Medical and neurological complications during inpatient stroke rehabilitation
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Background and Purpose  We sought to assess the type, frequency, and clinical predictors of neuromedical complications occurring during inpatient rehabilitation after stroke.

Methods  One hundred consecutive patient records were reviewed. All medical and neurological complications requiring a physician’s order for further evaluation or treatment were recorded.

Results  Complications were urinary tract infection (44 cases), depression (33), musculoskeletal pain (31), urinary retention (25), falls (25), fungal dermatitis (24), hypotension (19), diabetes mellitus (16), hypertension (15), and other neuromedical problems (194). The mean±SD numbers of medical and neurological complications per patient were 3.6±2 and 0.6±0.8, respectively. Complications were independently related to both the severity of functional disability as judged by Barthel score (r=-.42, P<.001) and length of rehabilitation hospital stay (r=.54, P<.001). Cardiac complications were predicted by New York Heart Association class 3 or 4 symptomatology on admission (P<.05). The age, sex, interval from stroke to rehabilitation hospital admission, and ischemic versus hemorrhagic etiology of the stroke were unrelated to the number of complications observed. Thirteen patients required transfer back to an acute-care hospital, one of whom died within 24 hours of transfer. There were no deaths on the rehabilitation unit.

Conclusions  We have defined the type and frequency of neuromedical complications during inpatient rehabilitation after stroke. Their frequency varies with the severity of score, cardiovascular comorbidity, and length of stay. (Stroke. 1994;25:358-361.)

Key Words  • cerebrovascular disorders • epidemiology • morbidity • rehabilitation

The current study was therefore designed to (1) review the existing literature concerning medical complications during inpatient stroke rehabilitation, (2) present our own experience with medical complications, (3) define patient-specific characteristics that allow comparison of medical complications among different institutions, and (4) suggest new areas of investigation to minimize morbidity and mortality on the stroke rehabilitation ward.

Subjects and Methods  We reviewed the inpatient Burke Rehabilitation Hospital discharge records for 1990 and selected 100 consecutive patients with hemorrhagic or ischemic stroke. Patients with subarachnoid hemorrhage or intracranial surgery were excluded. The diagnosis of stroke in each case was based on clinical history, neurological examination, and computed tomographic or magnetic resonance imaging study.

Previous studies have demonstrated the benefit of assessing patient outcomes based on the extent of motor, somatic sensory, and hemianopic visual deficits produced. Patients with unilateral hemispheric strokes were categorized as having motor deficits only, motor plus somatic sensory deficits, or motor plus somatic sensory plus hemianopic visual deficits. Patients with other combinations of deficits, with bilateral hemispheric involvement, or with infratentorial stroke location were listed as “other.” Assessments of neurological impairments were based on bedside neurological examination techniques and have been previously published. They were scored on admission to the rehabilitation unit. Barthel scores were generated by rehabilitation team members unaware of this study.

The Burke Rehabilitation Hospital is a freestanding rehabilitation hospital where surgical services and medical intensive care are not available. Admission criteria for stroke require that the patient need assistance with personal care, be able and willing to engage in 3 hours of rehabilitation pro-
Complications During Inpatient Stroke Rehabilitation

Data were recorded and analyzed using STATVIEW 512+ (BrainPower Inc, Calabasos, Calif). Statistical evaluations were as described in the Tables and the Figure legend.

Results

Table 1 displays demographic information for the 100 consecutive patients meeting selection criteria.

Tables 2 and 3 display medical and neurological complications, respectively. Of the 96 patients with complications, 83 were managed on the rehabilitation unit, and 13 required transfer back to an acute-care setting. One patient died within 24 hours of transfer. The causes for transfer to acute care are listed in Table 4.

TABLE 1. Patient Demographic Data

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
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<tbody>
<tr>
<td>Age, y</td>
<td>69±9</td>
</tr>
<tr>
<td>Sex, M/F</td>
<td>42/58</td>
</tr>
<tr>
<td>Time from stroke onset to Burke Rehabilitation Hospital admission, d</td>
<td>37±4</td>
</tr>
<tr>
<td>Admission Barthel score</td>
<td>52±2</td>
</tr>
<tr>
<td>Length of stay at Burke Rehabilitation Hospital, d</td>
<td>52±3</td>
</tr>
</tbody>
</table>

Data are mean±SEM.

Each category was scored only once per patient, even if the problem recurred.

Six of 10 patients who developed ischemic or congestive cardiac complications were scored as class 3 or 4 on the New York Heart Association scale at the time of rehabilitation hospital admission. Only 4 of 74 patients without a history of cardiac disease or with class 1 or 2 symptomatology developed ischemic or congestive cardiac complications during the course of stroke rehabilitation ($\chi^2=6.1, P<.05$).

There was no significant correlation between the patient's age or interval from stroke to rehabilitation hospital admission and number of complications. No significant differences were found between patients who had ischemic infarcts and those who had hemorrhagic infarcts.

Complications were significantly related to the severity of stroke as judged either by the extent of neurological impairment produced or the admission Barthel
sory deficit; MSV, motor plus somatic sensory deficit plus hemifield vision deficit; and other, other combination of deficits.

TABLE 5. Number of Complications Based on Extent of Stroke-Related Neurological Impairment

<table>
<thead>
<tr>
<th>Impairment</th>
<th>Complications, mean±SD</th>
<th>Significant Difference*</th>
</tr>
</thead>
<tbody>
<tr>
<td>M (n=26)</td>
<td>3.6±2</td>
<td>Vs MSV</td>
</tr>
<tr>
<td>MS (n=13)</td>
<td>4.1±2</td>
<td>Vs MSV</td>
</tr>
<tr>
<td>MSV (n=34)</td>
<td>5.7±3</td>
<td>Vs M</td>
</tr>
<tr>
<td>Other (n=27)</td>
<td>3.2±2</td>
<td>Vs MSV</td>
</tr>
</tbody>
</table>

M indicates motor deficit only; MS, motor plus somatic sensory deficit; MSV, motor plus somatic sensory deficit plus hemifield vision deficit; and other, other combination of deficits. *P<.05 based on ANOVA.

Discussion

To say “the patient is medically stable and ready for stroke rehabilitation” is inaccurate and misleading. Our data show that the inpatient stroke rehabilitation unit is a medically active service: 96% of patients developed complications, and 17% required transfer back to an acute-care hospital setting. These figures underestimate the need for medical and nursing supervision and intervention because only those evaluations performed by a physician that resulted in a physician order were included in our study. Moreover, recurrent events such as insulin or antihypertensive medication adjustments were counted as a single management problem.

The nine most common problems (urinary tract infection, depression, musculoskeletal pain, urinary retention, falls, fungal dermatitis, hypotension, diabetes mellitus, hypertension) accounted for 54% of all complications on our service. Given this frequency, admission assessment protocols for the identification and treatment of these commonly encountered problems should be established on each unit. It is not safe to assume that such problems have been detected at the acute-care hospital. Dobkin has observed that nearly half of all patients transferred to his rehabilitation unit had neuromedical complications that either were not previously noted or had been treated and were thought to have resolved.

A number of medical complications that are thought to plague the debilitated stroke patient were rare or absent: pneumonia, pulmonary embolization, myocardial infarction, and bony fractures after falls. We believe this is due to a combination of factors including our admission selection criteria and our use of risk management protocols, as mentioned above. It may also be due to the fact that there was a delay of 37 days from stroke to rehabilitation hospital admission. This seems to be unlikely since there was no correlation between the interval after stroke at which patients were admitted and the number of complications observed (r=.02, P=NS).

Although patients were resident on a neurological unit, neurological complications were much less frequent (0.6 per patient) than medical complications (3.6 per patient). Depression was the most common neurological complication observed. Depression in the stroke patient is often atypical, with prominent frustration, anger, pessimism, and emotional lability. Most of our patients responded well to antidepressants and the milieu of expectant optimism that pervades the stroke rehabilitation unit.

There are only three published studies concerning the frequency of medical complications during inpatient rehabilitation with which to compare our data. The definition of what constitutes a complication varies for the three studies. Six studies report only the frequency of complications severe enough to require transfer back to an acute-care setting. 1-3 The data of Dobkin suggest that up to 94% of patients admitted from other institutions during 1985 had neuromedical complications either on admission or during their rehabilitation hospital stay. Fourteen percent required transfer to an acute-care ward. There is no mention of mortality. Dobkin’s patients were admitted a mean of 9 days after stroke and remained on the rehabilitation unit a mean of 33 days. The frequency and spectrum of neuromedical complications observed by Dobkin are similar to those in the present study. Analysis of data reported by McClatchie indicates that 56% of his patients developed complications, and 17% required transfer back to an acute-care setting. There were no deaths. McClatchie’s patients were admitted a mean of 25 days after stroke and remained on the rehabilitation unit a mean...
of 58 days. Adler et al noted that 74% of their patients had medical complications, 11% of the total required transfer back to acute care, and none died while on the rehabilitation unit. Their average interval from stroke to rehabilitation hospital admission was 25 days, with an average length of stay of 33 days. Feigenson et al published a series of three studies from Burke Rehabilitation Center but did not note the frequency of medical complications other than to state that from 7% to 11% required transfer back to an acute-care setting, and from 0.4% to 2% of patients died on the rehabilitation unit. Feigenson's patients were admitted a mean of 48 days after stroke across the three studies and remained on the inpatient unit a mean of 44 days.

Previous authors have not studied the effect of stroke severity on the frequency of complications during inpatient rehabilitation. We found that the extent of stroke-related neurological impairment was a useful predictor of the number of complications observed. Patients whose deficits included motor, somatic sensory, and hemianopic visual impairments had a significantly greater number of complications than those patients with pure motor hemiparesis. The severity of disability as judged by the admission Barthel score was also related to the number of complications observed on the inpatient rehabilitation unit. These data indicate that comparisons of complication rates on different rehabilitation units must be adjusted to account for differences in the severity of neurological impairment or ADL dysfunction. Linear regression curves such as that shown in the Figure could be used as a means for such comparisons.

Wylie studied the relation between disability after stroke and death during inpatient rehabilitation. A Barthel score of 0 to 10 was associated with a 38% mortality over a mean of 22 weeks. The mortality for patients with a Barthel score of 60 or greater was 5%. Wylie's article was published in 1967, reflecting a rehabilitation environment quite different from our own. He does not provide information concerning the relation between Barthel score and number of complications or need for acute-care transfer.

Our experience suggests that medical and neurological complications are an ongoing and predictable part of inpatient rehabilitation after stroke. Protocols for the prevention, detection, and treatment of commonly encountered problems should be established on each unit. Quality-assurance audits linked to the severity of stroke, cardiovascular comorbidity, and length of stay should allow comparison of the spectrum and frequency of complications, need for acute-care hospital readmission, and mortality from one institution to another. The remarkable frequency of the most common complications (urinary tract infection, depression, and musculoskeletal pain) highlights the need for further investigation into the pathogenesis, prevention, and treatment of these disorders in the stroke patient.

References