The Influence of Stroke Unit Rehabilitation on Functional Recovery From Stroke

Lalit Kalra, PhD, MRCP(UK)

Background and Purpose  Shorter lengths of hospital stay in stroke units could be due to quicker functional recovery or mechanisms of expediting hospital discharge.

Methods  Stroke survivors with an intermediate prognosis at 2 weeks after stroke (n=146) were randomized for management in a stroke rehabilitation unit or in general wards. Barthel scores were monitored at weekly intervals until hospital discharge. The duration and type of physiotherapy and occupational therapy received by patients in either setting were also recorded. The rate of change of Barthel scores, therapy input, and the duration of hospital stay were compared between the two settings.

Results  Neurological deficits and median initial Barthel scores were comparable between patients in the stroke unit (n=73) and general wards (n=68). Median discharge Barthel score of patients managed in the stroke unit was significantly higher than that of patients managed in general wards (15 versus 12). Median Barthel scores in the stroke unit group rose rapidly after 2 weeks, reaching a plateau at 6 weeks. The change in median Barthel score in patients in general wards was significantly slower, reaching a plateau at 12 weeks despite similar therapy input. There was a significant delay in discharging stroke patients in general wards (20 weeks) compared with those in the stroke unit (6 weeks).

Conclusions  Functional recovery is significantly greater and more rapid in a stroke rehabilitation unit compared with general wards despite similar therapy input. These units also shorten hospital lengths of stay by expediting appropriate discharges.

Key Words  hospitalization rehabilitation

Subjects and Methods  Data for this study were collected during a randomized, controlled study comparing outcome in stroke patients managed in different settings. Stroke was defined according to World Health Organization criteria. Patients with first as well as recurrent stroke were included in the study. The diagnosis of stroke was based on history and clinical examination. Computed tomographic scanning was not routinely undertaken except when indicated by defined criteria.

Stroke patients were admitted to general wards during the acute phase of their illness for initial management and stabilization. Survivors at 2 weeks were randomized for management in the stroke rehabilitation unit or general wards and were stratified for expected outcome according to the Orpington Prognostic Score (OPS), which incorporates measures of motor deficit, proprioception, balance, and cognitive function. The score ranges from 1.6 (best prognosis) to 6.8 (worst prognosis). Three groups were identified: patients with a good prognosis (OPS<3), those with an intermediate prognosis (OPS 3 through 5), and those with a poor prognosis (OPS>5). Only patients with an intermediate prognosis were included in the present analysis.

Stroke patients were randomly allocated to a 13-bed stroke rehabilitation unit or continued to be managed on general wards according to existing practices. Despite different settings, all stroke patients had access to nursing care, physiotherapy, and occupational therapy. The type of physiotherapy used was based on Bobath techniques modified by the physiotherapists' experience and adapted to the needs of individual patients. Physiotherapy and occupational therapy input was provided by therapists of comparable seniority (senior I grade), who were assisted by therapy aides in both settings. Input was also available from speech therapists, social workers, and nursing home placement officers for patients unable to return home.

Patients in both settings were assessed at weekly intervals and their Barthel activities of daily living scores recorded by occupational therapists who were not aware of the possible use of these assessments in a comparative study at a later date. In
patients discharged before 12 weeks, an additional functional assessment was undertaken at 12 weeks during a postdischarge visit by the therapists. Because the therapy input received by patients may influence not only the level but also the rate of functional recovery, the duration and the type of physiotherapy and occupational therapy received by patients were also recorded. Data were also collected on the number of deaths and discharges in either setting. Patients who died during their hospital stay or before the follow-up visit were excluded from subsequent analysis (stroke unit, 2; general wards, 3).

Data in the remaining 73 patients in the stroke unit group and 68 patients in the general wards group were analyzed for the median discharge Barthel score and median scores at 0, 1, 2, 3, 4, 6, 8, 10, and 12 weeks in the two groups. In the absence of any agreed measures of the rate of functional improvement, the percentage of patients discharged from the stroke unit (50%) and general wards (45%) up to the time taken to achieve median discharge Barthel score was considered representative. Similarly, the differences in organizational aspects between the two settings were represented by the time required to discharge patients remaining in the hospital after the median discharge Barthel score was achieved in each group.

Age on admission, motor power on affected side, and duration of therapy received were analyzed using Student's t test. Group homogeneity for sex and neurological deficits and the type of therapy received by patients in either setting were analyzed with a χ² test. The median Barthel scores at different time intervals were analyzed by the Mann-Whitney U test. The z test was used to analyze the differences in rate of change of median Barthel score and the discharge rates between the two groups.

Results
The baseline demographic characteristics of the 73 patients on the stroke rehabilitation unit and 68 patients on general wards were comparable (Table 1). The extent of neurological deficit, frequency of urinary incontinence, and Barthel scores at the initial assessment in patients treated in the stroke rehabilitation unit did not differ significantly from those of patients treated in general wards (Table 1).

The median discharge Barthel score of patients managed in the stroke rehabilitation unit was significantly higher than that of patients managed in general wards (15 versus 12). Despite a similar median Barthel score for both groups at the start of the study, median Barthel scores, measured at weekly intervals, were significantly higher for patients managed in the stroke rehabilitation unit compared with those in general wards (Table 2). The increase in median Barthel score in the stroke unit group was initially slow but rose rapidly after 2 weeks, reaching a plateau at median discharge Barthel score at 6 weeks (Fig 1). Median Barthel score for patients in general wards showed little improvement for 3 weeks, after which they improved linearly until the median discharge Barthel score was achieved at 12 weeks (Fig 1). The rate of change of median Barthel score during the linear phase was significantly slower in patients in general wards (0.9/wk) compared with those in the stroke unit (2.2/wk) and is reflected by the difference in the slopes of their Barthel curves (Fig 1). The mean±SD value of Barthel scores of individual patients at 4 weeks as a proportion of their Barthel score at discharge was 0.79±0.22 in the stroke unit compared with 0.66±0.22 in general wards (P<.01).

Patients managed in the stroke unit had significantly shorter lengths of hospital stay compared with those in general wards (48.7±17.2 versus 104.6±28.6 days; P<.001). There were no significant differences between the percentage of patients discharged from the stroke unit (50%) and general wards (45%) up to the time taken to achieve median discharge Barthel score in each group. However, there were significant differences in the time taken to discharge patients remaining in general wards (20 weeks) compared with the stroke rehabilitation unit (6 weeks) once this level was achieved for the group. The mean±SD value of the time taken to achieve discharge Barthel scores by individual patients as a proportion of the duration of their hospital stay after randomization was 0.91±0.04 for patients in the stroke unit compared with 0.65±0.27 for patients in general wards (P<.01).

Differences in the speed of functional recovery also were seen when median Barthel scores of patients remaining in the stroke rehabilitation unit and general ward were plotted against time (Fig 2). There was a shift to the right in the curve that represented median Barthel scores in the general ward group, suggesting slower changes. The peak of the Barthel score curve coincided with the beginning of the sharp rise in the discharge curve both in the stroke unit and general wards, confirming that patients with poorer functional recovery stayed longer in hospitals regardless of setting (Fig 2).

Patients treated in general wards received significantly more physiotherapy on average than patients on the stroke rehabilitation unit during their hospital stay (Table 3). There were no differences in the average amount of occupational therapy received by patients in either setting. Although there was a trend toward a higher proportion of occupational therapy time being spent on specific needs of individual patients in the stroke rehabilitation unit compared with general medi-
TABLE 2. Median Barthel Scores and Discharge Rates on a Weekly Basis in Stroke Patients Managed in the Stroke Unit or General Wards

<table>
<thead>
<tr>
<th>Time of Assessment, wk</th>
<th>Median Barthel ADL Score (Range)</th>
<th>Percent Discharges</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SU</td>
<td>GW</td>
</tr>
<tr>
<td>0</td>
<td>4 (0-12)</td>
<td>4 (0-8)</td>
</tr>
<tr>
<td>1</td>
<td>6 (0-13)</td>
<td>4 (0-12)</td>
</tr>
<tr>
<td>2</td>
<td>9 (0-15)</td>
<td>4 (0-13)</td>
</tr>
<tr>
<td>3</td>
<td>11 (0-18)</td>
<td>5 (0-16)</td>
</tr>
<tr>
<td>4</td>
<td>13 (0-20)</td>
<td>6 (0-17)</td>
</tr>
<tr>
<td>6</td>
<td>14 (3-20)</td>
<td>8 (2-18)</td>
</tr>
<tr>
<td>8</td>
<td>15 (4-20)</td>
<td>9 (2-18)</td>
</tr>
<tr>
<td>10</td>
<td>15 (6-20)</td>
<td>10 (2-18)</td>
</tr>
<tr>
<td>12</td>
<td>15 (6-20)</td>
<td>12 (2-18)</td>
</tr>
<tr>
<td>20</td>
<td>...</td>
<td>12 (2-18)</td>
</tr>
<tr>
<td>28</td>
<td>...</td>
<td>12 (2-18)</td>
</tr>
<tr>
<td>32</td>
<td>...</td>
<td>12 (2-18)</td>
</tr>
</tbody>
</table>

Discharge: 15 (6-20) 12 (2-18) .001

ADL indicates activities of daily living; SU, stroke unit; and GW, general wards.

cal wards, this did not achieve statistical significance (Table 3).

Discussion

This study shows that functional recovery, as measured by Barthel scores, is not only greater but also significantly more rapid on a stroke rehabilitation unit compared with general wards. This improvement is achieved without any additional physiotherapy and occupational therapy input in the specialist setting. The shorter hospital stay in the stroke rehabilitation unit also may have been due to a mechanism of expediting discharges in appropriate patients as a result of closer liaison between the patient, care-givers, and the professionals in this setting.

The analysis was limited to patients in the intermediate prognostic group because this group has been shown to be most sensitive to stroke unit intervention in a previous report. Patients in the best prognostic group were considered inappropriate for the study because of the high initial Barthel scores and the short duration of hospital stay in both settings. Analysis was not possible in the group with the worst prognosis because of the small sample size, high mortality, and the small change in median Barthel score between admission and discharge in this group regardless of setting.

The reasons that stroke rehabilitation units shorten hospital lengths of stay have not been clear in the past. Although quicker functional recovery has been suggested, the possibility of organizational aspects resulting in better coordination and early discharges as the sole contributing factor also has existed. The faster rate of functional improvement seen in this study also has

Fig 1. Line graph shows weekly median Barthel scores and discharge rates of stroke survivors in stroke unit (n=73) and general wards (n=69). The symbol ● indicates median Barthel score (stroke unit); □, percent discharges (stroke unit); ○, median Barthel score (general wards); A, median discharge Barthel score of stroke unit group; and B, median discharge Barthel score of general wards group.

Fig 2. Line graph shows weekly median Barthel scores of the remaining stroke inpatients in the stroke unit and general wards shown against the rate of discharge. BADL indicates Barthel activities of daily living; ○, Barthel score (general wards); □, discharge rates (general wards); ●, Barthel score (stroke unit); ■, discharge rates (stroke unit); A, median discharge Barthel score of stroke unit group; and B, median discharge Barthel score of general wards group.
been reported previously, although therapy input was not quantified in that study. In addition, the time after which patients remaining in the hospital were discharged after the median discharge Barthel score was achieved was significantly longer in general wards (Table 2), providing objective evidence of poor organization suspected in previous reports. The group observations of speedier recovery and quicker discharges once functional potential was achieved in the stroke unit were supported by data on the proportion of change in Barthel scores occurring in the first 4 weeks and the proportion of time spent in the hospital once discharge Barthel scores were achieved in individual patients.

There is a risk that average lengths of hospital stay may be artificially shortened by discharging stroke patients before they achieve their functional potential. This risk is even greater in specialist settings such as a stroke unit, where one of the measures of efficacy may be a shorter length of hospital stay. If this were the case, the rapid discharge phase was associated with a rapid fall in median Barthel score levels achieved by the patient group (Fig 1). The rapid discharge phase was associated with a rapid fall in median Barthel score of the remaining patients (Fig 2). This model generates measures by which the functional efficacy of stroke settings (different stroke units or different specialist and non-specialist settings) can be assessed. The suggested measures (which need to be applied to patient groups of comparable deficits and prognosis) are (1) the median discharge Barthel score (measure of the extent of functional recovery in the setting); (2) time required by the patient group to achieve this score (measure of the rate of functional recovery in the setting); (3) time required to discharge the remaining stroke patients once the group achieves the median discharge Barthel score (measure of mechanisms to expedite discharges from the setting); and (4) the rate of decrease of median Barthel score of patients remaining in the unit after median Barthel scores are achieved (measure of appropriateness of discharges from the setting).

It is possible that other assessments (eg, motor, functional, and social) in stroke show similar patterns and relations to discharges. It may also be possible that some of these measures are affected by stroke unit rehabilitation, whereas others are relatively immune to such influences. Further research in this area will allow a more precise understanding of how stroke units affect rehabilitation and will help to develop better strategies of stroke management.

References

Kalra Stroke Units Hasten Functional Recovery

The influence of stroke unit rehabilitation on functional recovery from stroke.

L Kalra

Stroke. 1994;25:821-825
doi: 10.1161/01.STR.25.4.821

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://stroke.ahajournals.org/content/25/4/821