also tended to have worse outcome, particularly if they had perceptual and/or cognitive dysfunction or a HHA superimposed on other primary neurologic deficits.

Relationship of Age to Outcome and LOS

Table 3 shows that, between the ages of 51-80, age was unrelated to discharge disposition, functional status on discharge, or LOS. Thus, 79%-87% of these patients went home; more than 85% could walk on discharge, about 50% were independent in ADL, and 6-21% needed aids with bowel and bladder care, statistics which closely parallel group means. In the group over 81 years, however, outcome was worse than average. Thus, even though this elderly group often had less severe weakness on admission and even though 81% were ambulatory on discharge, fewer achieved independence in ADL (only 35%), 58% needed aid with dressing/feeding/hygiene, and 29% needed aids with bowel/bladder care. The poor ADL performance of patients in this group was largely responsible for the relatively high percentage discharged to nursing homes or extended care facilities. In addition, a proportionally larger number of patients in this group (over 81) were sent back to acute care hospitals for further evaluation or treatment of complicating medical problems. (Patients between 17 and 40 years tended to do well. Outcome statistics for the 41-50-year-old group are somewhat skewed because these patients had more severe weakness on admission and more severe functional disabilities.)

Relationship of Onset-Admission Interval to Outcome and LOS

Table 4 shows that onset-admission interval was related to all three measures of outcome, but unrelated to LOS. Although 81-82% of patients with O-A-1's of 0-60 days were discharged home, only 76% of those with O-A-1's of more than 60 days went home even though they had less severe weakness when admitted. On discharge, 90% of those with an O-A-1 of 0-30 days were ambulatory compared to 84% with O-A-1's of 30-60 days and only 80% of those with longer O-A-1's. O-A-1, however, seems most related to ADL status, since 62% of those with an O-A-1 of 0-30 days were independent in ADL as compared to only 50% of those with intermediate and 46% of those with long O-A-1's. It is this factor — i.e. lack of improvement in ADL — which is most responsible for the fact that fewer patients with long O-A-1's can be discharged home. LOS was unrelated to O-A-1 in this sample.

These statistics differ from those in our earlier study where there was a larger intergroup difference in discharge disposition and where ambulation status was more related to O-A-1. These differences suggest 1) that improved treatment programs can minimize the effect of long O-A-1 by improving ambulation status (and thus discharge disposition) and 2) that unless patients in this group can achieve sufficient independence in ADL, a higher percentage will have to be managed in nursing homes or extended care facilities. Although patients with long O-A-1's have longer periods to establish "poor habits," it is difficult to under-
stand why so many can become ambulatory, yet so few achieve independence in ADL. Anecdotal, but testable, hypotheses include:

1) patients with long O-A-I's have more severe neurologic deficits,
2) differences in patient/family motivation,
3) socioeconomic/psychosocial factors could select out a group of patients/families that
   (a) could be more accepting of continued ADL dependence as long as the patient was able to walk,
   (b) could derive definite secondary gains from continued ADL dependence.

Relationship of Functional Status to Discharge Disposition and LOS

The statistics in table 5 confirm our earlier findings that patients who cannot walk or who are dependent in ADL usually cannot be managed at home. The degree of ADL dependence is also related to discharge disposition. Slow functional recovery in patients with the capacity to make satisfactory gains tended to increase LOS.

Relationship of Stroke "Risk Factors" to Outcome and LOS

The presence of ASHD, hypertension, diabetes, and various combinations of these problems was essentially un-
Table 5: Functional Status on Discharge

<table>
<thead>
<tr>
<th>Number of patients</th>
<th>Home</th>
<th>Elsewhere</th>
<th>Average length of stay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walks --------------</td>
<td>89 (28%)</td>
<td></td>
<td>35 days</td>
</tr>
<tr>
<td>Walks with aids</td>
<td>181 (57%)</td>
<td></td>
<td>55 days</td>
</tr>
<tr>
<td>Can't walk ---------</td>
<td>42 (13%)</td>
<td></td>
<td>32 days</td>
</tr>
<tr>
<td>Independent in activities of daily living</td>
<td>159 (50%)</td>
<td></td>
<td>42 days</td>
</tr>
<tr>
<td>Requires supervision</td>
<td>8 (3%)</td>
<td></td>
<td>57 days</td>
</tr>
<tr>
<td>Needs aids with dressing/hygiene/feeding</td>
<td>143 (45%)</td>
<td></td>
<td>50 days</td>
</tr>
<tr>
<td>Needs bowel/bladder routine</td>
<td>54 (17%)</td>
<td></td>
<td>39 days</td>
</tr>
</tbody>
</table>

Factors found to be unrelated to outcome included:

(1) hemisensory loss
(2) dysphasia
(3) age (up to the ninth decade)
(4) presence of ASHD/hypertension/diabetes

Factors increasing LOS included:

(1) severe weakness on admission
(2) presence of perceptual dysfunction or a HHA
(3) presence of a hemisensory deficit
(4) presence of multiple neurologic deficits
(5) slow functional recovery

Factors unrelated to LOS included:

(1) age
(2) O-A-I
(3) presence of concurrent ASHD/hypertension/diabetes
(4) poor motivation
(5) cognitive dysfunction

References


Discussion

Analysis of our data on 318 patients screened before admission to eliminate those who might not benefit from a short-term rehabilitation program showed that preadmission screening did not improve overall outcome or reduce LOS. Referral sources usually did not furnish adequate information about the patient's neurologic or functional deficits because they often did not have the specialized knowledge and facilities to elicit all pertinent findings. Experience also indicated that physicians, nurses, and social workers rarely assessed mental status accurately and often felt that since all stroke patients were confused (sic) only patients with marked behavioral abnormalities should be "labelled" as having an OMS. Overt falsification of data rarely occurred. The improvement in outcome of patients with perceptual (but not cognitive) dysfunction was most likely due to improved assessment and treatment techniques.

Conclusion

Factors found to adversely affect outcome included:

(1) severe weakness on admission
(2) cognitive dysfunction, perceptual defects or a HHA
(3) presence of multiple neurologic deficits
(4) poor motivation
(5) an O-A-I of more than 30 days
(6) inability to walk at the time of discharge
(7) persistent urinary or fecal incontinence

Factors found to be unrelated to outcome included:

(1) hemisensory loss
(2) dysphasia
(3) age (up to the ninth decade)
(4) presence of ASHD/hypertension/diabetes

Factors increasing LOS included:

(1) severe weakness on admission
(2) presence of perceptual dysfunction or a HHA
(3) presence of a hemisensory deficit
(4) presence of multiple neurologic deficits
(5) slow functional recovery

Factors unrelated to LOS included:

(1) age
(2) O-A-I
(3) presence of concurrent ASHD/hypertension/diabetes
(4) poor motivation
(5) cognitive dysfunction
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